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USER EXPERIENCE (UX) IN LEARNING HAJJ WITH AUGMENTED REALITY (AR) TECHNOLOGY FOR EARLY CHILDHOOD EDUCATION IN MALAYSIA



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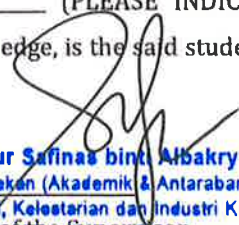

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ABSTRACT

The usage of Augmented Reality (AR) in Islamic studies among children is still rare, limited and far behind other learning subjects. The objectives of this study are to identify the suitable UX elements that will be implemented in the development of the Hajj AR mobile application, to develop a mobile augmented reality (MAR) application for learning Hajj and to evaluate user experience using the Hajj AR mobile application in learning Hajj among children in early childhood education (ECE). This study uses a quantitative approach via a quasi-experimental method. A DDR instructional design model was used to develop the Hajj AR mobile application. A total of 63 children from three different Little Caliphs Kindergarten were chosen as respondents through stratified random sampling. They were divided into three groups: control group (CG), experimental group 1 (EG1) and experimental group 2 (EG2). Each group have 21 children, respectively. The experimental group was assigned a mobile application treatment, whereas the control group was given a conventional learning aid. Smileyometer was used to evaluate user experience when exploring the Hajj AR mobile application. The instrument used in this research was a closed-ended questionnaire for collecting the data. Moreover, the instrument was validated by three experts. The empirical data were analyzed using descriptive and inferential statistic such as percentages, mean and one-way ANOVA. The questionnaire data showed that the respondents who used the Hajj AR mobile application agreed that the application was useful and enjoyable. Furthermore, the results show a significant difference between the post-test mean score of user experience among respondents in CG, EG1 and EG2, with p-value 0.001 smaller than α value 0.05. In conclusion, AR could enhance children's motivation to learn, making it more fun and enjoyable. The implication of the study is that the Hajj AR mobile application could be used and implemented in ECE in the future as an alternative and fun learning.





PENGALAMAN PENGGUNA DALAM PEMBELAJARAN HAJI DENGAN TEKNOLOGI REALITI TERIMBUH UNTUK PENDIDIKAN AWAL KANAK-KANAK DI MALAYSIA

ABSTRAK

Penggunaan realiti terimbuh dalam pembelajaran Islam di kalangan kanak-kanak masih terhad dan jauh ketinggalan berbanding mata pelajaran lain. Antara objektif kajian ini adalah untuk mengenal pasti elemen pengalaman pengguna yang sesuai dan akan diimplementasikan dalam pembangunan aplikasi mudah alih Hajj AR, membangunkan aplikasi realiti terimbuh mudah alih untuk pembelajaran haji dan menilai pengalaman pengguna menggunakan aplikasi mudah alih Hajj AR dalam pembelajaran haji di kalangan kanak-kanak dalam pendidikan awal kanak-kanak. Kajian ini menggunakan pendekatan kuantitatif melalui kaedah kuasi eksperimen. Model reka bentuk pengajaran DDR digunakan untuk membangunkan aplikasi mudah alih Hajj AR. Seramai 63 orang kanak-kanak dari tiga tadika Little Caliphs yang berbeza telah dipilih sebagai responden melalui kaedah persampelan rawak berstrata. Mereka dibahagikan kepada tiga kumpulan: kumpulan kawalan (*CG*), kumpulan eksperimen 1 (*EG1*) dan kumpulan eksperimen 2 (*EG2*). Setiap kumpulan mempunyai 21 orang kanak-kanak. Kumpulan eksperimen telah diberikan aplikasi mudah alih, manakala kumpulan kawalan pula diberikan alat bantuan pembelajaran secara konvensional. *Smileyometer* telah digunakan untuk menilai kepuasan pengguna semasa menggunakan aplikasi mudah alih Hajj AR. Instrumen yang digunakan dalam kajian ini merupakan soal selidik tertutup bagi tujuan mengumpul data. Selain itu, instrument tersebut telah disahkan oleh tiga orang pakar. Data empirikal telah dianalisis menggunakan statistik deskriptif dan inferensi seperti peratusan, min dan *one-way* ANOVA. Data soal selidik menunjukkan bahawa responden yang menggunakan aplikasi mudah alih Hajj AR bersetuju bahawa aplikasi tersebut sangat bermanfaat dan menyeronokkan. Tambahan pula, dapatan kajian menunjukkan perbezaan yang signifikan antara skor min ujian pasca pengalaman pengguna dalam kalangan responden dalam kumpulan kawalan, kumpulan eksperimen 1 dan kumpulan eksperimen 2, dengan nilai p 0.001 lebih kecil daripada nilai α 0.05. Kesimpulannya, realiti terimbuh mampu meningkatkan motivasi kanak-kanak dalam proses pembelajaran, menjadikannya lebih menyeronokkan dan menggirangkan. Implikasi kajian ini adalah menjadikan aplikasi mudah alih Hajj AR boleh digunakan dan dilaksanakan dalam pendidikan awal kanak-kanak pada masa hadapan sebagai pembelajaran alternatif yang menyeronokkan.





