



05-4506832



pustaka.upsi.edu.my



Perpustakaan Tuanku Bainun
Kampus Sultan Abdul Jalil Shah



PustakaTBainun



ptbupsi

**A FRAMEWORK OF MOBILE EDUCATIONAL APPLICATION FOR EARLY
READING AMONG KINDERGARTEN CHILDREN**

ABDUL JALIL BIN MOHAMAD



05-4506832



pustaka.upsi.edu.my



Perpustakaan Tuanku Bainun
Kampus Sultan Abdul Jalil Shah



PustakaTBainun



ptbupsi

**THESIS SUBMITTED IN FULFILLMENT OF THE REQUIREMENT FOR THE
DEGREE OF DOCTOR OF PHILOSOPHY
(INFORMATION TECHNOLOGY EDUCATION)**

**FACULTY OF ART, COMPUTING & CREATIVE INDUSTRY
UNIVERSITI PENDIDIKAN SULTAN IDRIS**

2017



05-4506832



pustaka.upsi.edu.my



Perpustakaan Tuanku Bainun
Kampus Sultan Abdul Jalil Shah



PustakaTBainun



ptbupsi



ABSTRACT

This study aims to formulate a framework of mobile educational application for early reading among kindergarten children. This study uses a design and development research (DDR) involving two phases. In the first phase, the design and development phase, the framework is formulated by obtaining experts' consensus using Fuzzy Delphi Method (FDM) involving 14 experts in early childhood education and mobile learning. A mobile educational application for early reading among kindergarten children, *Adik Jom Baca*, is developed according to the framework using prototyping method. In the second phase, the implementation and evaluation phase, *Adik Jom Baca* is evaluated in terms of usability and impact. Usability testing is carried out using the Modified Nominal Group Technique (NGT) involving 30 experts working as a kindergarten teacher. The impact assessment is carried out using Non-Equivalent Control Group Design involving 10 kindergarten children. The main finding of this study is the framework of mobile educational application for early reading among kindergarten children. A mobile educational for early reading that meets the child's development, *Adik Jom Baca* is developed according to the framework. Usability testing has shown that, *Adik Jom Baca* is useful in nurturing early reading skills among kindergarten children. Furthermore, the impact assessment showed that, *Adik Jom Baca* was able to provide a positive impact in nurturing early reading skills among kindergarten children. Overall, this study contributes a novel knowledge that are valuable to the research community, as a benchmark for educators and parents as well as being a reference to mobile educational application industry.





KERANGKA KERJA APLIKASI PENDIDIKAN MUDAH ALIH BAGI BACAAN AWAL DALAM KALANGAN KANAK-KANAK TADIKA

ABSTRAK

Kajian ini bertujuan memformulasikan kerangka kerja aplikasi pendidikan mudah alih bagi bacaan awal dalam kalangan kanak-kanak tadika. Kajian ini menggunakan pendekatan kajian rekabentuk dan pembangunan yang melibatkan dua fasa. Dalam fasa pertama, fasa rekabentuk dan pembangunan, kerangka kerja aplikasi pendidikan mudah alih bagi bacaan awal dalam kalangan kanak-kanak tadika diformulasikan dengan mendapatkan kesepakatan pakar menggunakan kaedah Fuzzy Delphi yang melibatkan 14 orang pakar dalam pendidikan awal kanak-kanak dan pembelajaran mudah alih. Aplikasi pendidikan mudah alih bagi bacaan awal dalam kalangan kanak-kanak tadika, Adik Jom Baca dibangun berdasarkan rangka kerja tersebut menggunakan kaedah prototaip. Dalam fasa kedua, fasa pelaksanaan dan penilaian, Adik Jom Baca dinilai dari aspek kebolehgunaan dan impak. Ujian kebolehgunaan dijalankan menggunakan kaedah Kumpulan Nominal Terubahsuai yang melibatkan 30 orang pakar terdiri daripada guru tadika. Penilaian impak dijalankan menggunakan Kaedah Rekabentuk Kumpulan Kawalan Tidak Setara yang melibatkan 10 orang kanak-kanak tadika. Dapatan utama kajian ini ialah kerangka kerja aplikasi pendidikan mudah alih bagi bacaan awal dalam kalangan kanak-kanak tadika. Daripada rangka kerja tersebut, aplikasi pendidikan mudah alih bagi bacaan awal yang menepati tahap perkembangan kanak-kanak, Adik Jom Baca dibangun. Ujian kebolehgunaan mendapati bahawa aplikasi pendidikan mudah alih bagi bacaan awal dalam kalangan kanak-kanak tadika, iaitu Adik Jom Baca, berguna dalam memperkembangkan kemahiran bacaan awal dalam kalangan kanak-kanak tadika. Penilaian impak menunjukkan bahawa aplikasi Adik Jom Baca memberi impak positif dalam memperkembangkan kemahiran bacaan awal dalam kalangan kanak-kanak tadika. Secara keseluruhan, kajian ini menyumbang pengetahuan baharu yang bernilai kepada komuniti penyelidik, menjadi penanda aras yang kepada pendidik dan ibu bapa serta menjadi rujukan kepada industri aplikasi pendidikan mudah alih.



