

**SPEECH DEVELOPMENT COURSEWARE FOR DOWN'S SYNDROME
CHILDREN WITH IMPLEMENTATION OF COGNITIVE THEORY IN
MULTIMEDIA LEARNING**

RISHALAVERNIA RAMANATHAN

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**SPEECH DEVELOPMENT COURSEWARE FOR DOWN'S SYNDROME
CHILDREN WITH IMPLEMENTATION OF COGNITIVE THEORY IN
MULTIMEDIA LEARNING**

RISHALAVERNIA RAMANATHAN

**This report is submitted in partial fulfillment of the requirements for the Bachelor
of Computer Science (Interactive Media)**

**FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
UNIVERSITI TEKNIKAL MALAYSIA MELAKA
2008**

BORANG PENGESAHAN STATUS TESIS *

JUDUL: SPEECH DEVELOPMENT COURSEWARE FOR DOWN'S SYNDROME CHILDREN WITH IMPLEMENTATION OF COGNITIVE THEORY IN MULTIMEDIA LEARNING

SESI PENGAJIAN: 2008

Saya RISHALAVERNIA RAMANATHAN

mengaku membenarkan tesis (PSM) ini disimpan di Perpustakaan Teknologi Maklumat dan Komunikasi dengan syarat-syarat kegunaan seperti berikut:

1. Tesis dan projek adalah hakmilik Universiti Teknikal Malaysia Melaka.
2. Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dibenarkan membuat salinan tesis ini sebagai bahan pertukaran antara institusi pengajiab tinggi.
4. ** Sila tandakan (/)

_____ SULIT

(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)

_____ TERHAD

(Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/ badan di mana penyelidikan dijalankan)

/ _____ TIDAK TERHAD



(TANDATANGAN PENULIS)

Alamat tetap: No.4, Jln Awan,
68000 Kuala Ampang,
Selangor

Tarikh: 28 Oktober 2008



(TANDATANGAN PENYELIA)

Muhammed Haziq Lim bin Abdullah

Tarikh: 29 Oktober 2008

CATATAN: *Tesis dimaksudkan sebagai Laporan Akhir Projek Sarjana Muda(PSM)
**Jika tesis ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa

DECLARATION

I hereby declare that this project report entitled

**SPEECH DEVELOPMENT COURSEWARE FOR DOWN'S SYNDROME
CHILDREN WITH IMPLEMENTATION OF COGNITIVE THEORY IN
MULTIMEDIA LEARNING**

is written by me and is my own effort and that no part has been plagiarized

without citations.

STUDENT :  _____ Date: 23 OCTOBER 2008
(RISHALAVERNIA RAMANATHAN)

SUPERVISOR:  _____ Date: 23 OCTOBER 2008
(MUHAMMED HAZIQ LIM ABDULLAH)

DEDICATION

I hereby dedicate the written words in this document and the produced software to the four individuals who have always supported and believed in me through both good and trying times; my mother, father and both my aunts.

ACKNOWLEDGEMENTS

I would like to express my gratitude to my project supervisor, Mr. Muhammed Haziq Lim Abdullah for providing me with ample suggestions, support, guidance and patience in helping me complete this project.

Thank you also to Pn. Norazlin bte. Mohammed for her comments and suggestions given throughout the evaluation process of this project.

Special thanks to the administrators, teachers and students of Kiwanis Down Syndrome Foundation of Kuala Lumpur for graciously accommodating my presence there during the analysis and testing phases of the project.

Last but not least, thank you to my family and friends for your support and cooperation in making this project a success.

ABSTRACT

The Independent Living Courseware is an educational courseware that will help children affected by Down's Syndrome learn basic speech and everyday activities. The courseware contains three modules which are Object Recognition, Procedures and Quiz Module. The first module concentrates on taking the child through recognition of common everyday objects and how their names are pronounced. The second module depicts procedures and ways in which these objects can be used in their daily lives. The final module is a summative quiz which evaluates the child on the concepts they have learnt in both modules 1 and 2. Through continuous usage of this courseware, the child should be able to recognize objects and pronounce their names, know how to perform everyday activities with the objects and learn basic computer skills along the way. The courseware was developed with the implementation of the ADDIE model. The spatial contiguity principle adopted from the Cognitive Theory of Multimedia Learning has been adopted in the development of the courseware's educational content.

