CONTENT DEVELOPMENT: COURSEWARE FOR STUDENTS WITH LEARNING DISABILITIES

by

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Dissertation submitted in partial fulfillment of

the requirement for the

Bachelor of Technology (Hons)

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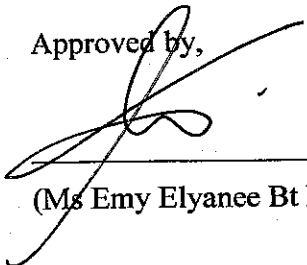
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CERTIFICATION OF APPROVAL

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Approved by,

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CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted I this project, that the original work is my own expect as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

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ABSTRACT

There is a growing concern on disabled educations and government agencies are accelerating their effort to support and help this group of people. Creating new education environment with technological advancement can be beneficial for disabled students as it provide better understanding in learning process. This report presents the idea of improving the content development of a learning courseware called "Fun Mathematics". The courseware was developed by previous Final Year student, Ms. Luxmi Jesudian for students with learning disabilities and Mathematics teachers at SK Pengkalan Pegoh, Ipoh as they are the target users for this courseware. The students' intelligence level in Mathematics is same level with Standard One students. The enhancement will focus on courseware's content development which basically divided in two elements; varies the mode of delivery and also improving the content of the syllabus. The mode of delivery varies into games, learning and exercises features. The content of the syllabus will followed the school's syllabus so that the students will have more understanding on the subject. The methodology used throughout this project is divided into several phases which include planning, analysis, design, construction, implementation and maintenance. Under construction phase, Prototype Model methodology will be implemented in order to enhance the courseware. Result shows that the teachers gave positive feedback on the improved courseware from the post testing questionnaires during user testing conducted in the school. It is hoped that the new version courseware will help the students to learn Mathematics subject better.

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CHAPTER 1

INTRODUCTION

1.0 INTRODUCTION

1.1 Background of Study

Integrating multimedia into courseware development supports users' learning on computer and has great potential to assist disabled people despite any kind disabilities that these people have. This project basically presents an enhancement project which continues the work of previous Final Year student, Ms. Luxmi Jesudian. Ms.Luxmi has developed a learning courseware called "Fun Mathematics" for teachers and also students with learning disabilities at Sekolah Kebangsaan Pengkalan Pegoh, Lahat, Perak. She had done a research on how technology can be applied in the respective school. The purpose of her research is to give opportunity to students with learning disabilities to familiarize themselves with technologies learning materials nowadays and also to contribute on enhancement of learning for the disabled. The outcome of the research is to develop a courseware which is compatible with the schools' personal computer operating system.

The courseware was build using Visual Basic 2005 Express Edition and the targeted users are particularly the teachers and also the students with learning disabilities of the respective school. This courseware focuses on Mathematic subject. The level of difficulties of the subject is divided into three levels which are easy, medium and hard. There are three level of difficulties designed for the questions as shown in *Table 1.1*:

Table 1.1: Description on level of difficulties in Fun Mathematics Courseware

Level	Description
Easy	Simple and easy questions create a good start for learners to understand the subject.
Medium	When students get comfortable and can answer questions in "Easy" level, they may proceed with "Medium" level. This level consists of average level type of questions.
Hard	This level challenge student's IQ and contains quite tough questions compared to "Easy" and "Medium" level. Students who managed to pass the previous level may proceed with this level.

Ms. Luxmi has designed the questions for the courseware content which totally followed the syllabus provided by the Malaysia's Ministry of Education (*Refer Appendix A-8*). Please refer to *Figure 1.1* below to see the main page of the courseware developed by Ms. Luxmi.

Figure 1.1: Primary Page of Version 1 Fun Mathematics Courseware

The feedback analysis from the user testing shows that there are lacks of delivery mode in the courseware and the content of the syllabus do not follow the school's syllabus. Thus, this creates difficulties for the student to understand the questions because they have not learned about some of the topics yet. Furthermore, the

students also have problems and difficulties in reading line of sentences especially in English language. The teachers request that the courseware should entertain the teaching process with songs and games because the students seem to be attracted with it. Implementing sing along Mathematics song might be helpful in helping the students to memorize the numbers. Besides that, the content of the courseware need to be change and follow the syllabus taught by the teachers. This will ensure that the students gain more understanding in Mathematics.

Education structure for disabled children in Malaysia was organized by the Malaysia's Ministry of Education. Malaysia's Women, Family and Community Development Ministry also contribute to accommodate children education services for those who have physical or mental disability [1]. Ministry of Education is responsible in supporting and providing special education and special needs for various types of disability of disabled students which includes hearing impairment, visual impairment and intellectual disabilities. This is due to an increasing number of registered disabilities in recent year 2006 and 2007.

According to Datuk Faizah Mohd Tahir (2006), the "data from the Social Welfare Department (SWD) show that there are 150,617 disabled people who have registered to obtain the services and facilities provided by the government. Selangor has the highest registered number of disabled people followed by Johor and Perak. From that total, 57,483 have an intellectual or learning disability." Datuk Faizah supported her previous statement by pointing out that "in 2004, the number of new cases of intellectual disability recorded was 8,207 where 61% of them are males and 39% are females, while 77% are less than 18 years old, that is, in the child to youth category and the rest are between 19 and 60 years and above. Those with an intellectual or learning disability form the largest category of disabled people registered with the SWD every year [2]."

The growing number of disabled people can be shown in the statistic done by SWD starting from year 2002 until the recent 2007 in *Table 1.2* [3]. The statistic showed in *Table 1.2* present the types of disabilities in Malaysia from year 2002 until 2007.

Table 1.2: Total of registered disabled people according to types of disability

JENIS KECACATAN	TAHUN					
	2002	2003	2004	2005	2006	2007
Penglihatan	14,738	14,154	15,364	16,211	18,258	20,039
Pendengaran	21,981	22,728	24,712	26,470	29,522	31,715
Anggota	41,311	45,356	51,090	58,371	66,250	73,559
Akal*	43,042	49,340				
Masalah Pembelajaran			57,483	66,906	76,619	85,812
Cerebral Palsy			34	623	887	1,787
Lain-lain	1,017	1,077	1,934	4,335	5,983	7,338
JUMLAH	122,089	132,655	150,617	172,916	197,519	220,250

* Kecacatan akal dimansuhkan, sebaliknya dipecahkan sama ada kecacatan Masalah Pembelajaran atau Cerebral Palsy

By referring to Datuk Faizah speech in the above statement, the number of males having intellectual disabilities is larger compared to females. This can be proved with SWD new statistic which covered the range of age, type of disabilities and group of gender for year 2007 as shown in *Table 1.3*.

Table 1.3: Total of new registered cases according to range of age, types of disability and gender, 2007

Kumpulan Umur	Penglihatan		Pendengaran		Anggota		Bermasalah Pembelajaran		Cerebral Palsy		Lain-Lain		Jumlah	
	L	P	L	P	L	P	L	P	L	P	L	P	L	P
Kurang dari 6 tahun	103	85	132	115	262	139	1125	725	197	129	141	109	1960	1302
6-12 tahun	95	84	219	154	354	182	2283	1091	90	62	122	75	3163	1648
13--18 tahun	100	55	120	103	343	247	1065	654	66	55	73	53	1767	1167
Jumlah (A)	298	224	471	372	959	568	4473	2470	353	246	336	237	6890	4117
19-25 tahun	96	60	173	118	576	243	503	373	65	43	107	76	1520	913
26-35 tahun	164	100	176	147	809	333	422	359	62	40	110	61	1743	1040
36-45 tahun	196	108	159	115	954	372	236	208	34	33	97	61	1676	897
46-59 tahun	275	129	158	124	1214	513	160	151	18	13	111	53	1936	983
60 tahun ke atas	154	86	134	83	667	337	26	35	6	2	65	46	1052	589
Jumlah (B)	885	483	800	587	4220	1798	1347	1126	185	131	490	297	7927	4422
JUMLAH (A + B)	1183	707	1271	959	5179	2366	5820	3596	538	377	826	534	14817	8539

1.2 Problem Statements

Some problems have been discovered throughout the previous user testing session done by Ms. Luxmi. Several questions in the courseware did not exist in the syllabus that was taught by the teacher. Some of the questions were too difficult for the students to understand and to answer. They need their teacher to assist them in solving the problems because they are having problem in reading and understanding the questions written in English. Besides that, there are minor functionality problems whereby the courseware does not operate properly in displaying result, radio buttons error and so on. Although the children are having problems to understand the questions, they have a great interest and amazing urge to learn. The emerging of technology advancement in education system takes accountability that the special student could not be left behind. Attractive technology medium could help these special children to absorb what they learn in better way.

The previous courseware delivery mode contains one main feature which is exercises. It required inputs from users and the answer will be prompt out whether it is right or wrong. The enhancement of the system could vary the delivery mode into several features like fun Mathematics game, exercises and also a learning section where they can learn about some Mathematics basic concept. This courseware can be improved concerning user's feedback and also the expert advices and reviews.

Studies show that there are lacks of technology implementation for disabled students for education purposes. Besides that, there was a gap between normal and students with learning disabilities because the intelligence level was different among this group of students. The result of the studies done by Zainudin Mohd Isa (*p.137*) shows that in curriculum for student with learning disabilities at three secondary schools in Federal Territories of Kuala Lumpur [4];

1) There are few differences in the implementation of the curriculum between special classes for learning disabilities student and normal classes

2) There are few differences on student interest and attitude towards learning between learning disabilities student and normal student

3) School does not give support to the program

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1.3 Objectives and Scope of Study

Primary objectives of this project are:

1) To improve the existing courseware which focuses on courseware's content development:
   a. Vary the mode of delivery into games, learning and exercises features
   b. Improve the courseware syllabus's content which followed the syllabus taught by the respective school's teachers
2) To test on user's acceptance during user testing

The project is concentrating on constant feedback from the users in SK Pengkalan Pegoh, Lahat, Perak. The target users are the teachers and also the students with learning disabilities. During the first visit at the school, I have identified several types of disabilities of the students which are learning disability, dyslexia, Down syndrome, autistic, speech delay and hyper active. Majority of the students are in the learning disabilities category. Therefore, this project will focus on helping the students with learning disabilities problems in learning Mathematics.

The school does not separate these children according to type of disabilities that they have but they combined all disabled students to learn together in separated class. The disabled students age range from six to twelve years old. However, their ability to understand the subject is same level with Standard One students. English has been used as the primary language for the whole learning process in this courseware.

Some of the types of disabilities discovered in this school match the result by Malaysia's Ministry of Education. Special Education Division Portal stated that there are four common types of student's disabilities discovered in Malaysia which are Down syndrome, low autism, attention deficit hyperactive disorder and mental retardation [1]. A brief summary below defines all types of disabilities as mentioned in previous statement:

1) Learning Disability

   This group of disabled students absorbs education slower compared to average or normal students. They need longer time to learn and understand a subject.

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2) Dyslexia

Dyslexia is considered to be a learning disability primarily as a difficulty with written language, particularly with reading and spelling.

3) Down Syndrome

Down syndrome (DS), also called Trisomy 21, is a condition in which extra genetic material causes delays in the way a child develops, both mentally and physically [5]. Down syndrome affects kids' ability to learn in different ways, but most have mild to moderate intellectual impairment. Kids with DS can and do learn, and are capable of developing skills throughout their lives. They simply reach goals at a different pace.

4) Autistic or Low Autism

Autism is a brain development disorder that impairs social interaction and communication and causes restricted and repetitive behavior, all starting before a child is three years old. The manifestations of autism cover a wide spectrum, ranging from individuals with severe impairments - who may be silent, mentally disabled, and locked into hand flapping and rocking - to less impaired individuals who may have active but distinctly odd social approaches, narrowly focused interests, and verbose, pedantic communication. Sometimes the syndrome is divided into low-, medium- and high-functioning autism (LFA, MFA, and HFA), based on IQ thresholds [6].

5) Speech Delay

Speech delay refers to a delay in the development or use of the mechanisms that produce speech [7]. For example, a child may be unable to produce intelligible speech sounds.

6) Hyper Active or Attention Deficit Hyperactive Disorder

Attention Deficit Hyperactivity Disorder (ADHD) is a condition that becomes apparent in some children in the preschool and early school years [8]. It is hard for these children to control their behavior or pay attention.

7) Mental retardation

Mental retardation means that someone has lower than average intelligence. Intelligence is a way of describing someone's ability to think, learn, and solve problems [9]. The person may have trouble learning and might need longer to learn social skills, such as how to be friends or how to communicate with others. People with mental retardation also might be less able to care for themselves or unable to live on their own as adults.

