



UNIVERSITI  
TEKNOLOGI  
PETRONAS

**Mobile Dyslexic Specialized Digital Game-based Learning Object for Learning  
Letters (DOLL)**

By

**Husnaini binti Hussin (12256)**

Dissertation submitted in partial fulfillment of  
the requirements for the  
Bachelor of Technology (Hons)  
(Business Information System)

MAY 2012

Universiti Teknologi PETRONAS  
Bandar Seri Iskandar,  
31750 Tronoh  
Perak Darul Ridzuan

# **CERTIFICATION OF APPROVAL**

**Mobile Dyslexic Specialized Digital Game-based Learning Object for Learning  
Letters (DOLL)**

By

**Husnaini binti Hussin (12256)**

A project dissertation submitted to the  
Universiti Teknologi PETRONAS  
In partial fulfillment of the requirement for the  
BACHELOR OF TECHNOLOGY (Hons)  
(BUSINESS INFORMATION SYSTEM)

Approved by,

---

(MOHAMMAD NOOR BIN IBRAHIM)

Universiti Teknologi PETRONAS  
Tronoh, Perak

May 2012

## **DECLARATION**

I hereby declare that the work in this thesis is my own except for quotation and summaries which been duly acknowledge.

September 2012

Signature: .....

**HUSNAINI BINTI HUSSIN**

## **ABSTRACT**

Ability to read is a unanimous privilege we have as human. Therefore, research and development on Learning Object (LO) specially built for learning disabilities children is crucial. The issues for this project are the problem encounter by dyslexic students in output generation and information processes; and the factors that affect the effectiveness of mobile learning specially built for dyslexic. The focuses of this project are to propose guidelines and to facilitate student with visual dyslexia, or/and auditory dyslexia or/and dysgraphia; specifically in learning basic Malay language letters with interactive teaching method. Research has been made to identify the focused type of dyslexia, determine the needs of dyslexic; and the effect of graphic and animation on the efficiency of teaching technique. New multimedia-based learning object is being proposed to attract interest of dyslexic children to learn letters in fun approach and improve their recalling skills in recognizing name, shape and sound of letters. The main elements of the proposed learning object are animation, oral narration and digital game-based. The theoretical framework proposed in this study is based on Principles of Teaching Program for Dyslexics, Stansfield Instructional Strategies, and Game-based Learning Object Framework. This project is carried out using ADDIE Instructional Design Model using Adobe Flash Professional cs5.5. A user experience testing is conducted with the dyslexic children. The result of the user experience testing showed more than half of the students would like to use the LO repeatedly. In addition, teachers agreed that DOLL act as a good new teaching tool in facilitating teaching process for dyslexic students.

## **ACKNOWLEDGEMENT**

In the name of Allah, Most Compassionate, Most Merciful, thank you mighty God for giving me the strength on completing my final project paper.

This project was made possible by the efforts of many good people who had provided valuable information, references material and collaborative support. First and foremost, I would like to express my highest appreciation to my supervisors, Miss Nazleeni Samiha binti Haron and Mr Mohammad Noor bin Ibrahim, for their patient, advice and critical review. This project was not made possible without their full support. Not to be forgotten, to the course coordinator of Final Year Project II CIS, Mr. Saipunidzam Mahamad, who always nicely treat students' questions and requests. Thank you very much.

My deepest appreciation and thanks to my parents, Hussin b Abdullah and Nasiah bt Hasbullah; and also my family members for their love and support that bring me spirit and strength to complete this project. My last grateful thank goes to my friends for the encouragement and friendship.

Thank you very much.

## TABLE OF CONTENT

<b>CERTIFICATION OF APPROVAL</b>	.	.	.	.	.	.	.	.	i
<b>DECLARATION</b>	.	.	.	.	.	.	.	.	ii
<b>ABSTRACT</b>	.	.	.	.	.	.	.	.	iii
<b>ACKNOWLEDGEMENT</b>	.	.	.	.	.	.	.	.	iv
<b>LIST OF FIGURE</b>	.	.	.	.	.	.	.	.	vii
<b>LIST OF TABLE</b>	.	.	.	.	.	.	.	.	viii
<b>ABBREVIATIONS AND NOMENCLATURES</b>	.	.	.	.	.	.	.	.	viii
<b>CHAPTER 1: INTRODUCTION</b>	.	.	.	.	.	.	.	.	1
1.1	Background of Study	.	.	.	.	.	.	.	1
1.2	Problem Statement	.	.	.	.	.	.	.	2
1.3	Objectives and Scope of Study	.	.	.	.	.	.	.	3
1.4	Project Feasibility	.	.	.	.	.	.	.	5
<b>CHAPTER 2: LITERATURE REVIEW.</b>	.	.	.	.	.	.	.	.	6
2.1	An Overview of Dyslexia	.	.	.	.	.	.	.	6
2.1.1	Definition of Dyslexia.	.	.	.	.	.	.	.	6
2.1.2	Diagnostic Approach for Dyslexia.	.	.	.	.	.	.	.	7
2.1.3	Types of Dyslexia	.	.	.	.	.	.	.	10
2.1.4	Causes of Dyslexia	.	.	.	.	.	.	.	13
2.2	Consideration of Dyslexic Students	.	.	.	.	.	.	.	15
2.2.1	Problem Facing Dyslexic Children	.	.	.	.	.	.	.	15
2.2.2	Relationship between Dyslexics and Multimedia.	.	.	.	.	.	.	.	18
2.2.3	Related Works	.	.	.	.	.	.	.	19
2.3	Android Platform	.	.	.	.	.	.	.	22
2.4	Theoretical Frameworks	.	.	.	.	.	.	.	23
2.4.1	Principles of Teaching Program for Dyslexic.	.	.	.	.	.	.	.	23
2.4.2	Stansfield Instructional Strategies	.	.	.	.	.	.	.	24
2.4.3	Game-based Learning Object Framework.	.	.	.	.	.	.	.	25
2.4.4	Aspects of Oral and Narrative Comprehension.	.	.	.	.	.	.	.	26
2.4.5	Sequencing	.	.	.	.	.	.	.	27

2.4.6	Color	.	.	.	.	.	.	28
<b>CHAPTER 3: METHODOLOGY</b>								29
3.1	Research Methodology	.	.	.	.	.	.	29
3.2	Project Activities	.	.	.	.	.	.	32
3.3	Tools	.	.	.	.	.	.	34
3.4	Key Milestone and Gantt chart.	.	.	.	.	.	.	35
<b>CHAPTER 4: RESULT AND DISCUSSION</b>								38
4.1	Prototype	.	.	.	.	.	.	38
4.2	Discussion	.	.	.	.	.	.	44
<b>CHAPTER 5: CONCLUSION AND RECOMMENDATIONS</b>								46
5.1	Conclusion.	.	.	.	.	.	.	46
5.2	Recommendation.	.	.	.	.	.	.	46
<b>REFERENCES.</b>								47
<b>APPENDICES.</b>								51

## LIST OF FIGURES

Figure 1: Framework representing different sources of variability that influence academic outcomes of children with Dyslexia.	7
Figure 2: Courseware to learn basic Malay language	20
Figure 3: DDLOLL model which consists of three phases.	29
Figure 4: Key Milestone for FYP 1	35
Figure 5: Gantt Chart for FYP 1	36
Figure 6: Key Milestones and Gantt Chart for FYP 2	37
Figure 7: Main Menu of DOLL	38
Figure 8: Objective Set For Each Activity or Stage	39
Figure 9: Color and Font Used in DOLL	40
Figure 10: Character for the proposed Game-Based Learning Object	40
Figure 11: Exercise (Self-test)	41
Figure 12: Multi-sensory Approach in DOLL	42
Figure 13: Phonetic Approach in DOLL	42
Figure 14: Feedback after User Interaction	43
Figure 15: Step-by-step Instructions	43
Figure 16: Usability of LO	46
Figure 17: Learning Feedbacks	46



## **LIST OF TABLES**

Table 1: Review on Three Diagnostic Approaches	10
Table 2: Classification of children with specific development dyslexia, based on diagnosis reading –spelling patterns	12
Table 3: Problem facing dyslexic children	15
Table 4: Smartphone Operating System Market Share (Source: IDC)	22
Table 5: Response on DOLL.	45

## **ABBREVIATIONS AND NOMENCLATURES**

3M	Skills of Reading, Writing and Arithmetic
PSHM	Harmony Social Association of Malaysia
LO	Learning Objects
IDEA	Individuals with Disabilities in Education Act
LD	Learning disabilities
NCLD	United States National Center of Learning
NINDS	United States National Institute of Neurological Disorders and Stroke
IDA	International Dyslexia Association
DOLL	Dyslexic Specialized Digital Game-based Learning Object for Learning Letters

# CHAPTER 1

## INTRODUCTION

### 1.1 BACKGROUND OF STUDY

The Government of Malaysia hopes that people will be able to control the efficiency of one hundred percent literacy by year 2020. Via 10<sup>th</sup> Malaysian Plan, government targeted an increased level of literacy and numeracy as it is crucial to reduce dropout rates students due to the inability of their learning. Mastery of literacy and numeracy at an early stage is very important because without skills, they will have difficulty learning in the later stages (Rajesvari, 2008). However, the basic skills of reading, writing and arithmetic (3M) may be difficult to be obtained. Jamila K.A Mohamed (2005) stated that, who have problems severe cognitive disabilities such as dyslexia will suffer complexity in terms of abstract thinking and needs repetitive process when learning new concept (as cited in Rajesvari, 2008, p.10).

According to the International Dyslexia (2010), 10% to 15% of the world population suffering from dyslexia. In Malaysia, the Statistics Department of Special Education, Ministry of Education Malaysia for year 2001 (Rajesvari, 2008) stated that there were 115,377 school children in the country Malaysia, suffered from dyslexia. President of Malaysia Dislexia Organization, Sariah Samirin estimated that there were about 500,000 to 600,000 of Malaysian citizens recorded with dyslexia (Shuhada, 2011). Parliamentary Secretary, Ministry of Education in 2004 (Komala, 2004) also reported that 5% of cases the effects of dyslexia in any community or one for every 20 students. Supplementary, the amount is large in comparison with down syndrome, which is about one in 600 people; and spastic, about one in 700 people. High population also reported by Harmony Social Association of Malaysia (PSHM), Nordin Ahmad (2005) that through association studies found 10-15% of primary school pupils across the country who mostly Malays, had dyslexia.

The worldwide recognition of dyslexia as a specific learning disability of major importance has attracts global attention to help this group of people in order to ensure the betterment of mankind. Therefore, the needs to analyze and understand the development of dyslexia has increased over the years with the objective to overcome the disability of students in terms of the basic skills of reading, writing and arithmetic (3M) by finding other alternatives to suit the needs of students with learning disabilities. One of the intervention approaches for dyslexic students is special approach method using multimedia. Based on the research made by researchers from Universiti Teknologi Mara (UiTM) on June, 2011, learning approach based on Learning Objects (LO) is considered the latest method which optimized current technology and has a great future in providing better learning and teaching tools (Ronaldi et al, 2011). Shepherd (2001) defines Learning Objects (LO) as way of thinking oriented by objects which being applied in world of teaching.

## **1.2 PROBLEM STATEMENT**

According to Handler et al (2011), they believe that learning disabilities comprises of diverse disorders in which dyslexic students have problems processing information or generating output. Dyslexia comprises of many categories and each has its own problems and difficulties. This research focused on three types of dyslexia: 1) Visual dyslexia, 2) Phonological dyslexia, and 3) Dysgraphia; which will be further discussed in next chapter (Chapter 2). The needs of LO as one of the interactive method to help and facilitate dyslexic students in mastering the basic literacy skills is vital. Hence, this research paper will provide empirical evidence in designing and apply some animation; simple oral comprehension; and gaming technologies in the development of special approach to teach basic Malay language in Malaysia.

Some considerations have been identified including the complexity of the design for the learning objects and the user acceptance towards the animation and oral narration used. Though animation and game-based application will have the characteristics of good user interaction by combining visual, sound and voice elements, it still gives different level of

messages being successfully conveyed. Apart from that, this research also focuses on identifying manipulated variables that affect the effectiveness of animation built to suit the technique of teaching Malay Language and the characteristics of dyslexic students.

### **1.2.1 Significance of the Project**

The animation feature embedded in the Learning Objects for dyslexic students in learning basic Malay language is so important and helpful for:

- **Parents and Teachers:** To give exposure and awareness towards learning objects as learning and teaching tools in order to facilitate teaching process.
- **Dyslexic students:** To provide interactive communication, motivation and passion to students in mastering basic Malay language and increased the academic performance.
- **Schools:** Provide awareness of school' authorities responsibilities in helping teachers by providing better tools for teaching.
- **Ministry of Education of Malaysia:** To get the attention of Ministry of Education especially, Department of Special Education in allocation additional budget for development and preparation of new teaching tools.

## **1.3 OBJECTIVES AND SCOPE OF STUDY**

### **1.3.1 Objective**

The objective of this project is:

- To propose guidelines and develop a new Digital Game-Based Learning Objects for dyslexic students in learning basic Malay language letters.
  - To attract interest of dyslexic students to learn letters
  - To improve their recalling skills in recognizing letters

### **1.3.2 Scope of Study**

This project requires research on combination of graphic sentences and images to convey messages effectively and have its own special analysis in terms of design. Considering the need of the appropriate animation's design, it is important to make approaches and studies to understand the reader in terms of their lifestyle, interests and beliefs.