ABSTRAK

Perisian pembelajaran Independent Living ini merupakan satu perisian pembelajaran untuk kanak-kanak Sindrom Down bagi mengajar mereka bertutur dan melakukan aktiviti seharian dengan betul. Perisian ini terbahagi kepada tiga modul iaitu 'Object Recognition Module' atau Modul Pengenalan Objek, 'Procedures Module' atau Modul Procedur dan 'Quiz Module' atau Modul Kuiz. Modul pertama mengajar pengguna mengenali objek-objek di sekeliling mereka dan juga cara menyebut nama objek tersebut dengan betul. Modul kedua mengajar pengguna cara bagaimana menggunakan objek-objek yang telah mereka pelajari dalam menjalankan aktiviti seharian mereka. Modul terakhir menguji konsep-konsep yang telah dipelajari oleh pengguna dalam Modul 1 dan 2. Penggunaan berterusan perisian ini mebolehkan kanak-kanak Sindrom Down ini belajar mengenali objek, mampu menyebut nama objek di sekeliling mereka, tahu menggunakan objek-objek tersebut dalam aktiviti seharian mereka, pada masa yang sama, mempelajari kemahiran asas penggunaan komputer. Metodologi yang digunakan bagi pembangunan perisian ini adalah model ADDIE. Prinsipal "spatial contiguity" yang diperolehi daripada Teori Kognitif Dalam Pembelajaran Multimedia digunakan untuk membangunkan kandungan pembelajaran courseware ini.

TABLE OF CONTENTS

CHAPTER	SUBJECT	PAGE
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGMENTS	iv
	ABSTRACT	v
	ABSTRAK	vi
	TABLE OF CONTENTS	vii
	LIST OF TABLES	xi
	LIST OF FIGURES	xiv
	LIST OF ABBREVIATIONS	xvii
	LIST OF ATTACHMENTS	xviii
CHAPTER I	INTRODUCTION	
	1.1 Project Background	1
	1.2 Problem Statement	2
	1.3 Objective	4
	1.4 Scope	5
	1.5 Project Significance	6
	1.6 Conclusion	6
CHAPTER II	LITERATURE REVIEW AND PROJECT METHODOLOGY	
	2.1 Introduction	

2.2	Domain	7
2.3	Existing System	17
2.3.1	Comparison of Existing System	24
2.4	Project Methodology	28
2.4.1	Instructional Design	31
2.5	Project Requirement	33
2.5.1	Software Requirement	33
2.5.2	Hardware Requirement	33
2.6	Conclusion	34

CHAPTER III ANALYSIS

3.1	Current Scenario Analysis	35
3.2	Requirement Analysis	46
3.2.1	Project Requirement	46
3.2.2	Software Requirement	56
3.2.3	Hardware Requirement	61
3.2.4	Other Requirement	63
3.3	Project Schedule and Milestone	63
3.4	Conclusion	65

CHAPTER IV DESIGN

4.1	Introduction	66
4.2	System Architecture	67
4.3	Preliminary Design	68
4.3.1	Storyboard Design	68
4.3.1.1	Character Profile	68
4.4	User Interface Design	69
4.4.1	Navigation Design	70
4.4.2	Input/Output Design	73
4.4.3	Metaphors	84

4.5	Conclusion	84
-----	------------	----

CHAPTER V IMPLEMENTATION

5.1	Introduction	85
5.2	Media Creation	85
	5.2.1 Production of Text	86
	5.2.2 Production of Graphics	87
	5.2.3 Production of Audio	90
	5.2.4 Production of Animation	91
5.3	Media Integration	95
5.4	Product Configuration Management	96
	5.4.1 Configuration Environment Setup	96
	5.4.2 Version Control Procedure	96
5.5	Implementation Status	98
5.6	Conclusion	101

