

TABLE OF CONTENTS

	Page
Acknowledgement	iii
Abstract (English)	iv
Abstract (Thai)	iv
List of Tables	xiii
List of Figures	xv
 Chapter 1 Context and General Problems	 1
1.1 Special Needs Education in Thailand	1
1.2 Background of Case Study	2
1.3 Research Hypothesis	6
1.4 Research Questions	7
1.5 Research Objectives	7
1.6 Problem Justification	7
1.7 Scope of Work and Outline of Thesis	8
1.8 Definitions	9
 Chapter 2 Literature Review	 11
2.1 Theoretical Approaches to Learning	12
2.1.1 Learning Disability	12
2.1.2 Hearing Impairment	13
2.1.3 Cognitive Learning	14
2.1.4 Stages of Cognitive Development	16
2.1.5 Working Memory	19
2.1.6 Memory Retention	20
2.2 Tools and Methodology literature review	21
2.2.1 Cone of Learning	21

TABLE OF CONTENTS (continued)

	Page
2.2.2 Vocabulary Language Acquisition	23
2.2.3 Language Immersion	23
2.2.4 Conditions of Learning	24
2.2.5 Total Communication	25
2.2.6 Situational learning	28
2.2.7 Learning System for Students with Hearing Impairment	32
2.2.8 Thai hearing impaired students in learning English	37
2.2.9 Conclusion of Literature review in research context	40
 Chapter 3 Theoretical Frame work	 42
3.1 Initial Conceptual Framework of Research	42
3.2 Research Design	44
3.3 Research Process	46
3.3.1 Curriculum analysis	47
3.3.1.1 English Curriculum Analysis	49
3.3.1.2 Vocabulary number set form Basic Curriculum	50
3.3.1.3 Hearing Impaired English Curriculum Analysis (Compared with mainstream students)	58
3.3.1.4 English Class Observing Summary	60
3.3.1.5 English, Thai and Mathematics Curriculum Analysis	61
3.3.1.6 Vocabulary immersion set for Primary 1 – 3	62
3.3.2 Design learning tools	63
3.3.2.1 TCAD system overview	63
3.3.2.2 Framework of TCAD system	64
3.3.2.3 Propose TCAD system architecture	65
3.3.3 Implementation and Evaluation	73
3.3.4 Results and Analysis	74

TABLE OF CONTENTS (continued)

	Page
Chapter 4 Experimental Methodology	75
4.1 Introduction	75
4.2 Conceptual Framework Tools	77
4.3 Data Gathering and Requirements Capture	78
4.4 Feasibility Study	79
4.5 Requirements Analysis and Specification	79
4.6 TCAD Design	79
4.6.1 Design and specification	79
4.6.2 Prototyping	80
4.6.3 Character design	81
4.7 TCAD Production	82
4.7.1 Motion capture	82
4.7.2 Motion Capture Process	85
4.8 System Implementation	95
4.8.1 TCAD Screen design	97
4.9 TCAD Pilot Testing	99
4.9.1 Animation dictionary	99
4.9.2 Total Communication with Animation Dictionary (TCAD)	99
4.9.3 TCAD with the vocabulary relational knowledge with group of vocabulary (TCAD+)	100
4.9.4 TCAD and Situational learning (TCAD++)	102
4.9.4.1 Situational English vocabulary learning via a free social network game application (TCAD++)	104
4.9.4.2 TCAD Web browser add on for Firefox browser	104
4.9.4.3 Learning story with vocabulary via leaning management system (TCAD LMS)	119
4.10 TCAD system Implementation and testing plan	129

TABLE OF CONTENTS (continued)

	Page
Chapter 5 Results and Analysis	131
5.1 Results of the pilot study: TCAD	131
5.2 TCAD+ Results	136
5.3 TCAD++ Results	143
5.4 TCAD++ game output from students	144
5.5 Analysis Results	146
5.5.1 Immersion with TCAD system	152
5.5.2 Surprising Results	154
Chapter 6 Discussions and conclusions	155
6.1 The Main Context of This Research	155
6.1.1 Problems	156
6.1.2 Methodology	157
6.1.3 Results	158
6.2 Discussion of TCAD system	159
6.2.1 Discussion on Implementation of TCAD system	161
6.2.2 Discussion on the Advantages of the TCAD system	166
6.3 Conclusions	167
6.4 Research Novelty	169
6.5 Research Generalizations	170
6.6 Research Limitations	173
6.7 Future work	174
References	175
Appendices	185

TABLE OF CONTENTS (continued)

	Page
Appendix A	186
Appendix B	193
Appendix C	202
Appendix D	207
Appendix E	210
Appendix F	214
Curriculum Vitae	218