CHAPTER 2

LITERATURE REVIEW

2.0 LITERATURE REVIEW

2.1 Courseware

According to a definition of WhatIs.com, courseware is an educational material intended as kits for teachers and trainers or as tutorials for students, usually packaged for use with a computer [10]. In the past, trainers had to either find the time to develop their own classroom or workshop materials or purchase expensive, inflexible books and workbooks [11]. However, having courseware in this new era has established a new way for managers and educators to deliver high quality training faster, cheaper price and even better.

According to Joao R. Galvao and Antonia M. Barreto (2005)

> The concept of courseware can be describe as key organizations, such as the National Education Delivery System (http://www.needs.org/), promote operations for the quality, growth, plan and conception of methodologies within an educational context and for projects of educational materials (educating/training) for use with computers, denominated as courses — courseware. With regard to the particular case of educational materials, these are also called educative programmes [12].

Courseware can encompass any knowledge area, but information technology subjects are most common. Courseware is frequently used for delivering education about the personal computer and its most popular business applications, such as word processing and spreadsheet programs. Courseware is also widely used in

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information technology industry certification programs, such as the Microsoft Certified Systems Engineer (MCSE) and the Computing Technology Industry Association's A+ examination. Courseware can include:

- Material for instructor-led classes
- Material for self-directed computer-based training (CBT)
- Web sites that offer interactive tutorials
- Material that is coordinated with distance learning, such as live classes conducted over the Internet
- Videos for use individually or as part of classes

The CD-ROM is the most common means of delivering courseware that is not offered online. For teachers and trainers, courseware content may include set-up information, a course plan, teaching notes and exercises.

2.1.1 Courseware for Disabled Students Worldwide

The importance of technology to people with disabilities is more thoroughly emphasized with interactive multimedia as an educational adaptive hypermedia system to help person with disabilities. Modeling adaptive presentation and adaptive navigation can enhance the learning process by having an interactive multimedia designed courseware to supplement traditional education teaching methods. Studies have shown that computer-based multimedia can help people to learn better than traditional classroom lectures [13].

The increasing number of disabilities every year raises the concern of each government agencies in all countries including the disabled welfare services, association, facilities and education system. Research by Dr G. Busby claimed that "statistically, one in ten of the world's population have a disability of some kind during their lives. In pure numerical terms this amounts to 33 million in Europe, 25 million in the United States, 6.8 million in the United Kingdom and 500 million in the world. Of course, not all these will be severely disabled, but approximately 4% will, which still equates to a large number of people being denied full citizenship [14]. He argued that the computers are currently interacting with only directed hand,

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eye or head movements, with voice, and not much else. From his point of view, "computers should be accessible and responsive to all body language functions".

Multimedia technologies have increasingly incorporated into courseware education software [15]. Independent approaches exist for the use of multimedia and for the development of courseware systems, but at present there is no model or documentation aiding integration.

In the countries throughout the world, all kind of new methods and means are used to improve education. To achieve improvement through the use of computer technology, it is necessary to educate teachers, introduce new learning model, and develop appropriate learning materials and educational software for learning-courseware. While in some countries these efforts are strategically planned, in others, such projects represent isolated initiatives and modest attempts which merely have a goal to build computer infrastructure and give schools and universities access to the Internet. In addition to the non adequate hardware and network outfit, the problem is that schools and universities computers are used rarely, except in subjects related to computer science [16].

There are many advantages of multimedia technology in enhancing the education methods. According to Computer Technology Research, it has been reported that students can retain only 20% of what they see, 30% on what they hear, 50% of a combination of those 'see' and 'hear' activities and 80% of what they see and hear simultaneously [17]. Thus, multimedia has been designed as a highly effective aid in education. Moreover, US Department of Education has reported that there are many benefits in using multimedia technology in education [18]. Some of the benefits include, the multimedia technology can help students to master their skills requirements for the workforces, multimedia technology can enhance the ability to remember and understand material, help students become independent learners and this technology can improve the teachers' skills and knowledge [19].

2.1.2 Courseware for Disabled Students in Malaysia

The Multimedia Super Corridor (MSC) has been developing rather rapidly in Malaysia. Recently, the field of education has taken the opportunity to seize the advantages offered by the multimedia technology to revolutionize the old education system in the country [19]. Stember, I.K agrees that the interactive multimedia technology has influenced the way people work, learn and communicate [20]. The interactive multimedia program in education has reformed the computer-based teaching materials where learners can learn independently in an interactive environment and in a meaningful way [21]. Therefore, multimedia courseware application has been widely used in the education field, ranging from the preschool to the higher learning institution.

Students have also identified that there are many benefits they can achieve through the multimedia courseware as a learning tool where they can work at their own pace, get a constant response on progress, more flexible access to education, cooperatively help one another by moving around the room, a more relaxed classroom atmosphere, reduces 'catch up' problems if a student is sick, increased mastery especially by weaker students and multimedia courseware provide a consistency in course content [22].

During the development of MSC, courseware has been widely used at various levels of education. There are many works related to multimedia courseware which has been developed to augment educational delivery system [19]. Thus, educational courseware has been developed by educators to help students gain the learning objectives and increase learner concentration [23]. Educational courseware has been developed for subjects like History [24], Mathematics [25], Science, Malay Language and also English Language. But, the courseware build is mainly for normal students and not for the disabled. For example, [26] has designed a courseware to cultivate and motivate a reading habit among the students especially in early age. A courseware to help Dyslexics has also been developed in Malaysia [27]. All courseware has the same purpose to provide an alternative to enhance and increase educational system [28].

In line with the globalization and the Information and Communication Technology (ICT) age, skills related are incorporated in the learning outcomes. These skills have been added to cater for schools that have ICT facilities. The skills include the multimedia resources such as TV documentaries and Internet resources as well as the utilization of computer-related activities such as e-mail activities, networking and interacting with electronic courseware.

2.2 Bilingual Courseware for Disabled Students

The world uses English language as an international language for people to communicate with each other. Realizing the importance to learn this language, Malaysia has made an action to implement English for both Mathematics and Science or better known as 'Teaching of Mathematics in Mathematics and Science in English (ETeMS)'. In order to help the learning disabled students to learn this language in this subjects, teaching them in both Malay and English language is better. Back to the old days before the implementation of this new education system, the students are exposed to learn the subjects in Malay. So by helping them to learn in both languages, students may absorb the education syllabus much easier. Developing bilingual courseware is one of the effective ways to help the students in this issue. Students can always refer back and learn from the courseware to master the subjects in English.

There are an increasing number of nonprogrammers, such as language tutors, who would like to generate computer-based tutorials on their own, but they do not have the required technical expertise [29]. One major problem occurs when both the tutors and the students are monolinguals in their own language. Therefore, student-tutor dialogues are impossible. In order to overcome language barriers, the prototype also incorporate an ability to translate student-tutor queries. The main aim here is to enable the students - who are learning the language via computer-based tutorials - to communicate with the tutor without any need to be fluent in each other's language.

A group of researcher, Noornina Dahlan and Srba Cvetkovic from University of Sheffield has done a research about developing a bilingual prototype of interactive tutoring system by implementing English - Malay translation abilities [29]. They use

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Multimedia Toolbook 3.0 (MMTB) because it provides a single environment in which programming and presentations are on the same platform, a user-friendly interface can be created with ease, a natural language database can be created without linguistic experts, multimedia features can be included (if necessary), and, usage is immediate and convenient.

By using MMTB, the conceptual model of the prototype is very similar to the concept of an electronic book [30], with pages which can contain any combination of text, sound, and pictures. The two primary functions of the pages include information display and book control which is achieved by making certain parts of a page reactive so that when they are referenced. Some forms of control operation will take place, such as, page down, go to page (page number), go to previous page and exit. As a preliminary experiment, the prototype enables Malay monolingual tutors to generate tutorials without any programming knowledge, and the prototype also enables English monolingual students to learn Malay in a multiple domain environment. Additionally, the prototype enables the students to send queries without being fluent in Malay. At this stage of development, however, the reply from the tutor and the conversion from Malay to English are yet to be completed *(Refer Figure 2.1).*
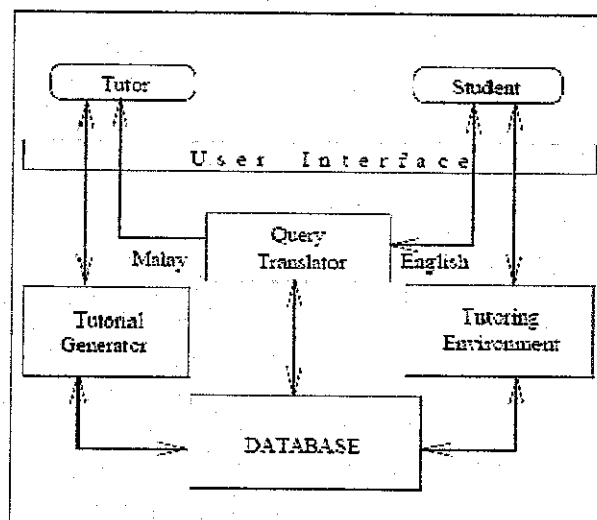

Figure 2.1 – An Overview of Prototype

2.3 Learning Disabilities

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There is no clear and widely accepted definition of "learning disabilities". Because of the multidisciplinary nature of the field, there is ongoing debate on the issue of definition, and there are currently at least 12 definitions that appear in the professional literature. These disparate definitions do agree on certain factors [31]:

1) The learning disabled have difficulties with academic achievement and progress. Discrepancies exist between a person's potential for learning and what he actually learns

2) The learning disabled show an uneven pattern of development (language development, physical development, academic development and perceptual development)

3) Learning problems are not due to environmental disadvantage

4) Learning problems are not due to mental retardation or emotional disturbance

2.3.1 "Early Warning Signs" of Learning Disabilities

Children with learning disabilities exhibit a wide range of symptoms. These include problems with reading, mathematics, comprehension, writing, spoken language, or reasoning abilities. Hyperactivity, inattention and perceptual coordination may also be associated with learning disabilities but are not learning disabilities themselves. The primary characteristic of a learning disability is a significant difference between a child's achievement in some areas and his or her overall intelligence. Learning disabilities typically affect five general areas [31]:

1) Spoken language: delays, disorders, and deviations in listening and speaking

2) Written language: difficulties with reading, writing and spelling

3) Arithmetic: difficult in performing arithmetic operations or in understanding basic concept

4) Reasoning: difficulty in organizing and integrating thoughts

5) Memory: difficulty in organizing and integrating thoughts

Among the symptoms commonly related to learning disabilities are [31]:

• Poor performance on group tests

• Difficulty discriminating size, shape and colour

• General awkwardness

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- Reversals in writing and reading
- Hyperactivity
- Easily confused by instruction
- Difficulty with temporal (time) concepts
- Overly distractible; difficult concentrating
- Difficulty making decision

2.3.2 Causes of Learning Disabilities

Little is currently known about the causes of learning disabilities. However, some general observations can be made [31]:

- Some children develop and mature at a slower rate than others in the same age group. As a result, they may not be able to do the expected school work. This kind of learning disability is called "maturational lag"
- Some children with normal vision and hearing may misinterpret everyday sights and sounds because some unexplained disorder of the nervous system
- Injuries before birth or in early childhood probably account for some later learning problems
- Children born prematurely and children who had medical problems soon after birth sometimes have learning disabilities
- Learning disabilities tend to run in families, so some learning disabilities maybe inherited
- Learning disabilities are more common in boys than girls, possibly because boys tend to be mature more slowly
- Some learning disabilities appear to be linked to the irregular spelling, pronunciation, and structure of the English language

2.4 Educating Disabled Children In Malaysia

Education for disabled children has dramatically increased as many public schools were built in early 1900s. This is due to impact of realization that these special children worth to live as normal person. By the 1920s, special education had become well established with its own curriculum and teachers throughout the nation [13].

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According to the Malaysian Ministry of Education, students with special needs are those who are visually handicapped or partially or fully deaf or suffer from the disability to learn (Akta Pendidikan 1996) [32]. Within most educational institutes there are a substantial number of students with varying disabilities. These might range from difficulty in reading to difficulty in attending the institute. Whatever their disability, it places a barrier between them and normal students especially on education. Reading difficulties constitute the most prevalent academic problem among students with learning difficulties (McNutt, 1980; Mercer, 1979) [33]. Kaluger and Kalson (1978) reported that an estimated 80% and 90% of all referrals for learning disability services are based on observed reading deficiencies [34]. These are the students that have been identified as suffering from physical-sensory deficiencies and learning disabilities. The Ministry of Education provides special education programmes for the three types of disabilities, namely, hearing, visual and learning disabilities [1].