The targeted user for the application being develop is dyslexic students between 7 to 10 years old. Since Malay language is the national language and commonly used by Malaysians, it will become the intermediate language used for the application. Besides that, the technique of teaching must be applied correctly to helps readers to be able to:

1. Identify the name of letter shown.
2. Recognize the shape of letter shown
3. Recognize the sound of letter shown
4. Associate the name, shape, and sound of letter shown

As researcher decided to develop a digital game-based application as the medium of learning objects, Flash provide a convenient option for serving the purpose. Therefore, researcher needs to explore the concepts behind Flash, the framework for constructing an application, and the tools for developing, testing, and publishing software for the platform. Thus, the scope of study also includes understanding of particular parts of the Flash framework that contribute to the success of this project. To ensure the feasibility of the project within the given time period, the scope of the project is defined by choosing two letters in Malay language and focus on differentiating letters based on its name, shape and sound. Finally, testing will take place continuously and debugging will be required to have the new application to learn basic Malay language function properly.

## **1.4 PROJECT FEASIBILITY**

Feasibility study of the project offers reliable method to identify the likelihood of the proposed solutions to solve the identified problem and examine the potential success of the project. In this section, researcher will analyze the feasibility of the project within scope, schedule and technical aspects.

### **1.4.1 Scope Feasibility**

There are three aspects of project scope identified for this project which are targeted users, syllabus and components of learning object. Based on discussion with teacher, the syllabus has been narrowed down, and at completion of learning object, learners should be able to associate the name, shape, and sound of letter shown. After considering dyslexic learning style factors, the targeted users have been identified for 7 to 10 years old and the learning object will be develop with three components which are: animation, oral narration and digital game-based. Using three theoretical frameworks, researcher has confidence that the designed learning object will meet the expectation to fulfill the objectives identified at the earlier part.

### **1.4.2 Schedule Feasibility**

The research and development of this project will be in duration of 26 weeks and overall project time frame is 29 weeks. The time frame is divided into two parts which are FYP1 where 14 weeks has been allocated and the rest 15 weeks will be done in FYP2. This project has high potential of completing within the time frame as systematic identification and analysis of alternative ways are used in achieving the project objectives.

### **1.4.3 Technical Feasibility**

Throughout the task of performing technical feasibility study, researcher found advantages and the disadvantages that underlie this project. Researcher has chosen Flash framework as the best platform for the proposed learning object which consists of open-source software: Adobe Flash Player, Adobe AIR, and Adobe Flash Professional cs5.5.

## **CHAPTER 2**

### **LITERATURE REVIEW**

For this paper, the literature review will be divided into four sections which are (1) Overview of Dyslexia that is crucial to understand the root of dyslexia and consists of definition, diagnostic approach, types and causes of dyslexia; (2) Consideration of Dyslexic Students that is needed to understand their learning styles and capabilities and it have three subsection: problem facing dyslexic children, relationship between dyslexics and multimedia, and related works; (3) Android platform; and lastly (4) Theoretical Frameworks that explained the techniques and theory used in design and development of proposed learning object.

#### **2.1 AN OVERVIEW OF DYSLEXIA**

##### **2.1.1 Definition of Dyslexia**

Dyslexia is not a disease, but is one of learning disorders commonly experienced by children (Shuhada, 2011). Typically, the learning problem faced is like reading, writing and arithmetic (3M). This has been supported by United States National Institutes of Health that defines dyslexia as a learning disability that can hinder a person's ability to read, write, spell, and sometimes speak. Thus dyslexia refers to those who have difficulty reading and writing despite having a normal mindset.

Based on opinion of Payne and Turner in Rajesvari (2008), the term 'Specific Learning Difficulties' is commonly used when refer to dyslexic students. In other words, dyslexic students not only have difficulties in mastering reading skills, but also have possibility to face problems in basic skills of literacy and numeracy.

The definition of dyslexia accepted by the Research Group on Developmental Dyslexia of the World Federation of Neurology reads:

“A disorder manifested by difficulty in learning to read despite conventional instruction, adequate intelligence, and socio-cultural opportunity. It is dependent upon fundamental cognitive disabilities which are frequently of constitutional origin.” (Critchley, 1970)

“Operationally, specific reading disability may be defined as the failure to learn to read with normal proficiency despite conventional instruction, a culturally adequate home, proper motivation, intact senses, normal intelligence, and freedom from gross neurological defects.” (Eisenberg, 1966)

According to Medicine.Net in its article “Definition of Dyslexia”, dyslexic means a learning disability that alters the way the brain processes written material which is due to a defect in the brain’s processing of graphic symbols. The article also stated that, the problem of dyslexic children do not lies on the visual aspect but linguistic aspect.

### 2.1.2 Diagnostic Approach for Dyslexia

Fletcher et al (2007) presented a framework on different sources of variability that influence academic outcomes, the primary manifestation of the disability in children with Learning Disability/ Dyslexia. It involves three level of analysis which consists of (1) specific academic skills deficits, (2) core cognitive processes and behavioral psychosocial factors and (3) neurobiological and environmental factors (Figure 3).

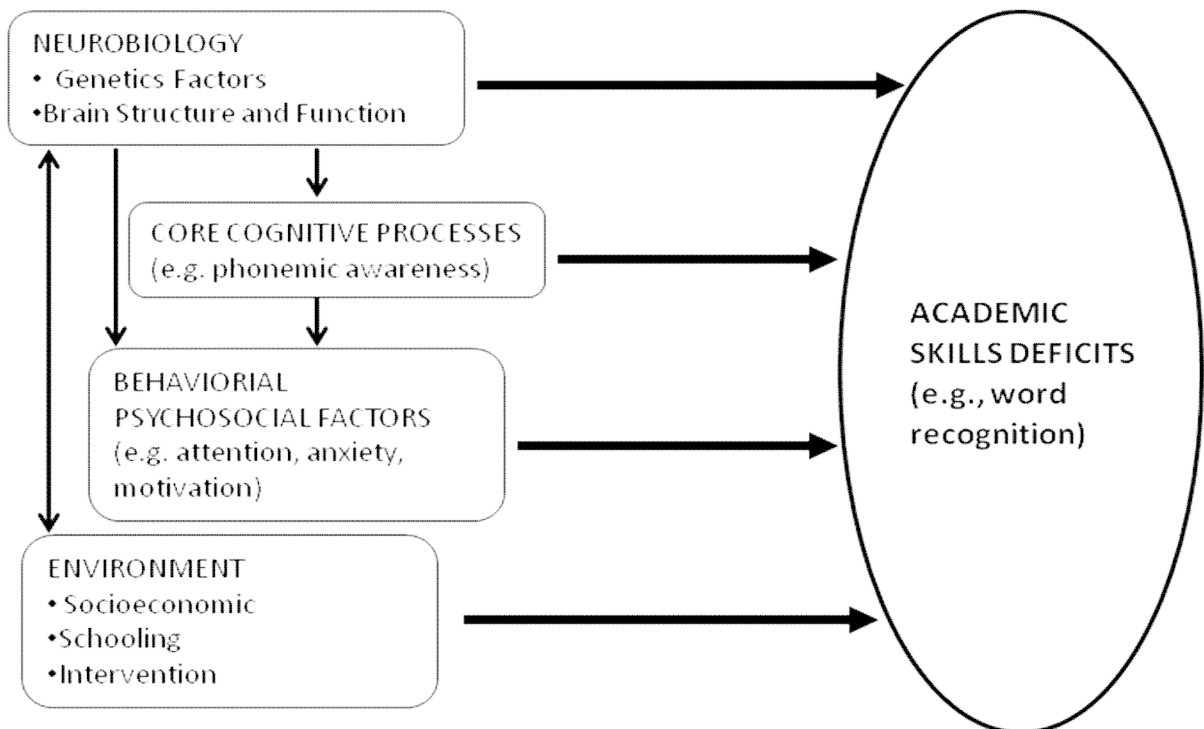


Figure 1: Framework representing different sources of variability that influence academic outcomes of children with Dyslexia.



Fletcher et al (2005) identifies four approaches to the assessment of children with dyslexia which based on:

(a) aptitude-achievement discrepancies, which assess students with administering a setback or a few tests and compare the performance of students on achievement test scores with a score of his ability.

(b) low achievement, based on those with intellectual ability in one or more of the areas: (1) oral expression; (2) listening comprehension; (3) written expression; (4) basic reading skill; (5) reading comprehension; (6) mathematics calculation; or (7) mathematics reasoning " (United States Office of Education, 1977, p. G1082). The eighth area has been added by Individuals with Disabilities in Education Act (IDEA) on 2004 which is reading fluency and changing mathematics reasoning to mathematics problem solving (USDOE, 2004).

(c) intra-individual differences, involves an examination of individual differences on measures of cognitive function.

"while IQ tests do not measure or predict a student's response to instruction, measures of neuropsychological functioning and information processing could be included in evaluation protocols in ways that document the areas of strength and vulnerability needed to make informed decisions about eligibility for services, or more importantly, what services are needed. An essential characteristic of Special Learning Difficulties is failure to achieve at a level of expected performance based upon the student's other abilities." (NCLD, 2002).

(d) Response- to- Intervention (RTI), by binding a specific assessment of the various attempts to interfere with the child, constructs an unexpected setback can operate at the top of the policy as not responsive to the direction that most of the other students react (Gresham, 2002).

Learning disabilities (LD) Summit recommended the use of hybrid model where low achievement is used as one of the several criteria (with exceptions) and Response-to-

Intervention (RTI) has considerable potential; and no single assessment can be used independently to establish eligibility for special education (Bradley et al, 2002).

According to Boder (1973), dyslexia is usually diagnosed in three ways: Process of Exclusion, Indirect approach and Direct approach (Table 1). Further review of these three approaches has been made in other publications (Boder, 1971).

<b>DIAGNOSTIC APPROACH</b>	
<b>Process of exclusion</b>	
Description	Relies on ruling out other explanations of the child's inability to read which covers various aspects: physical, mental, emotional or educational.
Advantage	Most widely used approach and provides useful definition of dyslexia.
Disadvantage	Excluding from consideration the crucial fact that dyslexia may co-exist with, and be aggravated by one or more contributory factors.
<b>Indirect</b>	
Description	Through neurological or psychometric concomitants.
Advantage	Important in understanding social psychology of dyslexic person.
Disadvantage	Insufficient for the diagnosis, since most of the concomitants can also exist without dyslexia problem.
<b>Direct</b>	
Description	Based on frequency and persistence of certain types of errors in reading and writing.
Advantage	Analyzing 'dyslexic errors' in reading and spelling performance and relating them to deficit functions.
Disadvantage	- Tendency to consider the deficits in reading and spelling separately from the assets with which they may be associated.

	- Underlying assumption that dyslexic children constitute a homogeneous group among whom the variety of dyslexic errors occur at random.
--	--

Table 1: Review on Three Diagnostic Approaches.

### 2.1.3 Types of dyslexia

Brown (2009) identifies five types of dyslexia eligible for special education purposes which are: (1) Visual dyslexia, (2) Phonological (auditory) dyslexia, (3) Dyspraxia, (4) Dysgraphia and (5) Dyscalculia. He identified visual dyslexia as a visual processing disorder proceeds from immature development of human visual system which affects the whole process that gets information from the eyes to the brain. Incomplete eyes development causing it to deliver incomplete information to the brain and results in poor comprehension of what the child has read, or poor memory of visual information. In certain cases, this process causes the invertibility of number and letter and the inability to write symbols in the correct sequence.

On the other hand, he described phonological (auditory) dyslexia or Auditory Processing Disorder (OPD) with involvement of difficulty with sounds of letters or groups of letters. Child with this type of dyslexia perceived sounds as jumbled or not correctly heard and with the processing of visual system, the brain correctly interprets information that it correctly sent by eyes.

Dyspraxia, also called Developmental Co-ordination Disorder (DCD) refers to the learning disability that affects motor skill development and characterized by impairment or immaturity of the movement organization, with associated problems of language, perception and thought. Usually, people with dyspraxia have problems in planning and performing fine motor tasks which may be seen to be clumsy and poorly coordinated (NCLD, 2010; Dyspraxia Foundation, 1996). Furthermore, United States National Center of Learning (NCLD) outlined four categories of dyspraxia that differs based on four varied components: ideomotor, ideational, oromotor and constructional (NCLD, 2010).

United States National Institute of Neurological Disorders and Stroke (NINDS) stated that dysgraphia is a neurological disorder characterized by writing disabilities. Specifically, the disorder affects how easily dyslexic children acquire written language and how well they use written language to express their thoughts and this been delineated by tendency of children's writing to be distorted or incorrect (NINDS,2011). People suffered from dysgraphia commonly have symptoms seen as poor letter formation in printing and trouble organizing letters, numbers, and words on a line or page. Partially, these difficulties are resulting from visual-spatial difficulties and language processing difficulties.

On the contrary, dyscalculia refers to an impairment of the ability to solve mathematical problems, usually resulting from brain dysfunction. Individuals with dyscalculia have difficulty with: numbers and recall of Mathematical facts and operations, telling time and with the duration of time, following directions, recalling schedules and sequences, and mathematical concepts (Chinn, 2010).

Kosslyn & Koeuig (1990) pointed out three subgroups of dyslexia which are Neglect dyslexia that is on basis of a person disregarding the left or the right side of words and mostly highlighted on reading long words; Semantic dyslexia when person distort the meaning of words; and Spelling dyslexia which results from problem reading all types of words and trouble identifying individual letters.