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่

Copyright© by Chiang Mai University
All rights reserved

LIST OF TABLES

Table	Page
2.1 Piaget's Stages of Cognitive Development	18
2.2 The support and accommodation provided in the Asia pacific	36
2.3 The requirements of educational media content from the teacher in school	39
3.1 Requirements of educational media content based on teacher input at a school for the hearing impaired, Thailand. (Source: MoE, 2007)	53
4.1 Illustrates the methodological process along with the tools used and rationale behind the process	77
5.1 Pre-Test independent t-test results between T group and A group showing that the difference in results is not statistically significant	134
5.2 Long-term post-test independent t-test results between T group and A group showing that the difference in results between the two groups is statistically significant	134
5.3 Paired t-test results for the A group post-test and long-term post-test results	135
5.4 Paired t-test results for the T group post-test and long-term post-test results	136
5.5 TCAD+ Post test vs. Pre-test Statistics	137
5.6 TCAD+ Post-Test and Long Term Paired t-test Results	138
5.7 Comparison of mean results between TCAD+ method and control group using time criteria and score result criteria	140
5.8 Independent t- test sample statistics from time using criteria results	140
5.9 Significant difference detected between the variances of the two samples	141
5.10 Independent t- test sample statistics from in score criteria results	142

LIST OF TABLES (continued)

Table	Page
5.11 Significant difference detected between the variance of the two samples	142
5.12 Paired t- test samples statistics from TCAD++ Posttest vs. Pretest results	144

LIST OF FIGURES

Figure	Page
1.1 Analysis based on curriculum content of English between Chiang Mai School for the Deaf (Anusarnsoontorn School) and mainstream student curriculum from the Ministry of Education, Thailand	5
1.2 Research Hypothesis	6
2.1 Literature review map	11
2.2 Cognitive Model of Learning Derry (1990)	15
2.3 Period of language learning adapted from Piaget's Stages of Cognitive Development	19
2.4 Buddeley's The model of working memory (2007)	20
2.5 Cone of learning Dale. (1969)	22
2.6 FarmVille game display screen	31
2.7 CityVille game display screen	32
2.8 Conclusion of Literature review in research context	40
3.1 The initial conceptual framework of this research	42
3.2 The research design framework of this research	45
3.3 The research process of this research	46
3.4 The learning areas main detail from MOE	48
3.5 The standard number of English vocabulary analysis from the MOE in each stage	50
3.6 List of main vocabulary group (J.A. Van EK, 1977)	52

LIST OF FIGURES (continued)

Figure	Page
3.7 The example of English language learning area in Primary level 1 from MOE	54
3.8 The example of English language learning area in Primary level 6 from MOE	55
3.9 The example of English language learning area in Secondary level 1 from MOE	56
3.10 The example of English language learning area in Secondary level 5 from MOE	57
3.11 The English curriculum analysis and observing result	58
3.12 English class observing summary	60
3.13 Thai vocabulary number set in Primary school student level 1 – 3 analysis from Thai curriculum MOE	61
3.14 Vocabulary immersion set for Primary 1 – 3	62
3.15 TCAD system architecture	65
3.16 TCAD service functionality and level of accessibility	66
3.17 TCAD e-dictionary screen showing the e-dictionary with male and female characters	68
3.18 TCAD+ screenshot depicting the main screen (vocabulary classified situation or location)	68
3.19 TCAD+ screenshot illustrating the context related to learning vocabulary associated with the word ‘house’	69

LIST OF FIGURES (continued)

Figure	Page
3.20 An example TCAD+ screenshot showing the contextual vocabulary associated with ‘living room’	69
3.21 TCAD++ Learning management system (LMS) and reading story	70
3.22 Learning management system (LMS), lesson management part	71
3.23 The TCAD vocabulary web browser plugin translators for Firefox add-on show the picture and sign language animation for the hearing impaired	72
4.1 Methodology Framework	75
4.2 Conceptual framework diagram	76
4.3 The first prototype of TCAD	80
4.4 2D model designs	81
4.5 3D model designs	82
4.6 Motion capture camera	83
4.7 The motion capture suit, body and glove marker setting in the sign language model (Sign language model)	83
4.8 The motion capture in the Evart model view	84
4.9 The motion capture in the Motion builder model view	84
4.10 The motion capture process	85
4.11 3 D model from Maya (Polygon Editing)	86
4.12 Skin and texturing	86

LIST OF FIGURES (continued)