CHAPTER VI TESTING AND EVALUATION

6.1	Introduction	102
6.2	Test Plan	103
	6.2.1 Test User	103
	6.2.2 Test Environment	105
	6.2.3 Test Schedule	107
	6.2.4 Test Strategy	107
6.3	Test Implementation	112
	6.3.1 Test Description	112
	6.3.2 Test Data	113
	6.3.3 Test Results and Analysis	115
	6.3.4 Analysis Testing	119
6.4	Conclusion	121

CHAPTER VII PROJECT CONCLUSION

7.1	Observation on Weaknesses and Strengths	122
	7.1.1 Weakness	122
	7.1.2 Strengths	124
7.2	Proposition for Improvement	125
7.3	Contribution	126
7.4	Conclusion	126

REFERENCES

APPENDICES

LIST OF TABLES

TABLES	TITLE	PAGE
2.1	Comparison Between Three Existing Systems	24
3.1	Modules and Their Description	48
3.2	Stations and Items Used at Each Station	52
3.3	Observation Gathered From KDSF	55
3.4	Software Required in Developing the Courseware	56
3.5	Hardware Requirements to Develop the Courseware	61
3.6	Schedule of Activities Performed in the Development of this Project	63
4.1	Icons Used in this Project	73
4.2	Input/Output Specification for Toiletries Menu Page	74
4.3	Input/Output Specification for Exit Page	75
4.4	Table 4.4: Input/Output Specification for Phone Click to Explore Exercise	76
4.5	Input/Output Specification for Kitchen Utensils Click to Explore Exercise	77
4.6	Input/Output Specification for Phone Click to Explore Exercise	78
4.7	Input/Output Specification for Traffic Click to Explore Exercise	79
4.8	Input/Output Specification for Toiletries Quiz	80
4.9	Input/Output Specification for Kitchen Utensils	81

	Quiz	
4.10	Input/Output Specification for Phone Quiz	82
4.11	Input/Output Specification for Traffic Quiz	83
5.1	Configuration Environment Setup for the Development of the Courseware	96
5.2	Version Control Procedures	96
5.3	Implementation Status of the Courseware	98
6.1	Hardware Requirements in Test Environment	106
6.2	Software Requirements in Test Environment	106
6.3	Test Schedule Used to Test Courseware	107
6.4	Functionality Testing Feedback Form Used by Interactive Media Students to Evaluate the Courseware	109
6.5	Usability Testing Feedback Form used by Teachers of Down's Syndrome Children to Evaluate the Courseware	110
6.6	User Acceptance Testing Feedback Form Used to Observe and Evaluate Down's Syndrome Children While They Use the Courseware	111
6.7	Test Data for Functionality Testing (Interactive Media Students)	113
6.8	Test Data for Usability Testing (DS Teacher)	114
6.9	Test Data for User Acceptance Testing (DS Students)	115
6.10	Results for Functionality Testing by 10 Interactive Media Students	116
6.11	Mean, Median and Mode for Functionality Testing by Interactive Media Students	116
6.12	Results for Usability Testing by 10 Teachers of Down's Syndrome Children	117
6.13	Mean, Median and Mode for Usability Testing by 10 Teachers of Down's Syndrome Children	117
6.14	Results for User Acceptance Testing by 10	118

	Down's Syndrome Children	
6.15	Mean, Median and Mode for User Acceptance Testing by 10 Down's Syndrome Children	118

LIST OF FIGURES

DIAGRAM	TITLE	PAGE
2.1	Three Types of Memory	9
2.2	Working Memory Model by Baddeley, 1986	10
2.3	Cognitive Theory of Multimedia Learning Developed by Mayer and Moreno, 2000	13
2.4	Interface Prompting Learners to Enter Their Name	20
2.5	Learners Learn About the Internet	21
2.6	Interface Providing the Interactive Options for Students to Either 'Learn' or 'Skip' Depending on Their Current Knowledge of the Web Browser	21
2.7	The Usage of a Simple Animation in the Teaching Process	22
2.8	Congratulatory Expression is Provided Alongside Extraneous Music at the Completion of Each Module	22
2.9	Flash Cards Used by the Down's Syndrome Association of New South Wales in Teaching their Students to Live Independently	23
2.10	Steps in the ADDIE Instructional Design Model	28
3.1	Phases in the Addition Operation	36