Ingram et al. (1970) describes three subgroups of specific dyslexia based on types of errors in reading- visuospatial difficulties, speech sound difficulties and correlating difficulties. Mattis French and Rapin divided dyslexia into three syndromes - Language Disorder group, Articulatory and Dyscoordination Group and a Visuospatial Verceptual Disorder group (Critchely, 1990). On the basis of four testing on 113 children on Intelligence Quotient, vision, hearing and academic exposure, these are the description:

- **Syndrome I Language Disorder-** This syndrome is characterized with anomia, comprehension deficits, confused imitative speech and speech- sound discrimination. Vision and motor coordination is normal.

- **Syndrome II Articulatory and Graphomotor Dyscoordination-** Children with this syndrome have gross and fine motor coordination disorders. They have poor speech and graphomotor coordination.
- **Syndrome III: Visuospatial Perceptual Disorder-** These children score 10 points more on verbal IQ than performance IQ. Their visuospatial perception is very poor, as is their ability to store and retrieve visual stimuli.

Boder (1973) identifies three group of dyslexia based on the relationship between how a dyslexic child reads and how he spell. These classifications derive from designing of the spelling tasks to complement the reading tasks, using information gain from the reading tasks (Table 2).

Group I : Dysphonic Dyslexia	Children whose reading-spelling pattern reflects primary deficit in symbol-sound integration, resulting in inability to develop phonetic word analysis –synthesis skills. No gross deficit in gestalt function recorded.
Group II : Dyseidetic dyslexia ( Gestalt – blind)	Children whose reading –spelling pattern reflects primary deficit in the ability to perceive letters and whole words as configurations, or visual gestalts. No gross deficit in analytic function recorded.
Group III: Mixed dysphonetic-dyseidetic dyslexia (Alexia)	Children whose reading-spelling pattern reflect primary deficit both in the ability to develop phonetic word analysis-synthesis skills and in the ability to perceive letters and whole words as visual gestalts.

Table 2: Classification of children with specific development dyslexia, based on diagnosis reading –spelling patterns

#### **2.1.4 Causes of Dyslexia**

According to Brown (2009), on the basis of the nature of the problem within the central nervous system or brain, dyslexia can be classified into three groups. First is called trauma dyslexia which refers to dyslexia causes by some form of brain trauma or injury to the area of the brain that controls reading and writing. This permanent brain injury results from severe head injuries.

Next, primary dyslexia is a dysfunction of the left side of the brain (cerebral cortex) and does not change with age. Individuals with primary dyslexia are rarely able to read above a fourth-grade level which need basic reading skills in place; faster reading; increased vocabulary; read more comprehensively; to understand antonyms, synonyms and homonyms; to understand compound words; to identify punctuation cues and graphic organizers; to understand the overall meaning of a passage; to understand the characters and their motivations within a story; and to summarize a story. Primary dyslexia is passed in family lines through their genes (hereditary).

Furthermore, a secondary or developmental type of dyslexia is felt due to hormonal development or malnutrition during the early stages of fetal development. Poor parenting, abuse, neglect, and/or poor nutrition during the developmental years 0 to 5 are also known causes. Developmental dyslexia will be reduced as the child matures. Compared to girls, this type of dyslexia is commonly suffered by boys.

John Bradford in Dyslexia Online Magazine, suggested that dyslexia can be caused in the following ways:- (1) by hearing problems at an early age; and,(2) by inherited factors (most common),or (3) by even a combination of both above (Juken Consultancy, 2004). Hearing problems at an early age is one of possible causes for dyslexia and it is usually happen when a child suffers frequent colds and throat infections in the first five years and the ears can be blocked from time to time so that hearing is impaired. The parents sometimes do not take this matter seriously and can easily be unaware of this until a doctor actually looks into the child's ear. If the difficulty is not noticed at an early stage, then the developing brain does not make the links between the sounds it hears. Therefore,

the brain misinterprets the sounds and causes the child's developing ability to handle language and text becomes weak. If corrective action is not taken at a very early stage, could results in lifelong dyslexia.

Because of inherited factors, dyslexia is very frequently found in families, and is often accompanied by left-handedness somewhere in the family (Juken Consultancy, 2004). More than 80% have a history of learning difficulties in their family, and more than 60% have a family member who is left-handed. A lot of research has been carried out to examine brains of dyslexic people, with the helps from rapid technology advances in brain-scanning. Certain patterns of abnormalities were found through the findings, including detection of bunches of cells beneath the surface of the brain which lie on the surface in the brain of a non-dyslexic person. During development of fetus, these groups of cells known as 'ectopic' cells ought to have moved to the brain's surface but failed to make the journey. These ectopic clusters of cells are mainly found in the left and the front of the brain - the areas which are important for reading and writing.

Moreover, another finding is the difference of size of mango-cellular system which dyslexic people have smaller size than normal people. This mango-cellular system deals with our ability to see moving images. Thus makes reading harder for dyslexic people as the brain has to quickly interpret the different letters and words which the eyes see as they scan works and sentences. As boys are more prone to have dyslexia than girls, some claims that child's mental development is altered by the hormone testosterone. The reason behind this is the thought that a child's immune system could be affected by an excess of testosterone. The third finding based on investigation using electroencephalogram (EEG) that measures and records the electrical activity of brain, is that the brains of dyslexic children show an unusual variation in left-and right-side activity.

Sometimes combination of both causes is detected when a child has experienced early hearing problems and has also inherited genes which dispose him or her towards difficulties dealing with the printed word (Juken Consultancy, 2004).

## 2.2 CONSIDERATIONS OF DYSLEXIC STUDENTS

### 2.2.1 Problem Facing Children Dyslexia

Dyslexia as being defines by International Dyslexia Association (IDA) is a specific learning disability that is neurological in origin. Normally, the characteristics of dyslexic person are on basis of difficulties with accurate and / or fluent word recognition and by poor spelling and decoding abilities. Due to their inability of the deficit in the phonological component of language that is often unexpected in relation to cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge (IDA Board of Directors, 2002).

The main problem faced by dyslexic children mostly are in the learning process. This problem can be classified into (Peter and Colin, 1990; Power of Dyslexia, 2011);

Spell	<p>The problem is due to initial problems as there is confusion in identifying the letters as:</p> <ul style="list-style-type: none"> <li>• <b>m - w ; y- g - j; u - n ; m - n; c - e; p - q; h - n; b - d</b></li> </ul> <p>There is also confusion in the sound-letter</p> <ul style="list-style-type: none"> <li>• <b>t - h; f - v, s-h; r-l</b></li> </ul>
Read	<p>Tendency to reverse the words such as:</p> <ul style="list-style-type: none"> <li>• <b>Batu - tuba</b></li> <li>• <b>Gula - lagu</b></li> </ul> <p>They also do a reversal in the sentence. For example, as follows:</p> <ul style="list-style-type: none"> <li>• <b>pada masa yang sama - dapa masa yang masa</b></li> </ul> <p>Confusion between Malay words in English. For example, as follows:</p> <ul style="list-style-type: none"> <li>• <b>Jam - jem</b></li> <li>• <b>cat - cat</b></li> </ul>
Write	<p>Have difficulty holding a pencil and cannot write according to the line provided. These children also tend to write words fads.</p>

Table 3: Problem facing dyslexic children



Early Intervention Support (2009) outlined the characteristics of dyslexic child as:

1. For visual dyslexia:
  - Difficulty reading and spelling
  - Enjoys being read to, but does not enjoy reading
  - Trouble learning to tell time on a clock with hands
  - Continued problems with visual & auditory processing
2. For phonological dyslexia:
  - Poor articulation of speech
  - Can't sound out new words
3. For dysgraphia dyslexia:
  - Reversing letters and/or numbers when writing
  - Leaving letters out of words or leaving words out of sentences
  - Putting words in the wrong order in sentences
  - Becomes visibly tired after reading/writing tasks
  - Problems learning cursive writing
  - Not establishing hand dominance
  - Problems distinguishing left from right
  - Completing written work more slowly or inaccurately than peers

Davis (1992) divided the characteristics of dyslexic students into- vision, reading and spelling; hearing and speech; writing and motor skills; memory and cognition; math and time management; and behavior, health, development and personality. This paper will only focus on the first four categories. The characteristics of visual dyslexic students in terms of vision, reading and spelling are usually by complaining of dizziness, headaches or stomach aches while reading; confusion by letters, numbers, words, sequences, or verbal explanations; reading or writing shows repetitions, additions, transpositions, omissions, substitutions, and reversals in letters, numbers and/or words; complaining of feeling or seeing non-existent movement while reading, writing, or copying; have difficulty with vision; reads and rereads with little comprehension; and spells phonetically and inconsistently (McCormack).

In aspect of hearing and speech, students with phonological (auditory) dyslexia problem usually have extended hearing; hears things not said or apparent to others; easily distracted by sounds; difficulty putting thoughts into words; speaks in halting phrases; leaves sentences incomplete; stutters under stress; mispronounces long words, or transposes phrases, words, and syllables when speaking (Engel-Eldar and Rosenhouse, 2000).

Typically, students suffered from dysgraphia dyslexia shows unique characteristics based on their writing and motor skills. They normally having trouble with writing or copying; pencil grip is unusual; handwriting varies or is illegible. Besides, people seen them as clumsy, uncoordinated, poor at ball or team sports; difficulties with fine and/or gross motor skills and tasks; prone to motion-sickness. They can also be ambidextrous, and often confuses left/right, over/under (Davis, 1992; Nicolson and Fawcett, 1999).

Apart from that, on basis of memory and cognition, dyslexic students have excellent long-term memory for experiences, locations, and faces; poor memory for sequences, facts and information that has not been experienced; and thinks primarily with images and feeling, not sounds or words (Davis, 1992).

Shaywitz (2003) identifies five critical characteristics of dyslexic child- delay in speaking (may not begin saying their first word until 15 months or so may not speak in phrases until two years old), difficulties in pronunciation (problem saying most words accurately), less sensitive to rhyme (have trouble penetrating the sound structure of words), talk around the word (the difficulty is with pulling out the right word) and difficulty learning names and sounds of the letters of the alphabet.

Anna Stephens in her article entitled, Visual Dyslexia (2011) stated that visual dyslexic children normally have variances in performance of the above, dependent on activity or environment such as increased difficulty when the lighting is different. Their information processes also affected by their health condition; for example, the difficulty level increased when tired, or reading being the cause of early tiring. Another characteristics is easily distracted and have own avoidance tactics, such as by being constantly too busy to undertake a reading task and do other things instead of reading. For them, other

activities always being more important and need their attention more than reading, writing or spelling.

Australian Dyslexia Association (ADA) has identified certain characteristic that are useful for visual dyslexic, phonological dyslexic and dysgraphia dyslexic. Most of the outlined characteristics support the earlier research in this section. Specifically for visual dyslexic, they have difficulty acquiring age appropriate sight words recognition skills or visual coding. Other characteristics are: they thinks in pictures, not words (which shows that image is important to them), problems in sequencing, exhibits inconsistencies between potential and performance, low memory recognition for lists, directions, or facts, needs repetitive teaching method, weak decoding in word recognition and easily distracted by visual stimuli.

On the other hand, ADA also pointed out that phonological dyslexic have own unique personality which are: problems in phonological awareness, including segmenting, blending and manipulating sounds in words, difficulty mastering the alphabetical principle and basic decoding skills (sounds to letters), slow, inaccurate laboured reading (lacking fluency) , and difficulty learning to spell accurately.

Lastly, for dysgraphia dyslexic, they often have weaker written language skills than oral language skills, difficulty acquiring and using written language, and also difficulty learning and retaining multi-syllabic vocabulary (ADA,2012).

The Power of Dyslexia (2011) described seven characteristics of dyslexic child in its article, “Signs of Dyslexia”- (1) Slow in developing speech; (2) Difficulty in gauging directions; (3) Difficulty in Deciphering Sequences; (4) Poor reading ability; (5) Poor handwriting; (6) Poor organizational abilities; and (7) poor memory about non-relevant facts.

### **2.2.2 Relationship between Dyslexics and Multimedia**

The multimedia-based Learning Objects are able to become an effective tool of learning. Keates (2000) supports the use of software to assist and facilitate the learning of dyslexia. Mortimore (2008) also confirmed that the research and experience suggest that students

who have dyslexia can succeed when learning is carried out in multi-sensory and using all the senses to reinforce learning.

By examining the use of mobile learning applications of interactive comics, Fadilahwati & Ronaldi (2000) found that children with dyslexia are very interested in the application based on animation approach. In addition, dyslexic children have no problem in identifying the character and read the words on the screen mobile phones. According to Keates (2000), people with dyslexia do not fail in using information technology tools such as computers. Beacham (2007) also believe that the use of multimedia has the potential to promote children's learning dyslexia. In 2010, through usability studies on Interactive Multimedia Learning Objects, Fadilahwati et al. (2010) found that dyslexic students are motivated, fun, easy, and assisted in understanding the subject content better.

