DESIGN GUIDELINES FOR ARABIC MOBILE LEARNING APPLICATION BASED ON COGNITIVE THEORY OF MULTIMEDIA LEARNING

MOHAMMED ABBAS NEAMAH AL-RIKABI

MASTER OF SCIENCE (INFORMATION TECHNOLOGY)

SCHOOL OF COMPUTING

UUM COLLEGE OF ARTS AND SCIENCES

UNIVERSITI UTARA MALAYSIA

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Thesis submitted to Dean of Awang Had Salleh Graduate School in Partial Fulfillment of the requirement for the degree Master of Science in Information Technology Universiti Utara Malaysia

MOHAMMED ABBAS NEAMAH AL-RIKABI

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Abstract

Arabic Language has an exceptional position in Islam. As the language of al-Quran, the needs to learn and understand it amongst Muslims is of paramount importance. In countries where their native language is not Arabic, it needs to be introduced to children at their early age such as in primary schools. With the advent of mobile technology, various kinds of multimedia tools have been developed for the purpose of learning language. Since children are attracted to mobile multimedia applications, it could potentially be used in learning Arabic too. Various applications have been available in the market, but most of them do not fully utilize the multimedia elements such as sounds, videos, images, and texts. In response to that, this study aims to design, develop and evaluate a mobile multimedia application. It is called A4Kids, targeted for children between 7 and 9 years old for learning Arabic language based on Cognitive Theory of Multimedia Learning CTML. First, this study initiated an investigation involving multiple fact finding techniques, which are interviews and review of related literatures to get a prototype for stakeholders' information needs. The preliminary analysis involves interviews with expert teachers who have taught Arabic subject for more than ten years in primary schools. Then, related literatures were reviewed. Further, an application was developed, and tested involving real users. The results of user evaluation on the A4Kids indicate that it is learnable, easy to use, and useful for children. Additionally, it is capable to help them learn Arabic easily, directly, and successfully regardless of location and time.

Keywords: Children, Arabic language, mobile learning, mobile application, CTML.

Abstrak

Bahasa Arab mempunyai kedudukan yang tinggi dalam Islam. Sebagai bahasa al-Quran, keperluan mempelajari dan memahaminya di kalangan orang Islam adalah sangat tinggi. Di kalangan negara-negara yang bahasa natif mereka bukan Bahasa Arab, ia perlu diperkenal kepada kanak-kanak pada usia muda di sekolah rendah. Seiring dengan kemajuan teknologi mudah alih, pelbagai alatan multimedia telah dibangunkan untuk mempelajari bahasa. Memandangkan kanak-kanak amat tertarik dengan aplikasi multimedia mudah alih, ia amat berpotensi diaplikasikan dalam pembelajaran Bahasa Arab. Pelbagai aplikasi telah tersedia dalam pasaran, tetapi kebanyakan mereka tidak menggunakan pelbagai elemen multimedia. Justeru, kajian ini menetapkan sasaran untuk mereka bentuk, membangun, dan menilai sebuah aplikasi pembelajaran multimedia. Ia dinamakan A4Kids, dikhususkan kepada kanak-kanak di antara 7 dan 9 tahun. Pada awalnya, konsep dan garis panduan untuk A4Kids telah dibentuk melalui temubual dan kajian dokumen. Kemudian, sebuah prototaip telah dibangunkan, dan diuji dengan pengguna. Dapatan menunjukkan A4Kids mudah dipelajari, mudah diguna, dan berguna kepada kanak-kanak. Malahan, ia mampu membantu mereka mempelajari Bahasa Arab dengan mudah, cepat, dan berkesan tidak tergantung kepada lokasi dan masa.

Kata kunci: Kanak-kanak, Bahasa Arab, pebelajaran mudah alih, aplikasi mudah alih, CTML.

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List of Acronyms

A4Kids	Arabic Language for Kids
CD	Compact Disk
CTML	Cognitive Theory of Multimedia Learning
E-learning	Electronic Learning
ICT	Information and Communication Technology
J-QAF	Jawi-Quran-Arabic and Fardhu ain
M-learning	Mobile Learning
MMS	Multimedia Messaging Service
MoE	Ministry of Education
SK	Sekolah Kebangsaan
SMS	Short Messaging Service
UML	Unified Modelling Language

CHAPTER ONE

INTRODUCTION

1.1 Introduction

The way of life of people in the contemporary societies has evolved, which implicates also their works and the organizational work styles. This is very much influenced by the advancement of the information and communication technology (ICT). As the world develops, the education also gets significantly influenced. In conjunction to that, the way people learn should also be reengineered. This has been seen in learning of various subjects (Kundishora, 2013). In education sector, the emergence of ICT in the last years has become indispensable for both teachers and learners in various fields. In fact, the Internet facilities have influenced the ICT to gradually pushing aside the traditional library from educational scene into digital infrastructure (Jacobsen & Lund, 2015), enabling people to acquire information from a distance.

In regards to that, the Malaysian government believes that the quality of education can be improved by utilizing ICT (Zaki & Danby, 2013). In addition, the education system in Malaysia has also gone through several important stages that feature it in the best way possible to match the emerging and changing needs of the contemporary society by following the trends of new media and technologies (Zaki & Danby, 2013). It is also seen that emerging technologies in the education system is highly sensing for the benefits of students' experience. With the emerging technologies, the new form of learning in electronic environment or M-learning has grown significantly, especially in training institutions (such as universities and schools).

In the past decade, mobile learning was introduced, as a generally new trend in the advancement of electronic learning (E–learning), in which with the assistance of handheld devices users have access to course materials from any place at any time. They not only managed the instructional content but also gave its adaptation and adequate visualization on the little screen of mobile devices (Georgieva, Smrikarov, & Georgiev, 2011).

Eventually it leads to mobile era, full with handheld mobile devices, which are transportable and small enough to be placed in pockets, for use anytime, anywhere (Srinivasan, Vinoth, Kalidas, Vinoth, & Vimala, 2014). With that, access to information and communication channels are very pervasive. Such advancement has made learning process more motivating, meaningful, and productive with teachers as facilitators or guides, besides learning resources like journals, books, learning materials, class notes, and communication tools (Hussin, Manap, Amir, & Krish, 2012). This supports the needs for learning every subjects either technical or non-technical, including learning language.

In Islam, learning Arabic language is a '*Sunnah*' and it appears in Muslims' hearts because it is the language of the Quran (Bakri, Zakaria, Nazirah, & AbuSafia, 2014). Thus, learning and understanding Arabic is greatly important among Muslims to understand the authentic meaning of Quran. While Arab people learn it as their mother tongue, other people learn it as a foreign language, which brings-in a great challenge for them at all ages. Hence, introducing the language to children at their young age, when they are most curious and so driven for learning, is the most appropriate. This refers to their age at primary schools. It is very significant and would help cultivating their interest in the language, which would eventually accelerate their acceptance and understanding on the language (Mubaslat, 2012; Stewart, 2005).

In current landscape, children have been very much attracted to mobile applications (Zawati & Muhanna, 2014). Based on that, learning application for Arabic language is possibly used for invoking their interest. With the advancement of mobile device technologies, many applications have been designed for the purpose of learning languages, and are available in App store and Google play. However, most of those applications do not make use of multimedia elements effectively, while some of them do not cover the full contents as intended in learning the Arabic language (Kelly, 2010; Salim, 2009). This has to be viewed as a drawback in supporting learning Arabic, and has to be addressed. According Kumar (2013), Mobile learning has significance can be summarized diagrammatically in Figure 1.1:

Figure 1.1: Significance of Mobile learning (Kumar, 2013)

At the same time, children are reluctant to read books because they find them boring. But, by using multimedia approach, the functions in books can be supported and made more sophisticated. Mobile multimedia applications can enrich information with pictures, sounds, video, and interactivity. As a consequence referring to the discussions in the previous paragraphs, it is anticipated that mobile applications for supporting learning Arabic will grow in the near future. This could be seen through a number of symptoms including the vast production of mobile devices and the organization of summits to grow the consciousness of the needs to enrich the Arabic digital content.

1.2 Problem Statement

Arabic language is highly important to all Muslims around the world. It is a sacred language because it is the language of the Quran and Islamic sources especially Tafseer and Hadith. The importance of Arabic language cannot be denied, especially in the religious aspect (Bakri, Zakaria, Nazirah, et al., 2014). In Malaysia, the people have to learn Arabic language to increase their understanding on matters related to religion because their first language is not Arabic (Zailani, Zainal, Ghani, & Hashim, 2015). Among Malaysians, Arabic language is perceived difficult, and teaching it is also difficult because it contains quite a big number of grammar and vocabulary. Recently, Al Muslim and Arifin (2014) discovered that Arabic language education in Malaysia is unsuccessful and needs radical changes in many ways, including the modern teaching aids and tools need to be incorporated into.

Learning is a process that is experienced by each human being to acquire knowledge (Hussin et al., 2012). Beyond that, the mobile technologies has also immersed into learning, creating a new concept that enables learning to take place everywhere at any

time, called mobile learning (Judge, Floyd, & Jeffs, 2015). This extends learning opportunities for everyone. Not only adults are carrying mobile devices, but also children too. They spend much time on their mobile devices every day. While carrying the devices, most of the children play games for various purposes, including for educational purposes. With the pervasive touch screen technology, the children have great opportunities to learn through technology at a younger age than ever before (Shoukry, Sturm, & Galal-Edeen, 2015).

Currently, various systems and applications for learning language and linguistics have been developed and commercialized such as dynamo.dictionary.com and SpellingCity.com, available in App store and Google play. They are designed for teaching English. On the contrary, learning application for Arabic language is too limited (Erradi, Nahia, Almerekhi, & Al-Kailani, 2012; Sahoo, 2014). Not only that, but also the learning Arabic applications do not cover full contents necessary (Kelly, 2010; Salim, Zulkifli, Mohamed, & Razak, 2012; Salim, 2009). In fact, literatures on the use of mobile applications and technologies in learning Arabic for non-native speakers is also lacking (Abedalla, 2015).

At the same time, Arrieya and Dyson (2015) discovered that there is a serious lack of local content in Malaysia, especially for mobile applications including applications for learning Arabic. Not only the in the contents, but also the lacking appears in user interface design, such as local language instructions. The use of Bahasa Melayu, or bilingual is very limited. Besides that, some limited features like small-sized text and button were found discouraging learning activities among children in utilizing mobile applications for

learning Arabic. This has to be viewed as a drawback in supporting learning Arabic, and has to be addressed (Al Muslim & Arifin, 2014).

Not only that, the applications available in market are not well-designed, in a way that supports user needs because most of applications do not make use of multimedia elements effectively, while most of the applications do not cover full contents as intended in learning Arabic language (Kelly, 2010; Salim, 2009). Most applications focus on one or two aspects of Arabic language only, such as the letters and colors. There are also applications covering Arabic Alphabet and vocabulary.

Based on the aforementioned discussion, it is obvious that the need for mobile multimedia application for learning Arabic among children is high. The application should cover most importantly skills in language learning such as reading, writing, speaking, and listening because it is important for children, at their young age. In response to that, this study aims at designing a mobile multimedia application for learning Arabic language based on scientific requirements. Hence, the question in the next section should be answered.

1.3 Research Question

In regards to the problem discussed in the previous section, this study aims at proposing a design guidelines for mobile multimedia application for learning Arabic based on a scientific requirements to ensure that the children could acquire Arabic language easily. Hence, this study needs to answer this question:

- What are the design requirements for mobile multimedia application for learning Arabic for children based on Cognitive Theory of Multimedia Learning CTML?

1.4 Research Objectives

Three objectives are utilized to achieve the aim of this study:

1. To obtain the design requirements for mobile multimedia application for learning Arabic for children based on Cognitive Theory of Multimedia Learning CTML.
2. To develop a mobile multimedia application for learning Arabic language based on the design obtained requirements.
3. To evaluate the proposed mobile multimedia application for learning Arabic language.

1.5 Research Scope

The main aim of this study is to propose design guidelines for mobile multimedia application for learning Arabic language that is called A4Kids. It is targeted for children between 7 and 9 years old because at this age, children are able to learn new languages easily and communicating using it (Stewart, 2005). In Malaysia, 7-year-old children start attending primary schools for formal learning. At this age also, they will be able to do a number of things for themselves that they could not do the years before. So, it is the age where they develop their intellectual and emotional maturity tremendously (Destefanis & Firchow, 2007).

In terms of tools used to design the A4Kids, UML diagrams is the most appropriate because the application involves various objects and interactions. UML diagrams are very advantageous for designers because they let developers and users to see the application from various points of view. Artifacts like use case, class diagram, state diagram, activity diagram, and sequence diagram are used to outline complex processes. The development then take place based on those artifacts.

The prototype has been tested on mobile devices with Android platform. Android has been selected because it is a popular operating system for mobile devices besides open and free (Vangie, 2011). The prototype of A4Kids was developed using Java programing language and Eclipse tool. Then, a set of questionnaires were utilized to evaluate the A4Kids because it is one of the most appropriate way for assessing the usability of mobile applications (Hussain, Dahr, Neamah, & Hussein, 2015). Altogether, 30 teachers teaching Arabic language have participated in this study, representing seven public primary schools in Kedah, Malaysia as listed below:

1. Sekolah Kebangsaan Dato' Wan Kemara.
2. Sekolah Kebangsaan Bandar Baru Bukit Kayu Hitam.
3. Sekolah Kebangsaan Bandar Baru Sintok.
4. Sekolah Kebangsaan (Felda) Bukit Tangga.
5. Sekolah Kebangsaan (Felda) Laka Selatan.
6. Sekolah Kebangsaan Bandar Baru Darulaman.
7. Sekolah Kebangsaan Jitra.

1.6 Significance of Research

Currently, primary schools are dealing with textbook in their teaching and learning. This traditional way makes students tired and bored. When this study proposed the utilization of the A4Kids application with multimedia elements that act as the channel for teaching and learning, the results prove an increase in children's motivation in learning the Arabic language. On top of that, it provides extra opportunities for the children to interact in their learning activities and hence enabling them to strengthen their understanding and

memorization of the learning contents. Based on that, this research has contributed in a number of ways to the current state of education in Malaysian primary schools. They are outlined in the following.

1. The proposed design guidelines for designing and developing mobile multimedia applications for learning Arabic language based on CTML:

   The purpose of the design requirements with the integration of CTML is to guide designers to arrange multimedia elements (text, sound, video, and picture) and so that they are more effective than the conventional mobile learning applications. With that, the application enhances and encourages the learning of Arabic subject among children in Malaysian primary schools. Hence, the proposed design guidelines for designing mobile multimedia application for learning Arabic language can be a reference model for other researchers or developers in developing similar purpose of educational learning materials.

2. Design and development of the mobile multimedia application for learning Arabic:

   This study designs a mobile multimedia application for learning Arabic language in Malaysia (referring to A4Kids). Children can get benefits from this application, which helps them learn Arabic language through the learning contents, which include introduction to Arabic alphabets, writing and reading Arabic characters, numbers, colors, days of week, months of year, game and quizzes. A4Kids is developed to contribute to the growth of Malaysian mobile multimedia applications and enhancing student learning and understanding of Arabic language. It is flexible (for use any time, at any place), available for use 24 hours a day, 7 days a week, which is very pervasive.

1.7 Thesis Structure

This thesis contains seven chapters, covering the background of the study, the philosophy of the design of A4Kids application, the design and development of it, and the look and feel of itself. Nevertheless, the way it has been tested is also deliberated, together with the obtained results and some recommendations for future enhancement. They are briefed in the following:

Chapter One: This chapter provides the background of the study. It focuses on Arabic language education and how the public can get the benefit if the education utilizes mobile applications. Then, this chapter discusses the problem being solved, in which there are difficulties in learning Arabic among Malaysian children. Hence, Arabic language education in Malaysia is quite unsuccessful and needs radical changes in many ways. Besides that, the availability of applications for learning Arabic language in Malaysia is still infancy. Accordingly, a research question is imposed, leading to the formation of research objectives. Nevertheless, this chapter outlines also its scope and addresses its significance. Lastly, this chapter explains about the organization of the thesis.

Chapter Two: This chapter reviews the previous works available in the literatures, which are related to this study such as ICT in education, mobile devices, M-learning, challenges of learning Arabic in Malaysia, existing applications that used Cognitive Theory of Multimedia Learning CTML, and mobile application for learning Arabic for children.

Chapter Three: This chapter discusses the methodology that has been used in this study, which comprise four phases. Among others, this chapter describes the data collection techniques including the instrument been used to achieve the stated objectives.

Chapter Four: The results of data analysis that are related to the current practice in teaching and learning are discussed in this chapter. The data that were collected at the beginning of the study by using multiple fact finding techniques, which are interviews with experienced teachers teaching Arabic language topic in primary schools and review of related literatures are discussed, which lead to the formation of the guidelines for mobile multimedia applications for learning Arabic.

Chapter Five: This chapter explains the steps in designing and developing mobile multimedia applications based on the guidelines described in Chapter 4. In details, the functional and non-functional requirements are discussed in this chapter. Also, it exhibits the UML diagrams used for designing the A4Kids. Finally, this chapter also exhibits the look and feel of the developed A4Kids.

Chapter Six: This chapter discusses the evaluation of the A4Kids prototype by using questionnaire technique. The SPSS version 20 software was utilized to analyze the collected data.

Chapter Seven: This chapter conveys a conclusion to the study. It recaps the results and findings and it maps them with the stated objectives. It proposes also some possible future enhancements to make this study more impactful based on the discovered limitations.

CHAPTER TWO

LITERATURE REVIEW

The previous works available in the literatures, which are related with this study will be explained in this chapter. In more detail, this chapter discusses about ICT in education, mobile devices, mobile learning M-learning, Arabic language, challenges of learning Arabic in Malaysia, mobile application for learning, existing mobile application for learning Arabic language for children.

2.1 Information and Communications Technology (ICT) In Education

Since the last 15 years, the utilization of ICT in education has significantly evolved (Alharbi, 2012). Currently, it is difficult to imagine our daily life without the presence of the Internet and mobile devices. ICT is a necessity nowadays for meeting the demands and the challenges imposed by learning in education. Indeed, ICT has changed how things work around the world. It is one of the best platforms to bring excellences in multicultural education that enhances student's capacity and accelerated pedagogy (Lubis, Embi, Yunus, Wekke, & Nordin, 2009).