CONTENTS

	Page
DECLARATION OF ORIGINAL WORK	ii
DECLARATION OF THESIS	iii
ACKNOWLEDGEMENT	iiv
ABSTRACT	v
ABSTRAK	vi
CONTENTS	vii
LIST OF TABLES	xiii
LIST OF FIGURES	xv
LIST OF ABBREVIATIONS	xvii
LIST OF SYMBOLS	xix
APPENDICES	xx
CHAPTER 1 INTRODUCTION	
1.1 Introduction	1
1.2 Research Background	3
1.3 Problem Background	7
1.3.1 Problem Statement	11
1.4 Research Objectives	14
1.5 Research Questions	14



1.6 Research Hypotheses	15
1.7 Theoretical Framework	15
1.8 Scope of Research	17
1.9 Significance of Research	17
1.10 Limitations of Research	19
1.11 Conceptual and Operational Definition of Variable	20
1.12 Summary	23

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction	24
2.2 Definition of Augmented Reality	25
2.2.1 Types of Augmented Reality	27
2.3 Implementation of Augmented Reality	29
2.3.1 Augmented Reality in Malaysia Education	33
2.3.2 Augmented Reality in Early Childhood Education	35
2.3.3 Augmented Reality in Islamic Content	38
2.3.4 Significant of Augmented Reality in Early Childhood Education	40
2.4 Learning Theory	43
2.4.1 Cognitive Theory of Multimedia	43
2.4.2 Constructivism Theory	45
2.5 Framework of Design and Development Research	46

2.6 Mobile Augmented Reality in User Experience	47
2.6.1 User Experience Design Principles for Mobile Augmented Reality Application	49
2.7 User Experience through User Experience Honeycomb	51
2.7.1 Usability	53
2.7.2 User-Centered Design	55
2.7.3 Usability Elements in User Experience	57
2.8 Early Childhood Education	61
2.9 Pre-School in Malaysia	62
2.9.1 Little Caliphs Kindergarten	64
2.9.2 Little Caliph: Simulation of Hajj	65
2.10 Summary	66

CHAPTER 3 METHODOLOGY

3.1 Introduction	68
3.2 Research Design	69
3.2.1 Sampling Method	71
3.2.2 Research Population and Sample	72
3.3 Instrument	76
3.4 Research Methodology	77
3.4.1 ADDIE Instructional Design Model	77
3.5 Analysis Phase	80

3.5.1 Preliminary Study	81
3.5.2 Result of Analysis Phase	82
3.6 Design Phase	83
3.6.1 Prototype Design	84
3.6.2 Result of Design Phase	86
3.7 Development Phase	87
3.7.1 Result Development Phase	97
3.8 Implementation Phase	103
3.9 Evaluation Phase	104
3.9.1 Smileyometer	105
3.9.2 Research Procedure	106
3.10 Summary	111

CHAPTER 4 DATA COLLECTION

4.1 Introduction	113
4.2 Preliminary Study	114
4.2.1 Demographic Information	115
4.2.2 Hajj Teaching Experience	116
4.2.3 Using Augmented Reality (AR) to Learn Hajj	117
4.2.4 Expectations in Developing Hajj AR Mobile Augmented Reality Application for Early Childhood Education	123

5.2.1 User Experience of Children in CG, EG1, and EG2	
towards Learning Method	157
5.3 Implication of Study	161
5.4 Contribution of Study	162
5.5 Conclusion	163
5.6 Future Research	165
REFERENCES	169
APPENDICES	185

LIST OF TABLES

No. Tables		Page
2.1	Definitions of Usability: an ISO 9241-11 Standard Concerning Usability and Jacob Nielsen's Usability Attributes	54
3.1	Variables in Research Design	70
3.2	An Adaption of Overview Procedure Within-Subject Study	107
4.1	Demographic Background of Educators	115
4.2	The Mean Score of The User Perception on AR	118
4.3	The Mean Score of The Perspective of Applying Augmented Reality in Learning Hajj	120
4.4	Demographic Background of Respondents	129
4.5	Devices Used Most Frequently	130
4.6	Data of How Enjoyable Respondents while using Devices	131
4.7	Descriptive Analysis of Pre-test Testing	133
4.8	Results Pre-Test: <i>One-way ANOVA</i>	134
4.9	The Uses of Augmented Reality Technology	135
4.10	Demographic Background of Respondents	137
4.11	The Scale and Interpretation of the Mean Score by Landell (1977)	138
4.12	Data Analysis for Element of Learnability	139
4.13	Data Analysis for Element of Memorability	140
4.14	Data Analysis for Element of Remove Errors	140
4.15	Data Analysis for Element of Satisfaction	141
4.16	Data Analysis for Element of Efficiency	142

4.17	Data Analysis for Element of Learnability	143
4.18	Data Analysis for Element of Memorability	144
4.19	Data Analysis for Element of Remove Errors	144
4.20	Data Analysis for Element of Satisfaction	145
4.21	Data Analysis for Element of Efficiency	146
4.22	Data Analysis for Element of Learnability	147
4.23	Data Analysis for Element of Memorability	148
4.24	Data Analysis for Element of Remove Errors	148
4.25	Data Analysis for Element of Satisfaction	149
4.26	Data Analysis for Element of Efficiency	150
4.27	Results Mean Score of User Experience	151
4.28	Results Post-Test: <i>One-way ANOVA</i>	152
4.29	Respondent's Favourite Hajj Ritual in the CG, EG ₁ and EG ₂	153



LIST OF FIGURES

No. Figures		Page
1.1	Theoretical Framework of User Experience in Learning Hajj with AR Technology (Hajj AR) for Early Childhood Education	16
2.1	Marker-based Augmented Reality	28
2.2	Peter Morville's UX Honeycomb	52
2.3	Usability in User Experience (UX)	54
2.4	User-Centered Design Process according to the ISO 9241-210 Standard	56
2.5	Jacob Nielsen's Usability Attributes	57
3.1	Research Design	69
3.2	An Adaption of Overview Procedure Within-Subject Study	74
3.3	Purposive Sampling Procedure	75
3.4	ADDIE Model: Instructional Design	78
3.5	Design and Development Framework of Hajj AR Mobile Application	79
3.6	The Sketches of Hajj AR Mobile Application and AR book	86
3.7	The Four Main Components of Augmented Reality	88
3.8	Flowchart of MAR Development Phase : Hajj AR Mobile Application	89
3.9	Build a Character in Autodesk Maya 2018	91
3.10	Unity 2018	92
3.11	Image with Marker	93
3.12	The Development of the Hajj AR Mobile Application in Unity 2018	94