TABLE OF CONTENTS

	Pages
ACKNOWLEDGMENTS	iii
ABSTRACT	iv
ABSTRAK	v
TABLE OF CONTENTS	vi
LIST OF TABLES	xv
LIST OF FIGURES	xix
LIST OF ABBREVIATIONS	xxi
LIST OF APPENDICES	xxii
CHAPTER 1 INTRODUCTION	
1.1 Overview	1
1.2 Research Background	1
1.3 Problem Statements	3
1.4 Research Questions	7
1.5 Objectives of the Study	7
1.6 Significance of the Study	8
1.7 Scope of the Study	10
1.8 Conceptual Framework of Study	10



1.9 Operational Definition	14
1.9.1 Content	14
1.9.2 Early Reading Skills	15
1.9.3 Framework	15
1.9.4 Kindergarten	15
1.9.5 Kindergarten Children	16
1.9.6 Mobile Educational Applications	16
1.9.7 Pedagogy	16
1.9.8 Technology	17
1.10 Summary	17

CHAPTER 2 LITERATURE REVIEW



2.1 Introduction	19
2.2 Kindergarten Early Reading Skills	20
2.2.1 Stage of Early Reading Development	20
2.2.2 Early Reading Development	22
2.2.3 Factor Contributed to Learning Difficulties among Children	23
2.2.4 The Negative Impact if Children are Unable to Read	25
2.3 Mobile Educational Application for Early Reading among Kindergarten Children	26
2.3.1 ICT for Kindergarten Early Reading	27



2.3.2 Multimedia for Kindergarten Early Reading	28
2.3.3 The Affordances of Mobile Learning	30
2.3.4 The Potential of Mobile Educational Applications for Nurturing Early Reading Skills	31
2.3.5 The Disadvantages of Existing Mobile Educational Application	32
2.4 The Existing Frameworks and Guidelines	35
2.4.1 A Framework for Integrating Technology in Teaching and Learning	35
2.4.1.1 TPACK Framework	36
2.4.2 A Framework for Integrating Technology in Early Childhood Education	38
2.4.2.1 Children's Interactive Media Rating Instrument	39
2.4.2.2 Haugland Developmental Software Scale	41
2.4.2.3 Guidance for Practitioners on Appropriate Technology in Early Childhood	43
2.4.2.4 Early Childhood Educational Technology Evaluation Toolkit	44
2.4.2.5 Technology and Interactive Media as Tools in Early Childhood Programmes serving Children from Birth through Age 8	45
2.4.2.6 A Framework for Quality in Digital Media for Young Children: Considerations for Parents, Educators, and Media Creators	47
2.4.2.7 Best Practices: Designing Touch Tablet Experiences for Pre-schoolers	48
2.5 Theories Underpinning	50
2.5.1 Intuitive – Piaget's Cognitive Development Theory	50

2.5.2 Scaffolding – Vygotsky Socio-Cultural Theory	52
2.6 The Need of a Framework	54
2.7 Summary	55

CHAPTER 3 METHODOLOGY

3.1 Introduction	56
3.2 Research Design	57
3.3 Phase One: Design and Development	58
3.3.1 Framework Formulation	59
3.3.1.1 Fuzzy Delphi Method	60
3.3.2 Mobile Educational Application Development	62
3.3.2.1 Prototype Methodology	62
3.3.3 Prototype Design	63
3.4 Phase Two: Implementation and Evaluation	64
3.4.1 Usability Testing	65
3.4.1.1 Modified Nominal Group Technique	66
3.4.2 Impact Assessment	68
3.4.2.1 Non-Equivalent Pre-test and Post-test Control Group Design	68
3.5 Summary	69