The Ministry of Education in Malaysia MoE considers ICT as a tool but not an end in itself. As being what is indicated, all endeavors are focused on growing new media as tools in the administration of better educational module, improved instructional methods, more successful hierarchical structures in schools, more grounded connections in the schools and strengthening disappointed learners. The Ministry trusts that appropriately planned and actualized processing and correspondences can possibly upset instruction and

enhance learning as significantly as it has changed medication, finance, fabricating, and various different parts of society (Zaki & Danby, 2013). Technology is not just a "vitamin" that exists in schools for better educational outcomes, and it is not just another piece of subject from syllabus, but it is designed for teaching students to use tools they may meet as adults. ICT in education, as seen by the MoE is rather a system that enables information gathering, manipulation, management, access, and communication in various ways. Two ICT policies have been formulated by the government for ICT in education. ICT for all students is the first policy, which implies that ICT is utilized as a tool to reduce the digital gap between schools. The second policy highlights the function and the role of ICT in education as a learning and teaching tool, as section of a subject, and as a subject by itself.

2.2 Mobile Learning (M-learning)

The term mobile devices include all devices like, personal digital assistants (PDAs), tablets, smart phone and mobile phones. Krannich (2010) classifies digital mobile electronic devices into three categories as seen in Figure 2.1, which are subjected to their transport ability, weight, form, components, capacity, and connectivity.

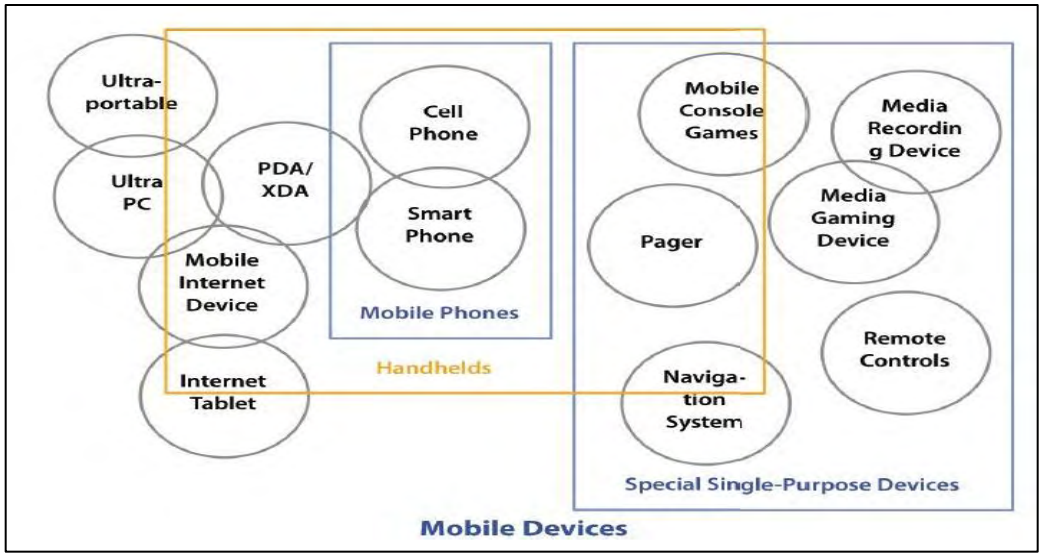

Figure 2.1: Class of The Digital Mobile Electronic Devices (Krannich, 2010)

Amongst the existing mobile devices, mobile phones are the most popular. Almost all students own it and it can be defined as an electronic telecommunications device, often pointing to as cellphone (Hussin et al., 2012). Through radio wave or satellite transmissions, all mobile phones connect to a wireless communications network. Most mobile phones offer Multimedia Message Service (MMS), voice communications, Short Message Service (SMS) and newer generation of mobile phones can also provide e-mail and Internet connection services as Web browsing.

This phenomenon appears worldwide including in Malaysia. Mobile phones have spread rapidly among the educated regardless of age, gender or socio-economic level of the learner. In fact, the number of mobile phones in some countries exceeds the number of individuals (Waard, 2013). This explains that utilizing mobile phones in teaching and learning purposes is highly practical. Since the last decade, the use of M-learning has been very wide and massive around the world. It makes learning activities very advanced, in which with the utilization of mobile devices, it alters the definition of M-learning. Accordingly Waard et al., (2012) define M-learning as "learning across multiple contexts, through social and content interactions, using personal electronic devices".

In learning process a learner is anticipated to attain a planned learning results within a specified time frame, in order to certify that the learning has taken place this learning outcome has to be measured (Ibrahim, Fatimah, Ahmad, & Shafie, 2013). Learning process will become more motivating and meaningful, and even productive with teachers as facilitators or guides, besides learning resources like journals, books, learning materials, class notes, and communication tools (Hussin et al., 2012).

Meanwhile, the letter "M", which refers to "Mobile" in M-learning, is only a mode of learning, and tablet PC or a handheld device is just a tool to improvement the process of learning. The main focus in M-learning is the learning process itself instead of the mobile phones that represent the technology. Owning a mobile phone for M-learning does not certainly ensure that learning takes place, however effectiveness of learning depends on how the learning process is conducted. Indeed, mobile phones will make learning way more interesting in the mobile environment (Hussin et al., 2012).

Mobile phones and other mobile devices are equipped with communication facilities as well as computing facilities that allow users to communicate with other people but also to access the internet, read data files, and create documents. Such technologies make computing and communication between people very convenient. Not only users can get instant text messages and multimedia messages, but also e-mails, video and audio files in 3G formats and lecture notes (Rossing, 2014). As a result, users are able to synthesize the complied information, look for Information on the internet, and restructure the information to make it a meaningful piece of knowledge for themselves. Beyond that, learning process is now no longer bounded on classrooms with the Internet (Behera, 2013). This implies that learning opportunities are available for everyone who is interested, including those staying in rural areas (Li & Qiu, 2011).

Besides making learning possible from any place, teachers are also equipped with utilities to keep their eyes on the learners virtually. They could monitor their learners' activities as those in the physical classrooms. In fact, their part in explaining to learners are better-supported. With multimedia contents and advanced infrastructure, all processes could be presented with the help of graphical representation. This results in efficient and effective

learning approach that leads to motivating learning experience (Mohamad & Al Ameen, 2014; Prasertsilp, 2013). M-learning is commonly prescribed as occupying a sub-space within the E-learning space, which is in turn a sub-part of digital learning (Mehdipour & Zerehkafi, 2013). There are a number of things M-learning differ from E-learning, in which some of them are outlined in Table 2.1.

Table 2.1

Comparison between E-learning and M-learning (Mehdipour & Zerehkafi, 2013)

Subject	**E-learning**	**M-learning**
Place	lecture in classroom or internet labs	learning anywhere, anytime
Pedagogical Change	More text- and graphics based instructions	More voice, graphics and animation based instructions
	lecture in classroom or in internet labs	learning occurring in the field or while mobile
Instructor to Student Communication	Time-delayed (students need to check e-mails or web sites	Instant delivery of e-mail or SMS
	passive communication	Instant communication
	Asynchronous	Synchronous
	Scheduled	Spontaneous
Student to Student Communication	Face-to-Face	Flexible
	Audio- teleconference common	Audio- and video-teleconference possible
	e-mail-to-e-mail	27/4 instantaneous messaging

Student to Student Communication	private location	no geographic boundaries
	travel time to reach to internet site	no travel time with wireless internet connectivity
	dedicated time for group meetings	Flexible timings on 24/7 basis
	poor communication due to group consciousness	Rich communication due to one-to-one communication, reduced inhibitions
Feed back to student	1-to-1 basis possible	1-to-1 basis possible
	Asynchronous and at times delayed	Both asynchronous and synchronous
	Mass/standardized instruction	Customized instruction
	Benchmark-based grading	Performance & improvement-based grading
	Simulations & lab-based experiments	Real-life cases and on the site experiments
	Paper based	Less paper, less printing, lower cost
Assignments & Tests	In-class or on computer	Any location
	Dedicated time	24/7 Instantaneous
	Restricted amount of time	Any amount of time possible
	Standard test	Individualized tests
	Usually delayed feedback	Instant feedback possible
	Fixed-length tests	Flexible-length/number of questions

Mobile learning can occur anyplace: in a school room, on a bus, on the eating room table, and everywhere. Portability isn't as critical because the potential of the learner to communicate, connect, collaborate, and create the use of equipment which can be effectively in hand. We've got them running as section of the M-learning project. We're the usage of the seductive power of these new technologies to re-inspire younger freshmen who are leave of conventional learning

Furthermore, Portio Research (2013) estimates that 1.2 billion users particularly use mobile applications all over the world, It is expected to grow this number 29.8% every year and reach 4.4 billion users by the end of 2017. Big part of this increase comes from Asia, which will represent around half of applications users in 2017. Table 2.2 illustrates the dramatic increase of mobile phone subscribers per 100 inhabitants distinctive developed and developing countries, this shows that the mobile phone has become essential in the lives of many people (Jimmy Yablonski, 2015).

Table 2.2:

Users of Mobile Applications Worldwide By Region 2012-2017 (Portio Research, 2013)

App Users Worldwide	**2012**	**2013**	**2017**
	1.2 Billion	N/A	4.4 Billion
Asia Pacific	30%	32%	47%
Europe	29%	28%	21%
North America	18%	17%	10%
Middle East Africa	14%	13%	12%
Latin America	9%	10%	10%

In 2009, Digital Media across Asia reported that there were 100.8 mobile phones per 100 Malaysians (Hussin et al., 2012). This indicates that in average, each person in Malaysia owns more than one mobile phone. Later, Malaysian Communications and Multimedia Commission in 2014 reported that the number of mobile phone subscribers in 2013 was more than 43 million, which means that there were 144.2 mobile phones per 100 people. Internationally, Malaysia was ranked the 9th highest mobile learning by the Ambient Insight Comprehensive Report (2011) between 2010 and 2015. With this growing number of mobile phone owners, it is necessary, particularly for teachers to consider the possibility of integrating mobile learning in primary schools.

Currently, M-learning is remained in its beginning and concentrate in majority of studies or projects are still lingering on the idea of establishing the design , foundation , kind of M-learning and supported activities mobile technologies (Pollara & Broussard, 2011). With that in place, Lee (2015) found that 35% of Malaysians use mobile phones only to access the Internet. Accordingly, Adkins (2015), believes that by 2017, ten countries in Asia; India, Laos, Nepal, Malaysia, Thailand, Cambodia, Pakistan, Bangladesh, Sri Lanka and Indonesia; will be spending more on M-learning than on E-learning.

2.3 Arabic Language

Arabic is the most prevalent and spoken by more than 422 million people around the world. They are distributed in the Arab world and Arabic is the first language in all Arab countries as well as many other neighboring regions such as Turkey, Chad, Mali, Senegal, and Eritrea. It is a great importance to Muslims, and a sacred language because it is the language of the Quran (Ishkewy, Harb, & Farahat, 2014). However, research on it is still lacking (Waheeb, 2014). In Malaysia, parents send their children to madrasah/religious

schools in their early age to learn how to recite Quran and pray and to learn other basic principles of Islam (Al-bazeli, Alreshidi & Naimie, 2014).

Standard Arabic language consists of 28 letters. Some linguists add Hamza letter, so the total is 29 letters. The direction of writing and reading is from right to left, like Hebrew and Persian languages and unlike many of the world's languages, and from top to bottom (Reilly, Bacha, Haley, Fan, & Li, 2014).

خ Kh	ح Haa'	ج Jiim	ث Thaa'	ت Taa'	ب Baa'	أ 'Alif
ص Saad	ش Shiin	س Siin	ز Zaayn	ر Raa'	ذ (Th)aal	د Daal
ق Qaaf	ف Faa'	ع Ghayn	ع 'Ayn	ظ (Th)aa'	ط Taa'	ض Daad
ي Yaa'	و Waaw	ه Haa'	ن Nuun	م Miim	ل Laam	ك Kaaf

Figure 2.2: Standard Arabic language letters (Ride, 2015)

Arabic affects directly or indirectly on many other languages in the Muslim world, such as Malay, Persian, Kurdish, Indonesian, Turkish, Urdu and some European languages, especially Mediterranean ones, for instance Portuguese and Spanish. As an instance, the overwhelming majority of the Malaysian people of all sects and religions use Arabic words in their talks in daily life, and this is done without realizing they are using the original Arabic words (Yousif, 2010). Some examples of the similar words are exhibited in Table 2.3.

Table 2.3

Examples of Similar Words

No.	The Word in Malay	The Word in Arabic	The Word in English
1	Nabi	نبي	Prophet
2	Quran	قران	Quran
3	Halal	حلال	Halal
4	Solat	صلاة	Prayer
5	Doa	دعاء	Doaa
6	Kitab	كتاب	Book
7	Jumaat	الجمعة	Friday
8	Sabtu	السبت	Saturday
9	Khamis	الخميس	Thursday
10	Aidilfitri	عيد الفطر	Eid al-Fitr
11	Akhlak	أخلاق	Ethics
12	Mahkamah	محكمة	Court
13	Maklumat	معلومات	Information
14	Jiran	جيران	Neighbors
15	Masjid	مسجد	Masjid

2.4 Challenges of Learning Arabic in Malaysia

The use of the Arabic language in Malaysia is not a strange phenomenon because the majority of the Malaysian population are Muslims and the Arabic language is part of their religion (Malaysian Federal Constitution 2006). In a sensational move to upgrade the learning of the Arabic Language in the nation, the Malaysian government has presented a project called (J-QAF) (Jawi-Quran-Arabic and Fardhu ain) to present Islamic studies and the Arabic Language in the schools (Express, 2006). This step was an endeavor to reconsider the curriculum to encompass Jawi, Arabic and Fardhu Ain in the schools.

The Arabic Language is characterized by a prolific vocabulary and grammar. This aspect makes it quite a difficult language to be tutored and learned, especially when it comes to grammar. Furthermore, several students from across the globe look at this language as a tough subject and consider learning it is as a significantly difficult task (Alkhasawneh, Rahman, Ayub, & Daud, 2013; Hansen, 2010). The pronunciation, which is typified by several distinct alphabetical sounds, makes it tougher for Malay learners. These sounds are uncommon in other languages such as Malay. Moreover, the Malay language has additional letters such as ch, g, nya, p, v, which do not exist in Arabic. These additional letters make it difficult for Malay learners to write in Arabic. Therefore, Malay students generally see Arabic as a very tough topic (Mohammed & Alsrhid, 2013).

Teaching Arabic language has always accompanied the curriculum of Islamic ethic and principles. For a Muslim believer, Arabic must be learned for self-perfection as stipulated. This makes language teachers certify that the challenges associated with Arabic teaching nowadays makes it an uneasy task for both teachers and learners. Hence, it is in a need of a restructuring and simplify the teaching and learning activities (Alkhasawneh et al.,

2013). In fact, pupils are more enthused to learn a second language if they are drawn towards that language. However, if they find the language unattractive or they lack the enthusiasm, they will never master that language. This is because a pupil's degree of motivation towards the target language is what drives his/her learning of that language (Meyad, Roslan, Chong, & Haji, 2014). This implies that the contents in learning Arabic language need some reengineering works.

2.5 Mobile Application for Learning Arabic Language

Mobile learning is a new form for teaching using the capability of mobile devices. Among the various types of mobile devices, mobile phone is a perfect platform for language learning (Edge et al., 2012; Edge, Searle, & Chiu, 2011) due to its portability, connectivity, and affordability, even in developing countries (Kumar, Reddy, Tewari, Agrawal, & Kam, 2012).

Muhamadul (2012) divides Arabic language teaching programs into three sections: Arabic education program as mother language, teaching Arabic as a foreign language program, and teaching Arabic as a second language program. The Arabic education program as mother language implies that the application is designed specifically for Arabic language speakers. It is a crash course to raise the level of the Arabic language. In contrast, teaching Arabic as a foreign language program reflects that the application is designed to teach Arabic in non-Arabic speaking environment. This program does not take into account the age of learners nor the cultural differences, including races and social, because it aims at enabling learners to communicate in Arabic language in everyday situations across the four skills; reading, writing, listening, and speaking. Meanwhile, the third type is the teaching of Arabic as a second language. It is intended for applications specially designed

for the Muslim non-Arab society such as Malaysia that use the Arabic language daily. The goal is wider that that in teaching Arabic as a second language program. Among the three sections, this is the focus of this study.

Acquiring a second language is an important and a challenging aim for many people worldwide throughout their lifetime, however it is difficult to achieve. The process may take a skilled linguist up to 2200 hours (88 weeks) of devoted effort at classroom with instructors to reach general proficiency in languages that are not their mother language (e.g. Arabic and English for native Malay speakers). To assist the learning process, micro-learning approach could be used. Many factors contribute to shape the second language learning activities depending on age, level of intrinsic motivation, talents, characters, strategies, learning styles, location, and native and target languages of learners. This could be supported by equally diverse mobile technologies, which can cover each modalities of language, which are: writing, reading, speaking and listening (Edge et al., 2011).

Mobile phone is one suggested solution to be used as a platform for micro-learning, as it permits small chunks of the teaching and learning content to be delivered to learners in a very specific way. Learners will feel they are in control of the content and time they want to learn. Unlike the situation with PCs, the high flexibility and the mobility of handheld devices, along with the low costs of replacement, use, and packing, makes them preferably suited to exploit opportunities for micro learning. Additionally, context-aware mobile systems that offer contextually relevant content could provide immediately valuable learning material since. However, there is a serious lack of local content in Malaysia. This limits the learning activities for students using mobile applications for learning in Malaysia (Arrieya & Dyson, 2015). Some of them, as showcased in Table 2.4.

Table 2.4

Summary of Mobile Application Products with a Malaysian Context (Ariffin et al., 2012)

	Mobile Application	Travel	Sports	News	Maps	Education	Malay Language	Games	Social Networking	Traditional Malay Culture	Malay Religion(Islam)	Reference	Business/Finance	Entertainment	Job Productivity	Utilities	Lifestyle	Bilingual
1	P. Ramlee On Mobile													X			X	X
2	Diary Muslim									X	X				X	X	X	X
3	1Malaysia	X										X					X	X
4	Sepang International Circuit		X									X		X			X	X
5	TV Trivia					X		X						X	X		X	X
6	My Headlines			X								X			X	X		X
7	KL Traffic				X										X	X	X	X
8	mCommerce-Suit2												X		X	X		X
9	SMS & MMS Match-Making Chat								X				X	X		X	X	X
10	MobileIRC Chat								X					X		X	X	X
11	WAP Site												X		X	X		X
12	Jawi Fun						X	X		X	X			X				
Total		**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**3**	**3**	**6**	**6**	**7**	**10**	**11**

2.6 Integration of Interactive Multimedia in Instructional Design

Instructional designers should understand that technology helps instructional arouses the young to learn purposefully, imaginably and elastically. Based on that, our classroom culture, which has ruled the learners for several decades, needs to be redefined in order to create an environment where students are contented and enjoy their learning in a momentous manner (Ahmad, Edwards, & Tomkinson, 2006).