3.13	Testing Process	96
3.14	The Build Setting of the Hajj AR Mobile Application	97
3.15	The Interface of the Hajj AR Mobile Application in Smartphone	98
3.16	The Process of the Hajj with AR Market Target	99
3.17	AR Image on the Hajj AR Mobile Application	100
3.18	The Cover of the Hajj AR book with QR Code	101
3.19	Examples of Content Hajj AR book	102
3.20	Smileyometer	106
3.21	A Process of Build Rapport	108
3.22	A Child started to Explore with the Hajj AR Book Mobile Application	108
3.23	Smileyometer to Evaluate User Experience	109
3.24	A Child Evaluate Experienced with Smileyometer	110
3.25	A Child with Rewards	111
4.1	Teaching Aids for Teaching Hajj	116
4.2	As a Teacher, Benefits from Participating in Little Hajj Simulation	117
4.3	Familiar with Augmented Reality	118
4.4	The Mean Score of The User Perception on Augmented Reality	119
4.5	The Mean Score of The Perspective of Applying Augmented Reality in Learning Hajj	120
4.6	Elements of UX to employ in the Hajj AR Mobile Application	122
4.7	Participation of a Respondent in the Post-Test Testing	127
4.8	Traditional Learning Aid	128

LIST OF ABBREVIATIONS

AR	Augmented Reality
AV	Augmented Virtuality
ADDIE	Analysis, Design, Development, Implementation, Evaluation
CTML	Cognitive Theory Multimedia Learning
CG	Control Group
ECCE	Early Childhood Care and Education
ECE	Early Childhood Education
EdAR	Education Augmented Reality
EG ₁	Experimental Group 1
EG ₂	Experimental Group 2
EMT	Educational Magic Toys
GUI	Graphical User Interface
HMD	Head- Mounted Display
HUD	Head-Up Display
LC	Little Caliphs
MAR	Mobile Augmented Reality
MOE	Ministry of Education
NKRA	National Key Result Areas
SRS	Stratified Random Sampling
TAR	Tactical Augmented Reality
TLCP	The Little Caliphs Program

UCD	User-Centered Design
UI	User Interface
UNESCO	United Nations Educational, Scientific and Cultural Organization
UX	User Experience
QR	Quick Response



LIST OF SYMBOLS

%	Percentage
α	Alpha
df	Degree of Freedom
f	Frequency
M	Mean
N	Population Size
n	Sample Size
p	Probability Value





APPENDICES

- A Preliminary Testing Questionnaire
- B Pre-test Testing Questionnaire
- C Post-test Testing Questionnaire
- D Syllabus of Learning Hajj in Little Caliphs Kindergarten
- E Table of Previous Research: Augmented Reality in Hajj
- F Table of Previous Research: Augmented Reality in Early Childhood Education
- G Table of Sample Krejcie & Morgan (2006)
- H Letter Verification for Conducting Research from University
- I Permission Letter to Conduct Survey in Kindergarten:
 - 1. Preliminary Study
 - 2. Pre-test and Post-test Testing
- J Validation Letter
- K Consent Letter from Parents
- L The Summary of The Revolution of Augmented Reality (AR)
- M The Hajj AR Book



CHAPTER 1

INTRODUCTION

1.1 Introduction

In this time of all-round technological advance and it become embedded in everything. Not only in the technology field, education also involvement a transformation from chalk to computer, and when implementing educational changes, it comes about to show a positive affect on learning and teaching style (Burner, 2018; Saidin, Halim, & Yahaya, 2015). Therefore, education and technology progressing with leading in technology, thus with the assistance of technology, integrating the current educational. According to N.K.Gupta et al., (2014), to seek knowledge is not constrained to a classroom or a school only, times changed thus the ways we teach and learn must adapt the changing (Burner, 2018). For instance, mobile learning, which has been around for about 20 years and allows for studying at any time and from any location, can be regarded as an established approach of learning (Yaacob & Rushdi, Muhammad Zahiruddin, Mustapa Kamal, 2020).



Malaysia have objective to achieve the top 20 nation in world by 2050. Thus, education is one factor contributing to this objective (Ahmad & Spykerman, 2017; Malaysia, 2017; Mohamad, 2017) and have society with a higher cognitive of thinking and intellect to face upcoming challenges. At the same time, United Nations Educational, Scientific and Cultural Organization (UNESCO) approach is reinforced in the Education 2030 agenda and in particular in target 4.2 of Sustainable Development Goal 4 which aims to “By 2030, ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education” (UNESCO, 2015, 2019). Thus, education considered as a continuing process, which all the experience, intelligence and learning, that an individual achieves at diverse stage of life through diverse as well it is formally, informally or incidentally.



Therefore, education ought to be need from Early Childhood Education (ECE), not as it were in higher education. Early upon, the approaches used are important in attracting children who are interested in learning. One of these, with advancement of technology, is augmented reality (AR). According to Gutierrez et al., (2022), for more than 40 years, researchers have researched the concept of AR. Advancement of technology is one of reasons why educational changed. AR has been used in various fields such as military, medicine, engineering design, robotic, telerobotic, manufacturing, maintenance and repair application, consumer design, psychological treatments and others including education (Cahyana, Mandasari, Prawita, Shafira, & Pratama, 2021; Gutierrez et al., 2022; Kesim & Ozarslan, 2012; Ozdamli & Karagozlu, 2018). Thus, due to its proficiency in various field, its usage in the field of education has recently grown widespread. Furthermore, the researchers have recently focused





their attention on preschool children due to the potential of AR to address the demand for engaging and appealing instructional technologies for preschool children.