Disabled students receive education materials much lesser and even slower compare to normal students. These special students do not exhibit normal or average learning pace like normal students do. Though technologies are running at slower pace for disabled students compared to normal students, there are improvements made by Malaysia's Ministry of Education to increase relevant education facilities to help these children. In 1920th, there were volunteers who were involved in opening schools for hearing and visual impaired. The Cabinet Committee Report that studies the Implementation of Education Policy through the Recommendatory 169 was the beginning of a clearer focus and emphasis on the development of Special Education in Malaysia [1]. This has developed the interest of Malaysia's Ministry of Education's Special Education Program to be aware of their full responsibilities in educating the disabled children and encouraging the involvement of volunteers.

The Malaysia Ministry of Education's Special Education Program (Program Pendidikan Khas Kementerian Pendidikan Malaysia) consists of [35]:

- Special Schools (Sekolah Khas) for students with vision and hearing disabilities.

- Special Education Integration Program (Program Pendidikan Khas Integrasi) is provided for children with learning, hearing and vision disabilities. The Program is carried out in normal primary and secondary school, as well as in technical/vocational secondary schools that use the withdrawal and partially inclusive approach to teach and learn.

The Special Education Integration Program is managed by the State Department of Education (Jabatan Pendidikan Negeri) while the Special Education Department (Jabatan Pendidikan Khas) is in charge of issues pertaining to policies and content. The organization has stated some conditions for students' entry into the Special Education School Program which are:

- Aged no less than 5 years (for Preschool Program)
- Aged 6+ to 14+ years (for Primary School Program)
- Aged 13+ to 19+ years (for Secondary School Program)
- Certified by medical doctor
- Can manage themselves (self-care) without the assistance of others.

Details below shows the duration of schooling:

- Length of primary schooling for children with special needs is 6 years
- Length of secondary schooling for children with special needs is 5 years
- This duration can be extended for a maximum of 2 years at any level, whether primary or secondary, depending on the needs of the student.

In Malaysia, all Special Primary Schools are academic-based. Facilities were provided at primary school level which includes hostel facilities and also free meals. Malaysia Ministry of Education's Special Education Program also gives students that are under the Special Education Integration Program options. They can take either the national curriculum or the alternative curriculum for their academic-basis.

2.5 Web accessibility and usability

Problems encountered by learning disabled participants were largely a result of inconsistencies in layout and in the modalities. Taking usability as a big issue for

courseware development, Andrew Swartz (2003) has wrote several guidelines that might be useful for creating courseware [36]. The following list below shows the guidelines and findings apply to courseware in general:

1) Relationship to textbook and course

Disabled students are not yet ready read long descriptions on printed book. They required someone to explain assisting them to learn on. Therefore, a develop courseware needs to ensure that parallel alignment between the text book and the course itself.

2) Immediate feedback

Good courseware will offered immediate feedback telling the students whether an answer was right or wrong. Having it this way, students will appreciate the exercises and learn faster.

3) Form of exercises

For disabled students, it is more sensitive in forming consistent form of the exercises, judging them mainly on whether they were too simple or complex. They are not like normal students who disliked questions that allowed for easy guesswork. They need some time to learn because majority of them are slow learner.

4) Number of exercises

A courseware for disabled must ensure that the learning process it is fun and entertaining. It is recommended having small numbers of exercises range to 4 until 10. This will help students to really understand the subjects.

5) Navigation and orientation

Some of these standard elements for navigation and orientation include:

- A persistent, consistent navigation mechanism, with the high-level choices in either a vertical or horizontal navigation bar. All key items should be visible on the bar, not hidden in a drop-down menu.
- A crumb-trail to show where in the navigation hierarchy the student is.
- While students should be allowed to travel through the material in any order they like, a sensible default order should be clear.
- Students expect every page to tell them what they "should" do next, and every page should end with a link to the next suggested page.

CHAPTER 3

METHODOLOGY

3.0 METHODOLOGY

A methodology is a set of methods that define the process and order of how the objective is to be achieved. Reeves (1992) believes there has been a paradigm shift from instructions to construction and that this has, in turn, reflected a change in methodologies from breaking down the project into single step tasks to a more holistic approach [37]. When designing programs for education, a less sequential methodology allowing for more feedback at all stages of the project is needed. The preferred method for education is the prototype, or a hybrid mix of prototype and an iterative process. For this project, I used the methodology as shown in *Table 3.1* and implement Prototype Model in "Construction" phase later on. Please refer *Table 3.1* and *Figure 3.1* to see the methodology used for this project.

Table 3.1: Methodology Used

Planning	Analysis	Design	Construction	Implementation	Maintenance
Research	User Requirement	Design Guidelines	Develop prototype	User Testing	Release Courseware
Visit and interview	Functional Requirement	Paper Prototyping	Evaluate Prototype	Feedback from User	User Survey
	Non-Functional Requirement	Design courseware		Add User Requirement	
	User Observation				

Implement Prototype Model In Construction Phase

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There are many hybrid extensions of the prototyping model for courseware. Carroll (1995) believes the incorporation of scenario based design helps recognize the tasks that are involved. Iteration can also be introduced throughout the whole operation as shown in *Figure 3.1* [37].
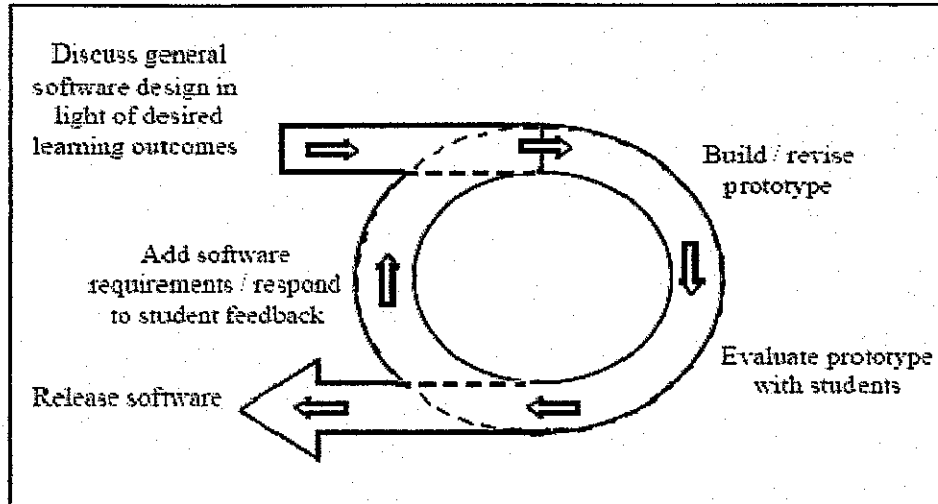

Figure 3.1: Methodology (Prototype based Model for Educational Prototype with student involvement)

(Pressman 1997, p. 3 as cited in Kennedy, 1998, p. 379)

The Prototype Model as shown in *Figure 3.1* is a methodology that was implemented in construction phase. This model is used because it will always come back to user to ensure that it meet user requirements [37]. Each module for the courseware were tested and evaluated informally by the developer and the target user. From the evaluation result, the strengths and weaknesses of the prototype could be accessed in order to improve the prototype and enhance the prototype to fulfill user's requirements.

This incremental development model involves developing the requirements and delivering the courseware incrementally. This allows the user to provide feedback for the latter parts of the program prior to their implementation. This iterative model provides the advantages of evolutionary prototyping, which gives evaluative feedback throughout the development process whilst maintaining a control over the direction of the project.

3.1. Planning

There are two elements under planning:

3.1.1. Research

To start developing the project, research must be done earlier to understand the learning process of disabled children in education system and what are the requirements needed to build a learning courseware specifically for them. Different types of disability might have some limitation to use a computer or to integrate with a system. Therefore, it is important to follow several guidelines to build the courseware as it is a very crucial issue for accessibility and usability. Some methods that can be used to do the research are:

1) Browse information on Internet: *UTP e-Resources, Articles, Journal, Research Papers and Theses etc.*
2) Visit to disabled school and having interview sessions (e.g. students or teachers)
3) Books and Magazines

3.1.2. Visit and Interview

Visits have been conducted twice at Sekolah Kebangsaaan Pengkalan Pegoh on and 22nd September 2008 and 4th February 2009. The purposes of the visits are:

1) To collect necessary details and information regarding the project during interview session
2) To get an experience in conducting the user testing done by Ms.Luxmi
3) To observe target user behavior (student with learning disabilities)
4) To get feedback from user
5) To collect and update user requirement
6) Continuously revise the product by conducting user testing and product evaluation

3.2. Analysis

Analysis is a phase of identifying complete description of system's behaviour to be developed [38]. Analysis need to be done to create a good learning courseware that meets the academic syllabus and user requirements. There are four elements under analysis section which are:

3.2.1. User Requirement

User requirement is something that user required for the courseware to do or to perform (functional requirement) and also to perform standard performance of the system (non-functional requirement). It is important to ask for user requirement to ensure that the courseware meet or exceed their expectation, hence, give satisfaction to the user. I have collected user requirements during the visits and continuously contact Ms. Jayenthi to update with the topic that she has covered in school.

3.2.2. Functional Requirement

At this stage, I have identified the functional requirement of the courseware. These are the type of behaviour user want the system to perform. The improvement of the existing courseware should be defined in term of what the courseware need to do [39]. For example, user required that the courseware should display the correct results and answers for every question. Therefore, I must ensure that the courseware should store all the answer for all problems in the learning material and the courseware should display the correct results.

3.2.3. Non-Functional Requirement

Non-Functional Requirement is restriction on the types of solutions that will meet the functional requirements [39]. It is relate to the behavior of the courseware. Examples of non-functional requirement are reliability and performance. The requirements are however quite simple, they are the restrictions or constraints to be placed on the system and how to build it. Their purpose is to restrict the number of solutions that will meet a set of requirements.

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3.2.4. User Observation

An observation was conducted during the visit to see the progress of students with learning disabilities and also the teachers in using computer. This method is used to get the general idea of the target users' experience in using the technology.

3.3. Design

Design is a process of problem-solving and planning for the courseware solutions [40]. Under design, there three elements namely:

3.3.1. Design Guidelines

To design the courseware, there are several guidelines that I must follow. The guidelines will ensure that the courseware will reduce accessibility and usability issues for the disabled. Things like proper use of fonts, font size, image, colours and audio must be prioritize by referring to Web Accessibility Initiative (WAI) guidelines. The syllabus provided by Ministry of Education used Bahasa Malaysia as the primary language to deliver the curriculum structure. But, the education system has now changed and used English in both Science and Mathematics subjects. Therefore, this courseware was designed with simple English language to help the students to learn this subject in English.

3.3.2. Paper Prototyping

A paper prototyping is a sketch on papers. It is better to design on paper first rather than start developing the courseware without proper planning. Having this paper prototype, it would be easier to design the navigation system and re-design the courseware without wasting too much time and money.

For this project, I planned to develop three sections which consist of exercises, games and learning sections *(Refer Figure 4.1)*. I have sketched the design of exercises and games using paper based prototyping Firstly, I designed 'Let's Do Some Exercises' section by creating different types of questions for different types

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of level. The questions designed must meet student's IQ level since the student absorbs the syllabus much slower compared to normal students.

Next, I designed 'Play Games' section. The games should be designed in Mathematics based form. Students can have fun by playing the games besides learning the subjects indirectly. I planned to design a game which follows the Math Games Multiplication concept from Quiz-Tree.com. Another game that I planned to implement in this courseware follows the 'Hang Bunny Game' concept. For this game, a bunny will be hanging to death if the player could not save it by answering all questions correctly. Please refer to *Appendix A-1* to see the 'Hang Bunny Game' paper prototype sample.

3.3.3. Design courseware

Most of the part for 'Fun Learning' section is design using Microsoft PowerPoint. After major part of the 'Let's Do Some Exercises' and 'Play Games' sections has been sketched in the paper, I transferred all the design into PowerPoint to make it easy for me to plan or make any changes regarding the project. I used Adobe Photoshop CS3 to design most of the courseware and crop some of the images from the PowerPoint using Microsoft Office Picture Manager. Some images are downloaded from Google and some are edited from my wallpapers.

3.4. Construction

As describe earlier, Prototype Model will be implemented in this phase. This phase is about revising the product and continuously getting feedback from the users. There are two sections under construction which are:

3.4.1. Develop Prototype

This is the stage where I start to develop the prototype using appropriate tools and software. The software used to develop this project is Microsoft Visual Basic 2005 Express Edition. After done designing the draft of the courseware in PowerPoint, I started to develop the courseware using VB 2005 Express Edition. The project has

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reached the first stage of releasing it to user to get the feedback from the user. User has evaluated the product and some changes have been made based on user's requirement. Several discussions, reviews and evaluation (verbal responses and form based) from users have been conducted continuously to revise the product and improve it in better ways.