The main purpose of instructional design is to assist humans learn better. It is offers a set of procedure for an effective learning. In addition, it provides explicit direction for learners on how to achieve excellence in their studies (Bakar, 2007). Instruction to strengthen knowledge new of students as well as allow them to practice the new knowledge. Instructional and recreational applications, particularly those designed for children, leave room for a bit more stylistic experimentation. Visual experience interface and content is part of the enjoyment of these applications, and can also be the biggest argument objective of the relationships between controls and content. Even in these situations, nevertheless, it should maintain the basic act capabilities so that users can, in fact, access to the content easily (Cooper, Reimann, & Cronin, 2007).

According to Hourcade (2008), interaction design for children is a research field concerned with designing interactive multimedia for children, interaction styles and the use of input devices as well as goals of interaction based on research and literatures on children's developmental psychology, i.e. taking into account their current stage in terms of motor skills, emotional and mental development, the three tools of interactive design, main steps of interactive design: researching the domain, understanding the users and their requirements, and filling in the design details.

Multimedia which generally uses a combination of text, sound, video, and picture offers a more effective and longer lasting learning experience. Teachers and pupils use interactive multimedia to promote learning and education quality (Leow & Neo, 2014). According to Neo & Neo (2001), humans can remember 20% of what they have just seen, 40% of what they have seen and heard, and 75% of what they have seen, heard, as well as done. In another similar research, Bass (2003) noted that people remember 10% of what they have read, 20% of what they have listened, 30% of what they have seen as well as listened, 50% of what somebody has elucidated to them, and 90% of what they have done on their own.

Interactivity refers to a scenario where we can somehow interact with a mobile device, such as for learning a new language. So, it can be concluded that multimedia is not only used as learning media for students but also used as the stimulus to increase student's motivation in learning Arabic language and it is can help a student learn terms, words and their contextual meaning. Besides that, multimedia offers multi-sensory learning.

2.6.1 Text-Based Interactions

Some significant factors need to keep in mind in dealing with the text. Text that has been developed need have size and fitting text styles. Fonts are useful in focusing attention on certain text on the display, enhancing projecting and readability a picture. The more interest with the text in the application is readability.

There are many factors ought to be considered while doing the textual content like heading, constant and font styling. Each part has headings and subheadings to attract attention and offer the user with fast identification of the part contents. The text made

within the application ought to be consistent. It's necessary to create the text readable. For instance, the screens ought to have the same heading.

Use font sizes that suitable with children's stages of developmental. As an instance, beginning readers need a bigger font size than is common for skilled readers (Naranjo, 2011). This is often particularly vital for hyperlinks and button labels. At a similar time, its common apply to use large headlines and titles to capture children's interest. In another study, Jacko (2009), discovered children aged seven to nine year's old preferred to read Arabic characters by utilizing Simplified Arabic because this type of font are easy and simple. It might be used to facilitate the reading for children. As well as, this specific font size can be used to quicken the reading capacities among children.

On the contrary, children for font attractiveness, selected different preference. Most of children are reading texts faster when using Arial Unicode MS with size 14-point, the same study was confirmed font types with 14-point size were desirable over the other font types with 12-point size. Usually the size, 14-point font (print) size is considered to be easier and faster to read, likewise as being a lot of engaging and a lot of desired for primary school-age children (Taylor, Bernard, Chaparro, Mills, & Charles, 2002).

2.6.2 Use of Sound and Pictures

Sound are important elements in design learning application. The use of sound can enhance the effectiveness of children with application (Chau, 2014). Too few studies has been carried out on the use of sound in user interfaces designed for children.

For his part, Mann et al., (2002) discovered children that aged twelve year olds benefited from listening to important information in multimedia educational software whilst in

comparison to a similar information is displayed in text. Integrating sound capabilities adds a crucial component of language use and learning (Godwin, 2011). The voice should be familiar to children (Bakri, Zakaria, Nazirah, et al., 2014). The saying, "a picture is worth a thousand words", Nielsen (2010) stressed the necessity for use pictures and enjoyable characters that ought not be distraction as well as friendly for children. They are widely implemented in application.

2.6.3 Menus and Buttons

Within the broadest sense, children experience menus (i.e., sets of choices) in software all the time. The problems come when these choices are not at once visible, and organized in drag down menus or other types of interactive structures. Certainly, navigation of menu structures has proved problematic for children (Wolock, Orr, & Buckleitner, 2006). Even when dealing with children that aged between ten to thirteen year old using portable device, Shoukry, Sturm & Galal-Edeen (2012) discovered that menus that needed to be introduced up the use of a soft button were easy to forget, the troubles even though, are especially dire with children younger.

2.6.4 Color Based-Interactions

Color in design is very subjective. What evokes one reaction in one person may evoke a very different reaction in someone else. Sometimes this is due to personal preference, and other times due to cultural background. Al-Allaf & Khawatreh (2006), discovered that uses pastel colors could attract user's attention also stated the scientists also believe that these kinds of colors let people focus on small objects better and are less likely to cause objects to appear to float on the mobile screen.

Colors influence the life of the Malay people, for instance, white represents purity, black represents bad luck, and yellow represents royalty.

The Malay usage of color is rarely bright unless it is used for festivals, such as "*Aidilfitri*" at the end of Ramadan or for weddings. In addition, the designer of the application must take into account the use of colors brown and green because these colors were seen as culturally appropriate colors in Malaysia because they were linked to the flora and fauna (Arrieya & Dyson, 2015).

2.7 Cognitive Theory of Multimedia Learning CTML

In general, learning theory is a theory that focuses on explanations on how learning occurred in the individual. Learning theory provides a basis for general strategies that can be used to improve the quality of learning. Cognitive theory of multimedia learning CTML is developed by education psychologist, Richard E. Mayer.

This theory involves multimedia presentation of explanation in verbs and visualization images as an approach in cognitive psychology of how humans learn from words and pictures (Mayer, 2005; Moreno & Mayer, 2000). According to Mayer (2009), multimedia learning refers to words and pictures.

Figure 2.3 illustrates CTML to the human information-processing system. The boxes represent memory storage which is sensory memory, working memory, and long-term memory. In the same figure, the arrow from words to ears and eyes are registered in sensory memory. The arrows from words to ears correspond to spoken text that has been registered in the ears, while the arrows from words to eyes correspond to printed text that has been registered in the eyes.

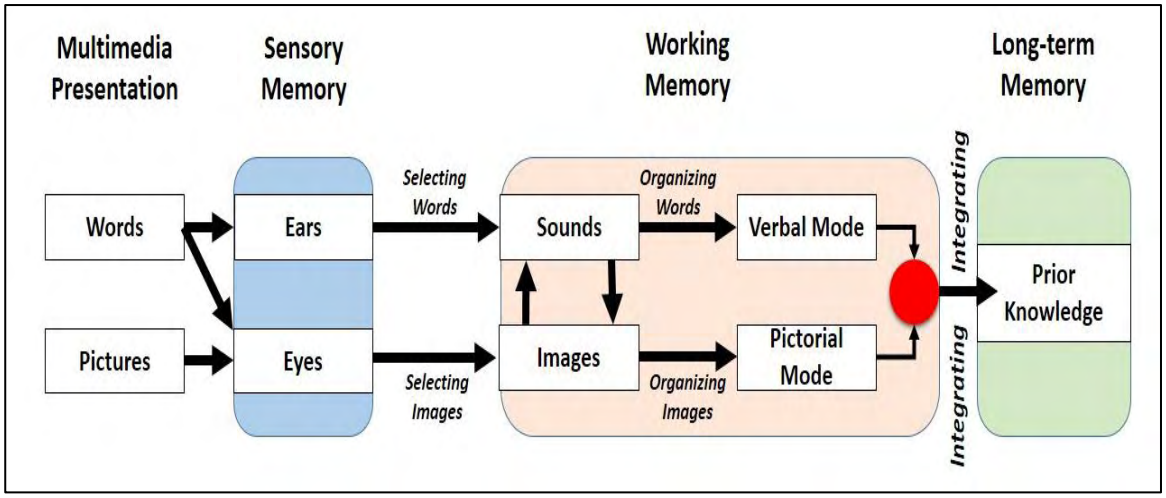

Figure 2.3: Cognitive Theory of Multimedia Learning CTML

It is the same with the pictures that registered in the eye sensory memory while looking at the pictures. According to Sun (2007), the sensory memory is the shortest memory typically 0.5 seconds until 4 seconds. Next is the working memory box. Working memory is used for temporarily holding the data typically for 15 seconds until 30 seconds (Sun, 2007). There are two subboxes in this working memory. The left subbox represents data from the sensory memory box. On the other hand, it has represented the data constructed in the working memory. Mayer (2009) defined multimedia instruction as the material that has been presented in the verbal form; while picture is the material that has been presented in the pictorial form. The auditory or verbal are the sound images of word, while visual or pictorial model is visual images of pictures. Finally, long-term memory box has stored a large number of data within a long period of time.

In order to construct a feasible instructional design, Mayer (2009) identifies the following twelve multimedia instructional principles of a good instructional design which were developed from nearly 100 studies over the last two decades. The principles are divided into three categories of principles in multimedia learning which are:

1. **To reduce extraneous process**:

   This process provides the irrelevant information to make the confusion in the learning session. The extraneous processing overloads when a situation that demands the extraneous material in a learning session affects the cognitive capacity or presented in confusing ways. There are five principles in this category, which are (Mayer, 2009):

   a. **Coherence**: Students learn better when extraneous words, pictures and sounds are excluded rather than included.
   b. **Signaling**: Students learn better when cues that highlight the organization of the essential material are added.
   c. **Redundancy**: Students learn better from graphics and narration than from graphics, narration and printed text.
   d. **Spatial Contiguity**: Students learn better when corresponding words and pictures are presented near rather than far from each other on the page or screen.
   e. **Temporal Contiguity**: Students learn better when corresponding words and pictures are presented simultaneously rather than successively.

2. **To manage the essential process**:

   The essential processing is a cognitive processing that aim to represent the essential material in working memory. The essential process overloads when humans are inexperienced and the presentation is fast with the basic material. There are three principles in this category which are (Mayer, 2009):

   a. **Segmenting**: Students learn better from a multimedia lesson is presented in user-paced segments rather than as a continuous unit.

b. **Pre-training**: Students learn better from a multimedia lesson when they know the names and characteristics of the main concepts.

c. **Modality**: Students learn better from graphics and narrations than from animation and on-screen text.

3. **To foster the generative process**:

The generative process provides sense making and organizing the material into coherent structures. It also integrates each of structures with the prior knowledge. There are four principles in this category (Mayer, 2009):

a. **Multimedia**: Students learn better from words and pictures than from words alone.

b. **Personalization**: Students learn better from multimedia lessons when words are in conversational style rather than formal style.

c. **Voice**: Students learn better when the narration in multimedia lessons is spoken in a friendly human voice rather than a machine's voice.

d. **Image**: Students do not necessarily learn better from a multimedia lesson when the speaker's image is added to the screen.

To relate this theory with this study, five principles are adopted:

1. **Coherence**: The extraneous material such as irrelevant words, pictures, sounds, music, unnecessary words and symbols are excluded from multimedia presentation.

2. **Spatial contiguity**: When words and picture are near on the page or screen, humans are able to handle them into working memory at the same time. Meanwhile, humans are less able to handle them into working memory at the same

time. It makes them understand the information better when words and pictures are near each other.

3. **Temporal Contiguity**: When corresponding words and pictures are presented simultaneously rather than successively students learn better.
4. **Multimedia**: Multimedia techniques involve words and pictures to construct and to build connection between verbal and visual mental models.
5. **Voice**: The voice technique uses the human voice to make the presentation more understandable rather than using a machine's voice.

2.8 Existing Applications That Used Cognitive Theory of Multimedia Learning

In Malaysia, there are some Arabic coursewares developed to learn Arabic language such as KAFA and BAIK. Wan Isa et al. (2010) introduced KAFA program for students under the age 6 to 12 years old. The aim of this program is to ensure that all children in that age category are able to recite Al-Quran properly, and also can learn and practice basic things that are necessary (fardhu) for a Muslim. In order to form a strong foundation of Islamic Studies and knowledge of Islam among these children.

In addition, the KAFA program was designed to the effective use of multimedia elements, such as text, audio, graphic, and video and educational technology so that the interaction between the meaning and media can be conducted in the learning process (Bakri, Zakaria, Nazirah, et al., 2014). KAFA program incorporated nine principles from Cognitive Theory of Multimedia Learning CTML, which are: modality, spatial contiguity, temporal contiguity, multimedia, personalization, coherence, redundancy, pre-training, and signaling.

Figure 2.4: Main Menu of KAFA App

KAFA program offers many benefits over traditional methods of delivering information. Information can be displayed in various formats that enable students to interact with the materials being presented as needed in their own time. KAFA subjects has to be assisted with interactive multimedia courseware to enhance learning and understanding without regard to time pace. As result, Wan Isa et al. (2010) noted that KAFA program has the potential to present information more effectively by using CTML principles compared to the traditional teaching approach using textbook, classroom teaching, and practical exercises.

On the other hand, BAIK (*Bahasa Arab Interaktif Kurikulum*) was developed by Faryadi (2012) is an electronic version of Arabic language curriculum applied to the 3rd grade students at primary schools in Malaysia. This courseware incorporated eight principles from Mayer's Cognitive Theory of Multimedia Learning for a suitable instructional design, which are: multimedia, spatial contiguity, temporal contiguity, coherence, modality, redundancy, interactivity, signaling, and personalization. This experimental study was conducted at a primary school in Malaysia. Two classes of grade 3 pupils, comprising 41 students, were selected. The mean age of the students was 9 years. As a

result, BAIK helped the learners by using words accompanied with pictures and articulating the words in a narration for better understanding and pronunciation (Salim et al., 2012).

Figure 2.5: Main Menu of BAIK App

Consequently, this research hypothesized that learning the Arabic language through a technology-based multimedia environment could significantly increase students' comprehension skills, motivation, satisfaction and enjoyment, thus resulting in better grades.

In summary, the previous studies confirmed that use of multimedia elements and incorporating the principles from Mayer's Cognitive Theory of Multimedia Learning can enhance learning process. This result also confirmed by Aldalalah et al. (2010) through their study on learning Arabic by using multimedia. They found that audio with images mode is an important aid to learning as compared to text with images mode. The principles of multimedia play important role building a good system as it helps developer analyze the state of content. Spatial contiguity principle will consider the place of content (Frey & Sutton, 2010). Temporal contiguity principle considered the style of delivering the context while Coherence principle considered the minimum use of pages with suitable information. Lastly voice principle considering the use of voice in delivering information which the voice used should be familiar for children.

2.9 Existing Applications for Learning Arabic

During the past decade, some instructional systems were recommended. Cheng, Basu, and Goebel, (2009), recommended an online multimedia education setup known as Crome to improvement the learning and tutoring competencies of kids. The setup comprises more than one module for information modelling, teaching, learning, and testing. Jumail and Rambli, (2010), formulated a system to assist kids improve their knowledge about particular topics. The system comprised two parts: one that lets the teacher to choose the subject of the story so as to be explained by means of flashcards; the second part asks the kids to organize the scenes according to subject of the tale.

Rosmani and Wahab (2011), designed an application known as I-IQRA. This application enlightens kids about the holy book 'Al-Quran' in a competent style. The app introduces Arabic alphabet through simple phrases, helps study them mechanically through the system, and through the use of quizzes. Tabot and Hamada (2012), developed a web-enabled multimedia learning mechanism to offer physics-related guidance on certain subjects. Erradi et al. (2012), recommended an ArabicTutor it's a multimedia learning platform. This platform offers simple sentences, Arabic spelling as well as different meanings of words, all made easy with the use of multimedia. Ping, Chan, Sharbini, and Julaihi (2011), devised an assistive learning mechanism to aid kids with hearing weakness in learning Malay. Dong and Li (2006), presented a multimedia system which could be utilized by many learner at the same time.

The massive production of Android-based devices around the world has lifted the way people interact with interactive applications up. It influences also the nature children socialize and play. Hence, they extend their love into interactive things. As a result, more

and more applications have been developed for the purposes of educational and recreational benefits, both commercially and purely for educational reasons. It includes applications for learning Arabic. Among many mobile applications, *Hamza', Belajar Menulis Hijaiyah, Hijaiya-Arabic Alphabet, I-IQRA', and ArabicTutor* are five examples of learning Arabic language, which maps the intention of this study. Accordingly, they are discussed in the following subsections.

2.9.1 Hamza'

This application as seen in Figure 2.4 is designed and developed to provide an M-learning platform of interactive Arabic learning. It makes use of game-like interaction style to help children acquire new linguistic skills in a joyful way using mobile devices.

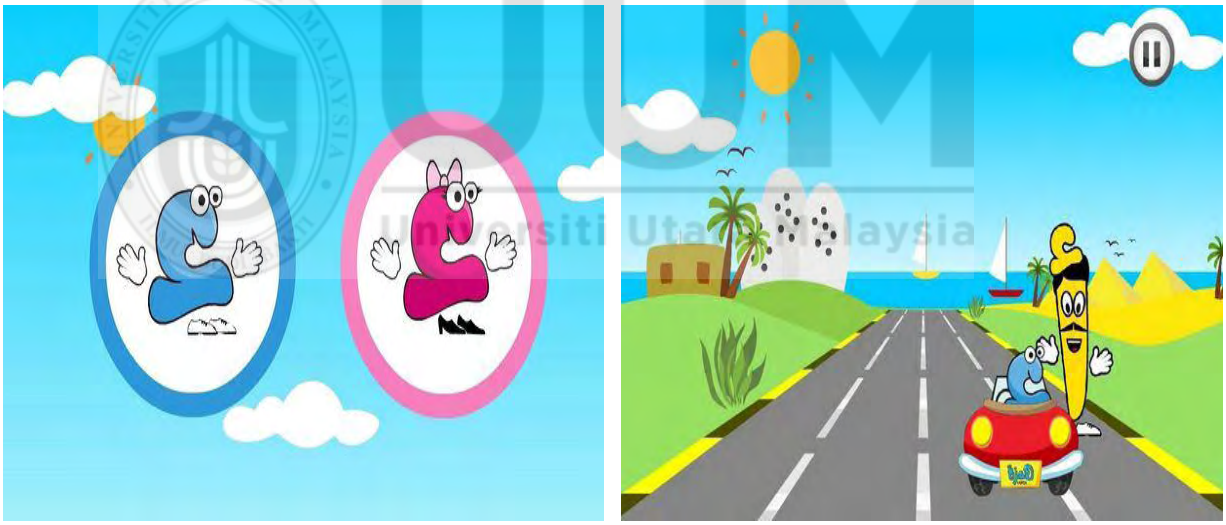

Figure 2.6: Screenshots of *Hamza'* Application (Shoukry, 2013)

2.9.2 Belajar Menulis Hijaiyah

Belajar Menulis Hijaiyah is mobile application that designed to help children teaching write Arabic letters also known as the Arabic letters. There are some features in this application include:

- Animations how to write, can change and choice of text color.
- There is a photo of an object in accordance with the alphabet under consideration.
- There are in Indonesian translation of the image that appears.