1.2 Research Background

The term of augmented reality (AR) was started used in 1990's by Caudell and Mizell (Corps, 2017). The origin of the AR dates back to the 1950's (Ozdamli & Karagozlu, 2018). Virtual Fixtures, created by Louis Rosenberg in 1992 for the AR Force, is one of the earliest and the first completely immersive AR systems (Corps, 2017), then apply in the military (Carmigniani & Furht, 2011; Yuen, Yaoyuneyong, & Johnson, 2011). Further, AR was in entertainment field which is the first to appear in theatre production (Corps, 2017). Besides, time changes have led the used of AR in sports likes games (Yuen et al., 2011). Then, AR is also used in advertising and marketing field (Yuen et al., 2011). In addition, AR is also adopted in commerce and travel (Yuen et al., 2011). Thus, AR was given a positive impact on every fields involved within.

With the clear affect gained from preceding study, AR was presently utilized in education. In addition, since AR technology that is simple to comprehend and utilise, it is widely used in many aspects of daily life (Aydoğdu, 2021). Thus, recently, AR started playing a role and more widespread in education in a few years especially in the process of learning and teaching. The used in education continuously develop as a result of technology development have consequently become more significant (Ozdamli & Karagozlu, 2018). Due of its visualisation capabilities, AR is essential for the expansion of learning interest in educational pursuits (Aydoğdu, 2021) and AR provides excellent





possibilities within education and much more excitingly redefines eLearning (Abdoli-Sejzi, 2015; D. F. Ali, Yahya, & Omar, 2020; Ozdamli & Karagozlu, 2018).

Furthermore, some of the institution of education had been used AR in their educational process and a few in area of subjects such as Science, Mathematics, English, History and others (Bistaman, Idrus, & Rashid, 2017; Frederick Bulagang & Baharum, 2017; Jamrus & Razali, 2021; Ozdamli & Karagozlu, 2018; Suhaimi, Aziz, Mior Ibrahim, & Wan Mohd Isa, 2022) including ECE. AR has advantageous to young children since they speed up learning, boost knowledge, reading and writing skills, foster creativity, increase student pleasure and with AR, learning is more efficient, quick, and enjoyable (Aydoğdu, 2021; Ozdamli & Karagozlu, 2018).



instruction and student outcomes (Aydoğdu, 2021). According to Adiseshiah (2018), AR presently being utilized as a cognitive tool for educational and training purposes across subject areas in both formal and informal learning environments. There are two major advantages of AR compared to the virtual reality (VR) is firstly, AR provides a common experience in the real environment which is the uses could simultaneously work with objects created by the computer and a direct engagement with AR. The new AR interaction options allow students to develop their own knowledge structures which is understandings. In addition, AR can help children's memory, thinking abilities, and imagination grow in a favourable way (Aydoğdu, 2021).





In Malaysia, AR has been utilised in different fields like advertising, entertainment and also education. According to Bistaman, Idrus, & Rashid (2018), AR is a technology with vast potential and great pedagogical that offers new methods for the purpose of education. For examples, in UUM International School, Sintok, Malaysia, with the advent of AR technology, the Word Mania mobile app, a fun educational games app for children, was designed to assist in the learning process (Hussain, Mkpojiogu, Kamal, & Lateef, 2019), then in Perlis, Malaysia, AR technology had been used in teaching and learning process for primary school (Bistaman et al., 2018). Teachers in Klang Valley, Malaysia, had been used AR in teaching English reading (Jamrus & Razali, 2021), also in learning Bahasa Melayu (Mohd, Shahbodin, Sedek, Hadi, & Daud, 2019). In addition, AR mobile application also had been used in Electronic Component Module in TVET. AR is also used to understand science either for primary school or kindergarten (Che Dalim, 2013; Nazatul Aini & Nooraidah, 2014; Ozdamli & Karagozlu, 2018). Thus, with AR, it is make the learning process more efficient, fast and enjoyable (Aydoğdu, 2021).

According to previous studies, as can be observed, the United States, Finland, and Malaysia are the countries that have published the most on the topic of UX with AR application (Gutierrez et al., 2022). As is common knowledge, AR is a new type of experience that combines the actual and virtual worlds. Thus, AR technology could acts as early exposure to the children about technology. AR technology allows children to see the actuality environment with virtual objects superimposed or composite in real world (Bistaman, Idrus, & Rashid, 2018; Ozdamli & Karagozlu, 2018) and can utilize to execute an AR-learning environment for preschool children.





Besides, AR acts as a initiate active learning and at the same time promotes advanced imaginative and innovative thinking (Elmy Mat-Jizat, Osman, Yahaya, & Samsudin, 2016). In additions, AR could give motivation and a positive attitude to children's engagement with the interesting learning environment and provide new approaches of interaction (Aydoğdu, 2021; Bujak et al., 2013; R. Rasalingam, Muniandy, & Rasalingam, 2014). According to R. M. Yilmaz, (2016), learning through AR also could boost imagination play and improve interaction with combining physical and virtual reality activities. Therefore, AR has a substantial impact on children's motivation since it increases their desire to engage in learning activities compared to those who utilise web-based applications (Aydoğdu, 2021), thus, bring unique benefits to the learning experience.



how people learn and teach (Ozdamli & Karagozlu, 2018). AR had a huge potential implication and various benefits for the augmented teaching and learning environment (Perdue, 2019; Sommerauer & Müller, 2018; Yuen, Yaoyuneyong, & Johnson, 2011). Although, the usage of AR in Malaysian education is still in initial phase, it increasingly accepted at all levels of education, and it can be improved from time to time. Thus, it is impossible to deny that AR applications have enormous probable in all subjects (Aydoğdu, 2021; Ozdamli & Karagozlu, 2018; Yuen et al., 2011).