3.4.2. Evaluate Prototype

During user testing with the teachers on 4th February 2009, the enhancement of the prototype was shown to the user for them to evaluate the product. The evaluation form consists of two types of forms:

1) Post Testing in *Appendix A-2*

2) Testing Questionnaires *Appendix A-3*

Notes were taken especially on the strengths and weaknesses of the courseware content development during the evaluation of the prototype so that further improvement can be made.

3.5. Implementation

For implementation, there are three elements under it which are:

3.5.1. User Testing

The first stage of user testing for the new version was conducted at the respective school on 4th February 2009. Before the testing session begins, I have given an overview about the product to the teachers and allowed them to test the courseware. While testing the courseware, we discussed briefly on the courseware functionality and I explained in details about the contents. During user testing, user used the courseware to perform a series of tasks while I observed on how they navigate with the courseware. We also revised all the questions provided in the courseware to ensure it meet the current school syllabus. Some of the content will be modified for future usage.

3.5.2. Feedback from User

Feedback forms are distributed to potential users to encourage them to give feedback about the courseware. It contains questions that asked what user's thought of the content (e.g. was it easy to read, was there too much or too little useful information, is the colour suitable or not and etc.).

3.5.3. Add User Requirement

Based from user testing and feedback from the user, I enhanced and revised the courseware. The added requirement is based on the analysis from user's feedback in order to develop the courseware that can perform better in its functionality.

3.6. Maintenance

Maintenance is the process where I need to do the modification of the courseware after delivering the prototype to correct faults, to improve performance or other attributes. It is also to ensure that the adaptation of courseware in the learning environment of the disabled. In maintenance, there are two elements which are:

3.6.1. Release Courseware

After the first release stage of the prototype has successfully launched and tested by the user, several improvements will be made before the official courseware is release to the targeted user. The courseware will then be used officially for SK Pengkalan Pegoh for the students' benefits.

3.6.2. User Survey

User survey is the final evaluation or feedback from the user about the product. It is a final stage of getting user opinions and comments on the release courseware. This step will look more on user satisfaction towards the end product.

3.7. Gantt Chart

3.7.1. Final Year Project Part I

ID	Task Name	Start	Finish	Duration	Aug 2008				Sep 2008				Oct 2008			
					8/3	8/10	8/17	8/24	8/31	9/7	9/14	9/21	9/28	10/5	10/12	10/19	10/26
1	Introduction	7/30/2008	8/8/2008	1.6w												
2	Research on Topic	8/11/2008	8/14/2008	.8w												
3	Preliminary Report	8/11/2008	8/15/2008	1w												
4	Interview the previous FYP Student	8/18/2008	8/25/2008	1.2w												
5	Research on topic	9/1/2008	9/11/2008	1.8w												
6	Progress Report	9/8/2008	9/12/2008	1w												
7	Visit and interview	9/15/2008	9/22/2008	1.2w												
8	Research Topic	9/23/2008	10/14/2008	3.2w												
9	Seminar 1	10/7/2008	10/15/2008	1.4w												
10	Research Topic	10/14/2008	10/27/2008	2w												
11	Interim Report	10/20/2008	10/28/2008	1.4w												
12	Oral Presentation	10/29/2008	11/3/2008	.8w												

Figure 3.2: Gantt chart for Final Year Project Part I

3.7.2 Final Year Project Part II

ID	Task Name	Start	Finish	Duration
1	Project Design Work - Paper prototyping - Draft the courseware in PowerPoint - Develop courseware	12/8/2008	1/23/2009	35d
2	Project Research Work - Update user requirement - Presentation pack for user testing - Prepare user questionnaire form - Submission of Progress Report	1/19/2009	2/4/2009	13d
3	Visit and User Testing - 2nd Visit to school - First user testing - Feedback from user - User questionnaire form - Follow up with user	2/4/2009	2/6/2009	3d
4	Project Design and Development- Modification on design - Add user requirement - Coding	2/9/2009	3/10/2009	22d
5	Project Research work (continues) - Edit progress report - Add new result - Submission Progress Report 2	3/6/2009	3/11/2009	4d
6	Project Design and Construction - Changes on courseware - Design - Coding - Debug and execution	3/12/2009	3/31/2009	14d
7	Pre-EDX	4/1/2009	4/8/2008	8d
8	Project Research work (continues) - Add information in final report - Submission Final Report	4/3/2009	4/13/2009	7d
9	EDX	4/22/2009	4/23/2009	2d
10	Oral Presentation	4/29/2009	4/30/2009	2d
11	Hard Bound Dissertation	5/1/2009	5/8/2009	6d

Figure 3.3: Gantt chart for Final Year Project Part II

3.8 Milestones for Fun Mathematics Content Development

END OF SEMESTER BREAK JULY 2008

No	Detail/Week	1	2	3	4	5	6	7	8	9
1	Review syllabus									
2	Create question									
3	Design/develop exercises using VB									
4	Design/develop training using VB									
5	Design/develop games using VB									
6	Revise/interview with target users									

Figure 3.4: Milestone for Fun Mathematics Content Development

Legend

Progress

Design Stage

Build/Revise Prototype

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3.9 Tools required

3.9.1 Hardware

Intel(R) Core(TM) 2 Duo CPU T5550 @ 1.83GHz, 3.00 GB of RAM

3.9.2 Software

- Microsoft Visual Basic 2005

  o To develop the system interface and the functions of the applications

- Adobe Photoshop CS3

  o To design the background interface for the courseware

- Microsoft PowerPoint

  o Draft the initial design of the courseware

- Microsoft Office Picture Manager

  o To crop the images designed in PowerPoint

- Sound Recorder

  o To record voice and integrate sounds with the courseware

CHAPTER 4

RESULT AND DISCUSSION

4.0 RESULT AND DISCUSSION

4.1 Result

Based from the research that has been done earlier, I managed to understand well about disabled students' education especially in Malaysia. The curriculum used in Special Schools and the Special Education Integration Program are the National Curriculum and the Alternative Curriculum. SK Pengkalan Pegoh is categorized under Special Education Program because it involves disabled students to participate in extra-curricular activities with normal students. I have conducted a discussion session with previous Final Year student, Ms. Luxmi to get the general idea and description of students with learning disabilities in SK Pengkalan Pegoh. From the collective details, I managed to identify type of disabilities of disabled students in the respective school as in *Table 4.1.*

Types of Disability	Range of age
1) Learning Disability	
2) Dyslexia	
3) Down Syndrome	6 years old to 12 years old
4) Autistic	
5) Speech Delay	
6) Hyper Active	

Table 4.1: Types of Disability and Range of Age of Disabled Students at SK Pengkalan Pegoh

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On 22nd September 2008, I managed to visit the school while accompanying Ms. Luxmi to de her user testing. We have conducted an informal interview and discussion with two of the school's teachers, Ms. Izhan (Bahasa Malaysia teacher) and Ms. Jeyanthi (Mathematics teacher). I was informed that a total number fourteen teachers was responsible to teach around fifty of disabled students this school. They have nine classes for overall subjects. The school does not separate the students based on their type of disabilities but they encourage the students to be mix up in one class despite of the disabilities that they have. A few students were selected to undergo Ms. Luxmi's user testing phase. During the execution of the courseware, the students were attracted with the welcoming page and voice instruction provided as the background sound. Throughout the testing process, I also discovered that the students were capable to understand some questions guided by Ms. Jeyanthi.

Ms. Luxmi mentioned that some of the students have the experienced of using the computer because most of them have computer at their home. Based on my observation, the experience does not include their expertise in integrating with any software product like Microsoft Word, PowerPoint and others. Basically, they just know how to move and click the mouse. Sometimes, they just click the mouse without understanding the instruction given. Although the school provides computer facilities but the usage of the computer is very limited for the students. The one hour computer lab session was held once in a week. There are only about three computers in the lab and two of them are already damaged. The computer lab for the disabled was very small and it only allows around five to six students to be in the lab at one time. The exposure of technologies is not very wide for this group of students. The students faced some problem to read and also to understand English but they still have the urge to learn. We also reviewed some of Mathematics CDs provided by Malaysia's Ministry of Education. I observed that some of the education CDs did apply bilingual concept. However, all of the CDs are mainly designed for normal students. Both Ms. Jeyanthi and Ms. Izhan did mention that the CD does not suit the IQ of their students and it was too advanced for them to learn and understand.

During the development phase of the courseware, I followed up with Ms. Jeyanthi about the update information on Mathematics' syllabus that she had covered in the school. During previous visit and interview on 22nd September 2008, I was informed

that the students have learned addition and subtraction and not beyond that syllabus. A month later, I contact Ms. Jeyanthi to know about the syllabus progress. I was informed that they have moved on to the next level and learn about multiplication of 2 and other topics like length, time and money. Please refer to *Appendix A-9* to see the sample of the school's syllabus in quizzes form.

The second visit was arranged on 4th February 2009. The purpose of this second visit is to do the user testing for the second version of this courseware and to get feedback from the user. The courseware has reached its first release stage. At this stage, I implemented the prototype methodology by revising the prototype continuously with the user and getting user requirement and feedback on the project. This time around, Ms. Anitha has joined together with Ms. Jeyanthi and Ms. Izhan to test and evaluate the courseware. Other teachers who taught other subjects like English and Kemahiran Hidup also joined the discussion which makes the user testing more interesting. About six survey forms have been distributed to the users but only one form was answered by both Ms. Anitha and Ms. Jeyanthi. Majorly, the teachers test the courseware while giving their comments and opinions verbally at the same time. The teachers revised all the questions and also the contents in the courseware. Some of the verbal responses and comments from the user are:

- Change some of the questions that are not suitable for the students. Please refer *Appendix A-4*
- Use Mathematical instruction and expression. Please refer *Appendix A-4*
- Positive feedback on overall courseware functionality and performance. Please refer *Appendix A-2* and *Appendix A-3*
- Do not provide answers for the questions because students may tend to see the answers without thinking how to find the solutions. If students get stuck, the teachers will guide them to solve the problem.

As mentioned by Giles B. [31], there many types of learning disabilities. The courseware is focusing several types of learning disabilities which are written language, reasoning, arithmetic and memory.

Written language is a condition where students have difficulties in reading, writing and spelling. The purpose of having the 'Count Number' and 'Spell Number' in learning section is to help Dyslexia students so that they can learn how to spell and how to read. The courseware also covered small part of memory. The learning section consists of 'Sing Along' which have some songs with education concept like Alphabets and 10 Little Indian Boy's. It can help the students to memorize alphabets letter and the sequence of numbers from one until ten. The exercises feature was developed to help the students to understand the basic concept of some mathematical operations. It is also to help the students to organize their thought so that they can think for the right answer when answering the questions. It is hoped that the new exercise feature can help the students who have Arithmetic and reasoning problems.