#### **2.2.2.1 Dyslexic and Music**

Dyslexic children have been identified to have timing difficulties in the domains of language, music, perception and cognition, as well as motor control (Katie, 2003). Katie Overy in her article "Dyslexic and Music: From Timing Deficits to Musical Intervention" suggested that rhythm games provide a valuable multisensory support tool for dyslexic children by encouraging the development of important auditory and motor timing skills and subsequently language skills. She added that research has been made and it shows that rhythmic lessons have positive impact on phonologic, spelling skills, and pitch skills but have problems with musical timing skills. Therefore, simple rhythm lessons are good to help dyslexic phonologically but extra consideration needed for the timing.

#### **2.2.3 Related Works**

Many researchers has made their contribution to help dyslexic in their learning process and produced many product using different types of frameworks and theories. These are products related to this study.

Computer game has been developed by psychologist in Finland to help children with dyslexia by improves reading ability using training on specific part of the brain. The game is based on matching shape and sounds where some manipulated variable are used: pitch, duration and intensity. The training shows increased in brain activity in the auditory cortex that is important in the processing of auditory signals or more particularly of speech. Basically, this game asked the subjects or dyslexic students to follow pattern of sounds and press the space bar when last element of the pattern was played (Briggs, 2001).

Currently, there is one courseware built to assist dyslexic children to learn basic Malay language which consists of the steps to recognize alphabets, and words (Abdullah et al, 2009). The courseware, named ‘MyLexics’ used two different theoretical frameworks which are Dual Coding Theory and Scaffolding Instructional Technique. The researchers stated that the usage of interactive multimedia elements gives freedom and ease to students to interact and at the same time attract them to complete certain tasks. However, the researchers have made some mistakes in the screen shown, for example the design does not match the ability of dyslexic students.

Dyslexic students have problems in identifying letter ‘b’ and ‘d’, especially when it is being written in black and have white as the background colour. This happen because the letter will be seen as moving and difficult to be read.

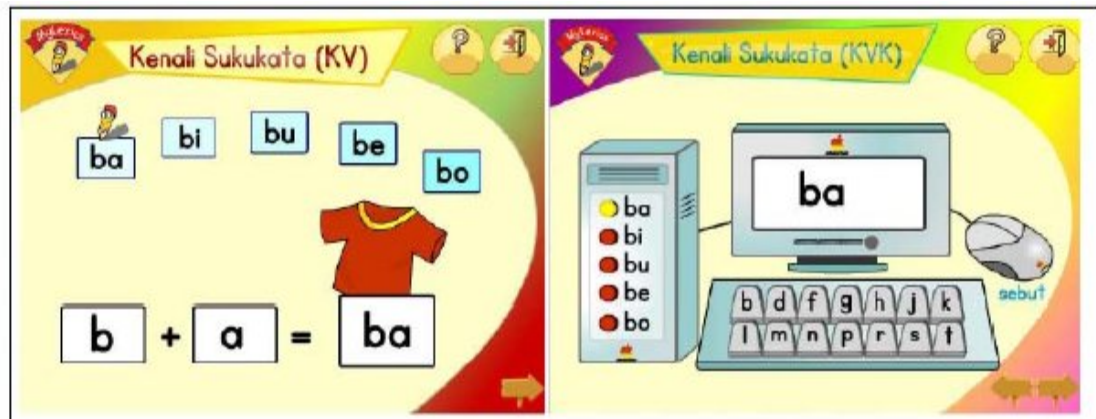


Figure 2: Courseware to learn basic Malay language

On Malaysian market, there are several products of teaching remedial tools including Siri Cepat Membaca Bacalah Anakku; which consist of a package of basic learning of Malay language for children, consisting of 8 books, 1 booklet, 1 VCD and 12 scan cards. The theory underlying Bacalah Anakku is phonetic theory which emphasized on auditory processing and linguistic information. Another reading teaching material is ReadEasy (<http://readnetwork.com>). Despite of its guided learning characteristics, most CD are not convenient to be used for performance monitoring and lack of user interaction. Adaptation of linear-technique in most courseware is inflexible and of limited capabilities in measuring learning progress. Moreover, most of the current products do not matched learning disabilities children's abilities and limitations.

Apart from that, JWor Enterprises produced their product called *Language Tune-Up Kit (LTK)* which is a remedial reading multimedia phonics software program based primarily on the Orton-Gillingham method. The courseware focuses on intensive, systemic and sequential phonics method of teaching language. The target user for this courseware is not limited to students with diagnosed learning difficulties but all individuals who need a multi sensory phonics approach and also individual learning English as a second language.

Another product, *Lexia's Reading Software* is based on the Orton-Gillingham method of reading remediation. The software provides users with phonemic awareness, sound-symbol correspondence, decoding, fluency, phonics and vocabulary. This software also makes use of good audio usage and useful comprehension to help users in sound- symbol integration.

The *Learning Equation (TLE)* is a computer-based multimedia-learning object that teaches Algebra to Year 9 students (Norton, 2002). Learning theories applied in this courseware are (i) dual coding theory - to have multiple representations of ideas; and (ii) scaffolding technique - to solve student's cognitive loads. Generally each lesson comprised four stages: application or mathematical modeling situations, instruction and explanation using audio and text, practice questions, word problems and terminology activities, and finally self test to assess the student's progress.

## 2.3 ANDROID PLATFORM

Android is a world class platform for creating application and games as it powers hundreds of millions of mobile devices in more than 190 countries around the world (Android, 2012). Therefore, it is recognized as the largest installed base of any mobile platform and growing fast. Its specialty of having own Android market which act as an open marketplace for distributing to android games and applications to Android users instantly.

According to the International Data Corporation (IDC) Worldwide Quarterly Mobile Phone Tracker, smart phone market will record a growth rate four times faster than the overall mobile phone market. The growth of smart phone market is catalyzed by the acceptance of consumers and enterprise users in turning their feature phones for smart phones with more advanced features. Table 4 shows that Android will have the biggest market share by 2015, which indicates that the needs for Andorid applications and games will increased.

Operating System	2011 Market Share	2015 Market Share
Android	39.5%	45.4%
BlackBerry	14.9%	13.7%
iOS	15.7%	15.3%
Symbian	20.9%	0.2%
Windows Phone 7/Windows Mobile	5.5%	20.9%
Others	3.5%	4.6%
Total	100.0%	100.0%

Table 4: Smartphone Operating System Market Share (Source: IDC)

## 2.3 THEORETICAL FRAMEWORK

Game-based learning object is interactive and innovative software application created to promote situated experiential learning and possess educational value; which utilize the gaming technologies with fun and motivating characteristics. This paper will focus on the design process of a digital educational game that facilitates literacy skills through narrative comprehension and animation in dyslexic children. The methodology design for the proposed learning object is based on Townend and Turner Principles of Teaching Program for Dyslexic, Stansfield Instructional Strategies, and Game-based Learning Object Framework. In addition to the three main theories, other theories are adapted to provide more details for the methodology: Oral and Narrative Comprehension Aspects and Sequencing.

### 2.3.1 Principles of Teaching Program for Dyslexic

Townend and Turner (2000) propose that the basic principles of a teaching program targeted to dyslexic children should include:

- **Structure:** the learning process should be performed in small coherent steps explicitly linked to each other.
- **A multi-sensory approach:** the process should be active, interactive and multimodal (including visual, auditory, kinesthetic and tactile interactions). The approach taken is to try and engage as many sensory receptors in the learning process as possible as on many occasions, dyslexic children appear to have additional receptive sensors that can be used to bookmark learning events within their memory.
- **Skill teaching:** the program should not only include the learning of information but the learning of useful transferable skills as well. Students with dyslexia need a lot of repetition to help them maintain their language-related information. Educational game helps dyslexic children avoid the monotony of repetition while still practicing their skills.



- **Reinforcement:** the learnt skills should be practiced and need to be stored in the long-term memory in order for the skill learnt, to be recalled automatically.
- **Meta-cognitive aspects:** this element involves thinking about thinking and the learners self-questioning how a particular response was arrived at. This component is essential for the bridging and transferring of knowledge and should be an integral part of every program.

### 2.3.2 Stansfield Instructional Strategies

Stansfield (2009) provides instructional strategies for learning objects which relates to behaviorist model of learning based on Skinner (1974) theory of stimulus and response. The strategies identified to improve understanding and retrieval of information in children with learning disabilities. The strategies are:

- (1) Motivating and engaging applications;
- (2) Cognitive strategies: requires participation from learners which involves enabling learner to manipulate language material in direct ways through reasoning, and synthesizing;
- (3) Has clear learning objectives defined in the game-play and scenarios presented while knowledge can be imparted through story-telling and narrative;
- (4) Scenarios defined are reflective and transferable to the real-world experience;
- (5) Provides freedom to interact in the game world through a set of defined actions. This can be done by providing navigation control to users.
- (6) Provides clearly defined feedback for every action taken. This allows learners to understand areas that need improvement and also responds with positive, motivating feedback on weak areas.
- (7) Both assessment and lesson can take place during game-play and include memory-related strategies. The strategies is needed to help learners link one concept with another; and

(8) Metacognitive strategies: matches learner's pace and intellectual ability.

### 2.3.3 Game-based Learning Object Framework

Sallen and Zimmerman (2003) defined three primary design schemas to represent a digital game in their conceptual framework (as cited in Stansfield, 2009):

- **Rules:** formally represent the 'mechanics' or operational constraints within the game construct, which in turn governs the level of interactivity within the game.
- **Play:** represents the experiential aspects of the game and communicated to the game player through activities that are distinctively categorized as interactivity, challenge and conflict. It consists of brain exercising activity that tries to capture the ability to recognize patterns in different contexts.
- **Culture:** refers to the beliefs and norms represented in the game world, which is often portrayed to game-players through artificial characters, objects, and settings via aural and visual representations of the game world, and through story-telling.

*Rules* and *culture* define the technical and intrinsic representation of some virtual world in the game to support the activity of the *play* (Stansfield, 2009). The educational game is a good approach for dyslexic children to learn by doing and retain the information in active manner.

Stansfield (2009) further discussed about the difference between computer games and educational games based on the three designed schemas *play*, *rules* and *culture*. According to him, *play* in the context of educational games is defined as interactions designed with an aim to educate learners through principles of cause and effect; that promote the formation of new concepts and development of cognitive skills. Apart from that, *rules* that govern game-play in educational games are characterized by measureable learning objectives that are assessable via interactivity. While *culture* is being explained as element dependant on subject matter and designed learning objectives. He also suggested that the *culture* should include belief and norms from some real-world scenarios to facilitate knowledge transfer from the virtual world to reality.

### 2.3.4 Aspects of Oral and Narrative Comprehension

Multiple factors influence the comprehension of individuals which includes both internal and external factors of the learner. According to Graesser, Olde and Klettke (2002), these cognitive processes contain six levels of discourse structure:

- **Surface code:** the exact wording and syntax of the explicit text (or the intonation patterns in the case of oral narrative). It involves reader's construction of a point for the text as it provides clues on the objectives and strategies of the narrative.
- **Textbase/ Oralbase:** the meaning of the explicit propositions in the oral and narrative includes small number of text-connecting inferences that link a structured set of propositions, and also voice or audio that tell the sequence and events of the story.
- **Situation model:** the mental micro-world describing the narrative. It details out the spatial settings and the timeline of the segments in the plot; focus on explicit and inferred information derived from the plot, and the style and procedure of actions. Timeline of the narrative and the sequence are crucial to ensure that the inferencing of their events is smooth and not time consuming.
- **Agent perspective:** Points of view from which the story is told. Graesser, Olde and Klettke argue that the perspective of the narrator is salient in the reader's mind in the order of second-person, first-person and third-person perspectives. In context of protagonist and objects, the effects in inference stimulation and recall in various perspectives are increased with proximity to the protagonist.
- **Thematic point:** the moral or premise of the story. Constructing theme during comprehension is a challenge for kids; therefore, indentifying appropriate theme for the narration helps in comprehension and sequencing of story events. The intentionality of the characters in the narrative affects readers' goal-related information and helps readers to form inferences to determine the intention behind

the actions.

- **Genre:** the category of narrative under consideration. The constraints of the six representational levels must be in harmony. Another consideration is the cause and effects of the events in the narrative where low and high casual relatedness will result in low recall and moderate casual relatedness produces high recall. In order to facilitate this accordance, the conversions of a genre can be used.

The *surface code* and *textbase* relate to memory for a text, whereas *situation model* concerns learning from a text. The difference between these categories is memory for a text reflects superficial recognition of information, whereas actual learning from a text involves integration of text material with prior knowledge (Irving et al, 2003).

### **2.3.5 Sequencing**

Story and narratives are often used to set the scene and provides an environment for the game-players into game world from various dimensional. The major difference in terms of effectiveness lies on the sequencing or structured set of defined events (game-play sessions) driven by the story. The sequencing should results in meaningful activities that would help game-players to understand the subjects (Stansfield, 2009).

Dyslexic children usually have problems in processing sequences of story. Reid (2003) proposed that when children engross in the activity of story-telling, a framework should be used to take into account the sequence of events especially the 5 Ws and 1 H approach (How did the story start?, What happened after that?, When was the main occurred?, Who was the main character?, Why the character did that?, Where was the event happened?).

Developing sequencing skills can also aid recalling process since the causation enables readers to form inferences and clues about their chronological relations that being unfolds in the plot. It is retained in memory much longer compared to decorative details.