CHAPTER 4 FRAMEWORK FORMULATION AND VALIDATION

4.1 Introduction	70
4.2 Framework Formulation	71

4.2.1 Proposing the Pillars of a Framework	71
4.2.2 Determination the Elements of a Framework	71
4.2.2.1 Technology Elements	72
4.2.2.2 Pedagogy Elements	74
4.2.2.3 Content Elements	76
4.2.2.4 A Proposition of the Elements in a Framework	77
4.3 Framework Validation	78
4.3.1 Selecting the Experts	80
4.3.2 The Questionnaires	81
4.3.2.1 Content Elements	81
4.3.2.2 Pedagogy Elements	82
4.3.2.3 Technology Elements	82
4.3.3 The Expert Consensus	83
4.3.3.1 The Framework Pillars	83
4.3.3.2 Content Elements	85
4.3.3.3 Pedagogy Elements	87
4.3.3.4 Technology Elements	90
4.4 Description of the Framework	92
4.4.1 The Elements of Content	93
4.4.1.1 Appropriateness	94
4.4.1.2 Educational	94
4.4.1.3 Safety	95
4.4.1.4 Theme	95

4.4.2 The Elements of Pedagogy	95
4.4.2.1 Playful	96
4.4.2.2 Scaffolding	97
4.4.2.3 Exploration	97
4.4.2.4 Individualisation	98
4.4.3 The Elements of Technology	98
4.4.3.1 Readability	99
4.4.3.2 Ease of Use	99
4.4.3.3 Gamification	100
4.4.3.4 Interactive	100
4.4.3.5 Intuitiveness	101
4.4.3.6 Legibility	101
4.4.3.7 Multimedia	102
4.5 Summary	102

CHAPTER 5 MOBILE EDUCATIONAL APPLICATION DEVELOPMENT AND IMPLEMENTATION

5.1 Introduction	103
5.2 Mobile Educational Application Development	104
5.2.1 Flowchart for the Development of Adik Jom Baca	105
5.2.2 Content Design	106
5.2.2.1 Learning Objectives	107
5.2.2.2 Learning Approach	107
5.2.2.3 Resources	109
5.2.3 Storyboard Development	110



5.2.3.1 Main Menu Screen	111
5.2.3.2 Kenali Huruf Vokal Module	112
5.2.3.3 Kenali Huruf Vokal Practice Sub-Module	113
5.2.3.4 Kenali Huruf Vokal Game Sub-Module	114
5.2.3.5 Belajar Membaca Module	115
5.2.3.6 Belajar Membaca Suku Kata Sub-Module	116
5.2.3.7 Belajar Membaca Suku Kata Game Sub-Module	117
5.2.3.8 Belajar Membaca Perkataan Sub-Module	118
5.2.3.9 Belajar Membaca Ayat Sub-Module	119

5.2.3.10 Latihan Module	120
-------------------------	-----

5.3 Adik Jom Baca Description

5.3.1 Technical Specification	121
5.3.2 Content Specification	122
5.3.3 Learning Approach	123
5.3.4 Technology Features	124

5.4 Usability Evaluation	126
--------------------------	-----

5.4.1 Procedure for Conducting Modified Nominal Group Technique (NGT)	126
5.4.2 Selection the Participants	128
5.4.3 Usability Evaluation Instruments	129
5.4.4 The Conditions of Agreement	131





5.5 Impact Assessment	131
5.5.1 Non-Equivalent Control Group Pretest-Posttest Design	131
5.5.2 Selection the Subjects	132
5.5.3 Procedure for Conducting Impact Assessment	133
5.6 Research Instruments	136
5.7 Summary	137