4.1.1 Story Boarding

With the objective of improving the delivering way of the current courseware, I need to clarify back with the previous developer of what need to be improved. Some of the enhancements that need to be considered are:

1) Develop a bilingual courseware (Malay-English) and make it optional to the users
2) Create fun mathematics games
3) Design a learning or training approach
4) Provide fun and relevant exercises

The overall idea is that the enhancement will focus on delivering mode and converting the older version of the courseware into a new version. For planning phase, I plan to implement games and training approaches for the courseware as shown in *Figure 4.1*:
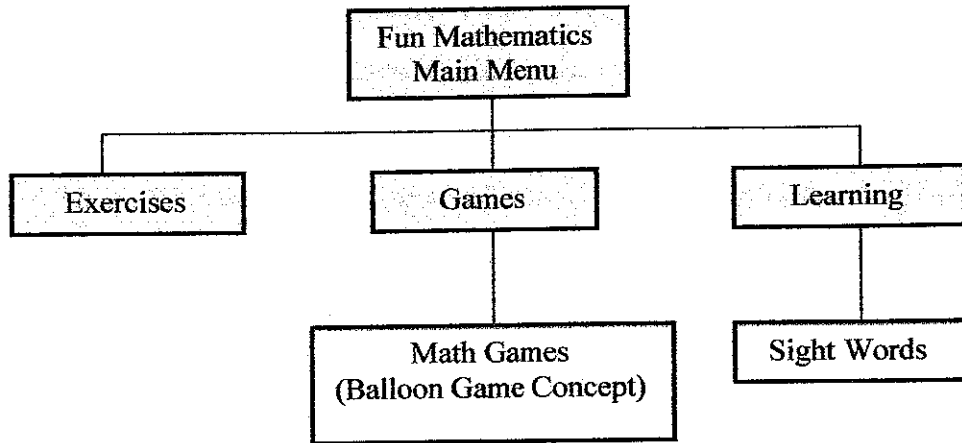
Figure 4.1: First (1st) Planning Phase for Fun Mathematics Version 2

- **Math Games**

As the game starts, the screen will display the question, a keypad for entering the answer, and a friendly robot that helps students in answering the questions correctly. The right answer will display a "Green" balloon and a smiley robot *(Refer Figure 4.2)*.
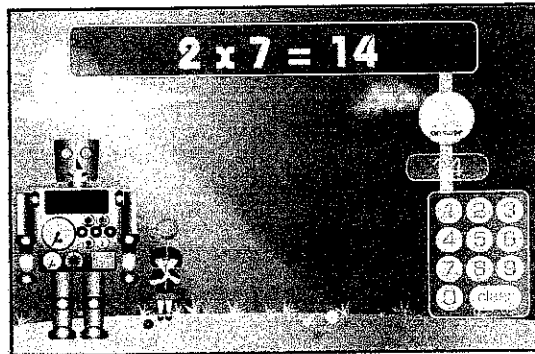
Figure 4.2: Sample Math Game

However, if the user answers the question wrongly, "Red" balloon will appear and the robot will show a sad expression *(Refer Figure 4.3)*.
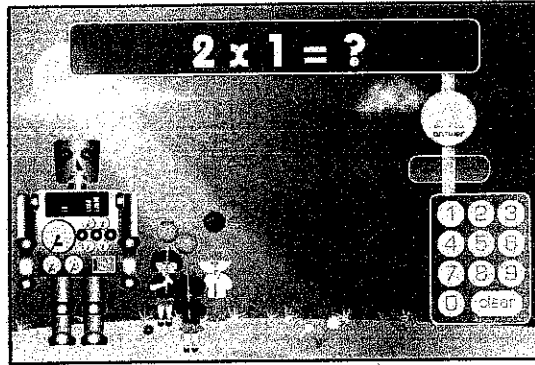
Figure 4.3: Sample Math Game

The quiz consists of 10 questions. Once all the questions are answered, the courseware will display the result.

- **Training**
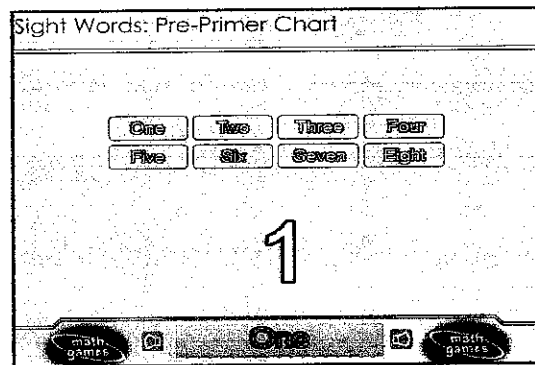
Figure 4.4: Sample Sight Words

The exercises are simple and it takes just a few seconds to learn how to use them *(Refer Figure 4.4)*. When the exercise starts, the student can click on any of the words provided in the gray box. Then, the students will hear one of the Sight Words and the number which represents the words will appear. Students may repeatedly learn and hear how to pronounce words by clicking on the speaker icon besides the blue box that displays the chosen word.

Throughout the process of developing the courseware, I have started to enhance the courseware using VB 2005 Express Edition after initially planning and designing the

courseware using PowerPoint. The design phase started with developing the ideas of what additional material needs to be implemented in the current courseware to help the students understand better. Malaysian Ministry of Education has introduced new education approach whereby Mathematics and Science subjects should be taught in English. Therefore, the basic platform is to help the students to know the alphabets, spell and learn how to read in English. Figure below shows the final plan and brief overview of the courseware *(Refer Figure 4.5)*:
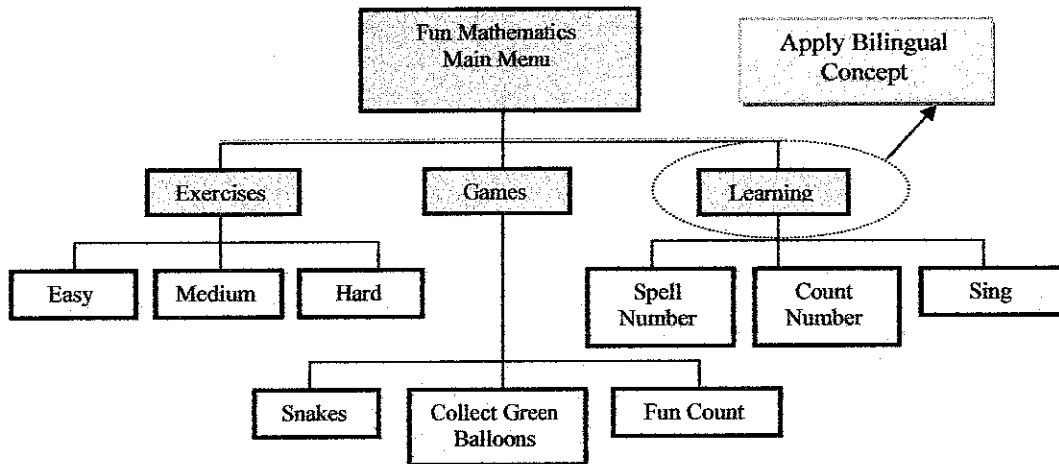
Figure 4.5: Second (2nd) Planning Phase for Fun Mathematics Version 2

Figure 4.6 shows the version 2 of Fun Mathematics homepage. Every page in this courseware is instructed with a voice that read the instruction and helps user to navigate with the courseware.
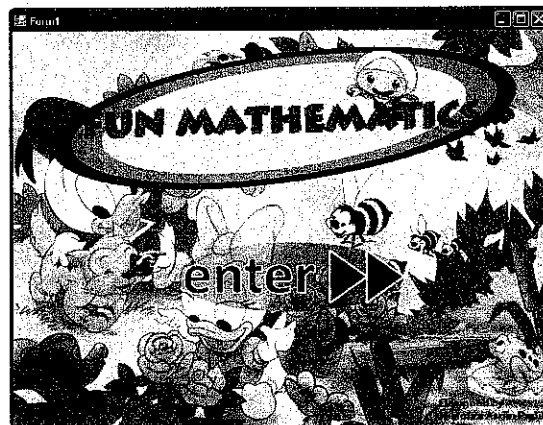
Figure 4.6: Fun Mathematics Version 2 Homepage

I have come out with three main sections for the main menu *(Refer Figure 4.7)* which are:

Figure 4.7: Fun Mathematics Version 2 Main Menu

1) Fun Learning Section

Fun Learning section is one of method that will be implemented in this courseware to improve the contents delivery. This section will help the students to learn the basic knowledge in Mathematics by getting to know the numbers, how to count, how to spell and read, and having fun with songs that relates to Mathematics. It applies bilingual concept where students can learn either in Bahasa Malaysia or English. Giving an option for the students to learn in two different languages is helpful because students may expand their knowledge in these two languages for Mathematics subject. Please refer *Figure 4.8*.
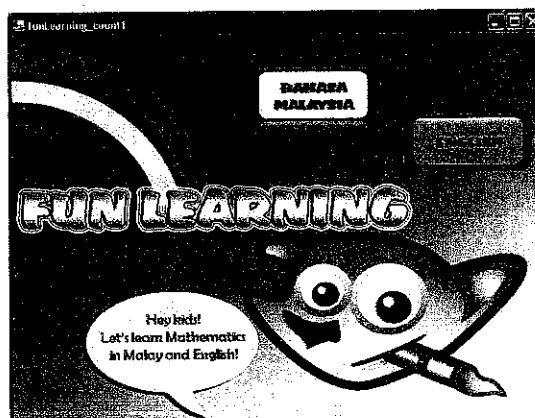
Figure 4.8: Bilingual Version

This section consists of three sub-sections which are:

1) Count Number

Students can learn how to count numbers and also learn to read indirectly. User can click button 'replay' to repeat the voice. Please refer *Figure 4.9.*
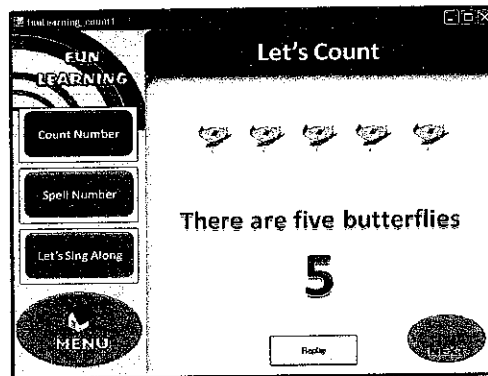
Figure 4.9: Sample Count Number

2) Spell Number

User can choose the range of the numbers (for example, from one to five) on the main page of this activity. Then, the page displays the number from one to five. Students can know the numbers and how to spell them correctly. They can choose to replay the voice to hear and learn how to pronounce the words and also spell the numbers correctly. Indirectly, this method can help the students to know the alphabets. Please refer *Figure 4.10.*

Figure 4.10: Sample Spell Number

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3) Let's Sing Along

Singing is one way to help students to learn and memorize easily. The courseware will able to play video songs. I download the videos song from YouTube.com and convert the file into .mpg so that it can be display in the courseware interface using VB. I choose several songs which relate to Mathematics like 'Five Little Monkey', 'Ten Little Indians', 'Count Until 20' and so on. Besides that, I also add 'Alphabets' song so that students will know the alphabet letters. For Malay song, I inserted video songs like 'Lagu Tiga Kupang', 'Anak Ayam' and others. Please refer *Figure 4.11* to see the sample interface and *Appendix A-5* to see the codes on how to play video using VB.
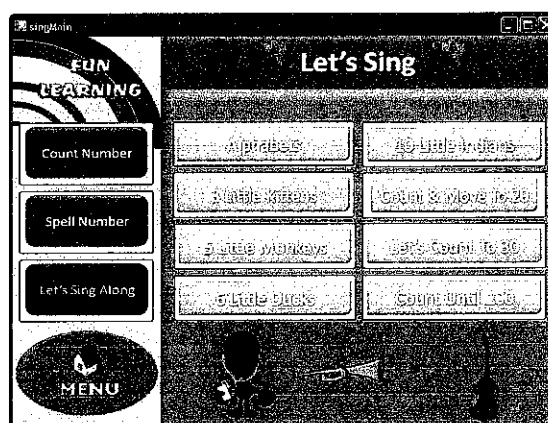
Figure 4.11: Sample Let's Sing Along

2) Let's Do Some Exercises Section

This section applies the same concept as the previous courseware done by Ms. Luxmi. However, the contents are different. Every page has the speaker to read the question. By doing it this way, students can indirectly learn how to speak, pronounce and read in English. For this section, user may have the options to do the exercises for different set of questions (Addition, Division, Multiplication, Subtraction, Length, Time, and Money) in three different levels (Easy, Medium or Hard). Each set in easy and medium level has four questions *(Refer Figure 4.12* and *Figure 4.13)*. For hard level, it consists of nine questions. The number of the questions should be between four to ten questions to avoid bored among the students [36].