Interactive technology such as AR, has been show positively impacted on the milestone of learning (Mohd, Shahbodin, Sedek, Hadi, & Daud, 2019). Therefore, AR could improve academic achievement and provide instant feedback, besides improving learning 21st century skills. Thus, technology in education has the potential to





encourage students to learn more actively, resulting in a more effective learning process and keep in memory (Aydoğdu, 2021; Saidin, Halim, & Yahaya, 2015) and by using technology into preschool education, teachers can assist young children develop their affective, cognitive, and psychomotor skills (Basri Nadzeri, Musa, Meng Chew, & Mahazir, 2023; Ozdamli & Karagozlu, 2018). Then, utilizing interactive teaching and learning tools encourages children's active cognitive mechanisms (Aydoğdu, 2021).

1.3 Problem Background

In recent times, AR has gotten a lot of interest in a variety of field, particularly education, whether it is in higher education or ECE. However, researcher in Malaysia discovered that the majority of AR technology is employed in entertainment and advertising. Furthermore, AR is only employed in a few disciplines in education, like storybooks, science, English, mathematics, and others (Abas & Zaman, 2011; Basri Nadzeri, Musa, Meng Chew, & Mahazir, 2023; Bistaman, Idrus, & Rashid, 2018; Che Dalim, 2013; Jamaluddin, Rusli, Lee, & Ling, 2020; Mahadzir & Phung, 2013; Nazatul Aini & Nooraidah, 2014). Therefore, there exist various issues with this study's background:

i. Inappropriate Existing Mobile Applications Graphic User Interface

Currently, one issue with mobile application is that they are inappropriate for children in the learning process. There are currently design standards for mobile learning applications, however they are not particularly geared toward children (Latiff, Razali,





& Ismail, 2019). Several of an existing hajj-related obligations mobile application on the app store are not educational, engaging, or well-organized for users, particularly children, commonly used for adults (Jamiat & Othman, 2019; Mohamed Ali, Mohamad Nizam, Abdul Rahman, & Ab Karim, 2023; Shaout & Khan, 2016). This is because the contents is difficult to read given the narrow font size and a large volume of static material on the smartphone screen.

Besides, some of the existing mobile application are similar to reading plain text on a page and delivery of information in the form of 2D images (Booton, Hodgkiss, & Murphy, 2021; Mohamed Noor, Lob Yussof, Yusoff, & Ismail, 2018). Furthermore, some of the applications are excessively dull, while others only dependent on linear scanning to complete all Hajj stages (Shaout & Khan, 2016). Some of the mobile application, provide limited evidence on what defines best implementation in children's mobile language learning (Aydoğdu, 2021; Booton et al., 2021). Furthermore, a lousy (very poor) user interface with a horrible colour scheme will make reading the information supplied to the user more difficult (Mohamed Noor, Lob Yussof, Yusoff, & Ismail, 2018; Shaout & Khan, 2016) and also, lacking sufficient components (elements) while designing educational mobile application (Kaur, Kalid, & Sugathan, 2019). As the result, the programmed is unlikely to be acceptable for children to learn, but it is likely ideal for the elders (Latiff, Razali, & Ismail, 2019; Shaout & Khan, 2016).

ii. Approach of Learning

Another issue for this studied is Islamic themes. Any curriculum's information cannot be learned well except when delivered in a precise way. Sometimes regarded as a boring



experience, making many children reluctant to engage in educational activities (Cahyana, Mandasari, Prawita, Shafira, & Pratama, 2021). In Malaysian school, the learning approach is still built on learning-centered classes focused on examination and concentrate on the traditional method, such as discussion (D. F. Ali, Yahya, & Omar, 2020; Nazatul Aini & Nooraidah, 2014). Teachers are advised to employ a range of techniques in a multimedia approach to diversify learning experiences in this situation (D. F. Ali et al., 2020; Zaiton & Hishamuddin, 2012), no research has been done specifically on how this technology can be used to educate and learn Islamic subjects.

Furthermore, students believe that the textbook's content and presentation are overly complex and obsolete. The information cannot be effectively assimilated unless it is presented in a specific manner, particularly in Islamic subjects, where children must learn using traditional methods. Traditional methods is learning that takes place in a classroom. Besides, the children not attracted with traditional studies (book) (Hussain, Mkpojiogu, Kamal, & Lateef, 2019). There is teachers who moderate and regulates the flow of information and knowledge, and a teacher arranges an environment in which activities can take place in person (Hussain, Mkpojiogu, Kamal, & Lateef, 2019; Ozdamli & Karagozlu, 2018). Furthermore, the teachers must explain to the children using the traditional technique that failing to do so would result in problems with involvement and concentration throughout learning sessions. Indirectly, it make children easily lose focus during the learning (Hussain et al., 2019). Despite the availability of a large range of learning media, for instance, television, papers, as well as the internet, studying through smartphone application has not yet been utilized well as an extra instrument in the studying process due to subject non-availability and some



application is usually just explaining (Cahyana, Mandasari, Prawita, Shafira, & Pratama, 2021; Nazatul Aini & Nooraidah, 2014).