CHAPTER 6 RESULTS AND DISCUSSION

6.1 Introduction	138
6.2 Results of Usability Evaluation	139
6.2.1 The Effectiveness	139
6.2.2 Efficiency	141
6.2.3 Satisfaction	143
6.2.4 Conclusion for Usability Evaluation	144
6.3 Impact Assessment	145
6.3.1 Letter Recognition Skill	145
6.3.2 Open Syllables Reading Skill	148
6.3.3 Simple Words Reading Skill	151
6.3.4 Simple Sentences Reading Skill	154
6.3.5 Conclusion for Impact Assessment	157
6.4 Summary	159



CHAPTER 7 CONCLUSIONS AND FUTURE WORKS

7.1 Introduction	160
7.2 Research Finding	161
7.3 Research Contribution	163
7.3.1 A Framework of Mobile Educational Application for Early Reading among Kindergarten Children	164
7.3.2 Mobile Educational Application – <i>Adik Jom Baca</i>	165
7.3.3 Knowledge Enrichment	166
7.4 Implication from the Research Contributions	167
7.5 Strengths and Limitations of the Study	168
7.5.1 The Formulation of Framework	168
7.5.2 The Development of Mobile Educational Application	169
7.5.3 Research Limitations	169
7.6 Recommendations for Future Research	170
7.7 Conclusion	172

REFERENCES	175
-------------------	------------

APPENDICES	192
-------------------	------------

LIST OF TABLES

No. of Table		Pages
2.1	Early Reading Aspects	20
2.2	Early Childhood Alphabetic Principle Observation	22
2.3	Children's Interactive Media Rating Instrument.	40
2.4	Haugland Developmental Software Scale	42
2.5	Early Childhood Educational Technology Evaluation Toolkit	45
2.6	A Framework for Quality in Digital Media for Young Children: Considerations for Parents, Educators, and Media Creators	48
2.7	Best Practices: Designing Touch Tablet Experiences for Pre-schoolers	49
2.8	Intuitive and Unintuitive Tablet Touch Gestures	52
2.9	The Need of a Framework	55
3.1	Study Phases, Objectives and Methods	58
3.2	Processes and Methodologies for Framework Formulation	60
4.1	Analysis on the Elements of Technology	72
4.2	Analysis on the Elements of Pedagogy	75
4.3	Analysis on the Elements of Content	76
4.4	A Proposition of the Elements for a Framework	78
4.5	Linguistic Variables of the Agreement	79

4.6	Description of the Experts	80
4.7	Expert Consensus on a Pillars of the Framework	84
4.8	The Experts' Consensus on the Elements of Content	86
4.9	Summary on Experts' Consensus for the Elements of Content	86
4.10	The Experts Consensus on the Elements of Pedagogy	88
4.11	The Summary on Experts Consensus for the Elements of Pedagogy	88
4.12	The Experts' Consensus on the Elements of Technology	88
4.13	The Summary on Experts' Consensus for the Elements of Technology	91
5.1	Learning Objectives from National Preschool Standard Curriculum 2017 (KSPK)	107
5.2	Examples of the Application Integrated Sound-Word Method	108
5.3	The Content of Adik Jom Baca Mobile Educational Application	108
5.4	Adik Jom Baca Content Development Resources	109
5.5	Procedure in Conducting a Study Using the Modified Method Nominal Group Technique	127
5.6	Usability Evaluation Participants Group A	128
5.7	Usability Evaluation Participants Group B	129
5.8	Usability Evaluation Participants Group C	129
5.9	Usability Metric Adapted from Tahir & Arif (2015)	130
5.10	Pre-test and Post-test Questions	137

6.1	The Result of Usability Testing From the Dimension of Effectiveness	140
6.2	The Result of Usability Testing from the Dimension of Efficiency	141
6.3	The Result for Usability Testing From the Dimension of Satisfaction	143
6.4	Mean Difference of Performance in Letter Recognition Skill between the Experimental Group and the Control Group in Pre-Test	145
6.5	Mean Difference of Performance in Letter Recognition Skill between Pre-Test and Post-Test of the Experimental Group	146
6.6	Mean Difference of Performance in Letter Recognition Skill between Pre-Test and Post-Test of the Control Group	147
6.7	Mean Difference of Performance in Word Recognition Skill between the Experimental Group and the Control Group in Post-Test	148
6.8	Mean Difference of Performance in Open Syllables Reading Skill between the Experimental Group and the Control Group in Pre-Test	149
6.9	Mean Difference of Performance in Open Syllables Reading Skill between Pre-Test and Post-Test of the Experimental Group	149
6.10	Mean Difference of the Performance in Open Syllables Reading Skill between Pre-Test and Post-Test of the Control Group	150
6.11	Mean Difference of Performance in Open Syllables Reading Skill between the Experimental Group and the Control Group in Post-Test	151
6.12	Mean Difference of the Performance in Simple Words Reading Skill between the Experimental Group and the Control Group in Pre-Test	151