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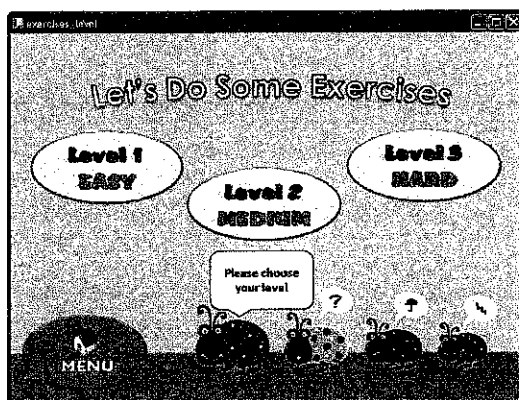
Figure 4.12: Different levels for 'Let's Do Some Exercises' section
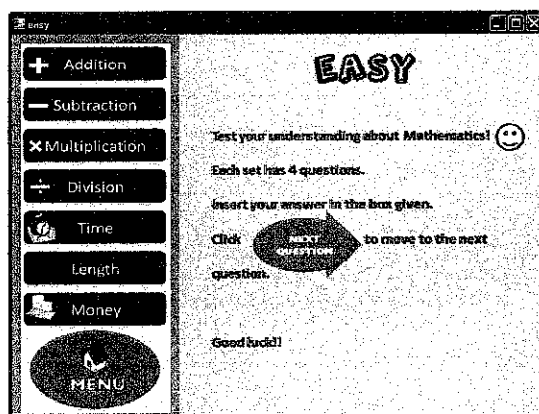
Figure 4.13: Multiple set of questions in 'Let's Do Some Exercises'

At first, I implemented the same concept as applied by Ms. Luxmi for exercise feature where user can always check their answer on every question by clicking "Check Button" answer *(Refer Figure 4.14)*. But, after revising the courseware with the teachers, I changed the courseware by excluding the check button answer. The advantage is that students will not always look at the answer without trying to solve the problem first. Besides that, user can always repeat the problem questions until they manage to answer it.
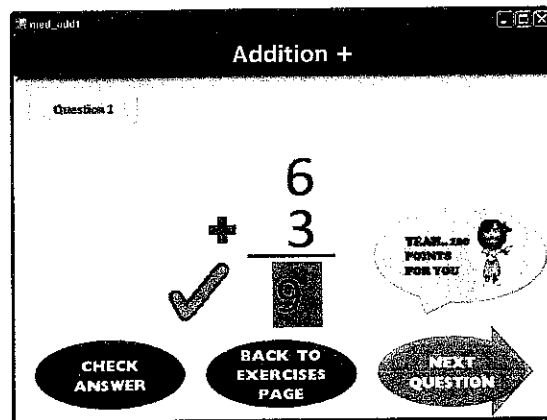
Figure 4.14: Sample of question with "Check Answer" button

Below is the process flow for this section:

1) User needs to insert their answer in the textbox. Some questions may require the user to click their answer in check box.
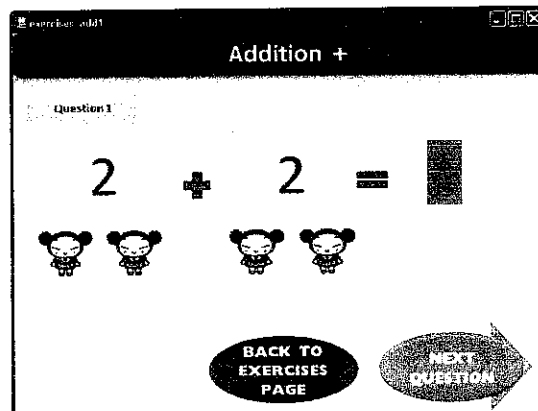
Figure 4.15: Sample of "Easy" level Addition question

2) If user does not insert an answer and click on "Next Button" question, the courseware will prompt a message box to remind user to insert their answer.

3) After user has inserted their answer, they can move on to the next question. It is optional for the user to always go back to exercise main page in case they cannot answer the questions, getting bored or they want to try another exercises or activities.

4) After user has completed answer all the questions, the courseware will display the result of the exercise *(Refer Figure 4.16)*. Please refer *Appendix A-6* to see the codes on how to calculate the result.
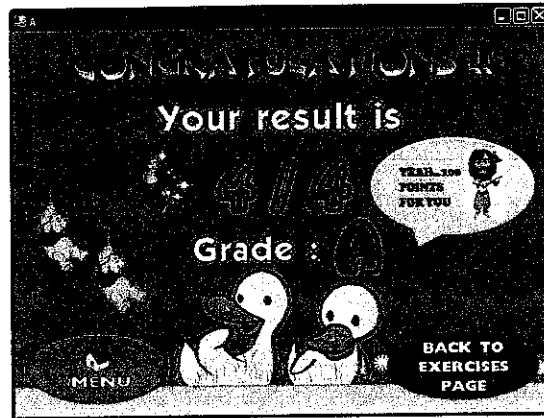
Figure 4.16: Result Page

Each level contains different type of questions which suits the students IQ level. After user has answered all the questions, the courseware will display the result.

3) Play Games

This section is another method to enhance the way to deliver the contents of the existing courseware. Games have the power to entertain children while they learn. I decided to include three games for this courseware which are:

1) Snakes

This game consists of two levels. User can always choose to play in either level. If user get all corrects, they can choose to move to Level 2. If user answers one of the questions wrongly, the game displays game over. *Figure 4.17* shows the sample of the game interface.
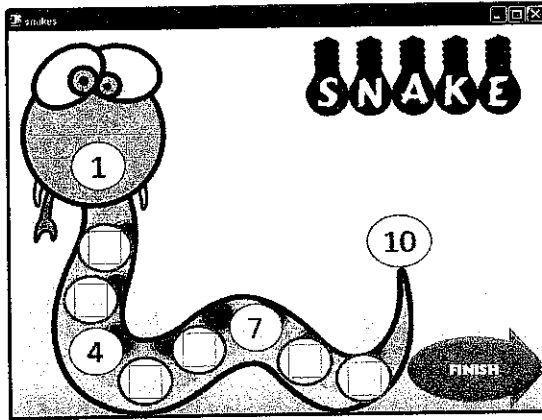
Figure 4.17: Sample Snakes Game

2) Fun Count

Student needs to count the numbers of the animals and flowers in the diagram given *(Refer Figure 4.18)*. If they can get all corrects, the courseware will display congratulation page to the player. Else, the game is game over.

Figure 4.18: Sample Fun Count Game

3) Collect the Green Balloons

The concept applies is the same as stated in 4.1.1 Story Boarding under Math Games. It consists of two levels. User can choose to play in either level. For this game, user needs to collect all green balloons by answering each question correctly. Once they answer it wrongly, they will get a red balloon. User can choose to move to Level 2 if they answer all questions correctly and get all

green balloons. Else, the game is over. Please refer to *Figure 4.19* to see the sample of the game interface.
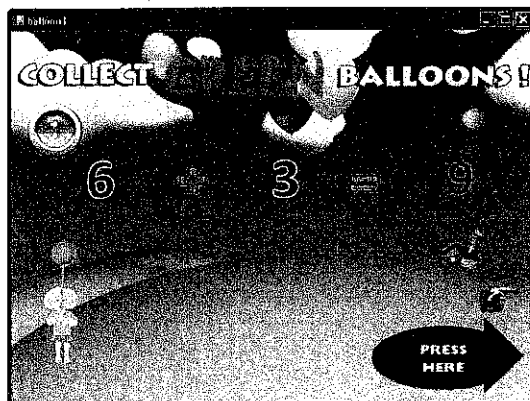
Figure 4.19: Sample Collect Green Ballons Game

I encountered some problems during program debugging process. The system could not load the sound resources because there are too many sound files which make the loading process become slower. All the sound files were corrupted due to loading error. I find the alternative way to solve the problem by directing it to the path (location) where it contains the name of the sound file. Please see *Appendix A-7* to see the codes on how to play the sound in the background without having to load the sound in VB resources.

4.2 Discussion

Fun Mathematics courseware used English as primary language to convey the message to the users. One of the ways to improve the courseware is to give users an option to choose Malay or English language for the courseware and make it as a bilingual courseware. It is beneficial to the students because they can learn Mathematics in both languages.

Reading is one of the most critical skills taught at school. It is virtually impossible for a person to live a productive life in our society without being literate. Children with reading difficulties will undoubtedly have trouble mastering nearly all school subjects. Based on the reviews concerning reading issues that I had gone through the

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previous courseware, I come out with the idea of developing a learning approach called Sight Words under Fun Learning section. Developing the Sight Words will eventually teach the students how to read and spell both in English and Malay language. Conversely, children will acquire one of the most basic skills needed because students are expected to be able to read simple material in order to continue their education. After the stage of designing and developing the product, I realized that I need to include more learning methods under Fun Learning section. Therefore, I have come out with three learning methods called Count Number, Spell Number and Let's Sing Along in Fun Learning section. This three learning methods will covered my initiatives to implement the Sight Words in better ways.

To ensure that this courseware is valuable to users, it must contains any form of exercises that will test students understanding in Mathematics. Initially, I followed the concept applied by Ms. Luxmi by having 'Check Answer' button. User can always check their answer by clicking on the button after they have answered the question. But, after revising the product, I have excluded the 'Check Answer' button because the teachers want their students to think on how to get the answer. Students can always learn from their mistake if they answer the question wrongly. The teachers said that they can always guide their students on how to solve the problem questions.

The exercises fall under 'Let's Do Some Exercises' section. In the previous version of this courseware, the developer included all topics in Mathematics in every level for the exercises. This might be hard for the student to capture the information given. In my opinion, it is better to separate the topics. For example, if user wants to do the exercises, they can have the options to choose the topics like addition, subtraction, multiplication and so on. With this way, students can gain more understanding for every topic and master the Mathematical operations. The topics are separated in two levels, Level 1 (Easy) and Level 2 (Medium). After students master in this two levels, they can move on to Level 3 (Hard) where the questions will mix up all topics and Mathematical operations. It is important to strategize the way of delivering the contents so that students can fully understand the subject.

One of the most important goals to meet the objectives of varying the delivery mode is to design Mathematics concept games. Students will tend to be bored with education software or courseware that focuses mainly on learning basis. Designing challenges and fun games may develop students' learning interests in this subject. I have come out with three different types of games. The games will test students' skills on memorizing the numbers, count and encourage them to think.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

As a conclusion, the Fun Mathematics courseware has been design and successfully develops for users in SK Pengkalan Pegoh. However, it is still need to be improved and tested before it could be delivered as final release. The expected improvement of the prototype will implement various learning and delivering approach by integrating various elements of multimedia. The courseware prototype can create an alternative medium and a new approach in students learning environment. This courseware is expected to contribute in learning and teaching Mathematics and hopefully, it react as a catalyst for the implementation of technology for this respective school. It is hoped that the content development improvement will help in enhancing the teacher's teaching process, thus resolving the "Education for All" issue. Although the courseware might not be perfect to all users, but it does returns benefits in term of encouraging better understanding on Mathematic subject, providing opportunity to disabled students to communicate with the technologies, reducing the gap of normal and disabled people in syllabus structure and adapting fun learning process for the disabled.

5.2 Recommendation

The courseware can be improved in a lot more ways in order to provide a better learning environment for the disabled students. Some of my recommendations are:

- Build the courseware using Flash because Flash have more animation which can attract the students
- Versatile the product into numerous subject like Bahasa Malaysia, English, Science and others specifically for the disabled students
- Build a bilingual concept courseware for Science and Mathematics subjects because nowadays both subjects are taught in English

- Connect the courseware to the database so that it would not repeat the same content which can cause user getting bored
- Add more features to the courseware. For example, build a 'Test' feature where user can do the test within specific time based on the level of difficulties
- Improve the existing content by expanding the syllabus which have not been covered in respective school for future usage

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APPENDICES

Appendix A-1 –Paper Prototype Samples
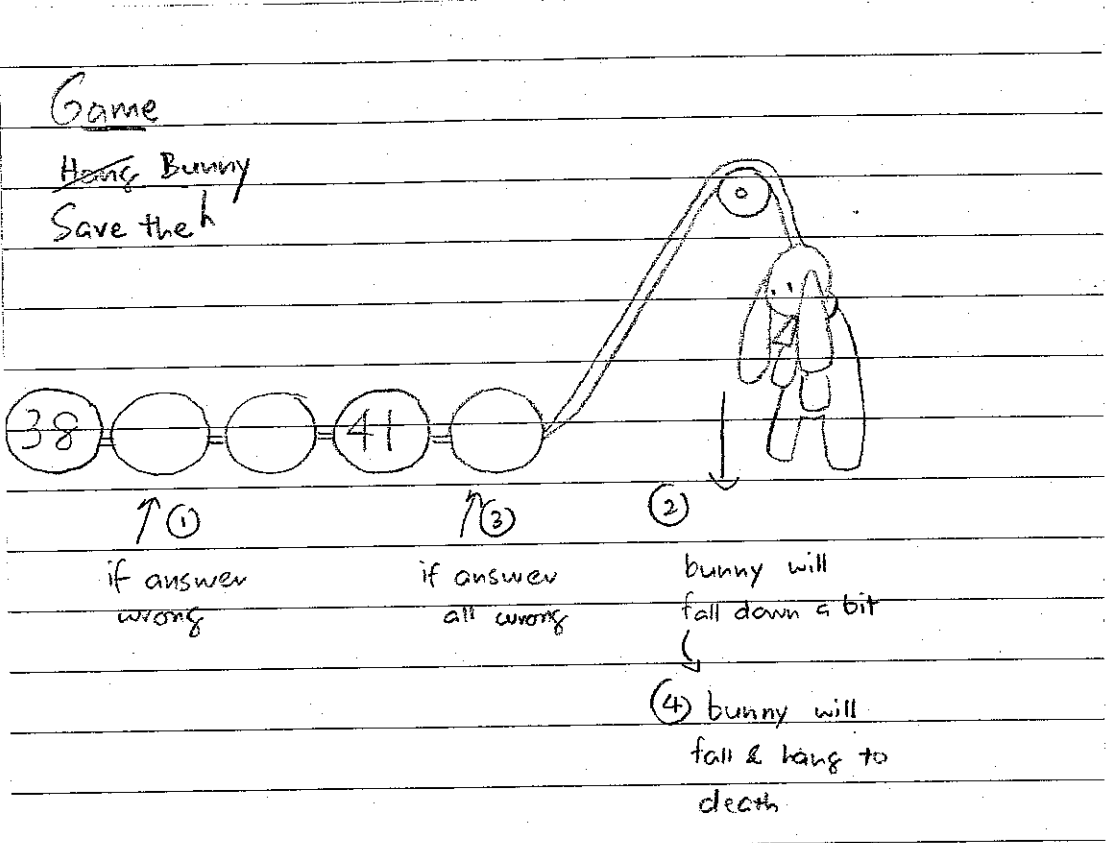
Game

~~Hang~~ Bunny

Save the ^h

38 ◯ ◯ 41 ◯

↑①   ↑③   ②

if answer   if answer   bunny will

wrong   all wrong   fall down a bit

④ bunny will

fall & hang to

death

Appendix A-1 –Paper Prototype Samples

J medium hard

(Exercises)

(Learning)   (Games)

Let's   sing along!   Snake   IQ Test
count   Learn
        to spell no.