Aside from that, students struggle to visualize abstract concepts, which might result to misunderstandings (Hairuddin, Abdul Rasam, & Razali, 2022; Saidin, Halim, & Yahaya, 2015). Therefore, the teacher need to change the traditional method teaching to help pupils develop a positive attitude towards Islamic learning. In addition to the issues listed above, there is a dearth of study on how technology, particularly AR, might be applied to teach and learn Islamic studies. As a result, learning using AR via a mobile application could assist to elucidate as well as make learning more entertaining. In the education sphere, AR might be referred to as an alternate educational medium (Jamrus & Razali, 2021; Saforrudin & Ahmad, 2012) and a new strategy to improve three-dimensional shape learning rather than the old method. Additionally, AR can be used to demonstrate dangerous circumstances, teach about things that can't be seen in a traditional classroom, embody abstract ideas, and present complex information (Jamrus & Razali, 2021; Ozdamli & Karagozlu, 2018). As a result, the usage of visualization technologies in education, for instance, AR is becoming more complex and complicated (Saidin et al., 2015).

iii. The Current AR Mobile Application's Constraints in terms of Hajj Learning for Children

Since AR is still in its development in Malaysia, a few research in the education field employs it (Bistaman et al., 2018; Saforrudin & Ahmad, 2012; Saidin et al., 2015). Despite the AR technology application fast gaining traction in many sectors (Mat-jizata,





Jaafar, & Yahaya, 2017; Saforrudin & Ahmad, 2012), there is still a lack of knowledge. It is unusual to encounter youngsters learning, particularly in Islamic studies. Moreover, several applications relating to education that employ AR as a mechanism of learning, like science, math, literacy, and more, may be discovered in the applications store (Mohamed Noor, Lob Yussof, Yusoff, & Ismail, 2018). Although, AR is widely used in education, it is not used in Islamic studies, it is still rare and far behind than other learning subjects (Cahyana, Mandasari, Prawita, Shafira, & Pratama, 2021; Mohamed Noor, Lob Yussof, Yusoff, & Ismail, 2018). Furthermore, most mobile application for learning Islamic studies only cover praying and fasting (Cahyana, Mandasari, Prawita, Shafira, & Pratama, 2021; Faizal Tan, 2011), but do not include information on learning Hajj.



In additional, certain applications based on Islamic were created by institutions

and individuals to aid pilgrims in performing Hajj. As a result, it is not appropriate for youngsters to learn (Khan & Shambour, 2017; Latiff, Razali, & Ismail, 2019; Mohamed et al., 2014). Essentially, the preceding research reveals that the application is only for the elderly who want to learn and perform the Hajj. As a result, children's learning opportunities are constrained.

1.3.1 Problem Statement

AR has been recently discovered, especially in preschool education which is ECE (Aydoğdu, 2021; Ozdamli & Karagozlu, 2018). There exists some subject have used AR as the medium in learning for children, however, the usage of AR in Islamic studies



among children is still rare, limited and far behind than other learning subjects such as science, language learning and others (Abdul Rauf, Hoe, & Samsudin, 2015; Cahyana et al., 2021; Mohamed Noor, Lob Yussof, Yusoff, & Ismail, 2018; Saidin, Halim, & Yahaya, 2015), although AR commonly used throughout ECE. From the previous research background, most of the mobile applications for Hajj that using AR was for elderly not suitable for children (Almoaid A, 2015; Mohamed et al., 2014; Mohamed Ali, Mohamad Nizam, Abdul Rahman, & Ab Karim, 2023; M. F. Yusoff, Zulkifli, & Mohamed, 2015).

Only a few of study and learning about Hajj for childhood in mobile application such as Learn Hajj by Mizan Applications (2018) and *Belajar Hajj dan Umroh* by Solite Kids (2018). Thus, for this two mobile application, there are lack in UX elements of memorability. Besides, some of the mobile application currently accessible are unsuitable for children learning which is not interactive, not informative and not organized (Hussain, Mkpojiogu, Kamal, & Lateef, 2019; Jamiat & Othman, 2019; Mohamed Ali et al., 2023). Also, due to shortage of adequate educational mobile applications, children's cognitive abilities to solve educational critical thinking challenges are declining (Kaur, Kalid, & Sugathan, 2019). In additional, learning in traditional ways is dull and tedious (D. F. Ali, Yahya, & Omar, 2020; R.-R. Rasalingam, Muniandy, & Rasalingam, 2014). As the text is hard to read, the amount of static text on the screen, linear scrolling and plain, similar with reading plain text on page (Cahyana, Mandasari, Prawita, Shafira, & Pratama, 2021; Shaout & Khan, 2016). Most of the learning Islamic studies still using traditional method (books) and in teaching, the teacher only explained to the children about Hajj without the virtual imaging of the



ritual of Hajj. This caused the students have difficulties in visualizing the concept as it will lead to misconceptions (Aydoğdu, 2021; Saidin, Halim, & Yahaya, 2015).

Due to limited Islamic studies in ECE especially in Hajj learning (Cahyana, Mandasari, Prawita, Shafira, & Pratama, 2021), the researcher decided to chosen subject of Hajj to develop a mobile augmented reality (MAR) application. The MAR application would be implementing the elements of user experience (UX) in learning Hajj among children in ECE, where the MAR technology will be used as a platform to introduce the children about interface of Hajj step by step. Since we know, AR technology has gained a following in the educational market for its ability to bridge gaps and bring a more tangible approach to learning, also to provide interaction on learning to overcome the shortage of Islamic and religious learning materials (Antonioli, Blake, & Sparks, 2014; Jamrus & Razali, 2021; Yasin, Isa, & Endut, 2016) with greater concept comprehension and ease in memory (Aydoğdu, 2021), whereas learning through AR still limited (Cahyana, Mandasari, Prawita, Shafira, & Pratama, 2021; Yilmaz, 2016).

Therefore, the MAR application was named as Hajj AR mobile application. It will help the children to explore and experience Hajj by themselves with fun and enjoyable environment. It is intended that by combining AR technology with UX, it would pique (attract) children's attention as they explore the application and help improve Islamic education by improving their comprehension towards the subjects they are learning. It's a brilliant idea since children learn through creativity and implementation of new technologies.