6.13	Mean Difference of the Performance in Simple Words Reading Skill between Pre-Test And Post-Test of the Experimental Group	152
6.14	Mean Difference of the Performance in Simple Words Reading Skill between Pre-Test and Post-Test of the Control Group	153
6.15	Mean Difference of Performance in Simple Words Reading Skill between the Experimental Group and the Control Group in Post-Test	154
6.16	Mean Difference of Performance in Simple Words Reading Skill between the Experimental Group and the Control Group in Pre-Test	155
6.17	Mean Difference of Performance in Simple Sentences Reading Skill between Pre-Test and Post-Test of the Experimental Group	155
6.18	Mean Difference of Performance in Simple Sentences Reading Skill between Pre-Test and Post-Test of the Control Group	156
6.19	Mean Difference of the Performance in Simple Sentences Reading Skill between the Experimental Group and the Control Group in Post-Test	157

LIST OF FIGURES

No. of Figure		Pages
1.1	Conceptual Framework	11
2.1	TPACK Framework from http://tpack.org	36
3.1	Prototype Process adapted from Carr & Verner (2004)	64
4.1	A Framework of Mobile Educational Application for Early Reading among Kindergarten Children	93
5.1	A Flowchart for the development of Adik Jom Baca	105
5.2	Storyboard for Main Menu Screen	111
5.3	Storyboard for Kenali Huruf Vokal Module	112
5.4	Storyboard for Kenali Huruf Vokal Practice Sub-Module	113
5.5	Storyboard for Kenali Huruf Vokal Game Sub-Module	114
5.6	Storyboard for Belajar Membaca Module	115
5.7	Storyboard for Belajar Membaca Suku Kata Sub-Module	116
5.8	Storyboard for Belajar Membaca Suku Kata Game Sub-Module	117
5.9	Storyboard for Belajar Membaca Perkataan Sub-Module	118
5.10	Storyboard for Belajar Membaca Ayat Sub-Module	119

5.11	Storyboard for Latihan Module	120
5.12	Adik Jom Baca Icon	121
5.13	Familiar and Understandable Word	122
5.14	Child-Friendly Theme	123
5.15	Playful Learning Approach	124
5.16	High in Readability and Legibility	125
5.17	Attractive Gamification Elements	125
5.18	Non-Equivalent Control Group Pretest-Posttest Design	132
5.19	Pre-test Session	134
5.20	Experimental Group in Treatment Session	134
5.21	Control Group in Reading Instruction Session	135
5.22	Post-test Session	135



LIST OF ABBREVIATIONS

DATEC	Developmentally Appropriate Technology for Early Childhood
DDR	Design and Development Research
FDM	Fuzzy Delphi Method
ICT	Information and Communication Technology
NAEYC	The National Association for the Education of Young Children
NGT	Nominal Group Technique
TPACK	Technological, Pedagogical and Content Knowledge
UNESCO	United Nations Educational, Scientific and Cultural Organization





LIST OF APPENDICES

		Pages
A	Expert Invitation Letter	192
B	Research Confirmation Letter	193
C	Questionnaire for Framework Validation	194
D	Questionnaire for Usability Evaluation	199
E	Weekly Lesson Plan	203
F	Pre-Test and Post-Test Questions	207
G	Words List	213





CHAPTER 1

INTRODUCTION



This chapter presents the overview of the present study. It illustrates the background, problem statements, questions and objectives of the study. Additionally, this section highlights the significance of the study, its scope and conceptual framework. This chapter is crucial in understanding the issues concerning the problems, theories related and the direction of the study.