Figure 2.7: Main Interface and Write Arabic Characters (Trustudio, 2012)

2.9.3 Hijaiya - Arabic Alphabet

The main feature of this application is that it appears at first glance is the use of a key figure drawn carefully and distinctive and attractive to the child, and use it for fun and nice interface, this application displays Arabic letters, and when you touch the letter make a sound. Sound is used in Arabic letters pronunciation.

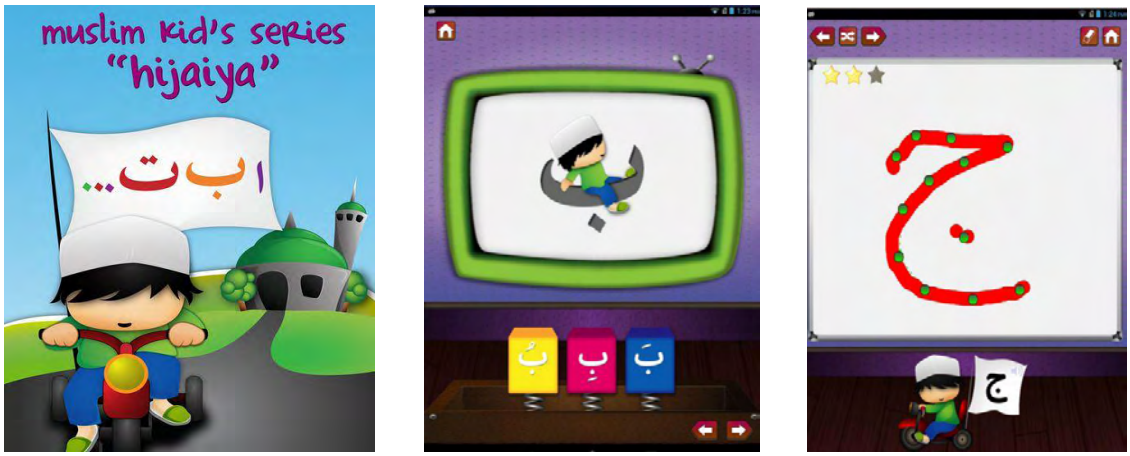

Figure 2.8: Screenshots of Hijaiya-Arabic Alphabet Application (Yufid, 2014)

2.9.4 I-IQRA'

The application was designed and developed to offers an interactive application (*I-IQRA'*) to teach children to read the Al-Quran efficiently and effectively. *I-IQRA'* application was developed by Rosmani and Wahab (2011) to persuade children learning Arabic characters uses the principle of Persuasive Technology and Principles of Multimedia Design in its design and development.

Figure 2.9: Main Interface of *I-IQRA'* Application (Rosmani & Wahab, 2011)

It was tested with children age of 5 to 8 years old. It is includes of three various modules to support the process of learning that are: (1) Introduction to Arabic Characters; (2) Reading Arabic Characters, and (3) Quiz.

Figure 2.10: Quiz Page of *I-IQRA'* Application (Rosmani & Wahab, 2011)

The pictures and text on the screen are presented simultaneously. This study utilizes simple words for the buttons and familiar graphic. Each button produces sounds, users said, telling the users on what the functions of every button. Vote useful to help young children who are not able to read. The sound are useful to help young children who are not able to read.

2.9.5 ArabicTutor

This application is a multimedia M-learning platform for learning of Arabic vocabulary and spelling.

Figure 2.11: Main Interface of *ArabicTutor* Application (Erradi et al., 2012)

It uses interactive methods of delivery of the game are similar to acquire new language skills in how to play using modern hand-held devices capabilities with multi touch technologies. The suggested platform offers an environment authored by learning Arabic language content, and delivering it to end-users in interactive mode, intuitive and fun. It is organized learning content in packages that include a list of vocabulary, and the various meanings of the word with instance sentences as well as multimedia illustrations.

In summary, each of *Hamza', Belajar Menulis Hijaiyah, Hijaiya-Arabic Alphabet, I-IQRA',* and *ArabicTutor* are developed for supporting learning Arabic language. Having analyzed them, this study discovers some limitations of these application in which those listed in Table 2.5 are aspects that implicate this study.

Table 2.5

Examples of Existing Mobile Arabic Learning Applications for Children.

Application	**Objective(s)**	**Limitation**
Hamza'-Shoukry, (2013)	Designing and implementing an interactive application for learning Arabic especially to children.	• Hamza game covers just an introduction to the Arabic Alphabet • Online Surveys have been out over a short period of time and because of their nature the participants cannot be considered representative of the Egyptian population. • The interface is in Arabic and neither Malay nor English is used.
Belajar Menulis Hijaiyah-Trustudio (2012)	Designing an interactive application to help children	• The interface is in Indonesian language and neither Arabic nor English were used.

	in learning to write letters Arabic alphabet.	• The application does attain writing skills only.
Hijaiya - Arabic Alphabet - Yufid (2014)	Interactive application to help children learn writing Arabic letters	• The interface is in Indonesian language and neither Arabic nor English were used. • Difficult to use the application especially in terms of learning writing letters and the size of buttons are very small. • The application does not attain Arabic numbers. • The application begins silently without any sound effects, this reduces the attractiveness of the application for children.
I-IQRA' (Rosmani & Wahab, 2011)	The application was designed to teach children how to read Al-Quran.	• The interface is in Malay and neither Arabic nor English were used. • The application does not attain writing skills.

ArabicTutor (Erradi et al., 2012)	Designing a mobile Learning for interactive learning of Arabic vocabulary and spelling.	• Although the application (The Text-To-Speech) Service is used to transform written text into voices but these voices Arabic words pronounce wrongly. • The application is considered quite hard for children to keep up with, that it uses complete sentences and not letter nor words. • The application's interface is in Arabic only, which makes it void for non-speaker of Arabic language.

In addition, these applications are not well-designed, in a way that supports user needs and most of those applications do not make use of multimedia elements effectively, while most of them do not cover the full contents as intended in learning the Arabic language (Kelly, 2010; Salim, 2009). As seen in Table 2.5, there is many limitations in design and lack on learn content of the current mobile Arabic learning applications for children because each of applications are interested in one or two aspect of learning Arabic language at most. For example *Belajar Menulis Hijaiyah* application designed to help children teaching writing Arabic letters only. On the other hand, *Hamza* application covers

just an introduction to the Arabic Alphabet, while *ArabicTutor* focus on learning Arabic vocabulary.

In same context, Arrieya and Dyson (2015) confirmed there is a serious lack of local content in Malaysia, especially for mobile applications including applications for learning Arabic language this lack related with the user interface design, such as lack in the use of local language (*Bahasa* Melayu) or bilingual interfaces for example: *Hamza*, *Belajar Menulis Hijaiyah*, and *ArabicTutor*. Moreover , there are other limited features like the small size of buttons in *Hijaiya - Arabic Alphabet* application (Al Muslim & Arifin, 2014). Based on the above, it can be said there is no application at the present time cover most sides of learning content Arabic language intended for children in Malaysia.

2.10 Summary

This chapter reviewed the literatures related to this study. It starts with its importance information and communications technology ICT in education. Also, it explained the concepts involve in this study such mobile learning, Arabic language, challenges of learning Arabic in Malaysia, instructional design and multimedia, cognitive theory of multimedia learning CTML and existing mobile Arabic learning application for children. The next chapter explains the methods involved in carrying out the research.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

In ensuring the objectives stated in Chapter 1 are achieved successfully, systematic tasks have been planned for achieving the objectives. Thus, current chapter clarifies the research methodology that used in present research. Basically, the research design of this study is based on methodology proposed by Peffers, Gengler, and Tuunanen (2003). As long as Design Research Methodology covers all the requirements of current study or project and it is acceptable by many researchers, so it has been chosen for applying it in this research. The methodology activities are divided into four main phases: Conceptual Study, Data Collection and Analysis, Development, and Evaluation.

3.2 Research Procedure

At the very beginning the problem to be solved has to be clarified. It is followed with the second phase represented the procedures of data collection and analysis. The data were collected by using several fact finding techniques; interview and reviews of literatures related to the problem being handled. Then, the data was analyzed by following a thematic analysis approach. The third phase focused on the A4Kids prototype development which was based on the design guidelines and Mayer's CTML guidelines to get a prototype for stakeholders' information needs. Finally, the fourth phase dealt with the A4Kids prototype evaluation by using test cases and usability testing questionnaire in order to evaluate the information needs and determine the extent of successful implementation of the proposed prototype. The detailed research procedure is illustrated in Figure 3.1.

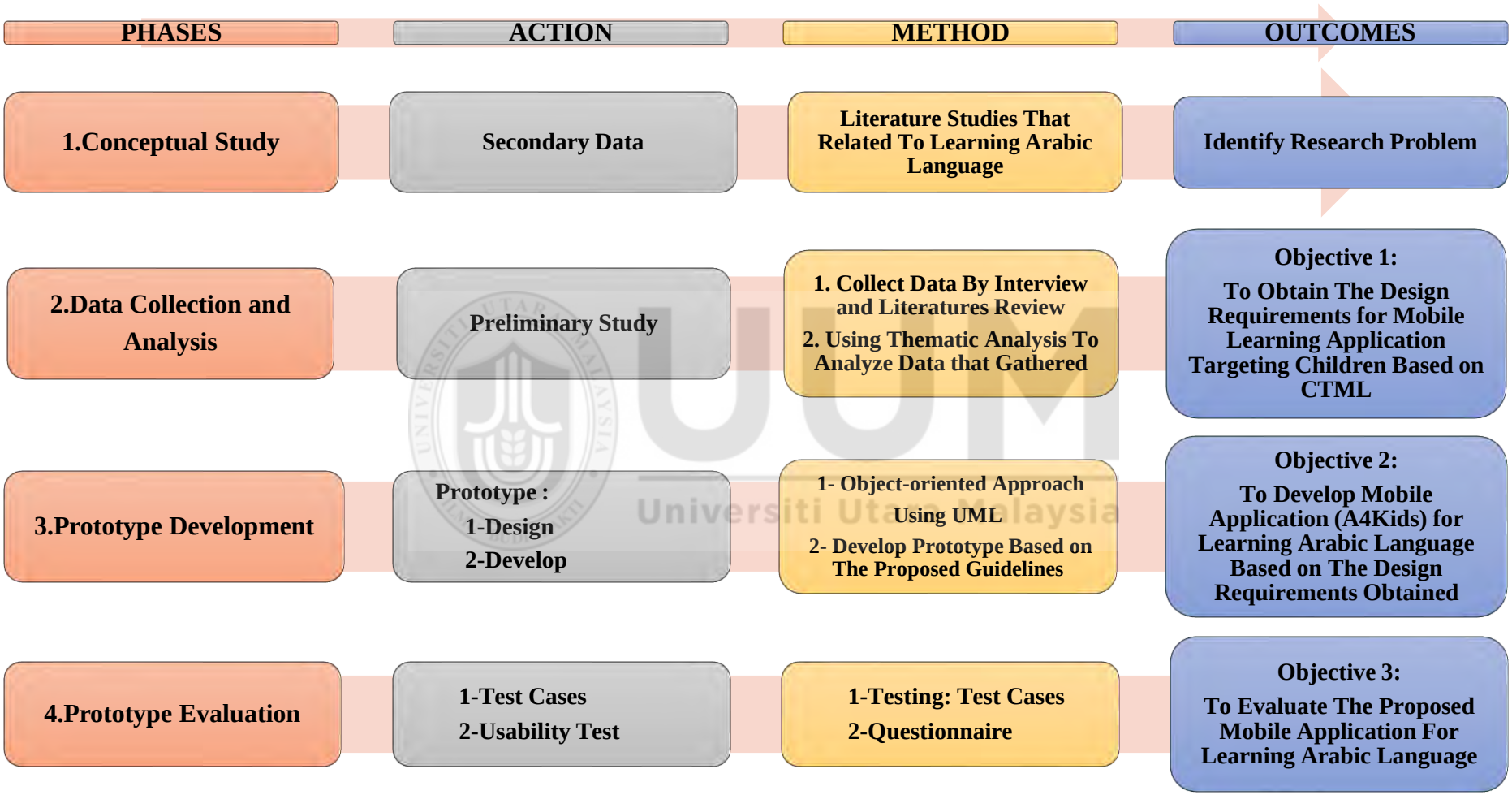

Figure 3.1: Research Methodology

3.2.1 Conceptual Study

Understanding the problem to be solved is the key success factor for this study. In the first phase, the researcher sought to investigate the key issues related on this phenomenon. Indeed, the problem was arose because Malaysian people and particularly children have difficulty in learning Arabic language. Several secondary data was used to shed light the issues of the difficulty in learning Arabic language. In the same context, the prior literatures also asserted that, using mobile devices can facilitate the process in learning Arabic. As a consequence, the outcome of this phase is identify problem of the research.

3.2.2 Data Collection and Analysis

Having understood the user needs in the first phase, this study suggests the use of mobile device to build an application for supporting Malaysian students at primary schools who need to learn Arabic language, and is named A4Kids. This phase involved data collection and analysis. According to Nawi, Hamzah, Ren, and Tamuri, (2015), the use of qualitative methods is effective to get the detailed information to provide in depth understanding of a research problem.

Based on that, there are two major approaches to gather related information that used in this study which are i) secondary and ii) primary sources (Kumar, 2011). According to Hoffer, George, and Valacich (1999), data collection can be done through direct interviews to find out children's interest as well as capture the functional requirements of the stakeholders. Consequently, the preliminary study of this research was acquired through interviews. The respondents were the teachers with more than ten years of experience in teaching Arabic language topic for student at primary schools.

Interview is a set of questions and answers, it which is done by the interviewer to get information from interviewee (Alkhazali, 2012; Zhang & Wildemuth, 2009). Achmadi and Narbuko (2009) classified it into three types as follows:

1) Un-guided interview

   The interviewer is free to ask anything to the interviewee without guided sheet.

2) Guided interview

   The interviewer prepares the questions that she/he wants to ask first so the interviewer asks the questions based on the guided sheet.

3) Free-guided interview

   It is the combination un-guided interview and guided interview which the interviewer gives the interviewee opportunity to express his/her idea, but the conversation does not deviate from the topic.

This study used the free-guided interview to collect data because this kind of interview the interviewee could give as much as information that the researcher needed to support the data, but it was still in the topic of learn Arabic language at primary schools.

In detail, the interviews involves questions and answers sessions face to face with three expert teachers. The following is the list of schools:

1. Teacher 1: Sekolah Kebangsaan Dato' Wan Kemara.
2. Teacher 2: Sekolah Kebangsaan Bandar Baru Bukit Kayu Hitam.
3. Teacher 3: Sekolah Kebangsaan (Felda) Laka Selatan.

The benefits of interviews with teachers at primary schools it to set the main aim of this research among problems with the highest priority and to understand the needs of learners

also to recognize the important requirements and components that should be interested in a mobile application for children to learning Arabic language (Mansur & Samad, 2015).

Figure 3.2: Interview for data collection

On the other hand, review of related literatures has been implemented. During the literatures review stage, information, ideas, problems, and issues relevant to the current study has been gathered. The information was focused on the issues in using technology as supportive tools, teaching methods, and topics should be focused. Reviews of the literature were gathered from various sources like journals, textbooks, thesis, proceedings, and existing application for learning Arabic. The investigation was aimed at finding an appropriate interface. It is very important because A4Kids application is designed for children between 7 and 9 years old. It is an informative, educational, and at the same time attractive and fun application.

There are several techniques that may be used to analyze qualitative data. One of these is thematic analysis. It is a realistic and flexible method to look for themes or patterns from the data. In current research the data that collected were analyzed by using thematic analysis because it is the principal technique that is used by qualitative researchers to

analyze data (Woodruff, 2013). Explanations on thematic analysis process is presented in Chapter 4 at section 4.2. Consequently, the outcome of this phase are design guidelines.

3.2.3 Prototype Development

The prototype was developed and implemented in the development phase. Initially, designs need to be drawn including the features in order to guarantee an organized functions. Meanwhile, the design had been based from the Unified Modelling Language (UML) diagrams that consists of use case diagram, activity diagram, sequence diagram, and class diagram are used to outline complex purposes (Borgida, Dalpiaz, Horkoff, & Mylopoulos, 2013; Booch, 2005).

There are many benefits of UML diagrams including that they allow developers and users to view the application from different perspectives. Usually, UML diagrams was drawn by using "Edraw Max" software. In details, the use case diagrams were used to describe the basic functions and activities that will be performed by the users of the application. The sequence diagrams were used to explain the objects that participate in a use case and the messages pass between them over time for one use case. The class diagrams were used to display the classes and relationship between classes that remain constant in the application over time. Lastly, the state charts that were used to illustrate the different states that a single object passes through during its life in response to events, along with its responses and actions.

The development take place based on those artifacts. The prototype tested on mobile devices. In this study, a prototype in which the environment has been used Android platform because it is a popular operating system for smart phone besides it is open and free (Vangie, 2011). Linux Kernel is the basic Android uses in its operation. The

framework of the Android is made up from system services as well as libraries which supply graphics, inputs and application services (Andrus, 2015). Finally, the providers of content gives the chance to create interface to retrieve and store various types of data stores, like SQLite databases or file systems (Aldo, 2014). Environment of the prototype development of current research can be summarized in Table 3.1.

Table 3.1

Environment of the Prototype Development

Environment of the Prototype Development	
Program language	Java programing language Using Eclipse tool
Operating System	Android platform
Database	SQLite
Deployment	Play store

When the outputs of the previous phase come into development phase, A4Kids is still non-functioning. So, it can be called the soul because A4Kids has been deployed during this phase by finding a suitable tool. The prototype has been developed by using Java programming language and Eclipse tool. Java is type of programming language that is provided by Sun Microsystems team (see Sun website). Also it considered as a second revolution in Java's short history (Naji & Naji, 2015).

Meanwhile, Eclipse is considered to be an open source software development environment. It has been written in Java, as well as used for the development of applications in Java. The environment of Eclipse is safe that we can encompass many projects within it, on the other hand, many files can be included within on project.

The editor is considered to be amiable to users, besides, a whole syntax while typing is being presented by the auto complete property (Tigrek & Obadat, 2012). Rapid Application Development methodology used minimal planning in favor of Rapid Application Development, allowing software to written faster and makes it easy to change the requirements.

The prototypes are typically incomplete examples of what a final application may seem. Every time a prototype is used, a formative evaluation gathers information for the next, revised a prototype. This cycle continues to refine the product until the final needs and objectives are met. Some of the advantages of rapid application development include the following (Rawat & Kaushik, 2015; Vaghela, 2015): 1) Reduced development time 2) Flexible to change 3) Easy maintenance. Based on the advantages discussed in the previous paragraphs, this study has been employed the rapid application development in developing the A4Kids.