### **2.3.6 Color**

Based on article by WebSemantics.com, a research on relationship of color with dyslexic's accessibility has been done. The research stated that dyslexic has certain requirements on color usage which impacts their accessibility and visual stimulation on symbol shown. They suggested that pastel backgrounds, bigger line-spacing, clear font choice and paragraph are most suitable for dyslexic. Comic Sans is not regarded as a professional font but experienced support practitioners have found that dyslexic students find this a very readable font especially as dark blue text on a pale cream background (WebSemantics.com). The font color use should be contra with the background color in order to emphasize the letter (Abdullah et al, 2009).

# CHAPTER 3

## METHODOLOGY

### 3.1 RESEARCH METHODOLOGY

This paper proposed a development of Digital Game-based Learning Object (LO) with oral narration and animation. It was specially designed to facilitate learning for dyslexic children who struggle from identifying letters and mastering spelling skills. This proposed learning object has been done after details research on the cause of learning problems and the relationship with dyslexic children on specified subject matter. The basic capital letter identification is chosen based on its importance in securing dyslexic children for mastery of literacy.

The design model was derived from ADDIE model of instructional design which encompasses the following five stages: (1) Analysis of learning needs, (2) Design learning object, (3) Development of the learning object, (4) Implementation, and (5) Evaluation of its effectiveness. In this proposed model called Dyslexic Specialized Digital Game-based Learning Object for Learning Letters (DOLL), there are three main phases: (1) Before Development, (2) During Development, and (3) After Development.

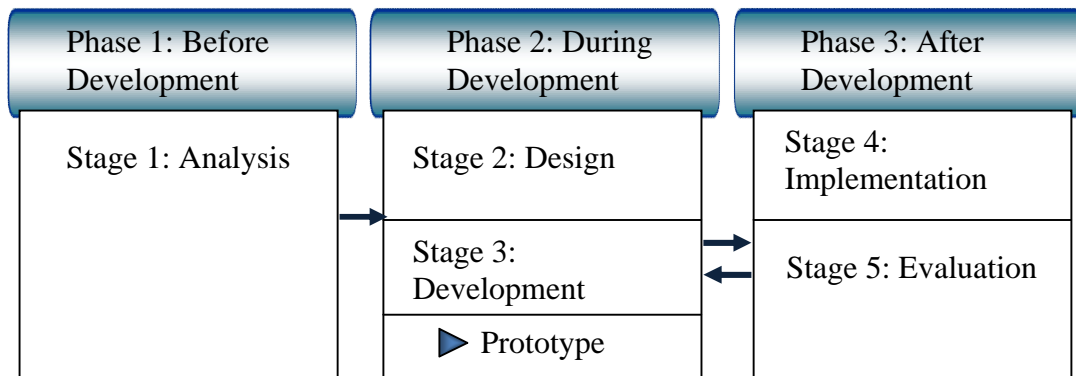


Figure 3: DDLOLL model which consists of three phases.

### **3.1.1 Before Development**

Researcher focus on analyzing three important areas: goals to be achieved, material that must be taught, and learner's current capabilities. This phase is important as it serves major role in quality assurance process and it also defines the learning object's needs and way to measure its success. The value of a needs analysis can be deduced as to prevent mistaken assumptions into the proposed learning object. Mistaken assumptions can be in form of wrong focus in terms of content may not address the learning subject; difficulty level of the course in relation with learner's capabilities; and inaccurate content of the course.

Researcher began needs analysis with the discovery process whereby any existing materials and documents that are relevant to this proposed learning objects is being discovered. These documents are collected with the objective to understand the learner's current situation and the course's context. Based on the interview made by the researcher with special education class's teacher, it is found that dyslexic children take a long time to learn a letter (more than four months a letter) and they are more likely to learn capital letter better and faster. Apart from that, via observation made during teaching of subject matter, researcher concludes that dyslexic children has less focus time on the subject that is being teach and needs to have certain motivational feedback to encourage them to give particular attention.

Researcher also decided to divide the learning subject into different modules to give more space for the dyslexic children to focus on one letter at a time, and defined feedback will be specified for different situation of learning progress. Besides that, the activities will be made based on interactive and fun approach to keep the interest of dyslexic children on the learning object while still practicing the identifying and recalling skills.

Based on analysis, researcher has made instructional analysis for development of prototype which can be used by dyslexic children to meet certain learning objective.

### **3.1.2 During Development**

After the course's learning objectives; and learner's characteristics and capabilities has been identified, researcher produced an instructional design document for the learning object which describes the learning object's content and the sequencing content.

The visual and audio aspects of the learning objects also have been given substantial attention especially in terms of color used, animation and sound throughout the course. In order to prevent visual stress for dyslexic children and facilitate ease of reading, some consideration has been indentified including the font of the text which should be a plain, evenly spaced sans serif font like Arial and Comic Sans; the font size supposed to be between 12 and 14 point and the font color that is more likely to be bright color with dark colored background. In the context of color, bright colored background is not suitable for dyslexic as they tend to perceive the object as moving and results in loss of focus (Ronaldi et al, 2011).

Moreover, the usage of oral narration is being emphasized in this course for the development of sequencing skills of dyslexic children. Therefore, storyline of the course helps in providing direct stimulation towards the learners through character, animation used, background sound, and icons that represents specific actions. This also helps to enhance retention and transfer by allowing learners to generalize the information they have learnt and apply it to other situations.

### **3.1.3 After Development**

After implementation or delivery of learning objects, some evaluation has been defined to measure the learning object's efficacy and identify any further improvements or opportunities for the learning object development. During the evaluation phase, there are several measurements in terms of the likelihood of the learning objects in learner's perspective; the achievement level of learning objectives by the learners; and the feedback on the quality and effectiveness of the learning objects based on results.

Researcher has categorized the evaluation into three levels which are Response (likelihood of the learning object), Learning (level of achievement of learning objectives), and Results (effectiveness of the learning object). For *Response* and *Learning*



level of evaluation, researcher prepared a quick post-course survey to ask learners through simple close-end questions about the learning object. On the other hand, in order to perform evaluation for *Results* level, researcher has taken into account the teacher's or parent's feedback on the learner's performance.

### **3.2 PROJECT ACTIVITIES**

Project activities for this digital game-based learning object can be classified into 7 groups:

- **Research**

Research is the discovery phase of this project, which is needed to understand the requirements and needed features and characteristics of the digital game-based learning object. The basics of current teaching method and multimedia-based learning object are to be known prior to the development phase. This includes the understanding of Dyslexic, Capabilities of Dyslexic children, Learning Object in education, and getting to know how to develop interactive multimedia LO. Design development and build environment is then identified to start designing so that reporting capability can be incorporated into the existing system. For instance, Adobe Photoshop is used to design the animation and background of the LO. Then, by using Flash platform, combination of animation, oral narration and game concept is made alive. On the whole, the user interface of LO and the activity and game in LO are two main parts of the research work.

- **Literature review**

Background information on the research area can be obtained by doing literature review, where journal articles, books, conference proceedings, theses, or piece of writing from other sources that are related to the project are perused to have thorough explanation of work. In particular, articles that have relatively concise information about Dyslexia and relationship between multimedia and dyslexic will be studied to obtain information of prior researches done, theories, and findings of the Learning Object.

- **User interface design**

User interface is the component of learning object that support user interaction. For this LO, user interface consists of the screen displays that provide instruction throughout the LO, the character and animation for oral narration, screens for game to assess performance and understanding, and screens that provide feedback to learners. The interface design is designed with characteristic that users will have a very simple-to-use function that teach learner step by step for every phase, while do the activities to assess understanding and performance of learner for every subtopic.

- **Implementation**

Putting the concept and design into place is indeed a very time-consuming and complicated job. Researcher needs to make sure that the design of learning object suits all the learning style and capabilities of Dyslexic, so that the learning objectives are achieved. User interface and game activities are the major part of this implementation phase and prototype will be generated as the development goes on. User interface has to be implemented on-screen to enable users to click, and drag and drop. The information and learning concept need to be displayed properly and correctly to ensure learner understanding and acceptance while encourage recalling and retention.

- **Testing and Evaluation**

Testing and evaluation is an ongoing and continuous task as the project development goes on. It is done with the aim of uncovering the LO defects and features that is not matching learner's learning characteristics. Rendering is thus one of the main processes done simultaneously as testing takes place. Evaluation sheets will be created to include the testing requirements for the product. Researcher has outlined the main testing tasks for this project to be as following: user interface testing, module testing, and lastly learning object testing as a whole. There will be three level of evaluation: Response (likelihood of the learning object), Learning (level of achievement of learning objectives), and Results (effectiveness of the learning object).

- **Documentation**

Reports are submitted in partial fulfillment of the requirements for completing this project as a whole. Documentation includes the composition of proposal, preliminary report, progress reports, interim report, poster, and dissertation. Documenting the findings, data analysis, results and discussions, researches, literature analysis and the likes is vital to archive the valuable information about the project as documentation is also one of the project deliverables.

- **Presentation**

The proposed digital game-based learning object will be presented verbally at the end of each semester. At the end of project period, demonstration of all the project works regarding the project will be done in a final oral presentation. Presentation provides an opportunity for students to exhibit the knowledge and findings about their project research area of the system that they are developing.

### **3.3 TOOLS REQUIRED**

The multimedia platform of learning object is essential in developing the new digital game-based learning object. Flash framework is chosen for its capability to combine animation, oral narration and game-based activities. For the user interface, Adobe Photoshop is being used to create character and animation for this learning object. The Flash framework consists of Adobe Flash Player, Adobe AIR, and Adobe Flash Professional CS 5.5. The specialty of Adobe Flash Professional CS 5.5 which can be used in Android operating system makes it the right platform to be used in this LO in order to suit the needs of this learning object which is to be used widely. As Android device become trends and the market is wide in Malaysia, it will not be a problem for parents to have new teaching assistance for their unfortunate children.