Figure	Page
4.13 Skeleton setting	87
4.14 Import to FBX file	87
4.15 Motion recording from Evart program	88
4.16 Motion recording from Motion builder program	88
4.17 Data cleaning from Evart program	89
4.18 Data cleaning from Motion builder program (source marker data)	90
4.19 Data cleaning from Motion builder program (take data from actor to model skeleton and Split DATA to each clip of vocab)	90
4.20 Data cleaning from Motion builder program (clean and edit data for each vocabulary)	91
4.21 Data cleaning from Motion builder program (put cleaned data to skeleton)	91
4.22 Render setting	92
4.23 Render testing	93
4.24 Rendering	93
4.25 Post product from rendering	94
4.26 Post product of the animation sign language	94
4.27 TCAD DFD, Context Diagram	95
4.28 TCAD DFD level 1	96
4.29 TCAD ER diagram	96
4.30 TCAD screen design	97

LIST OF FIGURES (continued)

Figure	Page
4.31 TCAD Screen (with boy and girl character)	98
4.32 TCAD plus word place (TCAD+) Main Screen (vocabulary classified by town or location)	100
4.33 TCAD plus word place (TCAD+) (group of vocabulary in “school”)	101
4.34 TCAD plus word place (TCAD+) (Farming group of vocabulary)	101
4.35 The example of XUL	106
4.36 The layout of Firefox technology plugin architecture	107
4.37 TCAD Web browser Add-on systems flow chart	108
4.38 The content folder files	109
4.39 Files of content folder	109
4.40 Figure 4.43 Show .XUL file	110
4.41 The .js file	110
4.42 Skin folder	111
4.43 .css file	111
4.44 Chrome.manifest file	112
4.45 Install.rdf file	112
4.46 XPCOMdatabase connection component	113
4.47 .xpi creation file	114
4.48 Building the extension file	115
4.49 Output of .xpi file	115
4.50 The installing process of .xpi add-on file.	116

LIST OF FIGURES (continued)

Figure	Page
4.51 The result after installing process of .xpi add-on file	116
4.52 The TCAD Firefox add-on control for the hearing impaired	117
4.53 The TCAD Firefox add-on show the picture and sign language animation for the hearing impaired	118
4.54 TCAD LMS Data flow diagram (Context Diagram)	120
4.55 TCAD LMS Data flow diagram	121
4.56 TCAD LMS Entity relationship diagram (ER)	122
4.57 TCAD++ portal page for the students	123
4.58 Learning management system (LMS) for the teacher, lesson management part	124
4.59 Learning management system (LMS), Quiz management in lesson management part	124
4.60 Learning management system (LMS), Vocabulary management part	125
4.61 Quiz report for the teacher	125
4.62 Story display and translation from text into picture and Thai sign language of vocabulary	126
4.63 Quiz display and translation from text into picture and Thai sign language of vocabulary	127
4.64 Quiz result from the student	128
4.65 TCAD system implementation details	129

LIST OF FIGURES (continued)

Figure	Page
5.1 Example of a screen from the TCAD test	131
5.2 T Group vs. A Group Performance (mean test results) for pre-test, post-test and long term post-test (9 months)	133
5.3 Individual student results of groups T and A	133
5.4 Post-Test and Long Term test Paired t-test Results (95% confidence interval)	136
5.5 Pre-test and Post-test from TCAD+ Results	137
5.6 Pre-Test and Post-Test results of TCAD+ method	138
5.7 Paired t-test Results of TCAD+ Post Test and Pre-Test	139
5.8 Comparison of independent mean results between TCAD+ method and control group Statistic results inscore criteria between TCAD+ group and Control group	141
5.9 The TCAD++ Pre-test and Post-test	143
5.10 Paired t-test results of TCAD+ posttest and pretest	144
5.11 The example of the Farmville game result from student using the TCAD++ system	145
5.12 The example of Farmville game result from student using the TCAD++ system	145
5.13 Analysis based on curriculum content of English between ChiangMaiSchool for the deaf and mainstream student curriculum from ministry of education Thailand	147

LIST OF FIGURES (continued)

Figure	Page
5.14 The TCAD tool system concept	149
5.15 The cone of learning Dale, E. (1969)	150
5.16 TCAD system implementation	152
5.17 TCAD system mapping results	153
6.1 The main context of this research	155
6.2 The Cone of Learning link with TCAD system	157
6.3 The TCAD system results	159
6.4 Pretest and posttest in implementation	161
6.5 Total communications in Thai hearing impaired classroom	162
6.6 TCAD implementation in Thai hearing impaired student classroom	163
6.7 TCAD+ implementation in Thai hearing impaired student classroom	164
6.8 TCAD++ implementation in Thai hearing impaired student classroom	165
6.9 The TCAD system conclusions	168
6.10 The results on how the TCAD system creates an effect for memory acquisition	169
6.11 The TCAD system at Play and Learn Center of School for the deaf	174