3.2.4 Prototype Evaluation

The evaluation has been conducted after the prototype developed. In detail, in current study the evaluation contained:

3.2.4.1 Population and Respondents

The evaluation was carried out at from seven different government primary schools in Kedah, Malaysia, with 30 Arabic language teachers, were chosen to participate in usability test to current study. The primary schools are detailed as follows:

1. Sekolah Kebangsaan Dato' Wan Kemara.
2. Sekolah Kebangsaan Bandar Baru Bukit Kayu Hitam.
3. Sekolah Kebangsaan Bandar Baru Sintok.

4. Sekolah Kebangsaan (Felda) Bukit Tangga.
5. Sekolah Kebangsaan (Felda) Laka Selatan.
6. Sekolah Kebangsaan Bandar Baru Darulaman.
7. Sekolah Kebangsaan Jitra.

Moreover, many methods have been proposed to evaluate of the prototype in current study in order to measure features, functionality, and usability of the A4Kids application included:

1. **Evaluating the functionality:**

   There are six items adopted into the questionnaire (Muhsen, 2010) to test all functions in A4Kids application. The test of functionality (Test Cases) was implemented to make sure that the functions of the prototype works as required.

2. **Evaluating the usability:**

   Usability testing refers to collecting data about users when they perform tasks. Collection of data was executed after the participants experienced the A4Kids application.

Firstly, The prototype was tested by the researcher and teachers by using the Test Cases to see whether the prototype features are fully function and the expected results are fulfill or not. Testing is a very important phase in mobile application development life cycle. Each stage ends with evaluation and verification to remove and identify all errors occurred in the phase. The main goal of testing is to eliminate and identify maximum errors in the development and ensure that the prototype functioned as desired. Usually errors occur during different phases, therefore testing should be done in various levels to identify errors

occurred during the various phases. Six test cases were conducted in order to test the prototype. The test was done by using Android 5.1 smartphone.

Secondly, usability evaluation is a key aspect as the actual test users are asked to use the product (Alhajj, 2012; Habeeb, 2009). The measurements here need to find out the usability of this application from the user's opinion. The method that called user testing which is based mainly on the questionnaire by provided to the participants in order to evaluate the application (Sardan & Rias, 2013). The questionnaire was conducted on 30 Arabic language teachers from seven different national primary schools in Kedah, Malaysia. The questionnaire method for data gathering (see in Appendix B) is divided into four sections. The general section of questionnaire works as a mechanism to collect user's demographics. The moderator assigns the test user predetermined test assignments one at a time. The user then executes the tasks through the user interface (Nielson, 2006).

The usability test was conducted to ensure that users find the A4Kids application to be useful, ease of use, and convenient to learn. Participants were given enough time to test the prototype and answer the questionnaire. Data analysis is the process of systematically detailing and arranging the gathered data. In this study, SPSS was utilized for the purpose of analyzing.

3.2.4.2 Instrument of Evaluation

Instrument is a tool that is chosen and used by the researcher to collect data. The researchers can use some various kinds of instrument in their method of collecting the data which is appropriate with their research.

Mobile application can be assessed and evaluated by many means possible such as using questionnaires, interviews, observations, and thinking aloud protocol. One most regularly

used ways to assess the usability of mobile applications is questionnaire (Hussain, Dahr, Neamah & Hussein, 2015). It contains a set of questions users respond to after testing respective application. McNabb (2015) states that for almost any type of research project, questionnaires can be modified to meet the objectives.

There are three type of questionnaire which is proposed by (Handayani, 2011). They are:

1) From the way how to answer the question
    a. Opened questionnaire, the respondent can answer the questions using their own sentences.
    b. Closed questionnaire, the respondents can directly choose the appropriate answer provided.
2) From the given answer
    a. Direct questionnaire, the respondents answer the questions about themselves.
    b. Indirect questionnaire, the respondents answer the questions related to other person.
3) From the form of questionnaire
    a. Multiple-choice questionnaire, the respondents choose the appropriate answer.
    b. An essay questionnaire, the respondents answer the questions by using their own sentences.
    c. Checklist questionnaire, the respondents put the check (√) on the appropriate column.
    d. Rating-scale questionnaire, the respondents choose the statement followed by rating column for example: Strongly Agree to Strongly Disagree.

Current study used a closed questionnaire in which the respondents could directly choose the appropriate answer provided. It was direct questionnaire and used a checklist form, so the respondents simply put the check (√) in the appropriate answer.

In addition, there are many advantages of using questionnaire in usability research for example (Kulkarni & Dixit, 2012; Osterbauer, Lackner & Weinberger, 2010; Kirakowski, 2000):

1. Questionnaire allows researchers to acquire feedback from users.
2. The measures gained from a questionnaire are to some extent, free from the users, system, or tasks to which the questionnaire is applied.
3. By using questionnaires can gather many data as surveys.
4. They are almost instant, hence, they are easy to manage and to score in terms of cost.

Consequently, this study used questionnaire to evaluate A4Kids application. In detail, the user evaluation section of questionnaire was divided into three parts, first part was for the measurement of perceived Usefulness, while used the second part for the measurement of perceived Ease of Use, followed by the last part for the measurement of Learnability. These questions were prepared and adopted from different standard questionnaire (Ali, 2012; Alorfi, 2012; Ammourah, 2009; Muhsen, 2010; Salim, 2009).

The evaluation questions were used Likert-scale to measure the level of agreement or disagreement to a statement. It has been divided into five levels (level 1 for strongly disagree, level 2 for disagree, level 3 for neither disagree nor agree, level 4 for agree, and level 5 for strongly agree) are shown in Table 3.2.

Table 3.2:

The Level of Likert-Scale

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

Therefore, this study needs to convert the Likert-scale as interval scale to analyze the data effectively (Brown, 2011) as shown in Table 3.3. The results were analyzed using statistical methods, which include mean and standard deviation.

Table 3.3:

The Level of Interval Scale

Level	Description
1.00 – 1.99	Strongly Disagree
2.00 – 2.99	Disagree
3.00 – 3.99	Neutral
4.00 – 4.99	Agree
5.00 – 5.99	Strongly Agree

3.2.4.3 Procedure of Evaluation

The questionnaire method was utilized in present study to evaluate A4Kids prototype. Before starting the test of usability, the researcher installed A4Kids prototype in a Samsung Galaxy Note 4, which uses an Android operating system, after that mobile device was given to the teachers. The teachers of the participants were given detailed instructions so as to help the participants adapt to the new prototype A4Kids, as shown in Figure 3.3.

Figure 3.3: The teachers were given detailed instructions on the use of A4Kids

This test required the researcher to go to the schools many times in a six weeks (4 sessions for each school). Although it has not been given a fixed time frame, about twenty minutes to half an hour were allocated on every visit to every of the students to use the A4Kids prototype (Hussain, Mutalib, & Zaino, 2014).

A researcher requested the teachers of the participants to complete a questionnaire which encompassed questions regarding their perception of the efficacy, user-friendliness, and learnability of A4Kids, on the basis of their observation of the students' interaction with the A4Kids through every session as shown in Figure 3.4.

Figure 3.4: The students were given detailed instructions on the use of A4Kids

The questions were adapted from various standard questionnaires (Ali, 2012; Alorfi, 2012; Ammourah, 2009; Muhsen, 2010; Salim, 2009). The above information was gathered using the questionnaire method, see Appendix B. The data and results are discussed in more detail in Chapter 6. SPSS version 20.0 software were utilized to analyze the collected data. At end of evaluation phase, the third objective of current study was achieved. In summary, the prototype has been evaluated by teachers through running and tested it by using questionnaire. Usability has been tested to link between the users' requirements and capabilities of the application. For the purpose of the evaluation, as illustrated in the following subsections.

During the evaluation process, the respondents were asked to test the prototype application and said whatever they are not clear or satisfied about it. The aim for this evaluation is to measure perceived usefulness, ease of use and learnability for the A4Kids application and also the respondent's opinion about the usability of the prototype application. If there are added requirements and recommendation, it can be used in the future recommendation section for future study. It also refers to methods for improving the ease of use during the design process. It is the combination of fitness for purpose ease of use that makes a product effective (Hrabe, Gazda, & Berg, 2004).

3.3 Reliability

The reliability and usability of the questionnaires was ascertained. The most typical way of determining the reliability of the questionnaires is to utilize the Cronbach's coefficient alpha (Ameen & Agha, 2015), which projects the uniformity of the items included in the questionnaire. Typically, it is expressed on a numerical scale, starting from zero (quite unreliable) to one (exceedingly reliable) (Aldalalah et al., 2010). The values of Cronbach's

alpha were computed by deploying the statistical package for social science SPSS version 20.0. The data for inter-item reliability was determined so as to evaluate the extent of internal uniformity between several measurements of an element. The values of Cronbach's alpha for Usefulness, Ease of Use, and learnability were .804, .816 and .826, respectively. This indicated high reliability (i.e. Cronbach's alpha more than 0.7).

3.4 Summary

This chapter outlined the selected development methodology. It is very important and also it law as guideline for the developer over the process to develop and evaluate the prototype. This study depended methodology that submitted by Peffers, Gengler, and Tuunanen (2003). The data that were collected at the beginning of the study it will be analyzed and their findings will be discussed in greater detail in the following chapter.

CHAPTER FOUR

RESULTS OF DATA COLLECTION AND ANALYSIS

4.1 Introduction

This chapter discusses the data collection results and analysis. The findings lead to the achievement of the first objective of this study, which is to determine the design requirements for mobile multimedia application for learning Arabic language for children based on Cognitive Theory of Multimedia Learning CTML. In accordance, the next section addresses the methods that used to data collection.

4.2 Results of Thematic Analysis

Interview is very useful for gathering information. In this study, it was carried out in a systematic procedure at the beginning of the study (Alkhazali, 2012; Zhang & Wildemuth, 2009) to understand the users' condition and requirements. It involves Arabic language teachers at primary schools to assist us to set the main aim to be achieved, to solve the identified problem, described in Chapter 1. Eventually, it leads to the concept for the solution for the problem (Mansur & Samad, 2015). Dornyei (2007), recommends that it is sufficient for small studies to involve a relatively small number of respondents to yield saturated and rich data. It could provide enough data, with small amount of investment. In fact, in some cases, the results are more accurate compared to involving a large sample.

A thematic analysis was conducted to analyze the data collection. It is a fairly straightforward approach of qualitative analysis. In thematic analysis, the researcher seeks to identify and analyze and report patterns. The data was analyzed in six phases as suggested by Braun and Clarke (2006).

In the phase one, *familiarizing*, the teachers' answers were audio recorded. Then, the audio was transcribed into transcripts. Occasionally, the researcher had to listen to the recordings several times in order to obtain an accurate transcription and to become immersed and intimately familiar with its content. The second phase, *generating initial codes*, generated systematic codes across the entire data set, the whole data set was given equal attention so that full consideration could be given to repeated patterns within the data. In the phase three, searching for themes, the codes were further elaborated and linked to emerging themes, this phase also involves examining the codes and collated data to identify significant broader patterns of meaning (potential themes). It then involves collating data relevant to each candidate theme, so that you can work with the data and review the viability of each candidate theme. *Reviewing themes*, is the fourth phase that involves checking the candidate themes against the data set, to determine that they tell a convincing story of the data, and one that answers the research question. In this phase, themes are typically refined, which sometimes involves them being split, combined, or discarded. In the fifth phase, *defining and naming themes*, the essence of each theme, as well as their roles in the emerging overall story, was refined and identified. Lastly, Phase six, *producing the report*, was the final step of analysis, where selected conclusive extracts were embedded within the analytical narrative to produce a coherent and internally consistent report.

Based on thematic analysis, this study analyzed all interviews that conducted with teachers from different primary schools (*Sekolah Kebangsaan Dato' Wan Kemara, Sekolah Kebangsaan Bandar Baru Bukit Kayu Hitam, and Sekolah Kebangsaan (Felda) Laka Selatan*) in Kedah, Malaysia (Fedda & Oweini, 2012; Ghwaileh, 2014).

They were asked eleven open-ended questions, in between twenty minutes to half an hour. The questions were adapted from Shoukry (2013) and Huda (2013). The first part of the interview contains the following questions, which are related to the respondents' experience in primary schools, and children's characteristics:

1. How long have you been in the primary school education sector?

2. What is the range age of children attending your class?

Those questions were asked to ensure that respondents have experience in educating children on Arabic language in primary schools. Therefore, their views and opinions could be considered as valid and relevant to this study. With regard to these questions, all respondents have teaching experience in Arabic language topic for more than 10 years at primary schools, as shown in Table 4.1.

Table 4.1:

Experts Teachers

Teacher	Gender	Years' Experience	Academic Level	Specialization
Teacher 1	Male	14 years	Master	Teaching Arabic
Teacher 2	Female	12 years	Bachelor	Teaching Arabic
Teacher 3	Female	11 years	Bachelor	Teaching Arabic

The second part of the interview asks four questions, which are related to children's characteristics. It includes activities they enjoy in the classroom. Additionally, they were asked to determine the current strategies or methods used by teachers in teaching Arabic

language. In the remaining paragraphs, each question is listed, followed with some discussions on their results.

3. What are the children's characteristics and the activities that enjoy them in your class?

According to the teachers, the children have various special characteristics and things that they enjoy. As an instance, Teacher 1 said "*There are many activities that attract students like nasheed song, choral speaking, and short conversation*". Meanwhile, Teacher 2 replied "*Children have high ability to concentrate on something and are easy to memorize knowledge*". Basically, Teacher 3 agree with those statements by saying "*Students at this age like to play, like to do choral speaking and singing educational songs. Also, they are attracted to bright colors*".

Not only that, when answering this question, all teachers stressed that children like to compete to get attention, have high ability to concentrate, are attracted to bright colors, are easy to memorize knowledge, and the capability, efficiency, and the development of each stage are different even though they are in the same level.

4. Do you think that parents are concerned about teaching their children the Arabic language? Why?

With regards to this question, the teachers highlighted many factors motivating the parents in motivating their children to learn Arabic language. This is seen in Teacher 1's answer, that "*Most of the family in our school are Muslim. Therefore they like their children to understand their religion*". Similarly, Teacher 2 answered "*I think the parents are interested to teach their children Arabic language because it is the language of Quran*". Teacher 3 agrees when expressing "*In my opinion, parents are highly motivated to teach*

their children Arabic language because children who speak Arabic have a better understanding upon the Quran and Islam in general".

Those answers explain that Arabic language is highly important to all Muslims. It is a sacred language of Islam because it is the language of the Quran and Islamic sources, especially Tafseer and prophetic texts. Therefore, the parents in Malaysia are interested in teaching their children the Arabic language.

5. What is the current strategies and methods to teach your students Arabic letters and vocabulary?

Through the interviews, this study discovers several strategies and methods used by teachers in teaching the Arabic language. Regarding this, Teacher 1 mentioned "…*the ways I currently use in teaching them are textbook and flash card*". It almost similar with Teacher 2, who mentioned "…*I use paper-based materials in most cases, including curriculum, pictures, and exercises*". Teacher 3 also go with almost similar techniques through "*I am using many strategies including colored cards and tape in teaching them Arabic topics*" statement.

Through their current practice, the teachers found that those conventional methods bring some constraints. The generally create one-way communication for teaching and delivering information, which is not attractive in this digital era. As a result, when students just receive information, they get bored easily in learning Arabic language. Therefore, an urgent reaction is needed in solving this problem.

6. Could the students which you dealt with distinguish Arabic letters? Why?

Regarding this, all teachers agree that "*…the students are able to distinguish the Arabic letters because they also learn Jawi alphabet*". Having finished discussing about the questions in the second part of the interview, this paragraph and the remaining discuss the findings of the questions in the third part of the interview. They focus on the usage of technology as a supporting tool in teaching Arabic topic in Malaysia.

7. Are you in favor of using new technologies available to educate and entertain children?

With respect to this question, all respondents expressed their view as follows: *"Yes, it is good because using new technology makes lessons easy and interesting for the students".* They also agree that new technologies make lesson more efficient and more interesting to children. They really believe in that because currently, some of the teachers use compact disk CD to support their teaching and learning process. It fails to attract children's attention to learn Arabic.

8. How can technology help children in early literacy development in primary school?

The response to this is overwhelming. They all agree that using new technologies can help students in learning Arabic. As an instance, Teacher 1 said: *"...modern devices can help children at primary schools absorb language in their early childhood".* On top of that, Teacher 2 expressed *"...using new technologies can make lesson more attractive and more efficient".* It was added by Teacher 3 that *"...teaching Arabic language is considered a difficult subject in Malaysia therefore, there is an urgent need for a modern way to support their teaching and learning process and increase children's attention to learn Arabic".*

Having understood the situation, questions in the last part of the interview ask about the important features or contents that can be deployed in applications for children, especially for making the application fun for them. Besides, special usability considerations in the interface for Malaysian children is also asked. The findings from the questions are discussed in the following paragraphs.

9. What are the important features or contents which you would like to see more employed in applications targeting children?

According to the respondents (teachers), educational contents to be used in the application must be based on the current syllabus. Besides, Teacher 1 expressed "…*students are basically taught on how to read and pronounce Arabic letters and vocabulary. So, the application should contain pictures of the Arabic characters and pronunciation*". Teacher 2 extended it by saying "…*students at the primary level learn Arabic topics based on textbook, like vocabularies including days of week, months of year, colors, and numbers*".

Similarly, Teacher 3 agrees with those statements when saying "…*students at this level are taught on how to write Arabic alphabet, words, and simple sentences. Hence, the application should be user friendly and suitable for children*". The evidences in the above paragraph explain that level of educational contents must be based on textbooks. Students are basically taught on how to write and pronounce Arabic alphabets as well as vocabularies like days of week, months of year, colors, and numbers.

10. In your opinion, what especially makes an application fun for children at primary schools?

When addressed that question, Teacher1 answered "*In my opinion, to make an application fun for children, the designer should use pictures with sounds, attractive music, colorful interface, and the language of interface should be simple and proper for children*".

Then, it was added by Teacher 2 "…*most children like playing and challenging. So, the application can contain games and quizzes to make it enjoyable for children*". While teacher 3 commented "…*the application should be friendly and suitable for children may be can using educational songs to making easy alphabets pronunciation and memorizing for the children*". The answers from the teachers explain that the designer should use friendly and colorful interfaces, suitable images with sounds, the language of interfaces should be simple and proper for children, and applying educational songs, games and quizzes.

11. Are there special usability considerations when designing interfaces for Malaysian children?

About this question, Teacher 1 replied: "*The designer should use friendly human voice, interesting characters, traditional clothes, and traditional places when designing the interface for Malaysian children*". Nevertheless, Teacher 2 added that "…*the designer can utilize cartoon character, and simple and short texts for children at this age range*". On the same question, Teacher 3 answered "*Use various media elements like picture, video, and sound to attract the attention of children and makes lessons more effective"*.