FUN MATHEMATICS WORLD.

Learning
count no
spell no.
~~write~~ sing along
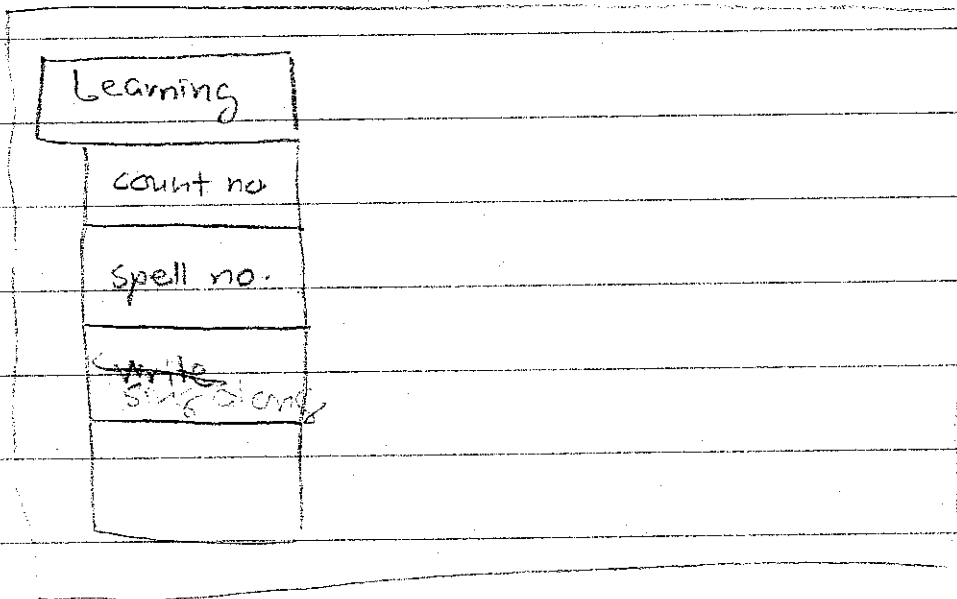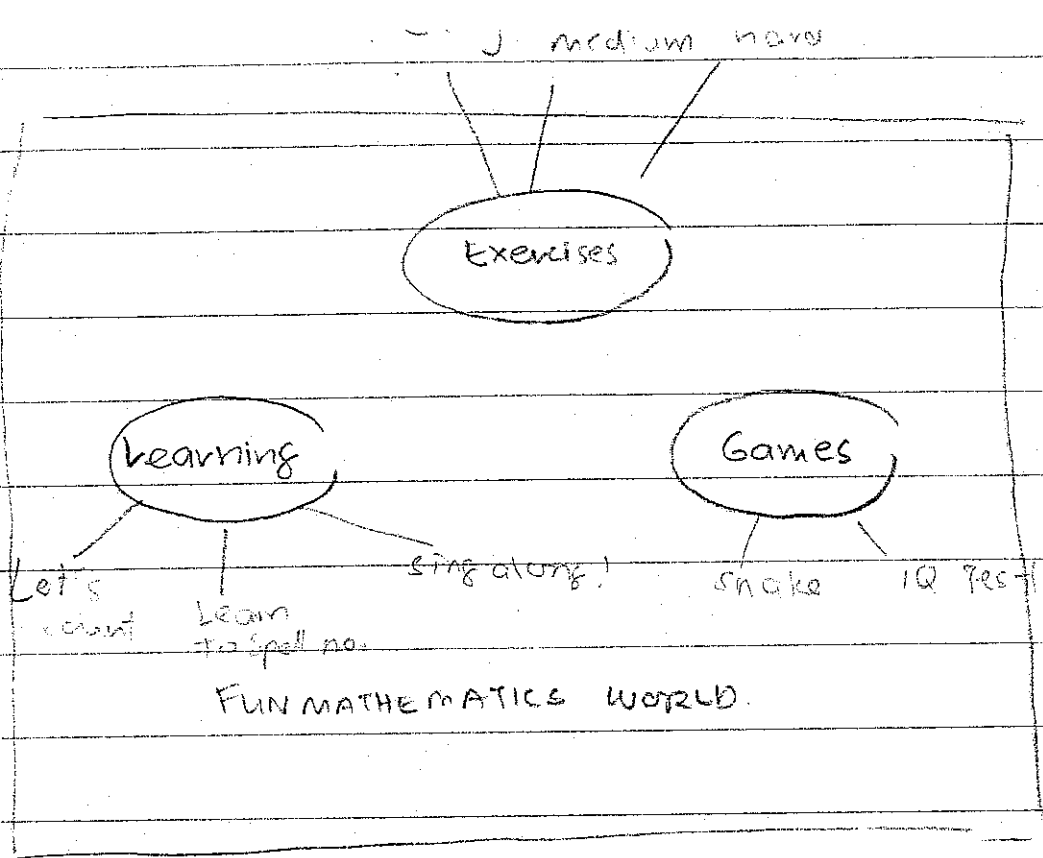
Exercises
- Addition
- Subtraction
- Multiplication
- Division
- Time
- Length
- Money

Games
- Snakes
- Dollar

Learning.

count no.

(1) 🍎

(2) 🍎 🍎

(3) 🍎 🍎 🍎
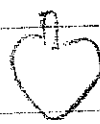
| Ten | |

Spell no.

(1) 🍎
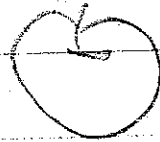
one
_____

◁   ▷

write

Three apples.

names:

Andles

44   46
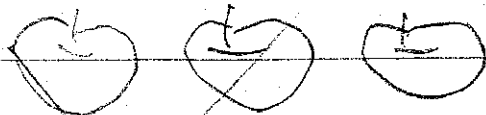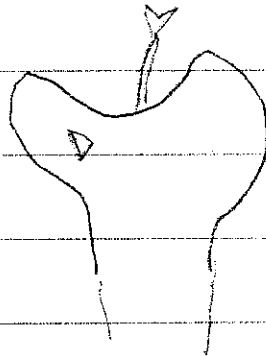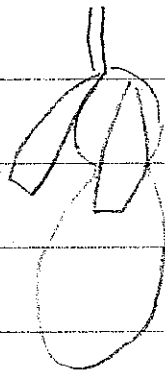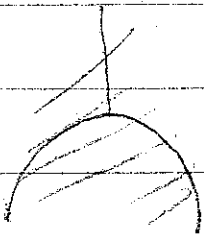
Let's Do Some Exercises

(Level 1 Easy)   (Level 2 medium)   (Level 3 Hard)

| Let's Do Some Exercises | Level 1 : Easy   Instruction |

1) | Addition |

2) Subtraction

x) Multiplication

3) Division

4) Time

☐ Length

5) ☐ Money

Question 1

🝙 🝙 + 🝙 🝙 = ☐

2   2

🝙 🝙
🝙 🝙

(check answer)   (next ques)

Q1

Q2) 5 + 4 = ☐

Q3) 7 + 2 = ☐

Q4) 3 + 1 = ☐

wat 1 window   Q5) 6 + 2 = ☐

Subtraction	Q2)	5 − 3 =	☐
	Q3)	8 − 4 =	☐
	Q4)	9 − 5 =	☐
	Q5)	6 − 1 =	☐

(check my answer)   (next qu)   (next ques)   (Exit to exercise)

multiplication

	Q1)	1 × 3 =	☐
	Q2)	2 × 4 =	☐
	Q3)	3 × 3 =	☐
	Q4)	5 × 2 =	☐
	Q5)	6 × 2 =	☐

division	Q1)	4 ÷ 1 =	
	Q2)	10 ÷ 5 = 2 ÷ 2	
	Q3)	6 ÷ 3 =	
	Q4)	8 ÷ 2 =	
	Q5)	5 ÷ 5 =	

	Time			
9sy		Q.1)	(circle)	= 1.00 p.m
		Q2)	3	☀ = 3.00 p.m
		Q3)	4	☾★ = 7$.00 p.m
		Q4)	10	☀ = 10.00 a.m
		Q5)	8 ←	☀ = 8.00 a.m

	Length	
		(box with scribble)

	Money		
	Q1)	km 1	
	Q2)	50¢ + 10¢	=
	Q3)	20¢ + 50¢	=
	Q4)	10¢ + 10¢	=
	Q5)	20¢ + 10¢	=

Addition:

Q1)   10
    + 4

Q2)   6
    + 3

Q3)   ~~2~~ + □

Q4)   8 + □
    +

Q5)   + (illegible)

subtraction

Q1)   ~~ ~~ 12
        − 2

Q2)   ~~50~~ 10
      −   − 5

Q3)   □

Q4)   7 −

Q5)   3

multiplication

Q1)
$$\begin{array}{r} \cancel{6}2 \\ \times\ 4 \\ \hline \end{array}$$

Q2)
$$\times \cancel{32}\ \ \times\frac{3}{5}$$

Q3) $\square \times 2 =$

Q4) $\square \times 3 =$

Q5)

Division

$3 \div \square = 1$

Q1) $2\overline{)8}$

Q2) $2\overline{)10}$

Q3)

Q4) 3

Q5)

$\square \div 2 = 4$

Time

Q1) 10:00   [ ] o'clock   Q4) 4:15

Q2) 8:00   Q5) 7:00
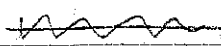
Q3) 2:30

⓪ Length.

Length

Write long or short

Q1)

a)

b)

Q2)

a)

b)
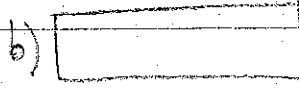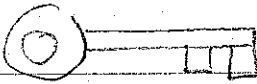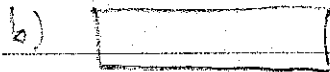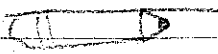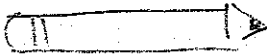
Choose the taller objects

Q3) O ⬡ O ⬡

O O

Q4) O O
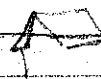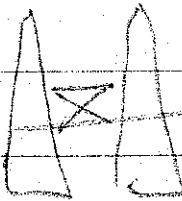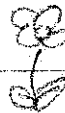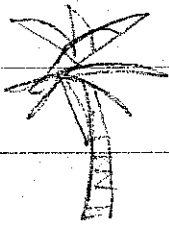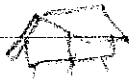
(money) count & write the correct amount of money

Q1) | RM 1 | _____ | |

Q2) (50 ¢)   (̶ ̶2̶0̶ ̶¢̶)   = RM | 0 . 50 | sen

Q2) (50 ¢)   (20 ¢)   = RM | 0 . 70 | sen

Q3) (50 ¢) (20 ¢) (10 ¢)   = RM 0 . | 80 | sen
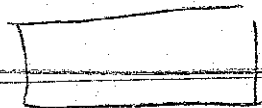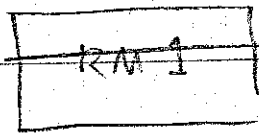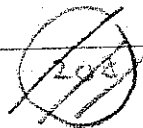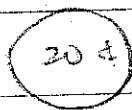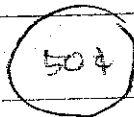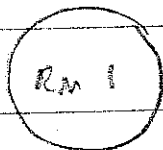
Q4) (RM 1)   = RM | ☐ | . 00

Addition

Hard

Q1) write in numerals.

~~twenty-one~~ = fourteen = [ ]

Q2) ~~circle~~ choose the smallest numbers.

○ 20

○ 16

○ 5

Q3) Aminah eats ~~⅛~~ 2 candies. ~~piece of cake.~~

She eats another 5 candies.