1.4 Research Objectives

The objective of this study is to evaluate a user experience using Hajj AR mobile application among children. Based on problems statement, the research objective was identified. The three (3) objectives outlined of this research was given in the following:

1. To identify the suitable UX elements of Hajj AR mobile application for ECE.
2. To develop Hajj AR mobile application in learning Hajj for ECE.
3. To evaluate UX of learning Hajj using Hajj AR mobile application among children in ECE.

1.5 Research Questions

Based on the objectives, the three (3) research questions of this research was identified:

1. How to identified elements of UX in designing Hajj AR mobile application for ECE?
2. How to develop Hajj AR mobile application in learning Hajj for ECE?
3. How to evaluate UX of learning Hajj using Hajj AR mobile application among children in ECE?

1.6 Research Hypotheses

The following are the research hypotheses. There are two null hypotheses proposed in this study:

H₀₁: There are no significant difference between the pre-test mean score of respondents in control group (CG), experimental group 1 (EG₁) and, experimental group 2 (EG₂).

H₀₂: There are no significant difference between post-test mean score of user experience among respondents in control group (CG), experimental group 1 (EG₁) and, experimental group 2 (EG₂).

1.7 Theoretical Framework

The Hajj AR mobile application, that employs MAR as its learning tool, was created using the UX element as a guideline. In additional, Hajj AR mobile application play a role as an integration towards conventional methods with AR technology then enhancing the UX approach. In this study, the theoretical framework consists of two factors which is MAR and UX. MAR acted as independent variable, while UX is a dependent variable in this study. You may refer to *Figure 1.1* for further detailed of theoretical framework in this study.

According to previous study conducted by Kamaruzaman, Ahmad, Zambri, & Mukmin (2022), recent research revealed that the use of AR in educational settings has

been increasing in acceptance since AR proved beneficial for the learning process. Their finding supported by finding from a study conducted by Suhaimi, Aziz, Mior Ibrahim, & Wan Mohd Isa (2022), where they discovered that using AR would benefit students by boosting their learning process's engagement and enjoyment. Besides, the finding study conducted by Basri Nadzeri, Musa, Meng Chew, & Mahazir, (2023), also found AR enhance the learning experience by making learning more engaging has a beneficial influence on teaching and learning, and assist in comprehension especially in abstract concepts. Therefore, it is intended that by combining traditional methods of instruction and AR technology, children will be more interested in the learning process.

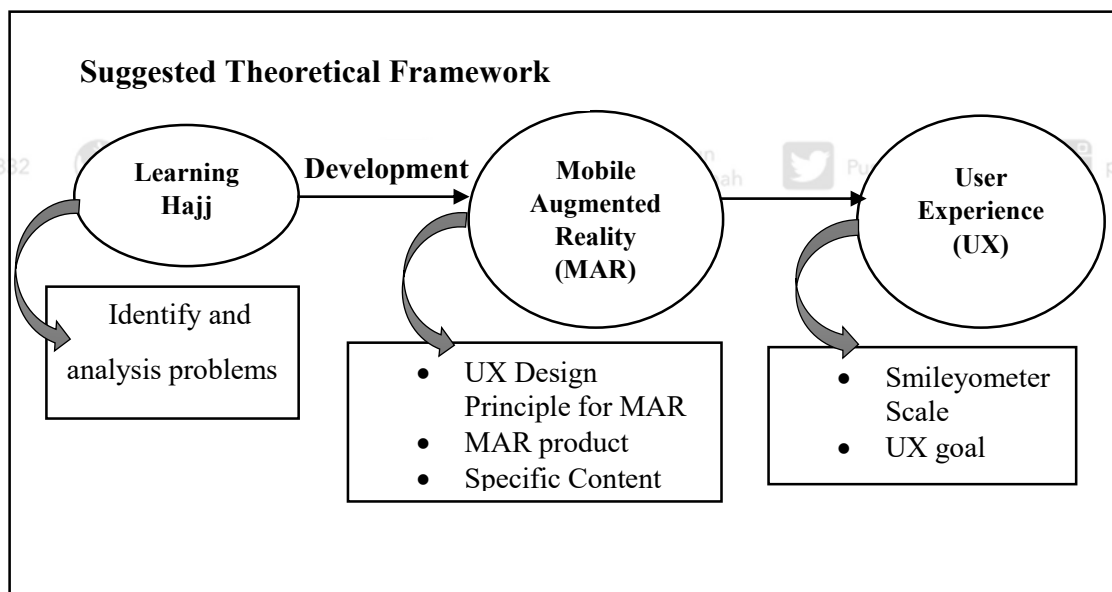


Figure 1.1. Theoretical Framework of User Experience in Learning Hajj with Augmented Reality Technology (Hajj AR) for Early Childhood Education

1.8 Scope of Research

The following are the delimitations of the study:

1. This study only focused on topic Hajj in Islamic subject for six years old children in Bangi, Selangor Valley with only three kindergarten involved.
2. This research only focused the ritual in doing Hajj based on topic Hajj in the syllabus.
3. This research intends to develop a MAR application as a platform in learning Hajj for ECE.

1.9 Significance of Research

There are some significations of this study among:

- i. Practitioner

In this context of study the practitioner is consist of children's and educators:

- a) Children

The significant of this research is to engage children and AR technology, to have enjoy and creative in learning, besides as early exposure to children about Hajj. Children's brain likes span that will absorb everything easily. AR to craft the children to immersive



the experience of the Hajj AR mobile application (Aydoğdu, 2021). In context learning Hajj among children, AR could help them in figuring out the real situation of the event and learning (Ozdamli & Karagozlu, 2018), and understand the process in performing Hajj.

b) Educators

AR could be as guidance for educators in teaching process besides using books (traditional method) to attract their interest in learning process (Ozdamli & Karagozlu, 2018). In addition, AR could present their imagination. This is because children learn through imagination (Aydoğdu, 2021; R.-R. Rasalingam, Muniandy, & Rasalingam, 2014). Besides, using AR is easier and could enhanced enjoyment in environment, thus the students more focus (Cahyana, Mandasari, Prawita, Shafira, & Pratama, 2021; Jamiat & Othman, 2019).