3.2	Overview Flowchart of Down's Syndrome Internet and Email Course by Multimedia Instructional Design of Ireland	37
3.3	Learn About the Internet (Module 1)	38
3.4	Go Into the Internet (Module 2)	39
3.5	Search the Internet (Module 3)	40
3.6	Learn About Email (Module 4)	41
3.7	How to Use Email (Module 5)	42
3.8	What is the RTE Website (Module 6)	43
3.9	Make Your Own Webpage (Module 7)	44
3.10	Flowchart of Flash Cards Activity on How to Use the Toilet	45
4.1	Hierarchy Diagram	67
4.2	John the Pedagogical Agent Used the Narrator in This Courseware	69
4.3	Navigation Design of the Courseware	70
5.1	Flow of Activities for Production of Text from Adobe Photoshop CS3	89
5.2	The Production Process for Developing a Hand Drawn Graphic	90
5.3	Graphic Images of a Hairbrush and a Spoon Fully Hand Drawn Using a Graphic Tablet.	90
5.4	The Process of Graphic Production Through Tracing	91
5.5	The Graphic on the Left has been Imported from the Internet whereas the Graphic on the Right is the Traced Product of the Former Graphic.	91
5.6	Audio Production of Voiceover	92
5.7	Audio Production Process for Audio Downloaded from the Internet	93
5.8	The Production Process to Create a Text Animation	94

5.9	Text Animation is Placed Next to the Item in Accordance to Spatial Contiguity Principle	95
5.10	The Process of Graphic Production	96
5.11	The Figure on the Left Shows the Scene Before the Soap Item was being Clicked. The Figure on the Right Shows the Graphic Animation of the Soap Bubbles when the Soap Button has been Clicked.	96
5.12	The Process of Integrating Each Multimedia Element	97
6.1	Layout at UTeM Solutions	105
6.2	Layout at Kiwanis Down's Syndrome Foundation	105
6.3	Mean Graph for Functionality Testing	119
6.4	Mean Graph for Usability Testing	120
6.5	Mean Graph for User Acceptance Testing	120

LIST OF ABBREVIATIONS

DS	–	Down’s syndrome
MS	–	Milliseconds
LD	–	Learning Disability
ITS	–	Interactive Tutoring Systems
MOH	–	Ministry of Health
KDSF	–	Kiwanis Down’s Syndrome Foundation

LIST OF ATTACHMENTS

APPENDIX	TITLE
A	Navigation Flow Chart
B	Module Flow Chart
C	Interview Questionnaire
D	Project Gantt Chart
E	Storyboard

CHAPTER I

INTRODUCTION

1.1 Project Background

The development of this project is mainly for the teaching industry that deals with learning disabilities connected with children affected with Down's syndrome (DS). Specifically, it helps in facilitating a higher retention power in the area of learning day-to-day activities and the usage of inherent basic speaking and language skills that comes with these activities.

Without speech, DS children may find it tough to communicate with the world around them. At the same time, teaching the child how to speak alone without knowing the implementation as in how and where to use the words learnt may be viewed as an incomplete method. Therefore this courseware not only teaches the child basic speech but also shows them how to implement it in real-life situations.

Using the Cognitive Theory in Multimedia Learning developed by Mayer and Moreno (2000), the development of this courseware investigates the works of the child's way of thinking which affects their physical actions. The way in which information is put forth in this courseware will be influenced by the findings from the Cognitive Theory in Multimedia Learning, applying the Spatial Contiguity Principle which is one

of the six main instructional design principles from which the theory has been derived from.