### 3.4 KEY MILESTONE AND GANTT CHART

#### 3.4.1 Key Milestone for FYP 1

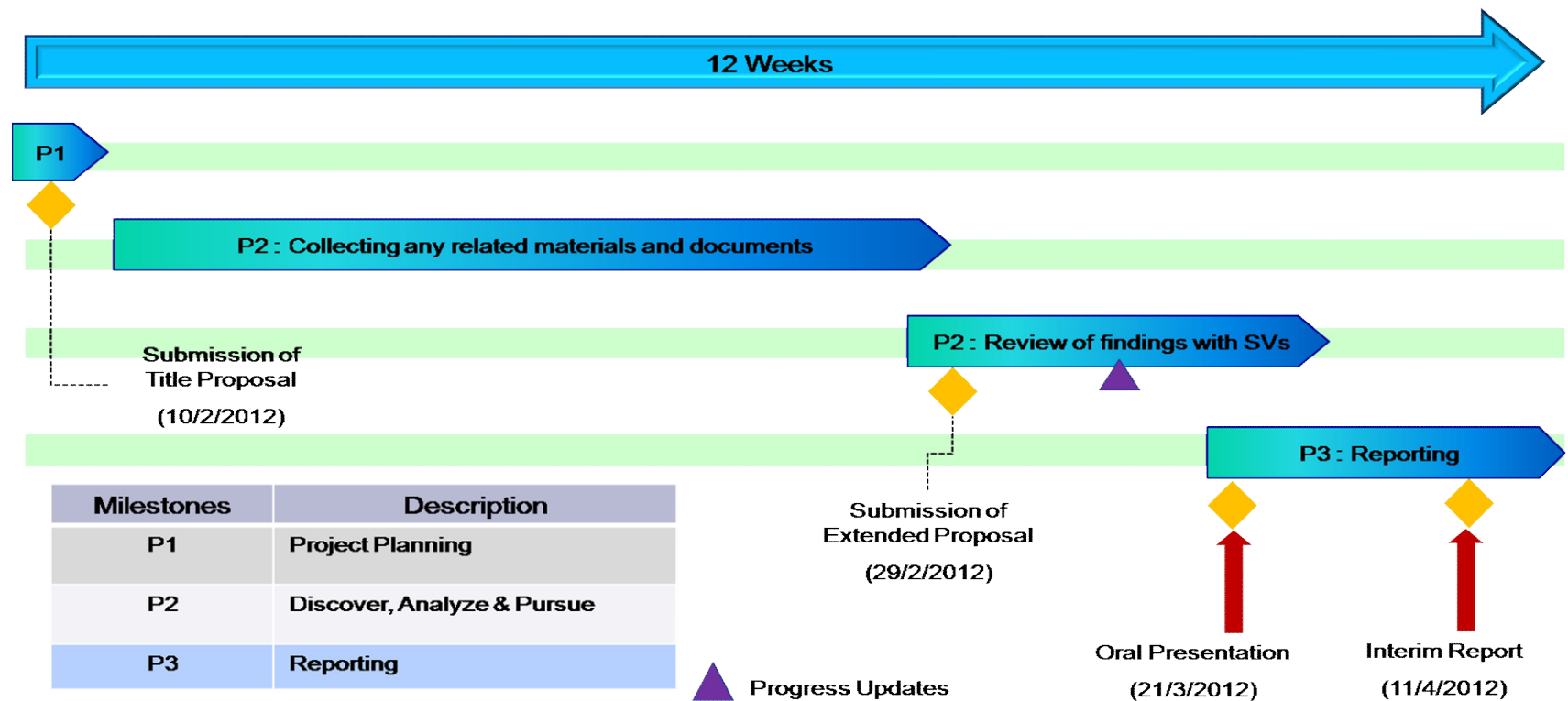


Figure 4: Key Milestone for FYP 1

### 3.4.2 Gantt Chart for FYP 1

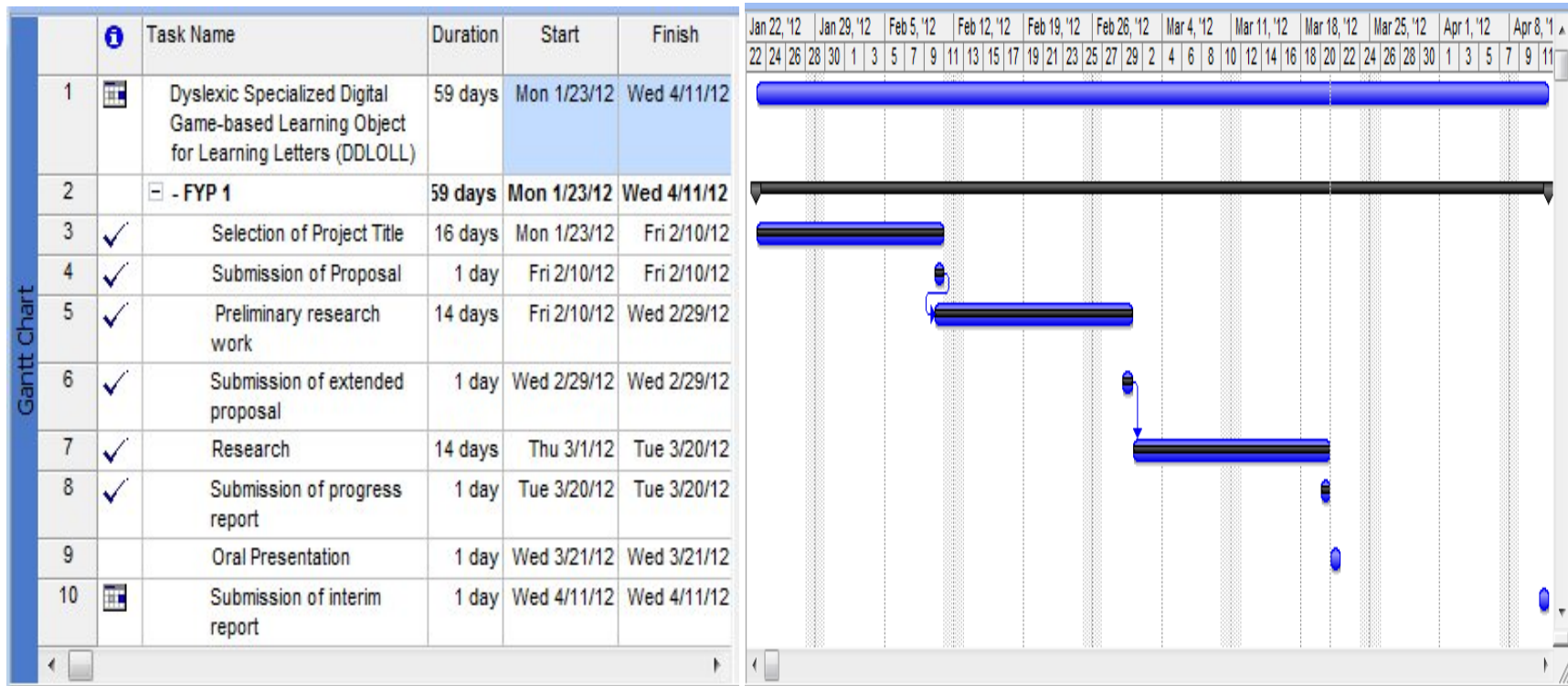


Figure 5: Gantt Chart for FYP 1

### 3.4.3 Key Milestones and Gantt Chart for FYP 2

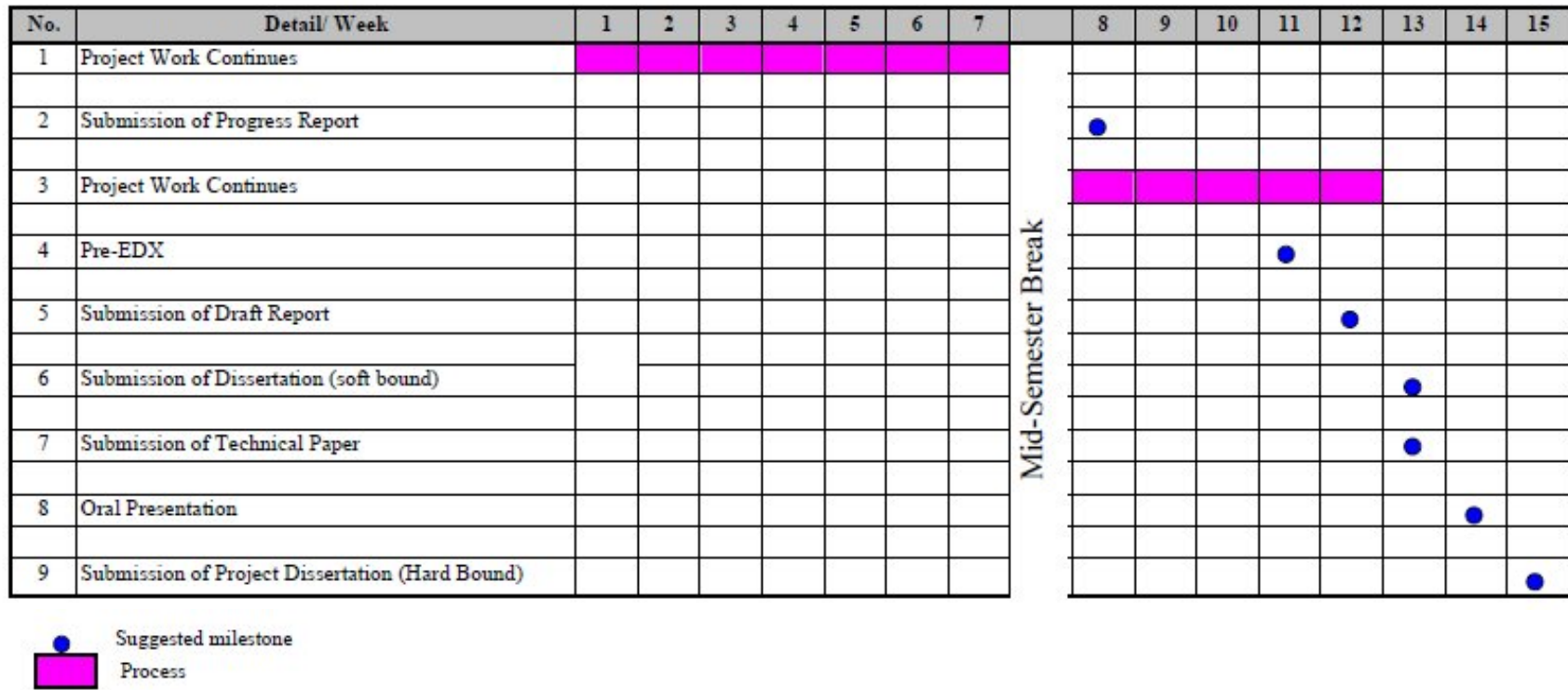


Figure 6: Key Milestones and Gantt Chart for FYP 2

## CHAPTER 4

### RESULT AND DISCUSSION

#### 4.1 PROTOTYPE

##### 4.1.1 Structure, Learner Control and Audio

The LO start with menu screen which shows monkey holding a card written 'MULA'. Students need to touch the card to start the game. The background music will start playing. The next screen will be introduction to character which is Ana. This is done by audio of Ana introducing herself and asking students to join her learning letters (Graesser, Olde and Klettke, 2002). After that, students will be required to choose which letter they want to learn. This provides students with learner control over LO. Based on Stansfield instructional strategies, proposed learning object are designed with main menu (Figure 7). The main menu and submenu provides students with the structure of the LO which consists of steps or stages that are linked with each other (Townend and Turner, 2000).



Figure 7: Main Menu of DOLL

### 4.1.2 Learning Objectives

Figure 8 shows learning outcomes; for learners to set their aim in achieving it. There are three main objectives for every letters, which are to recognize the name of letters, to recognize sound of letters and to recognize shape of letters. These objectives act as transferable skills that students should possessed after completing each stage. Every stages comprises of repetitive lessons on learning concepts to facilitate students learning new information (Townend and Turner, 2000). Rules schematic design is being applied in the learning object to set instructions for the activity (Sallen and Zimmerman, 2003). The learning objectives and explanation on activities detailed out the guidelines of the games to provide students with the necessary information for the interactivity within the game.



Figure 8: Objective Set For Each Activity or Stage

### 4.1.3 Graphics, Color and Narration

The character will then start telling the story of alien which has been left by its spaceship. The alien have shaped as letter and Ana will introduce the alien name as the letter's name. The screen use dark background and contra font color to suit dyslexic students' needs and to reduce dyslexic students' sight sensitivity (Figure 9) (Ronaldi et al, 2011). The font used is comic sans ms which is best for dyslexic (Ronaldi et al, 2011). Using meta-cognitive aspects of teaching program as reference, the 3D image of letter; sound effects, concept imagery and story-telling elements are combined to increase imagination of learner to enjoy the learning object (Townend and Turner, 2000).



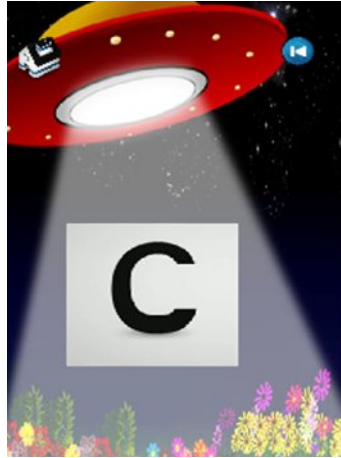


Figure 9: Color and Font Used in DOLL

#### 4.1.4 Animation

In Figure 10, the learning object use character of a girl named Ana is created to make the story line more attractive and helps in sequencing (Stansfield, 2009). In addition, character of Ana acts as agent perspective of the story being told and helps learners identify the theme of the story which is important in oral comprehension (Graessar, Olde and Klettke, 2002). Animation elements are added to facilitate explaining the contents and structure of the learning object (Townend and Turner, 2000). Artificial character, animation and settings are combined to represent the culture of game world for dyslexic students' understanding and helps in the ability to recognize game patterns (Sallen and Zimmerman, 2003). The background color is pale in order to give more emphasize on the object and letters.

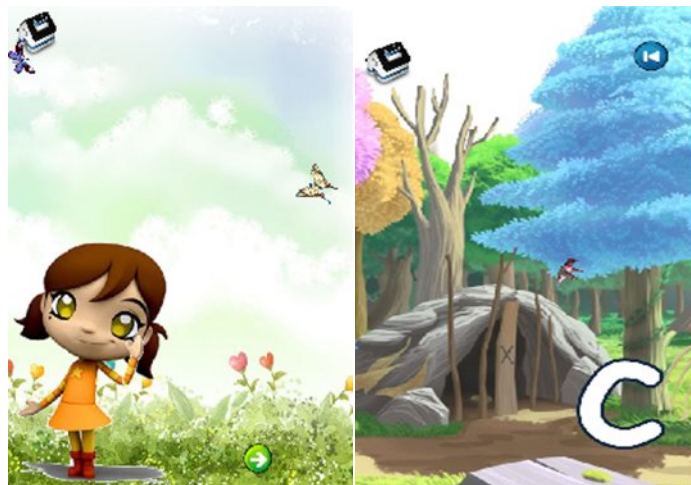


Figure 10: Character for the proposed Game-Based Learning Object

#### 4.1.5 Reinforcement

After every learning objective, students will be tested with simple questions to test their understanding and memory about what has been taught in the section. Self test activity is done right after students learn every phase of learning and it is considered as memory-related strategies while stress on the needs to link the concepts with the activity done (Stansfield, 2009). As their focus is low and problem in recalling skills, reinforcement and practice need to be done faster to improve and encourage their recalling skills (Townend and Turner, 2009). Simple question is needed as dyslexic has difficulties in understanding long instructions and sentences (Figure 11) (Graesser, Olde and Klettke, 2002).



Figure 11: Exercise (Self-test)

#### 4.1.6 Multi-sensory Approach

The concept of self-test is simple; students only need to touch the object with correct answer. Every box will produce its own sound, which contains answer. Therefore, students need to give particular attention to the box and the sound from the box in order to answer the question. Basically, the activity is multimodal (kinesthetic, auditory and visual interactions). Eventually, students will engage many sensory receptors in the learning process and remember more (Townend and Turner, 2000). Multi-sensory approach used in play schematic design to access learners' understanding and stimulate

recalling skills, while increase learning by experience through to user interaction (Figure 12) (Sallen and Zimmerman, 2003).



Figure 12: Multi-sensory Approach in DOLL

#### 4.1.7 Navigation and Video

Researcher designed the learning object using phonetic approach to stimulate learner's auditory elements and video is used to show correct way to produce correct sound of the letter (Figure 13) (Townend and Turner, 2000). Button icons with specific action are placed on the screen to provide students with navigation control (Stansfield, 2009).