In summing-up the findings of the interview, current research discovers that the main limitation of the methods in teaching and learning Arabic language is heavily on the textbooks. In current situation, students just view static images in textbooks, which is not effective and not attractive. In addition, the respondents agree that students at primary

schools learn fast because they are attentive and they have good attitude. It has to be taken as an advantage. At their early age, their ability to digest and grasp the fundamental knowledge has to be well-supported with something that enhances the basic level. This could further invoke their creative and critical thinking skills to assist their mental development. Having analyzed the requirements for designing an educational mobile application for learning Arabic language at primary schools, this study forms a set of guidelines as a reference. The guidelines are recommended based on the interviews with teachers. Table 4.2 lists the guidelines, together with very straight-forward practical tips.

Table 4.2

Guidelines from interviews

No.	**Guidelines**
1.	Topics should be selected from the current national Arabic curriculum by the Ministry of Education to provide a friendly environment for students.
2.	The level of educational contents should be suitable for students.
3.	Use music and sound to attract the attention of children and makes lessons more effective.
4.	Use interesting pictures and cartoon characters that should not distract and are also child-friendly.
5.	Using a friendly human voice with child-appropriate language.
6.	The interface should be colorful.
7.	Use educational songs to enhance pronunciation and memorizing.

8.	Use various media elements and interface design that children are familiar with such as traditional clothes and traditional places.
9.	Use simple and proper language for children at this age range.
10.	Provide quizzes and games so that the children could test their knowledge.

Although reading is more to do with reviewing literatures, it is also an instrument for studying (Annum, 2014). Public documents such as newspapers, journals, and private documents such as kids' books, articles, curriculum, thesis, and existing application are among resources for gathering information to support this study. Curriculum is an important input in because this study deals with educational material.

In Malaysia, the national curriculum forms the basis for the education system. It is tailored for public schools across the primary level (Osman & Bakar, 2012). Teachers are expected to abide by the syllabus drawn up by the Ministry of Education. Thus, each student in public primary schools is projected to attain the same level of knowledge. Hence, this study considers only topics included in the national curriculum (from *Buku Teks Bahasa Arab Tahun 1, Buku Teks Bahasa Arab Tahun 2, and Buku Teks Bahasa Arab Tahun 3*). It is very important, to ensure a friendly environment for children and to avoid unnecessary information in the application, that can reduce children's attention and focus and likewise confuse them. In the literatures, many of researchers have highlighted various guidelines for developing mobile applications for children. They could be used to assist designers to design and develop good applications. In this context, good refers to fitting the requirements of the target group (students at primary schools). From the various sources, this study gathers and compose them in Table 4.3.

Table 4.3

Guidelines from Review of Related Literatures

No.	Guidelines
1.	Unnecessary information should be avoided (Parsons, Ryu, & Cranshaw, 2007) because they can reduce children's attention and focus (Inkpen, 1997).
2.	Using educational songs to facilitate alphabets and vocabulary pronunciation and memorizing for the children (Alsumait & Al-Osaimi, 2010; Bakri, Zakaria, & Alaa, 2014).
3.	Text should be easy to read, short, attractive, relatively large (14-18 point), and meet the desire of learning material for children (Jacko, 2009; Large & Beheshti, 2005; Naranjo, 2011; Taylor et al., 2002).
4.	Use music and sound to attract children's attention (Alsumait & Al-Osaimi, 2010; Nielsen, 2010; Laila Shoukry et al., 2012).
5.	Using a friendly human voice with child-appropriate language (Ali, 2015; Bakri, Zakaria, Nazirah, et al., 2014; Borse, Robles, & Schwartz, 2006). Availability in multi languages (Laila Shoukry et al., 2012).
6.	Use cartoon characters and interesting pictures which are either like the child or from his own culture and at the same time it should not be distracted (Alsumait & Al-Osaimi, 2010; Nielsen, 2010; Laila Shoukry et al., 2012).
7.	The main icons should be large, easy to select and distinguished (Lyan, Amjad, Shaden, & Khalid, 2015; Wolock et al., 2006).

8.	Use single-click (Segers & Verhoeven, 2002) and touch screen (Chiasson & Gutwin, 2005) Main interface accessible everywhere (Wolock et al., 2006) in terms of interaction between users and the application.
9.	Provide repetition (hearing the vocabulary more than one time) can help words learning (Fluckiger, 2010; Hourcade, 2008).
10.	Include self-assessments to advance children achievement (Alsumait & Al-Osaimi, 2010; Tsai, 2005; Kletzander, Kögler, & Tellio, 2014).
11.	Use multimedia elements include (sound, images, videos) and interface designs that children are familiar with such as traditional clothes (Alsumait & Al-Osaimi, 2010; Fluckiger, 2010; Korat, 2001).
12.	Ensure user-friendliness interfaces, support understandability (Sam Goundar, 2011; Bunt, 2010; Grasso & Roselli, 2005).
13.	Avoid complex navigation and scroll bars to making children see all of the contents (Ali, 2015; Buchanan et al., 2001; Inkpen, 1997).
14.	Ensure consistency because it is the most important aspects in measuring user interface design principle (Korhonen & Koivisto, 2007; Nielsen, 1993).
15.	Eliminate extra work (animated graphic, long text, etc.) (Naranjo, 2011).
16.	Measure the children's understanding through game (Iyer & Kalbande, 2014; Muhammad & Nor Aziah, 2011).

4.3 Utilizing Cognitive Theory of Multimedia Learning CTML

Mayer's cognitive theory of multimedia learning CTML provides guidelines that help designers to arrange multimedia elements (text, sound, picture, and video) and to design more effective learning application than the conventional mobile learning systems. It also helps enhancing the quality of education and encourage learning for children (Smink, 2012; Sorden, 2012).

Mayer (2001) proposes that CTML deals with the nature of the competition of the dual-channel (audio and video) for processing information in knowledge creation. Additionally, designers like to use the most effective delivery for information as well as to achieve a balance between the demands placed on the learner's auditory and visual channels of communication processing. So, the visual (seeing) and auditory (hearing) aspects should be considered as it is delivered to children. This implies that the design of content and material should be appropriately decided in order to actively connect the working memory of children.

This principle can be applied to most multimedia projects (Frey & Sutton, 2010). For instance, the coherence principle eliminates extraneous text, sounds, and images that do not contribute to the learning (Frey & Sutton, 2010). The Spatial contiguity principle advises designers to place the words near their corresponding images and keep scrolling to a minimum (Smink, 2012). The elements of multimedia such as texts, sounds, pictures, and video has been helped in the learning process and integrating multimedia to education and learning has become a very effective tool for learning (Roblyer, Edwards, & Havriluk, 2002). This was confirmed by Aldalalah et al. (2010) through their study on learning

Arabic using multimedia. They found that audio with images mode is an important aid to learning as compared to text with images mode.

Accordingly, this study considers the principles in CTML in design and develop the learning application for Arabic language. This study believes that the combination of the principles in CTML with the gathered guidelines through other literatures (Table 4.2 and 4.3) would make impactful result to learning experience among children. Pictures, texts and sounds of Arabic characters and vocabulary are arranged visually and verbally. Also, the principles has been integrated to help children memorize the Arabic characters for a long duration. Finally, this study hopes to retain more understanding and memory for Arabic characters and vocabulary to the children. To cater that, coherence, spatial contiguity, temporal contiguity, multimedia, and voice principles were adopted, as illustrated in Table 4.4.

Table 4.4

Utilizing Cognitive Theory of Multimedia Learning CTML

No	Principle	Description	Applied in A4Kids
1.	Coherence	Students learn better when extraneous material is excluded rather than included.	The extraneous material such as irrelevant words, picture, sounds, music.
2.	Spatial contiguity	Students learn better when corresponding words and pictures are presented near than far from each other on the page or screen.	Placed printed words near corresponding picture.

3.	Temporal contiguity	Students learn better when corresponding words and pictures are presented simultaneously rather than successively.	Presents alphabet or word simultaneously with corresponding picture.
4.	Multimedia	Students learn better from words and pictures than from word alone.	Added pictures to words (rather than words alone).
5.	Voice	Students learn better when the narration in multimedia lesson is spoken in a friendly human voice rather than a machine's voice.	The voice technique that used the human voice to make the presentation more understandable rather than using a machine's voice.

4.4 Proposed Guidelines to Designing Mobile Application for Children A4Kids

Based on the interviews with teachers from three different primary schools and the extensive reviews on related literatures, this study proposes a set of guidelines and the basic requirements that should be incorporated in the A4Kids prototype. They are detailed in Table 4.5.

Table 4.5

The Proposed Guidelines That Implemented In A4Kids

No.	CTML Principles	The Guidelines	
1.	Coherence Principle	Content	➢ Topics should be selected to align with national Arabic curriculum set by the Ministry of Education MoE. They are chunked according to those stipulated by the ministry. ➢ Avoid unnecessary information. Unnecessary information in the A4Kids can irritate children's focus and attention and also confuse them.
2.		Consistency	➢ Consistency is the most important aspects in measuring user interface design guidelines.
3.	Multimedia Principle	Interface Design	**I. Multimedia Design** ➢ Use multimedia elements including sounds, videos, images, and texts. ➢ Use music and sound to attract the attention of children and makes lessons more effective.

3.	Spatial contiguity Principle Temporal contiguity Principle Voice Principle	Interface Design Interface Design	➢ Use interesting pictures and cartoon characters that should not distract and are also child-friendly. ➢ Text should be easy to read, short, attractive, relatively large (14-18 point), and meet the desire of learning material for children. ➢ Eliminate extra work like animated text, animated graphic navigation, and long text, etc.) ➢ Use vary bright colors. **II. Learning Design** ➢ The level of educational contents should be suitable for level of children. ➢ Use educational songs to facilitate alphabets and vocabulary pronunciation and memorization. ➢ Utilize repetition when necessary. Hearing the vocabulary more than one time can help words learning.

	Coherence Principle Multimedia Principle Spatial contiguity Principle Temporal contiguity Principle	Interface Design	➢ Ensure user-friendliness interfaces, support understandability to learn the A4Kids. **III. Cultural Design** ➢ Use various media elements and interface design that children are familiar with. ➢ Utilize traditional clothes, and traditional places. ➢ Use terminologies properly for children.
4.		Navigation & Control	➢ Avoid using complex navigation and minimize scrolling. ➢ Icons must be big and easily distinguished. ➢ Use single-click and touch screen.
5.		Evaluation	➢ Provide quizzes, so that the children could test their knowledge. ➢ Measure understanding through games. ➢ Include self-assessments to advance child achievement.

6.	Voice Principle	Language	➢ Use simple and proper language for children at this age range (7-9 year). ➢ Using a friendly human voice with child-appropriate language.

4.5 Summary

This chapter describes about the data collection carried out at the beginning of the study. Basically, interviews and reviews of literatures have been carried out, systematically to ensure the findings are rich. Then, the data was analyzed by following a thematic analysis approach, which eventually leads to the proposed guidelines for designing the A4Kids application. The findings leads to achieve of the first objective of this study. The proposed guidelines incorporated into the prototype, which is elaborated in the next chapter.

CHAPTER FIVE

APPLICATION DESIGN AND DEVELOPMENT

5.1 Introduction

This chapter describes the steps in design and develop the A4Kids application based on the proposed guidelines described in Chapter 4 and Mayer's Cognitive Theory of Multimedia Learning CTML guidelines. The proposed guidelines have been incorporated in a prototype for evaluation, in which the prototype is elaborated at length in this chapter and the results of evaluation are discussed in Chapter 6. Generally, all functional and non-functional requirements are discussed in this chapter. Nevertheless, this chapter outlines the Unified Modelling Language UML diagrams, including use case diagram, sequence diagram, activity diagram, and class diagram. In the end, the chapter showcases the interfaces of A4Kids application.

5.2 Requirements of A4Kids Application

This section attempts to capture the requirements of A4Kids application the definition of application's requirements it is the most important phase to develop an accurate and effective application. It consists of functional requirements and non-functional requirements.

5.2.1 Functional Requirements

The functional requirements are the functions or techniques used, for application. In this study, Table 5.1 lists the functional requirements for A4Kids where: M: Mandatory, D: Desirable, and O: Optional.

Table 5.1:

Functional Requirements of A4Kids.

No.	Requirement ID	Requirement Description	Priority
	A4Kids_1	**LEARN LETTERS**	
1.	A4Kids_1_1	The learner can view all the main menu options on the main interface. The options are “Letters”, “Words”, “Number & Colors”, “Days & Months”, “Quiz”, and “Game”. Easy-to-read font, interesting characters and sounds.	M
2.	A4Kids_1_2	The learner can select the subcategories “Letters”, which consists of: “Alphabet”, “Write” and “Song”.	O
3.	A4Kids_1_3	A4Kids provides several pictures of interesting characters for learning Arabic alphabets with three buttons (Next, Previous, and Play).	M
4.	A4Kids_1_4	The learner can click on “Play” button to play the audio tracks associated with Arabic alphabet pronunciation for selected letter.	D
5.	A4Kids_1_5	The learner can press on “Next” button to go to the next letter.	O

6.	A4Kids_1_6	The learner can press on “Previous” button to go back to the previous letter.	O
7.	A4Kids_1_7	The application provides an educational video song about Arabic alphabet when the learner clicks on “Song” icon.	D
8.	A4Kids_1_8	A4Kids allows learner to go back to the main interface of application by clicking on “Home” icon.	M
	A4Kids_2	**LEARN WORDS**	
9.	A4Kids_2_1	The learner can choose “Words” category to learn its details, which includes “Classroom”, “Fruits”, “Clothes”, “Transport”, and “Song”.	O
10.	A4Kids_2_2	A4Kids provides a group of pictures for Arabic vocabulary with the text in Arabic language with three buttons (Next, Previous, and Play).	M
11.	A4Kids_2_3	The learner can click on “Play” button to repeat any words more than once.	D
12.	A4Kids_2_4	The learner can press on “Next” button to go to the next word.	O

13.	A4Kids_2_5	The learner can press on “Previous” button to go back to the previous word.	O
14.	A4Kids_2_6	The application provides an educational video song about Arabic words. The learner can watch the song by pressing on “Song” icon.	D
15.	A4Kids_2_7	The learner can return to the main interface of A4Kids by pressing on “Home” icon.	M
	A4Kids_3	**LEARN NUMBERS & COLORS**	
16.	A4Kids_3_1	The learner can select “Numbers & Colors” category from the main interface to learn its details. It consists of “Numbers”, “Colors”, and “Song” subcategories.	O
17.	A4Kids_3_2	A4Kids provides many pictures of Numbers and Colors with Arabic text with three buttons (Next, Previous, and Play).	M
18.	A4Kids_3_3	A4Kids allows learners to listen to Arabic pronunciation for Numbers or Colors repetitively by clicking on “Play” icon.	D

19.	A4Kids_3_4	The learner can click on “Next” icon to go to the next Number or Color.	O
20.	A4Kids_3_5	The learner presses on “Previous” icon to go back to the previous Number or Color.	O
21.	A4Kids_3_6	The application provides appropriate educational videos songs about Arabic Numbers and Colors.	D
22.	A4Kids_3_7	The learner can return to the main interface of A4Kids by clicking on “Home” icon.	M
	A4Kids_4	**LEARN DAYS & MONTHS**	
23.	A4Kids_4_1	The learner selects “Days & Months” category from the main interface to learn its details, which includes “Days”, “Months”, and “Song” subcategories.	O
24.	A4Kids_4_2	The learner can select one of the subcategories by clicking the icons.	O
25.	A4Kids_4_3	A4Kids shows the text of Day or Month in Arabic with three buttons (Next, Previous, and Play).	M

26.	A4Kids_4_4	A4Kids allows learner to listen to Arabic pronunciation of Day or Month more than once by pressing on “Play” icon.	D
27.	A4Kids_4_5	The learner clicks “Next” button to go to the next Day or Month.	O
28.	A4Kids_4_6	The learner clicks on “Previous” icon to go to the previous Day or Month.	O
29.	A4Kids_4_7	The learner can go back to the main interface by pressing on “Home” icon.	M
	A4Kids_5	**DO QUIZ**	
30.	A4Kids_5_1	The learner can select “Quiz” icon to answer quizzes.	O
31.	A4Kids_5_2	A4Kids displays to the user a picture with a list of answers for each question.	M
32.	A4Kids_5_3	The learner can choose one option as his/her answer.	M
33.	A4Kids_5_4	A4Kids prompts the answer, whether correct or not in voice message directly.	M

34.	A4Kids_5_5	The learner can click on “Next” icon to go to the next question.	O
35.	A4Kids_5_6	The learner can press on “Previous” icon to go back to the previous question.	O
36.	A4Kids_5_7	A4Kids provides a “Home” button to return to main interface.	M
	A4Kids_6	**PLAY GAME**	
37.	A4Kids_6_1	The learner can click on “Game” icon to play.	O
38.	A4Kids_6_2	A4Kids displays the game page.	M
39.	A4Kids_6_3	The learner can press on two hidden pictures to match them.	M
40.	A4Kids_6_4	A4Kids verifies the similarity of the selected pictures.	M
41.	A4Kids_6_5	A4Kids hides the selected pictures if they match.	M
42.	A4Kids_6_6	When the learner ends their game, the trials number to match the pictures will be appeared and they may tap on “New Game” icon shown to start a new game	M

5.2.2 Non-Functional Requirements

The non-functional requirements of application refers to a pragmatic and methodical approach in ensuring children enjoy utilizing it. It has to be carefully considered, because it is the forefront of the A4Kids application, which motivates children to utilize it. Having carried out the a series of interviews, as described in Chapter 4, Table 5.2 lists the non-functional requirements of A4Kids.

Table 5.2:

Non-Functional Requirement of A4Kids.

No.	Requirement ID	Requirement Description	Priority
	A4Kids_7	**USABILITY ISSUES**	
1.	A4Kids_7_1	A4Kids must be ease of use and should be friendly.	M
2.	A4Kids_7_2	A4Kids should be easy to learn and remember.	M
3.	A4Kids_7_3	The A4Kids must provide big buttons and easy.	M

5.3 UML Diagrams

This section describes the UML diagrams that used in this study, which include Use Case Diagram, Sequence Diagram, Activity Diagram, and Class Diagram. All diagrams have been drawn by using "Edraw Max" version 7.9 software. Use case is used to represent the functional requirements and expose business rules. It consists of actors (which are the user) and a scenario (which are the actions taken by the actors). In other words, use case is good for describing the flow of A4Kids, a graphical depiction of the interactions among

the elements of A4Kids. The goal of use case diagrams is to show the functionalities that A4Kids provides and to portray the way users will communicate with A4Kids while using that functionality. In this study, there is a single actor who is the learner of Arabic language, as seen in Figure 5.1.