Therefore, building from the above concepts, this courseware will include, primarily, the child being first exposed to the visual representation of a particular object. The name of the object will be shown on screen together with auditory backing. Next the child will be presented with ways in which to use the particular object in their daily lives. A pedagogical animated character is used to create a friendly and interactive atmosphere to enhance the child's motivation. Essentially, this courseware has a combination of basic speech training and how this speech should be implemented in everyday activities to help parents and teachers guide these children to live independently.

1.2 Problem Statement

Down's syndrome (DS) is one of the most familiar congenital syndromes and also the most rampant chromosomal disorders causing intellectual disability in the world. In Malaysia DS occur approximately 1 in 1,000 births (MOH, 2003). Currently there are approximately 50, 000 individuals with DS in the country. It is normally seen in all ethnic groups and is generally more predominant in males.

In the past, these children did not have a positive outcome of education and were dependent on their families. The formation of the Special Education Department by the Ministry of Education in the year 1995 has changed the scenario.

According to Associate Professor Dr. Sharifah Zainiyah Binti Syed Yahya, president of Down Syndrome Association of Malaysia, in her presentation entitled “Advancing the Educational Frontiers of Children with Down Syndrome in Malaysia”, has stated that children with DS have speech problems, hence difficulties in language development. They also have an IQ range from between 35 to 70 whereas the average IQ range of Malaysians is in the range of 87 to 92. Although the Malaysian range may be small compared to other countries, but it still places a significant gap between the intellectual levels of the DS children and the people around them in this country. Each child has his or her own strengths and weaknesses where no single intervention or plan will be suitable for all. Besides being intellectually challenged, children with DS may or may not have other medical complications such as hearing abnormalities, eye complications, hypothyroidism, low muscle tone and leukemia.

Through the Program Khas Bermasalah Pembelajaran” (PKBP) which was introduced in selected schools all over Malaysia, special classes were run in mainstream schools. The disadvantages found from this program are that all forms of learning disabilities including DS, Autism, Dyslexia and Slow Learners are put together as one. This should not be the case as children affected by particular types of disabilities should be taught in a specific way. By summarizing that all disabilities are the same and thus subjecting each child to the same method of learning may not bring in positive results.

Kiwanis Down Syndrome Foundation is one the most prominent privately owned schools for DS children in Malaysia with trained teachers and up-to-date teaching coursewares and materials. An observation was carried out at the school and it has been found that although computer training is being done for these children, the coursewares used are those designed for typically developing children. This situation poses a problem for the children as the level of progress is not suitable for the learning levels of the DS child. More often used are paper based teaching products and other forms of educational toys such as storybooks, flash cards and jigsaw puzzles which are used in the teaching and learning process while accompanied by teachers. This proves difficult as the

children normally has a small attention span and are likely to not appreciate what is being taught as the method used may be mundane and dull.

1.3 Objectives

This project is developed mainly for the use of the educators for children with Down's syndrome (DS). Most children with DS have much better receptive than expressive language skills thus they will be able to understand what we are saying before they are able to express themselves verbally (Kumon, 1998). These children physically have a handicap in relaying what they need and want to say because of the nature of their mouth physique where they will have a protruding tongue (due to small oral cavity, and an enlarged tongue near the tonsils). In addition to this, speech may be hampered due to muscle hypotonia (poor muscle tone) around the lip area. Normally, children with DS who are not pushed to use speech will fall back to using gestures and facial expressions, which are far easier to them, in order to interact (Chapman et. al, 1998). This poses a disadvantage for them as they are not mute and are perfectly able to speak, if properly trained. Fortunately, these physical drawbacks can be rectified by constant practice and supervision from parents or therapists. In this context, this courseware fits the job perfectly where the need for practice is fulfilled by the constant usage of this courseware under parent or teacher supervision. Therefore, the objectives of this project are:

- i. To develop a multimedia based courseware to facilitate the practice of basic speech in day-to-day activities in DS children;
- ii. To enhance the quality of information retention by implementing the Spatial Contiguity Principle;
- iii. To develop a stand alone CD-ROM courseware.