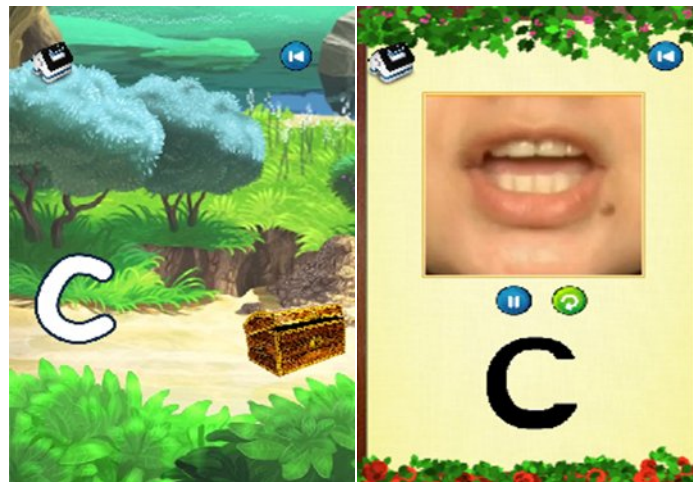


Figure 13: Phonetic Approach in DOLL

#### 4.1.8 Feedback

Figure 14 shows the feedback for every achievement by using emoticon clapping hands to congratulate learner for their achievement (Stansfield, 2009). Reward being given based on the number of smiley they collect at upper level of the screen. If the result is negative, then the feedback should be in the form of encouragement and motivation.



Figure 14: Feedback after User Interaction

#### 4.1.9 Skill Teaching

Proposed learning object also design with skill teaching aspects to help learner by providing step-by-step instructions and helps learners to have useful transferrable skills (Townend and Turner, 2000) (Figure 15).

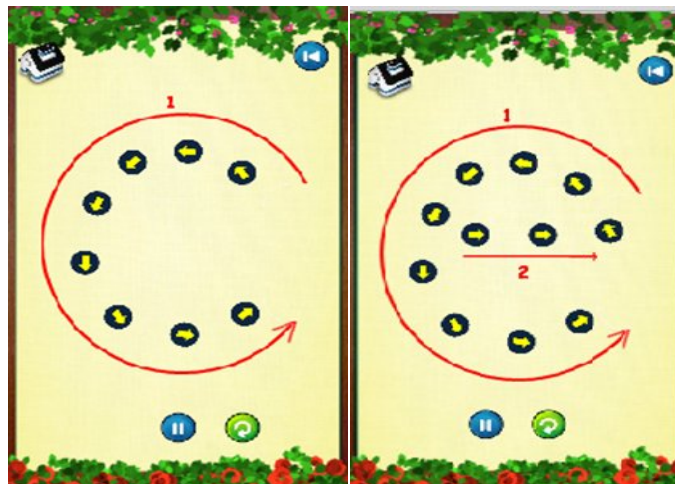


Figure 15: Step-by-step Instructions

## 4.2 DISCUSSION

Schools involved in this study were Sekolah Kebangsaan Meranti, Pasir Mas, Kelantan. Demographically, students here are from different races with different economic status. Due to the limited number of students in each school, the number of students involved in this research was 10 people (population). All students are Malays with the three levels: good, average and poor. Researcher gave students the access to the LO which has been stored on the tablet computer. After use, they are required to assess LO evaluation survey form provided.

For the first part of Table 5 describes the use of LO where majority of students admitted the LO is easy to use. Students' response that functions icons are easy to understand and they can browse the contents by pressing the button icons. Function buttons are available in LO for navigation to repeat the story, and continuing the story. 80% students agreed that the LO well structured. The structure of the concept of storytelling helps LO be able to organize content based on the syllabus. At the same time, the duration of animation short as the narrative makes the content more organized and understandable. While 100% of students agreed that they like what they see and feel. Through video observation and teacher approval, your students react interest, feel curious and motivated when using the LO.

Moreover, 100% of students agree that the images and animations are an important component of the LO. They understand the iconic images of alien shaped C as letter C. Animation to be shown followed by the reaction of focus, curiosity, and nodded his head. Furthermore, all of the student love the multi-sensory approach and find it very interesting and helpful. They respond very well by clicking correct answer and said that this helps increase their confidence level. In context of sound usage and oral narration, they also respond by following narrator voice out the name of letter, and the sound of letter. While 90% of the students agreed that the activities narrative is appropriate and helpful.

Storytelling activity is designed to encourage users for fun and excitement for knowing new friend while understand the name, sound and shape of letter. 90% of students agreed that the instruction in LO is simple and easy to understand. With simple instruction and oral question, students understand more and find it more interactive.

With the majority agree to all the questions divided use LO, suggesting that dyslexic students have a clear perception of how easy and they can follow the teaching and activities presented using animation techniques that have been specially designed.

No of Students: 10	Agree		Neutral		Disagree	
Question	No.of Students	%	No.of Students	%	No.of Students	%
<b>Part 1: Usability of LO</b>						
Easy to use	10	100	-	-	-	-
Clear instruction	9	90	1	10	-	-
Clear and suitable font usage	8	80	-	-	2	20
Interesting color usage	9	90	1	10	-	-
Systematic LO's structure	8	80	-	-	2	20
Story and comprehension are helpful	9	90	1	10	-	-
Suitable sound usage	10	100	-	-	-	-
Love multi-sensory approach	10	100	-	-	-	-
Image and animation attract interest	10	100	-	-	-	-
Loves challenges in LO's activity	9	90	-	-	1	10
<b>Part 2: Learning (level of achievement of learning objectives )</b>						
LO is interactive and fun	10	100	-	-	-	-
Activity in LO is helpful and encouraging	9	90	-	-	1	10
Content suit the needs	9	90	1	-	-	-
Understand learning objectives	8	80	-	-	2	20

Table 5: Response on DOLL.

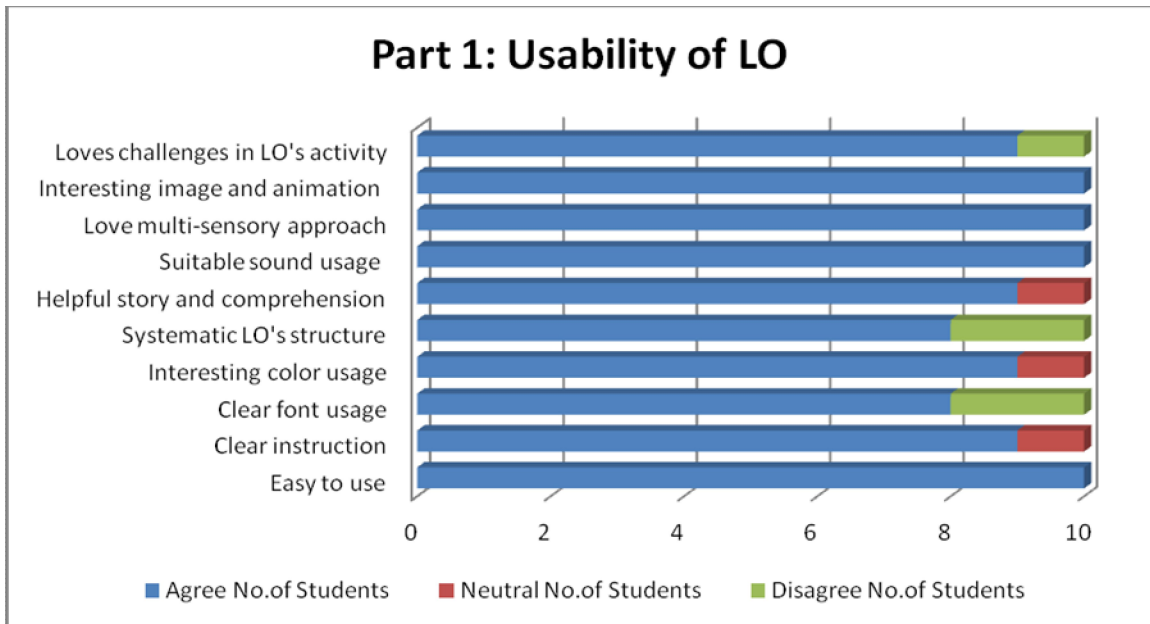


Figure 16: Usability of LO

For the second part, Table 5 shows a positive reaction on learning value. 100% of students agreed that the LO is interesting. Not only the students using the LO, other students non-LO at the same time showed a desire to participate with such LO. All of them express the desire to learn through these forms of learning to other subjects. 90% students also agreed that the content is appropriate to the needs. Students find that use of images and animations, designed for students with dyslexia can be well accepted and all students to demonstrate understanding on content. As a conclusion for the value of learning, found that the majority approval of all items and solutions to animation has been specially designed effective in helping them to learn and understanding of content.

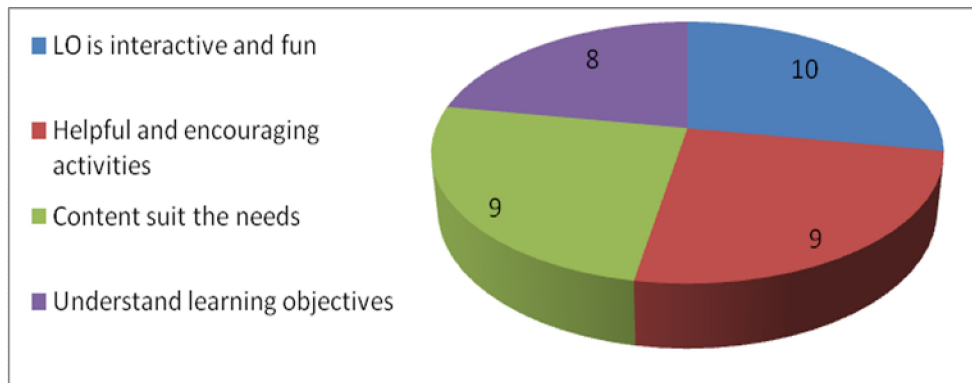


Figure 17: Learning Feedbacks

## **CHAPTER 5**

### **CONCLUSION**

#### **5.1 RECOMMENDATION**

- Voice recognition would be really helpful for dyslexic students with symbol-sound integration problem.
- Augmented reality in educational game provides 3D perspective for dyslexic students to understand better.
- Using better visualized graphics and animation will give more impact to dyslexic by providing more real-life scenario which helps in the sequencing and generate better inference to link events with another.
- Online interaction between students within game will give more positive responds and impact on students' interactivity. Dyslexic students loves challenges and competition with other students throughout the game make the game becomes more interesting.

#### **5.2 CONCLUSION**

Currently, DOLL is in its final development stage. Throughout this learning object development, researcher has gained great knowledge on dyslexia teaching methods, instructional designs theory and learning materials design framework. The proposed learning object will be based on interactive, fun, and animation which is expected to develop interest of dyslexic students to learn letters and applied the knowledge in reading skills. As conclusion, this learning object has great potential to bring teaching methods for dyslexic in Malaysia to a higher level in order to increase literacy level of citizens and produce intellectual and productive individuals.



## REFERENCES

- [1] Abdullah, M Haziq. Hisham, S. & Parumo.S. (2009) MyLexics: An Assistive Courseware for Dyslexic Children to Learn Basic Malay Language. SigAccess Newsletter, Issue 95. [Cited: February 25, 2012.] [http://www.sigaccess.org/community/newsletter/september\\_2009/sep09\\_2.pdf](http://www.sigaccess.org/community/newsletter/september_2009/sep09_2.pdf).
- [2] Android. [Cited: March 29, 2012.] <http://www.android.com/about/>.
- [3] Anna Stephens (2011). Visual Dyslexia. [Cited: June 27, 2012.] <http://dyslexiawayofthinking.co.uk/tag/visual-thinkers/> .
- [4] Australian Dyslexic Association (ADA). Characteristics of dyslexia. [Cited: June 27, 2012.] <http://demystifyingdyslexia.weebly.com/what-are-the-characteristics-of-dyslexia.html>.
- [5] Beacham, N. (2007) The potential of multimedia to enhance learning for students with dyslexia. Skills for Access. [Cited: February 19, 2012.] <http://skillsforaccess.org.uk/articles.php?id=150>.
- [6] Boder , E. (1971) 'Development Dyslexia: Prevailing diagnostic concepts and a new diagnostic approach.' *In Myklebust, H.R (Ed.) Progress in Learning Disabilities, Vol. 2. New York: Grune and Stratton, p.293.*
- [7] Boder , E. (1973) Developmental Dyslexia: A diagnostic Approach Based on Three Atypical Reading- Spelling Patterns, pp 667.
- [8] Bradley, R., Danielson, R.L., & D.P. Hallahan, D.P. (2002). *Identification of learning disabilities: Research to practice.* Mahwah, NJ: Erlbaum.
- [9] Briggs, H. (August,2001). Computer Game Helps Dylexics. BBS News, August 20, 2001.
- [10] Brown, E.K (2009). Learning Disabilities: Understanding the Problem & Managing the Challenges. Publisher: Langdon Street Press.
- [11] Chinn, S. (Nov, 2010) Dyscalculia: Why some children fail at Maths? Retrieved from <http://www.hillslearning.com/home.steve.chinn.dyscalculia.workshop> on February 25, 2012.