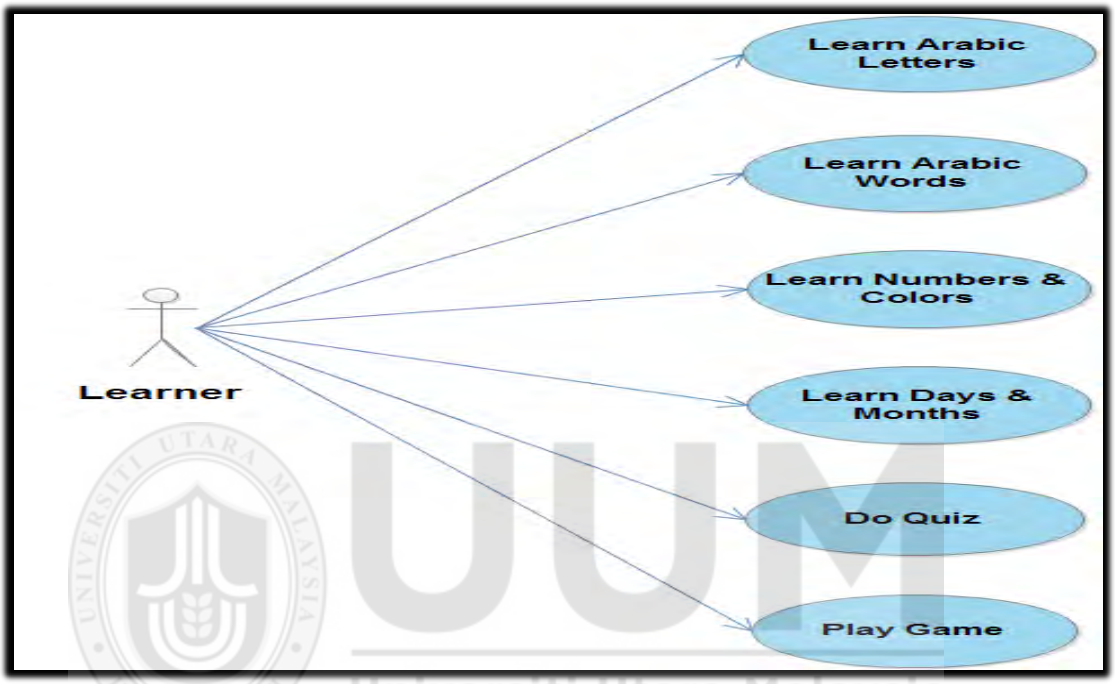

Figure 5.1: Use Case Diagram for A4Kids

The details of every use case such as description of cases, pre-condition, characteristics of use case, flow of events, post-condition, rules of use case, constraint sequentially, and sequence diagram explains in Appendix E.

5.4 Activity Diagram

An activity diagram is deployed for modelling a major activity's sequential work flow by emphasising on action sequences and corresponding action initiating conditions (Syed et al., 2015). It pertains to the process's flowcharts, and is utilised to depict activities in A4Kids. To suit the purpose, the activity diagram for A4Kids is depicted in Figure 5.2 and Figure 5.3.

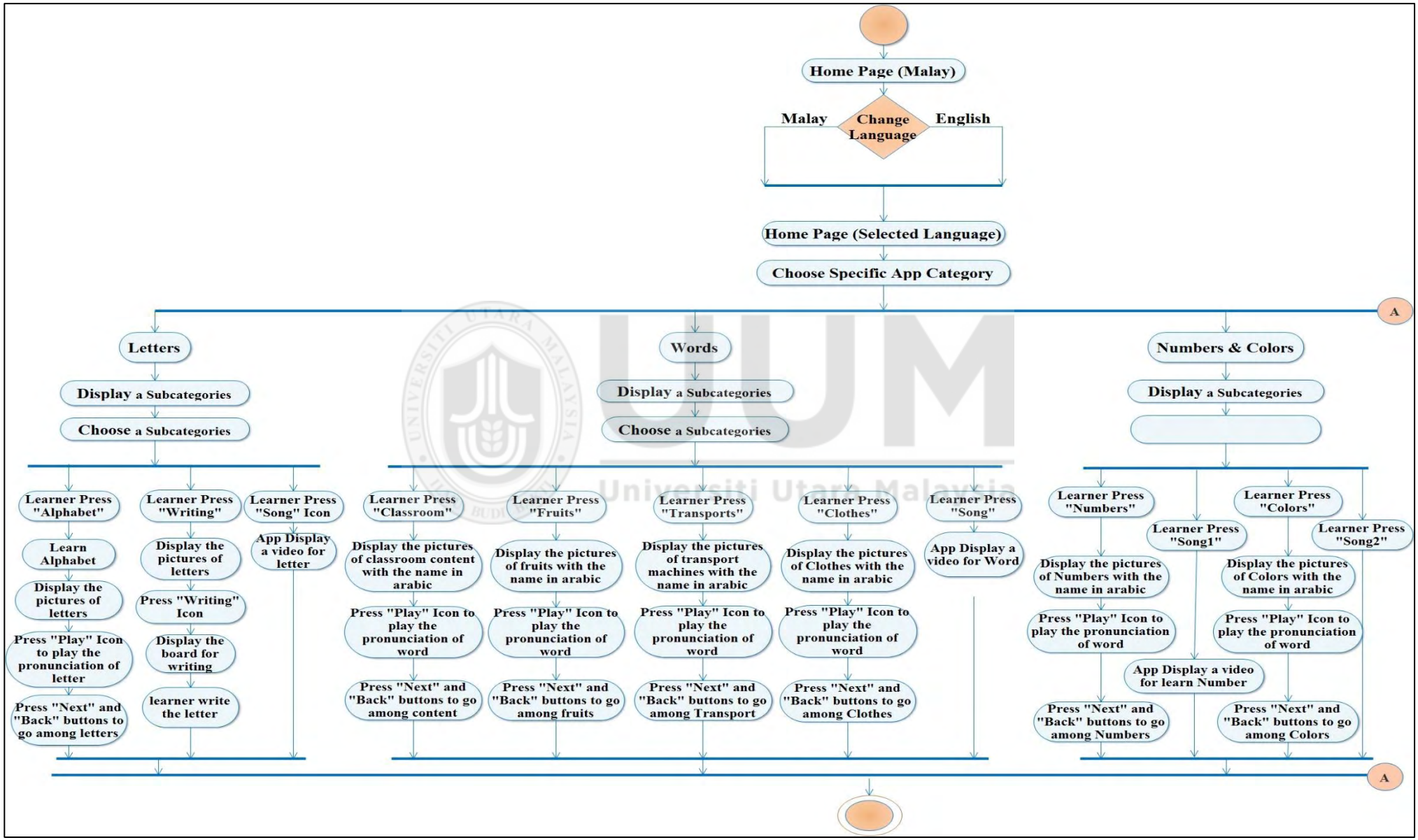

Figure 5.2: Activity Diagram (A)

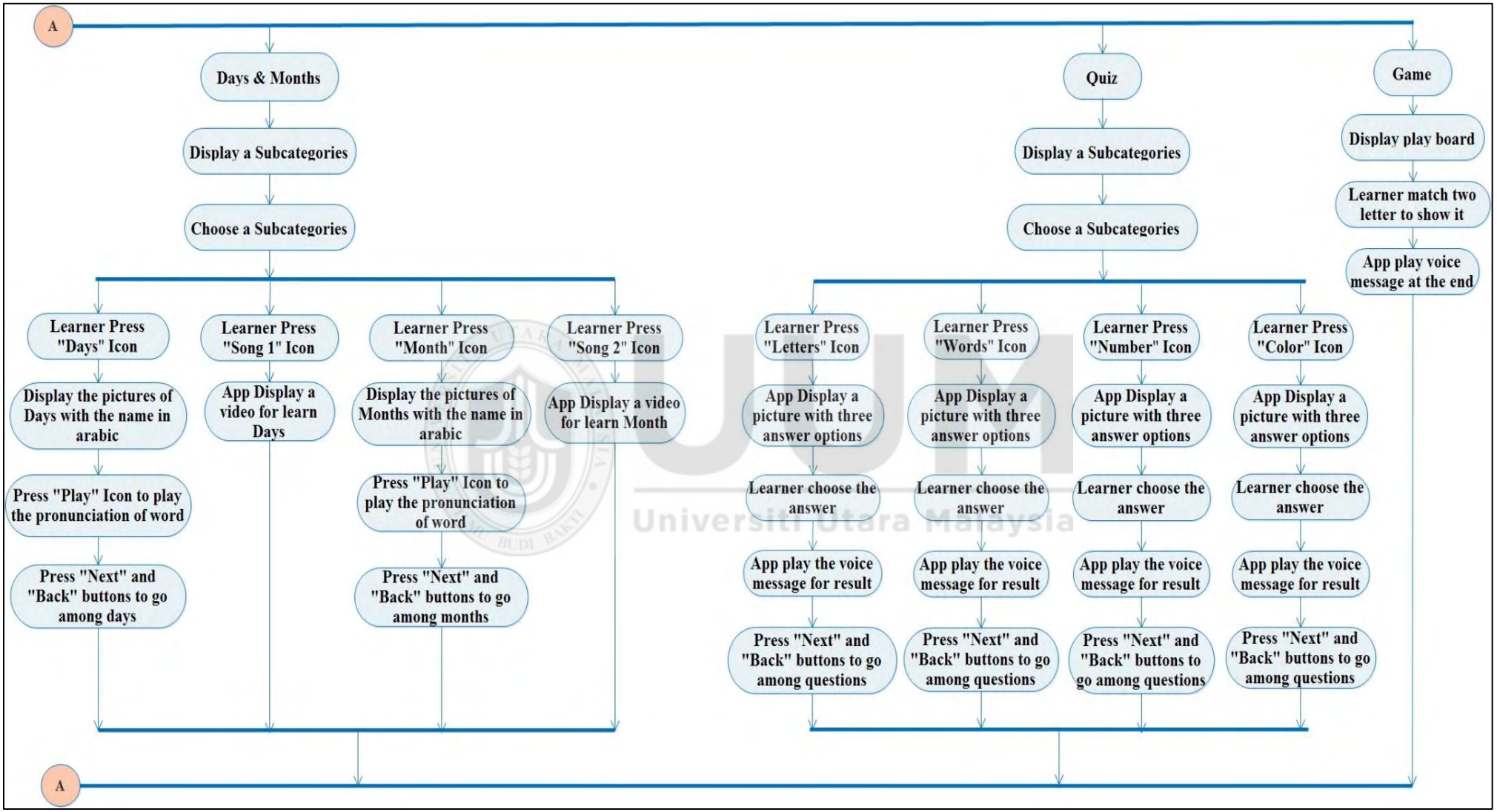

Figure 5.3: Activity Diagram (B)

5.5 Class Diagram

Having detailed the state chart, class diagram presents the main classes of A4Kids. The purpose of class diagrams is to represent the classes involved in A4Kids (Martin, 2003), in which it is used to depict all the objects in A4Kids. It is a reference to the extended class diagram which includes the attributes and operations of the classes (Semertzidis, 2013). The class diagram provides a vast set of uses like detailed design of the target application and modeling the data structure. Figure 5.22 shows the classes of application and the relationship between them.

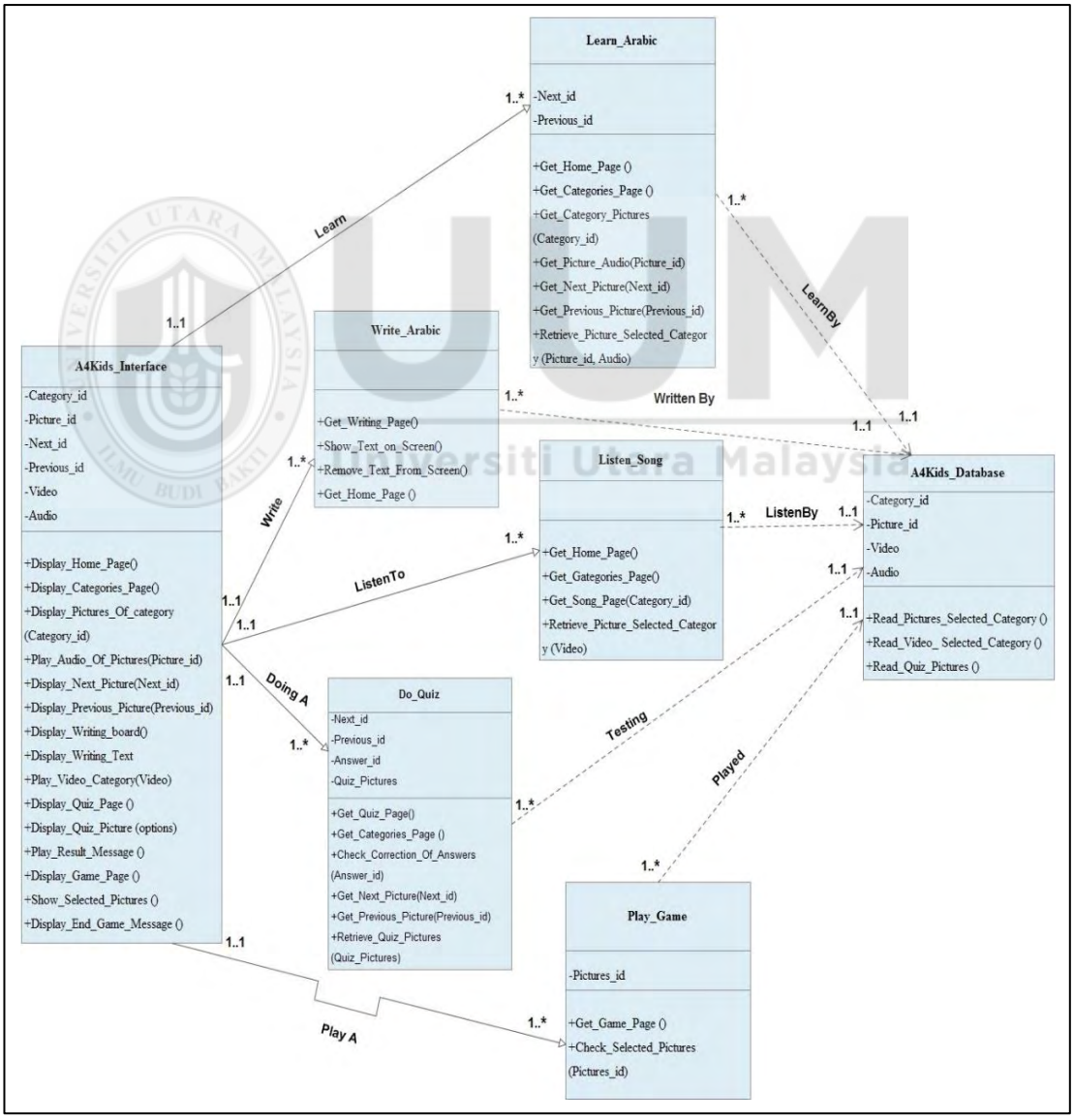

Figure 5.4: Class Diagram

5.6 Prototype Development

Prototype is an early product or sample used for testing purposes before the final product is released (Krannich, 2010; Semertzidis, 2013). The guidelines described in Chapter 4, as well as Mayer's principles in CTML were transformed into a working prototype. Hence, the work on designing mobile multimedia application took place.

For A4Kids, the prototype is developed on Android operating system, because it is a popular operating system for mobile devices besides it is open and free (Vangie, 2011). The major development tool is Eclipse. Besides, audio recording were accomplished using Sound Forge. Meanwhile, image editing was done in Adobe Photoshop CC. In addition, the prototype incorporates the functional and non-functional requirements that explained at the beginning of the current chapter. The guidelines are in line with recommendations by Maish, (2009):

i. Clear goals.
ii. Useful and engaging start up screen.
iii. Meaningful interactions.
iv. Interesting game.
v. Appropriate feedback.

Clear goals is a must, because A4Kids should meet its objective. The startup screen needs to be useful and easy for the users to understand. In addition, it should have interesting educational games in order to attract users. Games can be utilized to test the user's knowledge on the learned topics. Besides that, interaction styles is also important in A4Kids. Generally, A4Kids provides two types of feedback; explicit and implicit feedback. In terms of explicit feedback, A4Kids provides direct feedback and are most accompanied by positive or negative activities on screen. In contrast, implicit feedback is mostly embedded in the game.

The term ‘interface’ refers to the strategies and gadgets that are utilized to accommodate the interaction between machines and the people who use them (Zhang, 2008). The interface of A4Kids must be able to maintain user interest. As an instance, the interface ought to be enjoyable to use to excite the interest of user and his/her actions.

Designers or developers ought to comprehend the accessibility of objects in the screen architecture. For instance, title ought to be at the top, a next button ought to be at the right. Further, the interaction should avoid or minimize all kinds of excise. Excise could be in the form of reading textual content, animated text, scrolling, complex navigation, and continuous audio (Naranjo, 2011).

5.6.1 Main Interface

When the main interface loads, it has an element of surprise. The graphics, characters, and the background are taken from the students’ school. It is important to decide on the metaphor because studies have indicated that relevancy increases motivation (Keller & Suzuki, 2004). Harun and Tasir (2003), suggested using large fonts for children, and simple text to ensure that the font is easy to read and consistent.

For the interfaces, the create pictures, sounds and videos for each interface followed by five principles from Cognitive Theory of Multimedia Learning CTML, which are: Coherence, Spatial Contiguity, Temporal Contiguity, Voice, and Multimedia. All pictures were produced using Adobe Photoshop CC.

In detail, main interface consist of six icons: Letters, Words, Numbers & Colors, Days & Months, Quiz, and Game that offer to the user many choices for further action.

In addition, A4Kids runs in two languages; Malay and English, in which Malay is the default language. Staff in Language Centre UUM translated the words from English into Malay Language (refer Appendix D). As a result of multitude of languages, the main interface has a two icons to switch between languages. The following figures illustrates all above function.