How many candies does Aminah eat?

[ ] + [ ] = [ ]

Q4)

| Ali | ☆ ☆ |
| Abu | ☆ ☆ ☆ |

How many stars does Ali and Abu have?

[ ] + [ ] = [ ]

Q5) $4 - \boxed{} - 2 = 1$

Q6)
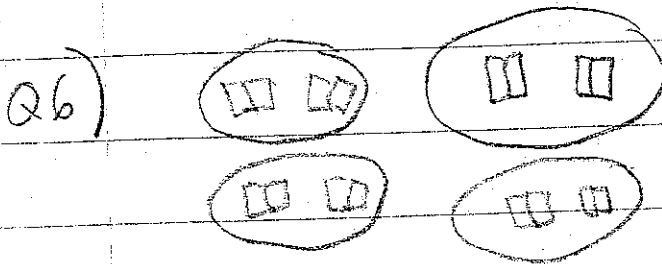
How many books are there?

$\boxed{}$

Q7) $4\overline{)12}$ with $\boxed{}$ as quotient

Q8) $\boxed{RM\ 1} + \bigcirc{50¢} = RM \boxed{} . \boxed{}$

Q9) ~~write longer than~~

Q10) what day falls after tuesday?

Tuesday → ?

Wednesday
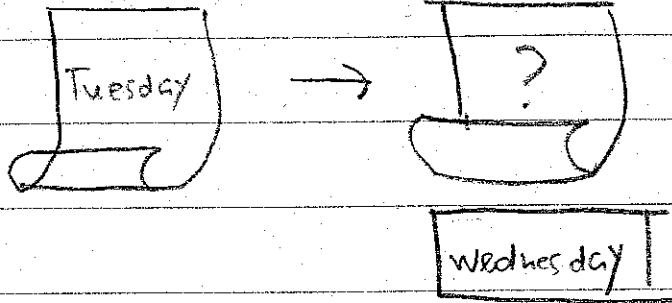
Appendix A-2 – Questionnaire Sample: Result of Post Testing

Post Testing

Name: _Ms. Jayanthi & Ms. Anitha_

Please <u>tick</u> either <u>ONE</u>.

In what aspects do you think that this new version courseware is better than the previous courseware?

Criteria	Version 2 (New Version)	Version 1 (Old version)
Primary Homepage	✓	
Varity of activities provided in the courseware	✓	
Fun activities and learning	✓	
Good amount of activities	✓	
Good contents and information	✓	
Provide better practices to learn and understand Mathematics	✓	
Better in delivering the contents of the courseware	✓	
More fun to explore	✓	
Attractive	✓	
Easy to understand	✓	
Easy to explore	✓	
Easy to read	✓	
Good font size	✓	
Better design (graphics, text, colours)	✓	

Appendix A-3 – Questionnaire Sample: Result of Testing Questionnaire

Testing Questionnaires

Name: _____

1) How would you rate the new version of this product?
   a. Excellent
   b. Good ✗
   c. Fair
   d. Poor
   Comments (if any): _____

2) Do you accept the new version of the courseware to be one of learning method for the slow learner students?
   a. Yes ✗
   b. No

3) Do you think that the new version of the courseware have more potential than the previous courseware?
   a. Yes ✗
   b. No
   Comments (if any): _____

4) Do you think that the new version of this courseware would help the disabled students to understand better in Mathematics?
   a. Yes ✗
   b. No
   Comments (if any): _____

5) What is your overall impression about the new version of this product?
   a. Over expectation
   b. Meet expectation ✗
   c. Below Expectation

6) What are the changes/criticizes that you would like to make to improve this product?

   _____
   _____
   _____
   _____
   _____
   _____

Appendix A-4 – Sample: Changes made by the teachers

should be include in Appendix, and refer.

Hard

Question 9

What is the day **AFTER** Tuesday?

TUESDAY → ?

Hard

Ali

Abu

- Q4) How many stars does Ali and Abu have?

+ 3 =

- =

- Q5) 4   2   1

(handwritten, margin) + just 1 lesson?

Hard

- Q6) How many apples are they?

× = 4

Hard

- Q7) Fill the answer in the box below

4) 8

- Q8) Find the total of the money

+ 50 = RM

Hard
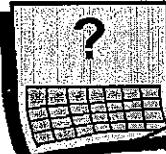
- Q9) What is the day **AFTER** Tuesday?

TUESDAY → ?

(handwritten, margin) What day after comes? What day comes Tues?

Question 3

Insert the value of the coin:

50 ✚ 20

= RM 0.   sen
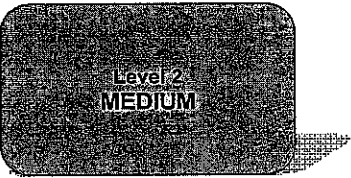
Question 4

Insert the value of the money:

= RM   .00

Level 2
MEDIUM

↑

Let's Do Some
Exercises

➕ Addition
➖ Subtraction
✖ Multiplication
➗ Division
🕐 Time
Length
💰 Money

Test your understanding about Mathematic 😊

Each set has 4 questions.

Insert your answer in the box given.

Click CHECK ANSWER to check your answer.

Click NEXT QUESTION to move to the next question.

Good Luck!!

Additions up to 50
Multiplication (Times 2 only)

Addition ✚

Question 1

6
✚ 3

Addition ✚

Question 2

10
✚ 4

Appendix A-5 – Coding: How to Play Video Using VB

1) Display 'Alphabets' video song

```
Public Class alphabet

    Inherits System.Windows.Forms.Form

    Private Sub Form_Load(ByVal sender As System.Object, _
        ByVal e As System.EventArgs) Handles MyBase.Load

      ' Open the file from location path.
        MMC.FileName = "C:\Program Files\Total Video
Converter\Converted\Alphabet.mpg"

        MMC.Command = "Open"

        ' Hide the playback bar.
        MMC.Visible = True

        ' Show video in the PictureBox pic.
        MMC.hWndDisplay = pic.Handle.ToInt32()
    End Sub
```

2) Play command for 'Alphabets' video song

```
Private Sub cmdPlay_Click(ByVal sender As System.Object, _
        ByVal e As System.EventArgs) Handles cmdPlay.Click
        ' Rewind to the beginning.
        MMC.Command = "Prev"

        ' Start playback.
        MMC.Command = "Play"
    End Sub
```

3) Stop command for 'Alphabets' video song

```
Private Sub cmdStop_Click(ByVal sender As System.Object, _
        ByVal e As System.EventArgs) Handles cmdStop.Click
        ' Stop playback.
        MMC.Command = "Stop"
    End Sub
```

Appendix A-6 – Coding: Calculate Result for 'Let's Do Some Exercises' section

Sample on how to calculate result for Addition - Question 1 - Easy Level

1) Create a module. It is an area without any screen where everybody can use

```
Module Common

        'declaration to display result
        Public DisplayAddResult As Integer

        'retrive value from user for question no.1
        Public AddAQ1 As Integer

'declare function - use function to hold the answer and calculate
result
Public Function ResultAdd()

        'declare variable to set answer for question no.1
          Dim vAnswerQ1 As Integer
        'declare variable for result
          Dim vResult As Integer
        'set the answer for question no.1
          vAnswerQ1 = 4
        'set result value to 0
          vResult = 0

        'set the condition to calculate marks
          If AddAQ1 = vAnswerQ1 Then
              vResult = vResult + 1
          End If

        'Passing result value to display related "Result of Excercise
        screen"
          DisplayAddResult = vResult

        'Reseting value to 0 / default
          vResult = 0
          AddAQ1 = 0

          Return 0

End Function
```

2) Code for 'Next Question' button. The courseware will hold the answer of question 1 after user clicks this button to answer the next question.

```
'declare variable ans to hold the answer inserted in the text box
Dim ans As String
        ans = TextBox1.Text

        If TextBox1.Text = "" Then
            MsgBox(" Please insert your answer!",
MsgBoxStyle.Information, "Fun Mathematics")
        Else
```

```vb
        AddAQ1 = ans 'retrive user answer and check it with the
answer set in the module. Function in module will began calculating
the result
        add_Q2.Show()
        Me.Hide()
    End If
```

Appendix A-7 – Coding: How to Play Background Audio in VB

Previous code

```
'the file sound named pls select the menu.wav must be loaded in
Resources first in order to use this code. It caused the program to
load longer during debugging process

My.Computer.Audio.Play(My.Resources.pls_select_the_menu,
AudioPlayMode.Background)
```

Current code

```
'locate the path to play the audio without having to load the sound
files in Resources

My.Computer.Audio.Play("C:\Program Files\Total Video
Converter\Converted\Aruiteru.wav", _
                    AudioPlayMode.Background)
```

Appendix A-8 -- Sample: Syllabus provided by Malaysia's Ministry of Education

OBJECTIVE	CONTENT	SUGGESTED TEACHING AND ACTIVITIES	TEACHING AIDS/NOTES
	form b. vertical form	$8 - 4 = 4$ ii. Vertical form $\begin{array}{r}6\\-4\\\hline 2\end{array}$ $\begin{array}{r}9\\-3\\\hline 6\end{array}$ $\begin{array}{r}8\\-2\\\hline 6\end{array}$	
4.4 complete mathematical sentences for subtraction	4.4.1 Emphasize the completion of mathematical sentences for subtraction	a. Complete mathematical sentences for subtraction example: $4 - 3 = \underline{\quad}$ $5 - \underline{\quad} = 2$ $\underline{\quad} - 3 = 4$ $\underline{\quad} - \underline{\quad} = 3$	
	4.4.2 Reverse addition facts		

OBJECTIVE	CONTENT	SUGGESTED TEACHING AND ACTIVITIES	TEACHING AIDS/NOTES
	4.2.2 Subtract two numbers a. without regrouping b. regrouping	a. Subtract any two numbers i. without regrouping $7 - 4 = 3$ $9 - 2 = 7$ ii. regrouping $11 - 9 = 2$ $15 - 6 = 9$	
4.3 write mathematical sentences for subtraction	4.3.1 Introduce the symbols of subtract (-) and equals (=)	a. Introduce the symbols of subtraction (-) and equals (=)	
	4.3.2 Mathematical sentences for subtraction a. horizontal	a. Write mathematical sentences for subtraction i. Horizontal form $5 - 3 = 2$	

OBJECTIVE	CONTENT	SUGGESTED TEACHING AND ACTIVITIES	TEACHING AIDS/NOTES
4.5 subtract any three numbers	4.5.1 Any three numbers a. without regrouping b. regrouping	a. Subtracting any three mathematical i. without regrouping $4 - 1 - 2 = 1$ ii. regrouping $11 - 2 - 7 = 2$	$11 - (2 + 7)$ $11 - 9 = 2$
4.6 construct stories	4.6.1 Stories from mathematical sentences 4.6.2 Mathematical sentences from stories	a. Constructing stories from mathematical sentences Example $8 - 3 = 5$ I have ___ ducks. ___ ducks died. How many ducks left? a. Constructing mathematical sentences from stories Example Ali has five books. Abu borrowed	

OBJECTIVE	CONTENT	SUGGESTED TEACHING AND ACTIVITIES	TEACHING AIDS/NOTES
4.7 Problem solving (subtraction)	4.7.1 Solve problems using stories, diagrams and tables	a. Solve problems using stories, charts and tables two from Ali. How many books does Ali have? ___ · ___ = ___	

OBJECTIVE	CONTENT	SUGGESTED TEACHING AND ACTIVITIES	TEACHING AIDS/NOTES
	and tables	Mathematics Score (Marks vs Months) — Siti, Abu, Ali i. How many marks did Siti get for mathematics in January? ii. What is the difference between Siti's and Ali's marks for mathematics in January? iii. What is the total of Abu's marks for two months?	

OBJECTIVE	CONTENT	SUGGESTED TEACHING AND ACTIVITIES	TEACHING AIDS/NOTES
5. Combination of two operations Enable students to: 5.1 construct stories.			
	5.1.1 Stories from mathematical sentences	a. Construct stories from mathematical sentences. Example 9 – 6 + 2 = 5 Siti has ___ sweets. She gives ___ sweets to her brother. Siti's sister gave her ___ more sweets. How many sweets does She have?	flash cards
	5.1.2 Mathematical sentences from stories		
5.2 Solve problem involving two operations	5.2.1 Basic facts within tens	a. Graphs	table, diagram etc.
	5.2.2 Problems in real solving using stories, diagrams		

Appendix A-9 – Quizzes Sample: SK Pengkalan Pegoh syllabus

PART D (10marks)

CALCULATE THE ANSWER FOR EVERY QUESTION.WRITE IN THE BOX.

4   1   = [ ]

3   2   = [ ]

2   4   = [ ]