- [12] Critchley, Macdonald (1990). "Dyslexia Defined." *Mattis, French and Rapin-Language Disorder group, Articulatory and Dyscoordination Group and a Visuospatial Verceptual Disorder group*. [Cited: February 26, 2012.] <http://www.mcalester.edu>.
- [13] Critchley, M. (1970). *The Dyslexic Child, 2<sup>nd</sup> Edition*. Springfield,III : Charles C Thomas.
- [14] Davis, R.D. (1992). 37 Common Characteristics of Dyslexia. Retrieved February 26, 2012 from Davis Dyslexia Association International, Dyslexia the Gift Web site: <http://www.dyslexia.com/library/symptoms.htm>.
- [15] Dyspraxia Foundation (1996). What is Dyspraxia? [Cited: February 25, 2012.] <http://www.dyspraxiafoundation.org.uk>.
- [16] Early Intervention Support (2009). Diagnosis for Children with Special Needs: Dyslexia. [Cited: February 26, 2012.] <http://www.earlyinterventionsupport.com>.
- [17] Eisenberg, L. (1966). Reading retardation. I: Psychiatric and sociologic aspects, *Pediatrics*, p.37,352.
- [18] Engel-Eldar, R, and Rosenhouse, J. (2000). Reading Difficulty Characteristics in Dyslexic and Hearing-Impaired Students in Educational Psychology: An International Journal of Experimental Educational Psychology, v20 n4 p459-82 Dec 2000.
- [19] Fadilahwati Abdul Rahman, Fattawi Mokhtar & Ronaldi Saleh Umar. (2010) Usability Testing on Interactive Multimedia Learning Object for Dyslexic Children: Proceeding of 5th International Conference on e-Learning, 12-13 July 2010. Universiti Sains Malaysia, Penang, Malaysia.
- [20] Fletcher JM, Francis DJ, Morris RD, Lyon GR. (2005). Evidence-based assessment of learning disabilities in children and adolescents. *J Clin Child Adolesc Psychol*. 2005 Sep; 34(3):506-22.
- [21] Fletcher, J.M., Fuchs, L.S., Barnes, M.A. (2007). *Learning Disabilities: From Identification to Intervention*. New York, NY: Guilford Press.
- [22] Graesser, A., Olde, B. and Klettke, B. (2002) How does the mind construct and represent stories?, in *Narrative impact: social and cognitive foundations*, Lawrence Erlbaum Associates, Inc., Mahwah, N.J., pp.229-262.

- [23] Gresham, F.M. (2002). Responsiveness to intervention: An alternative approach to the identification of learning disabilities. In R. Bradley, L. Danielson, & D.P. Hallahan (Eds.). *Identification of learning disabilities: Research to practice* (pp 467-564). Mahwah, NJ: Erlbaum.
- [24] IDC News: IDC Forecasts Worldwide Smartphone Market to Grow by Nearly 50% in 2011. [Cited: March 29, 2012.] <http://www.idc.com/getdoc.jsp?containerId=prUS22762811>
- [25] Ingram, T.T.S. , Mason, A.W., Blackburn, I. (1970) ‘A retrospective study of 82 children with reading disability.’ *Development Medicine and Child Neurology*, 12, 271.
- [26] Irving B. W., Alice F. H., Donald K. F., Robert W. P., John A. S., Wayne F. V. (2003) *Handbook of Psychology: Experimental psychology*. Publisher: John Wiley and Sons.
- [27] Juken Consultancy (Nov, 2004). Addressing Specific Learning Difficulties in Children: Dyslexia. [Cited: February 25, 2012.] <http://www.jukenworld.com>.
- [28] Julina Johan (2005). Kementerian rujuk aduan masih banyak pelajar gagal kuasai 3M, Utusan Malaysia 14 Februari:14
- [29] Katie O. (2003). Dyslexia and Music: From Timing Deficits to Musical Intervention. In *Annals of the New York Academy of Sciences; the Neurosciences and Music, vol. 999 (pp 497–505)*.
- [30] Keates, A. (2000). *Dyslexia and Information and Communication Technology: A Guide for Teachers and Parents*. London: David Fulton Publishers.
- [31] Komala, P. Devi. (2004, September 22). Disleksia- Ramai Kanak-kanak tidak kenal huruf. Utusan Malaysia, p.17.
- [32] McCormack, W. Understanding the Needs Of Students With Dyslexia. [Cited: February 26, 2012.] [http://www.ncge.ie/handbook\\_docs](http://www.ncge.ie/handbook_docs).
- [33] Mortimore, Tilly (2008). *Dyslexia and learning style: a practitioner’s handbook* 2nd ed. England: John Wiley & Sons Ltd.
- [34] National Center for Learning Disabilities (NCLD), (2002). *Achieving better outcomes - maintaining rights: An approach to identifying and serving students with specific learning disabilities,p.4* . New York: Author.

- [35] National Center for Learning Disabilities (NCLD), (2010). What is Dyspraxia? [Cited: February 25, 2012.] <http://www.nclld.org>.
- [36] Nicolson, R. and Fawcett, A. (November 1999). "Developmental dyslexia: the role of the cerebellum". *Dyslexia: an International Journal of Research and Practice* 5: 155–7.
- [37] Nor Afzan Mohamad Yusof. (2006). Kerajaan perlu tambah program khas di sekolah. *Berita Harian*, 31 Julai 2006.
- [38] Nordin Ahmad (2005). "350,000 murid sekolah rendah alami Disleksia". *Utusan Malaysia*, 17 December 2005, p. 2.
- [39] Norton, S., Cooper, T.J., McRobbie, C. (2002). *Cognitive Load, Scaffolding and an ILS Algebra Tutor*, Australian Association for Research in Education.
- [40] Peter, D. P., Colin D. E. (1990). *Children's difficulties in reading, spelling, and writing* pp 155-157. Routledge, Feb 1, 1990.
- [41] Rajesvari A/P Ramasamy (2008). *Masalah Disleksia Dalam Kalangan Murid-Murid Pemulihan Di Sekolah Rendah, Pulau Pinang*, p. 15.
- [42] Reid G. (2003) *Dyslexia: A Practitioner's Handbook*. Publisher: Wiley.
- [43] Ronaldi Saleh b Umar, Fadilawati Abdul Rahman, Fattawi Mokhtar & Nor Aziah Alias (2011). *Menggunakan Animasi di dalam Intruksi Khas untuk Kanak-kanak Disleksia*.
- [44] Shaywitz, S. (Sept, 2003). *Overcoming Dyslexia: Learning disabilities that are diagnosed early are much easier to remediate*, p.12.
- [45] Shuhada Mansor (June, 2011). *Beri Semangat Anak Disleksia*. *Harian Metro*, July 18, 2011.
- [46] Stansfield M. (2009) *Games-based learning advancements for multi-sensory human computer interfaces: techniques and effective practices*. Publisher: Idea Group Inc.
- [47] Stephen M. Kosslyn and Oliver Koeuig (1990). *Wet Mind: The New Cognitive Neuroscience*, pp.185-207. New York: The Free Press.
- [48] *The Power of Dyslexia* (2011). *Signs of Dyslexia*. [Cited: February 27, 2012.] <http://www.thepowerofdyslexia.com/dyslexia/>.
- [49] Townend J. and Turner M. (2000) *Dyslexia in Practice: A Guide for Teachers*, Springer.

- [50] U.S. Department of Education (2004). Individuals with Disabilities Education Improvement Act of 2004, Pub. L. No. 108-446 & 1400 *et seq.*
- [51] U.S. Office of Education. (1977). Assistance to states for education for handicapped children: Procedures for evaluating specific learning disabilities. *Federal Register*, 42, G1082–G1085.
- [52] United States National Institute of Neurological Disorders and Stroke (Sept, 2011). NINDS Dysgraphia Information Page. [Cited: February 29, 2012.] <http://www.ninds.nih.gov/disorders/dysgraphia>.
- [53] United States National Institutes of Health: Dyslexia. [Cited: February 29, 2012.] <http://www.nih.gov/>.

APPENDIX



UNIVERSITI  
TEKNOLOGI  
PETRONAS

**BORANG KAJI SELIDIK DOLL: Dyslexic Specialized Digital Game-based Learning Object for Learning Letters**

Nama Peserta: \_\_\_\_\_ Jantina: L/P  
Umur: \_\_\_\_\_

Soal selidik ini bertujuan untuk menguji kefahaman anda terhadap bahan pembelajaran yang diberikan kepada anda. Anda perlu menjawab setiap soalan di kawasan kosong yang disediakan. Soal selidik ini merangkumi tiga(3) bahagian: Tindak balas (kemungkinan objek pembelajaran), Pembelajaran (tahap pencapaian objektif pembelajaran), dan Keputusan (keberkesanan objek pembelajaran).

Untuk setiap jawapan juga menunjukkan (dengan meletakkan tandakan dalam ruang A, B, C) sama ada anda:

A. Tidak Setuju  
C. Setuju

B. Neutral

Bil	Soalan	A	B	C
<b>Bahagian 1: Penggunaan Bahan Pembelajaran (LO) ( Usability of LO)</b>				
1.	LO senang digunakan			
2.	Saya dapat memahami arahan dalam LO dengan baik			
3.	Jenis tulisan yang digunakan dalam LO adalah jelas			
4.	Warna yang digunakan di dalam LO menarik dan sesuai			
5.	LO distruktur dengan baik			
6.	Suka dengan apa yang saya lihat dan rasa			
7.	Cerita di dalam LO menarik			
8.	Penggunaan bunyi di dalam LO adalah sesuai			

9.	Suka dengan aplikasi multi-deria digunakan LO			
10.	Imej dan animasi menarik minat			
11.	Suka dengan cabaran aktiviti yang diberikan			
<b>Bahagian 2: Pembelajaran (tahap pencapaian objektif pembelajaran) (Learning Values of LO)</b>				
1.	LO interaktif dan menarik			
2.	Aktiviti di dalam LO sesuai dan membantu			
3.	Kandungan sesuai dengan keperluan			
4.	Faham objektif pembelajaran dalam setiap bahagian LO			



## **BORANG KAJI SELIDIK DOLL: Dyslexic Specialized Digital Game-based Learning Object for Learning Letters**

Borang Kaji Selidik ini disediakan oleh Husnaini binti Hussin, pelajar tahun akhir, jurusan Business Information System (BIS), di Universiti Teknologi PETRONAS, Tronoh Perak berkenaan Projek Tahun Akhir.

Kajian ini dilakukan keatas kanak-kanak yang mempunyai masalah disleksia, berusia 7 hingga 10 tahun. Tujuan kajian ini dijalankan adalah untuk mengenal pasti potensi mendedahkan kanak kanak kepada pembelajaran Bahasa Melayu melalui penggunaan produk pembelajaran multimedia menggunakan tablet atau telefon pintar. Walaubagaimanapun, kajian ini memerlukan penyertaan ibubapa atau guru-guru kerana mereka ini adalah golongan yang paling dekat dengan kanak-kanak serta secara tidak langsung memahami kehendak kanak-kanak. Borang kaji selidik ini bertujuan untuk mengumpul maklumat dalam penghasilan produk multimedia khas untuk pengajaran dan pembelajaran khusus untuk kanak-kanak disleksia yang berusia 7 hingga 10 tahun. Justeru, jawapan yang tepat digalakkan supaya produk yang dihasilkan akan lebih berkualiti.

Objektif:

- Untuk mendapatkan komen dan pandangan mengenai sistem pembelajaran menggunakan komputer dan multimedia serta tahap penggunaan komputer di rumah.
- Untuk mendapatkan pengesahan pandangan dari Iubapa dan Guru-guru mengenai kaedah pembelajaran mengenal huruf melalui Produk Multimedia Pembelajaran di dalam tablet atau telefon pintar.

NAMA

PESERTA: \_\_\_\_\_

—

(Iubapa/Guru-guru)

Kepada Iubapa dan Guru-guru, sila tandakan jawapan di dalam borang kaji selidik ini bagi pihak anak-anak anda.

Soalan 1 – Soalan 14: Sila Tandakan (✓) di dalam kotak yang berkenaan. Pilih satu (1) jawapan yang berkenaan sahaja.



1. Anda adalah seorang...

(        ) Ibu Bapa

(        ) Guru

(        ) Kedua-duanya

2. Jantina :

(        ) Lelaki

(        ) Perempuan

No	Soalan	Ya	Tidak
3.	Adakah anda bekerja?		
4.	Adakah pasangan anda bekerja?		
5.	Adakah anda mempunyai komputer peribadi/komputer riba di rumah?		
6.	Adakah anak anda tahu menggunakan komputer peribadi/komputer riba?		
7.	Adakah anda menyokong penggunaan tablet/ telefon pintar sebagai alat untuk tujuan pendidikan dan pembelajaran?		
8.	Pernahkan anda menggunakan mana-mana produk pembelajaran multimedia untuk anak-anak anda?		
9.	Pada pandangan anda adakah kanak-kanak berusia 7 hingga 9 tahun berminat terhadap Produk Multimedia Pembelajaran?		
10.	Apakah penggunaan Produk Multimedia Pembelajaran memberi kesan yang bagus kepada kanak-kanak?		
11.	Adakah anda dan pasangan anda mempunyai masa mendidik anak anda mengenal huruf di rumah?		
12.	Adakah anda menyokong pembelajaran mengenal huruf Bahasa Melayu melalui penggunaan Produk Multimedia dalam tablet/telefon pintar?		

**Bahagian 3: Keputusan (keberkesanan objek pembelajaran) (LO Efficiency).**

13. Masa yang diperlukan oleh peserta untuk mengenal sesuatu huruf berkurangan.

- (        ) Sangat Setuju
- (        ) Setuju
- (        ) Sederhana
- (        ) Tidak Setuju

14. Penggunaan Objek Pembelajaran menarik minat peserta untuk mengenal huruf.

- (        ) Sangat Setuju
- (        ) Setuju
- (        ) Sederhana
- (        ) Tidak Setuju