ii. Researcher

The significant of this research to researcher is to introduce AR technology among children in ECE, where this technology still lacking a foundation in ECE. Besides, to produce one prototype of teaching aid that using new technology which is AR that could help educators in teaching (D. F. Ali, Yahya, & Omar, 2020). Besides, as an initial step in bringing AR in education area in Malaysia. In addition, as a ways to enhanced fun learning. As we known, AR have potential for redefining information distribution and the ability to place the world in context of learning in this era of technology. Thus, to



see widely of many more development of AR in learning especially for children in ECE in other field.

iii. Parents

The significant of this research is parents could take the positive impacts that AR brings in many contexts especially in education aspects (Jamiat & Othman, 2019). Through AR, parents could help their children in learning process, to make it creative and fun. At same time, parents could exploring the world of learning with their children. In addition, parents also could know how the technology takes place to help the children in learning process. Thus, parents should be accept the positive impacts, how the AR technology could takes place in ECE nowadays.

1.10 Limitations of Research

There are some limitations of this research:

1. This study only covers a sub-topic Hajj from the syllabus Islamic subject for six years old children in the Little Caliphs kindergarten. A Little Caliph kindergarten was chosen because in recent years, this kindergarten was organizing Hajj simulation programmed for their preschool children. In 2017, “Little Hajj 2017” program with 5,684 children from Kindergarten Little Caliphs throughout the country recorded its own history when it received the Malaysia Book of Records (MBOR) recognition (Little Caliph International

Sdn Bhd, 2017). This is the biggest Hajj simulation that involved kids six years old from 212 kindergartens Little Caliphs.

2. The topic needed to explain with visuals, facts, years, early history about AR, ECE and others that involved in this research. There are lack of previous research regarding learning Hajj for children.
3. The populations for this research is six years old children from three different Little Caliphs kindergarten around the area of Bangi, Selangor, Malaysia. The reason of chosen same area of population because to avoid bias of data and get average results from every kindergarten. According to Little Caliphs kindergarten's website (Bhd., 2022), five from 464 branches all over Malaysia is from Bangi.
4. The Hajj AR Mobile application only focused on the rituals of doing Hajj based on the syllabus in Islamic subject without others features likes games.
5. Due to pandemic, children were unable to spend time together in kindergarten. In addition, they were required to wear masks and follow other pandemic regulations, thus, due to obligation wear masks, discouraged them from expressing their joy or learning through Hajj AR mobile applications.

1.11 Conceptual and Operational Definition of Variable

A conceptual definition highlights the basic concepts underpinning a term, while an operational definition outlines a metric for measuring something of interest.

i. Children

According to Oxford Dictionaries (2017), a child is a young human being below the age of puberty or below the legal age of majority. While according to the *Kamus Pelajar Bahasa Melayu*, child is young children usually the age below seven years old (Tajudin & Tajuid, 2016). Whether boy or girl that are still small. In additional, early childhood, described as the years between birth and the age of eight, is a period of amazing development, with brain development at its maximum (UNESCO, 2019).

In this study, the age of children who involve was six years old. The information related to the study obtained from the demographic background that attached with the set of the questionnaires.

ii. Early Childhood Education (ECE)

The meaning of education is the process of teaching or learning, especially in a school or college or the knowledge that the person get from home or anything (Cambridge University Press, 2019). History shown early childhood education has been started since year of 1950-70s. Whereas in Malaysia, early childhood education has commenced from the year 1940-50s. The concept of ECE has been divided into two ranks which is ranked first starts empty until three years old (0-3) and ranked second, starting from four to six years old (4-6). In addition, ECCE comprises preschools for children aged 4-6years, and childcare centers for young children aged 0-4years. Early Childhood Care and Education (ECCE) in Malaysia is based on the belief that every child has the right to quality care and holistic development, which consideration all

aspects of physical, emotional, social, intellectual, and health development during the early years of life (Lim, 2015).

iii. User Experience (UX)

According to Farrell & Nielsen (2014), UX covers pretty much everything experienced by the user of a design or service. In addition, according to ISO standard “ISO 9241-11:2018 (en),” (2018), users’ perceptions and responses include the users’ emotions, beliefs, preferences, perceptions, comfort, behaviors and accomplishments that occur before, during and after use.

In this study, UX testing in learning Hajj with AR, involved three groups of respondents which is control group (CG), experimental group (EG₁) and experimental group (EG₂). UX measure using Smileyometer scale. This Smileyometer scale consists of five scale which is; (1) boring, (2) awful, (3) neutral, (4) happy and (5) excited.

iv. Augmented Reality (AR)

AR was chosen to enhance the features of mobile learning (m-learning) in terms of visualizing the learning content to appear in the real environment in order to realize the enhancement of engaging student attraction through mobile learning (Gutierrez et al., 2022; Senisi, 2012; Z. Yusoff, 2014). According to Frederick Bulagang & Baharum (2017), the concept of mobile learning begins with e-learning and gradually transforms into it as technology advances over time. AR was beginning to grasp a new type of human-computer connection with children or youngsters. In this study, researcher have

been developed a mobile augmented reality (MAR) in learning Hajj to evaluate the UX among the children in ECE.

1.12 Summary

This research is conducted to evaluate the user experience in learning Hajj using MAR among children in ECE was named as Hajj AR mobile application. This chapter is explains the background of the research that contains objectives, problems statements, and research questions, as well significance of the research among practitioner, researcher and parents. Also, in this chapter, the researcher discussed about theoretical framework, delimitations, limitations and others that are related. In the next chapter, this research will discover the literature review, AR background and other contents that connected with this research.