1.2 Research Background

Reading is an important skill to be acquired by every young child. Through reading, children are able to explore the knowledge behind every book, magazine and other printed materials. Furthermore, their success in school also depends on their ability to





read. However, the journey of learning to read is quite a challenge for young children (Guernsey & Levine, 2016). A study demonstrated that children with the proficiency to read are active, vibrant and competitive in learning activity (Tarasat & Daud, 2014). On the contrary, children with reading difficulties usually have a low self-esteem, unmotivated, unable to cope with learning and are often involved with disciplinary violation (Jamian, 2011; Jusoh, Abd Rahman, Mohd Kiram, & Roslan, 2013).

Many studies have been conducted focusing on the reading problems among young children. A report from the Government Transformation Programme: The Roadmap (Jabatan Perdana Menteri, 2010) demonstrated that in 2008, there are more than 54,000 primary year 1 students (about 31%) around Malaysia who did not meet the targeted literacy skills set by the Ministry of Education Malaysia. Moreover, a study carried out by Jamian (2011) discovered several problems in mastering reading and writing skills even in Malay language among rural primary year 4 and 5 students. Nevertheless, reading difficulty is not an isolated problem since it is also being faced by the school children of many countries around the globe (Haron, 2004). For instance, a study by the Ministry of Education Ontario (2003) identified problems in reading difficulty among children of kindergarten and first grade, which sometimes remain until the third grade in some cases. Furthermore, a report by Annie E. Casey Foundation (2010) recorded that there are one million American children at the fourth grade who have a low basic reading skills. In recent study, two-third of fourth grade American children have been seen not achieving proficiency level in reading skills (Guernsey & Levine, 2015). Subsequently, these children may be at risk of dropping





school since they are unable to catch up with the learning process (Center for Public Education, 2015; Ministry of Education Ontario, 2003; Patel, 2014).

In recent years, many mobile educational applications for early reading among kindergarten children have been made available in the market (Vaala & Levine, 2015). They have become popular learning tools due to their ability to provide engaging instructional experience to young learners (Ok, Kim, Kang, & Bryant, 2016). An analysis conducted by Shuler, Levine, & Ree (2012) demonstrated that there are over 80% of the top selling paid mobile educational applications in the education category of the Apple Apps Store were targeted for young children with the applications for kindergarten children being in the most popular category (58%).

Moreover, according to National Association for the Education of Young Children



(NAEYC), technology can potentially enhance children performance if it is appropriately used (Donohue, 2014). Nowadays, mobile educational application running on smart devices potentially fosters the reading ability among young children. Additionally, mobile devices with touch screen feature are more suitable for kindergarten learning compared to traditional computer (Neumann, 2014). On top of that, mobile educational application offers a fascinating experience since it provides playful exploration (Plowman, 2016).

1.3 Problem Statements

New advancement in educational technology has changed the landscape of early childhood education. The availability of smart devices featured with interactive and





fascinating applications promises interesting learning opportunities for young learners (Forzani & Leu, 2012). These applications, if appropriately developed, have a great potential to improve early reading skills among young children (Korat, 2010). Several studies have revealed the potential of mobile educational application in nurturing early reading skills for young children. For example, a study by Beschorner & Hutchison (2013) clarified that mobile educational applications offer a novel and attractive approach to facilitate reading, writing, listening and speaking skills. This notion is supported by Yahaya & Salam (2014), which depicts that a mobile educational applications are capable of encouraging and motivating young children to identify letters and spellings. Similarly, Neumann & Neumann (2015) found that mobile educational applications possess a great potential in enhancing children's emergent literacy skills such as alphabet knowledge, print concepts and emergent writing. Moreover, a recent study by Cordero et al. (2015) suggests that mobile educational applications are capable of fostering language abilities such as reading, writing, listening and speaking skills among young children.

However, there are some studies stating that some mobile educational applications do not fit with the needs and developmental level of the children. A content analysis on the existing mobile educational applications in Apple's App Store indicated more than 40% applications for young children that were not appropriately designed (Chau, 2014). Meanwhile, Murray & Olcese (2011) in their study revealed several mobile educational applications that were developed without any strong theoretical pedagogies and frameworks. Additionally, many educational applications in the market have less criteria of high-quality mobile educational applications by their ambiguous interface design, unclear instruction and inappropriate content (More