Figure 5.5: Main interface of the A4Kids in Malay language (first number (s) is referring to the guidelines in Table 4.2 and second number (s) is referring to the guidelines in Table 4.3)

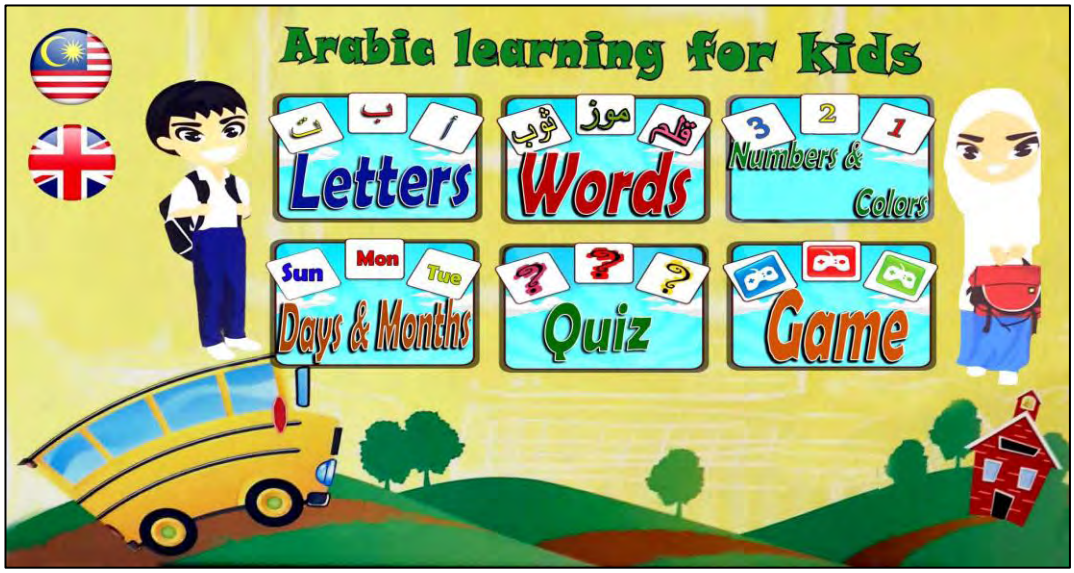

Figure 5.6: Main interface of the A4Kids in English language

5.6.2 Learn Letter Function Interface

The main function of this application is a learning Arabic. Learning Arabic letters is a basic task in this study. Learning letters begins with pressing on "Letters" icon, which displays the subcategories under "Letter" category. The learner presses on "Alphabet" icon in case of displaying letter. Then, A4Kids shows the pictures for each Arabic alphabets.

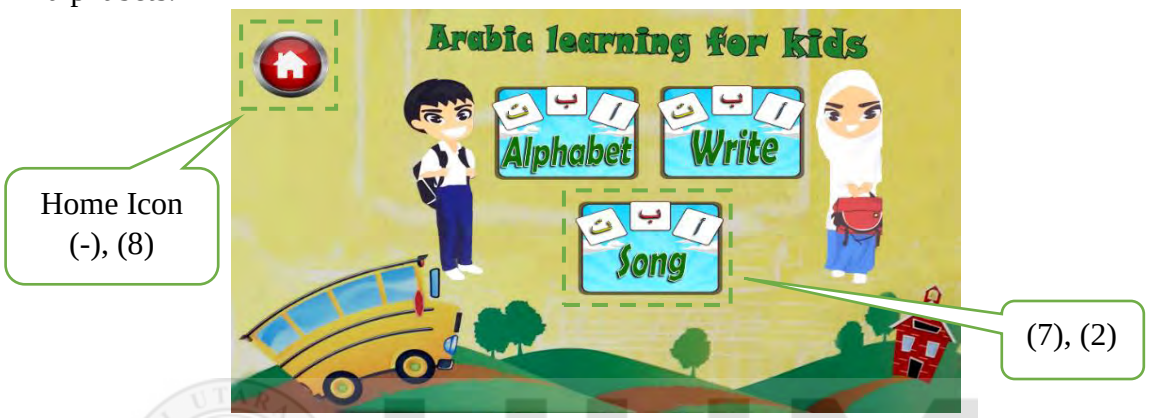

Figure 5.7: Learn Letter Interface (first number (s) is referring to the guidelines in Table 4.2 & second number (s) is referring to the guidelines in Table 4.3)

Additionally, A4Kids provides some buttons to switch among letters and to play the pronunciation of appeared letter. The learner can also learn writing Arabic alphabets and vocabulary in this part by pressing on "Write" icon. Moreover, when a learner presses on "Song" icon, A4Kids displays instructional video about letters. The figures below show the steps of this function. In the end, the learner can get back to the main interface from every interface by just pressing on "Home" icon.

Figure 5.8: Example of Learn Letter (first number (s) is referring to the guidelines in Table 4.2 & second number (s) is referring to the guidelines in Table 4.3)

5.6.3 Learn Words Function Interface

Learning Arabic words is an essential function in this study. Learning words starts by clicking on "Words" icon. The application then displays the subcategories of "Words" category, which are "Classroom", "Fruits", "Clothes", "Transports", and "Song". The learner presses on one of the subcategories to displaying their pictures. Then, A4Kids show the pictures of selected category. Additionally, the application provides some buttons to switch among pictures and to play the pronunciation of appeared picture.

Figure 5.9: Learn Words Interface

On other case, the learner presses on "Song" icon the application display learning video about words. Temporal, spatial contiguity principles were applied through placed printed words near corresponding picture and applied multimedia principles by added pictures to words (rather than words alone). Lastly using a friendly human voice with child-appropriate language to implement voice principle.

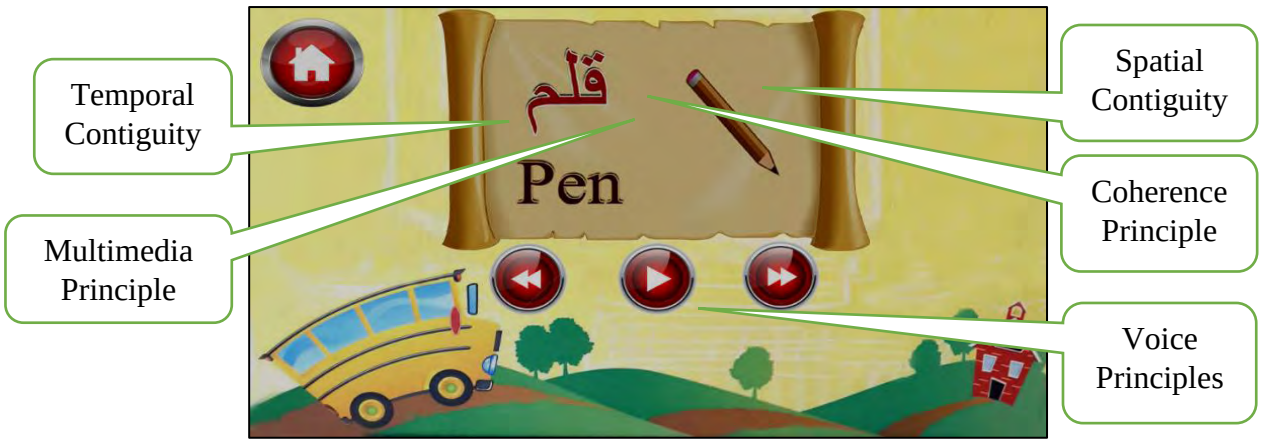

Figure 5.10: Example of Learn Words interface (see CTML principles in Table 4.3)

5.6.4 Learn Numbers & Colors Function Interface

Learning colors and numbers in Arabic language starts by click on "Numbers & Colors" icon. A4Kids displays the subcategories of "Numbers & Colors" category that are "Colors", and "Number" icons as well as "Song1" and "Song2" icons for every subcategory. The learner presses on one of the categories in case of displaying their pictures of subject and its word in Arabic and selected language.

Figure 5.11: Learn Numbers & Colors Interface

Besides displaying related pictures of selected category, A4Kids displays three buttons to move among pictures and to play the pronunciation of appeared picture. Also, A4Kids displays an educational video when the learner presses on "Song" icon. The figures below shows the steps of this function. At end, the learner can back to main interface from every interface by click on "Home" icon.

Figure 5.12: Example of Learn Numbers & Colors Interface

5.6.5 Learn Days & Months Function Interface

Learning days and months in Arabic language starts by clicking on “Days & Months” icon. A4Kids shows the two subcategories of that category; “Days” and “Months” icons, as well as “Song” icon for every subcategory. The learner presses on one category in case of displaying their pictures of subject and its word in Arabic and selected language. A4Kids displays related pictures of the selected category. In addition, the application displays three buttons to move among pictures and to play the pronunciation of appeared picture. Nevertheless, the learner presses on “Song” icon, and A4Kids displays a learning video about date. Finally, the learner can get back to the main interface from every interface by click on “Home” icon.

Figure 5.13: Learn Days & Months Interface

Figure 5.14: Example of Learn Days & Months Interface

5.6.6 Do Quiz Function Interface

According to Hargreaves (2007), assessments actually increase learning effectiveness. So, A4Kids constantly evaluates learners to make sure they learn effectively. Quiz is used for such purpose. In detail, Do Quiz function is an evaluation case, which is used to evaluate the quality of A4Kids for teaching Arabic language. First, the learner presses on "Do Quiz" icon to display its details. A4Kids displays the main categories of quizzes; "Quiz Letters", "Quiz Words", "Quiz Number", and "Quiz Color". Then, the learner chooses one of those categories.

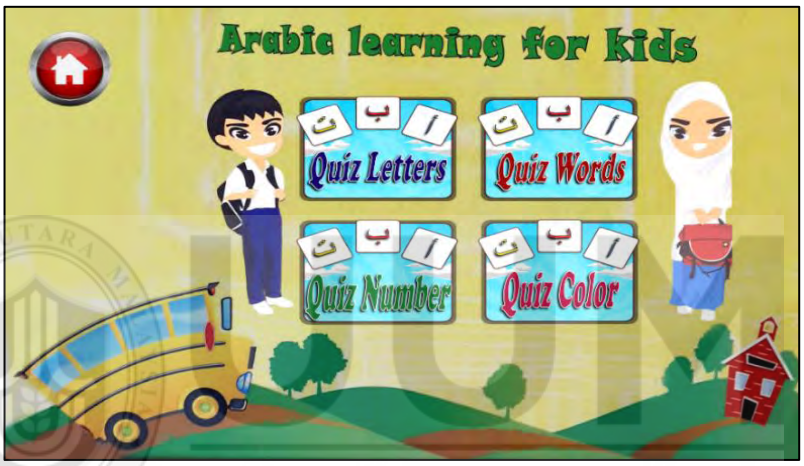

Figure 5.15: Do Quiz Interface

A4Kids shows the question of selected category. Later on, the learner chooses the correct answer for every question and the application responds to the answers through audio feedback. In addition, A4Kids displays three buttons to move among question.

Figure 5.16: Example of Do Quiz Interface

5.6.7 Play Game Function Interface

In this part, children learn the Arabic language through play game. The game is composed in such a way to motivate them to continue learning. Studies show that games are excellent in transferring knowledge (White & McCormack, 2006). In detail, Play Game starts by pressing on “Play Game” icon to display its details. The game is related to the Arabic alphabet letters. A4Kids displays the main page of the game, which consist of many squares that hide pictures. Then, the learner guesses similar picture and presses two blocks. Later, A4Kids shows the right selection of pictures. In the end, the learner can get back to the main interface from every interface by click on “Home” icon.

Figure 5.17: Play Game Interface

5.7 Summary

The present chapter begins with a focus on the A4Kids requirements. Each functional and non-functional requirements needs are summarized. It is then translated into UML diagrams. The prototype has been developed to support Malaysian students at primary schools who need to learn Arabic language. Hence, it has been defined by taking a screenshot photos. The evaluation of the A4Kids prototype will be discussed in the next chapter.

CHAPTER SIX

EVALUATION

6.1 Introduction

The present chapter explains the evaluation of the A4Kids prototype, which was the last objective of the current study. Evaluation is a tool to get more about the positive and the negative aspects of the product (Salim, 2009). Test cases were implemented to make sure that the functions of the prototype works as required. Moreover, usability test carried out, as described in Chapter 3, to find out the usability of A4Kids from the user's opinion and to evaluate the proposed guidelines that have been incorporated in a prototype (Nielsen, 1994). Then, the results of evaluate were discussed.

6.2 Procedure of Evaluation

The procedures for test cases and the usability test were carried out in this study. The next sections illustrates these procedures in detail.

6.2.1 Test Cases

Testing is a very important phase during the application development life cycle (Hussain, Jomhari, Kamal, & Mohamad, 2014). Each phase ends with the evaluation and verification to identify and remove all the errors occur in the phase. The main aim of testing is to identify and eliminate maximum errors in the system and to prepare and a test suite that contains. Usually errors occur in the system during different phases, therefore testing should be done in various levels to identify errors occurred during the various phases.

6.2.2 Usability Test

Appraising the usability is a key aspect as the actual test users are asked to use the product (Alhajj, 2012; Habeeb, 2009). The moderator assigns the test user predetermined test assignments one at a time. The user then executes the tasks through the user interface (Nielson, 2006). The test was conducted to make sure that children find the A4Kids application to be useful, easy to use, and easy to learn based on the requirements and design guidelines detailed in Chapters 4 and 5. Thus, the views were gathered through the teachers, using the questionnaire.

Questionnaire was performed on 30 Arabic language teachers from seven national primary schools (*Sekolah Kebangsaan Dato' Wan Kemara, Sekolah Kebangsaan Bandar Baru Bukit Kayu Hitam, Sekolah Kebangsaan Bandar Baru Sintok, Sekolah Kebangsaan (Felda) Bukit Tangga, Sekolah Kebangsaan (Felda) Laka Selatan, Sekolah Kebangsaan Bandar Baru Darulaman, and Sekolah Kebangsaan Jitra*) in Kedah, Malaysia, each of them was given a detailed explanation about A4Kids application.

6.3 Results of Evaluation

This part highlighted the results from the test cases and usability testing. Separate discussions are conducted about the results. Test cases results are described first, followed by the usability test results.

6.3.1 Result of Test Cases

To make sure that the users are not distracted by means of any technical mistakes which can have an effect on their experience, the functions were attempted one after the other within the A4Kids prototype. The primary aim of the test cases become to

obtain information on whether the A4Kids prototype exceeded or failed in term of functionality.

Table 6.1 explains the Link to Learn Letters test case. In this test case, user had tested the link to learn Letters on the main interface. After user clicked on Letters icon at the main interface, the application was redirected to the learn Letters interface and it shows a pictures of letters with three buttons. The learner can press on “Play” icon to play the audio of subject’s pronunciation in Arabic also can press on “Next” icon to go to next learning subject and on “Previous” icon to go back to previous learning subject. Result shows that the learn Letters interface was successfully executed when user clicked the Letters icon at the main interface and the test for link to learn Letters was passed.

The 2nd test case was Learn Words (as described in Table 6.2). This test was conducted as to test the application display the interface of Learn Words and all buttons inside it. When the learner clicks on Words icon at the main interface, the application shows a pictures of learning subject with the text in Arabic with three buttons. The user can click on “Play” icon to play the audio of subject’s pronunciation in Arabic also can press on “Next” icon to go to next learning subject and on “Previous” icon to go back to previous learning subject. The Learn Words interface was successfully executed when user clicked the Words icon at the main interface and the test for link to Learn Words was passed.

Table 6.3 illustrates the Link to Learn Numbers & Colors test case. In this test case, user had tested the link to Learn Numbers & Colors on the main interface. After user clicked on Numbers & Colors icon at the main interface, the application was redirected to the Learn Numbers & Colors interface and it shows a pictures of Numbers or Colors with three buttons. The learner can press on “Play” icon to play the audio of subject’s

pronunciation in Arabic also can press on “Next” icon to go to next learning subject and on “Previous” icon to go back to previous learning subject. Result shows that the Learn Numbers & Colors was successfully executed when user clicked the Numbers & Colors icon at the main interface and the test for link to Learn Numbers & Colors was passed.

The 4th test case was Learn Days & Months (as described in Table 6.4). This test was conducted as to test the application display the interface of Learn Days & Months and each buttons inside it. When the learner press on Days & Months icon at the home interface, the application displays a pictures of learning subject and the text in Arabic with three buttons. The application provides some buttons to switch among pictures and to play the pronunciation of appeared picture. The Learn Days & Months interface was successfully executed when user clicked the Days & Months icon at the main interface.

The 5th test case was about Link to Quiz (as shown in Table 6.5). The link to Quiz on the main interface was tested by user in this test. After user presses on the Quiz icon at the main interface, the application should redirect to the Quiz interface. The learner chooses answer and the application will play a voice message as a result of answer if the answer is correct or not. Result shows that the Quiz interface was successfully redirected when user presses on the Quiz icon at the main interface.

As shown in Table 6.6, the last test case was about Link to Play Games. The link to game on the main interface was tested by user in this test. After the learner clicks the game icon at the main interface, the application should redirect to the game interface. Result shows that the game interface was successfully redirected when user press on the game icon at the main interface and the test for link to play game was passed.

Table 6.1

Test Case 1: Learn Letters Functionality

<table>
<tr><td colspan="2">Test Case 1: Link to Learn Letters</td><td>Priority (H,L): High</td></tr>
<tr><td colspan="3">Test Objective: The application display the interface of learn letters.</td></tr>
<tr><td colspan="3">Test Description: This use case is the main function of application which provides interfaces for learning the Letter language.</td></tr>
<tr><td colspan="3">Requirements verified: Yes</td></tr>
<tr><td colspan="3">Test environment: Samsung Galaxy Note 4, Android 5.1 and Eclipse IDE</td></tr>
<tr><td colspan="3">Test step/Pre Condition:
1. The application shows the main interface which has the icons of main category for learning subject, as well as, Quiz and Game icons.
2. The learner chooses “Letter” category to learn its details.
3. The application shows the subcategories of selected category for learning, as well as, song icons.
4. The learner press on “Alphabet” icons.
5. The application shows a pictures of learning subject (letters) with the text in Arabic three buttons (Next, Previous, and Play).
6. The learner press on “Play” icon to play the audio of subject’s pronunciation in Arabic.
7. The application play the pronunciation sound of subject in the shown picture.
8. The learner press on “Next” icon to go to next learning subject.
9. The application show the next picture of selected category.
10. The learner press on “Previous” icon to go back to previous learning subject.
11. The application show the previous picture of selected category.</td></tr>
<tr><td colspan="2">Actions: The application shows a pictures of letters with three buttons. The learner press on “Play” icon to play the audio of subject’s pronunciation in Arabic.</td><td>Expected Results: The application display the interface of learn “Letters”.</td></tr>
<tr><td colspan="2">Pass: Yes</td><td>Fail: No</td></tr>
<tr><td colspan="3">Problem: Nil</td></tr>
<tr><td colspan="3">Notes: Successfully Executed</td></tr>
</table>

Table 6.2

Test Case 2: Learn Words Functionality

<table>
<tr><td colspan="2">Test Case 1: Learn Words</td><td>Priority (H,L): High</td></tr>
<tr><td colspan="3">Test Objective: The application display the interface of learn Words.</td></tr>
<tr><td colspan="3">Test Description: This use case deals with learning the Words in Arabic language</td></tr>
<tr><td colspan="3">Requirements verified: Yes</td></tr>
<tr><td colspan="3">Test environment: Samsung Galaxy Note 4, Android 5.1 and Eclipse IDE</td></tr>
<tr><td colspan="3">Test step/Pre Condition:
1. The application shows the main interface which has the icons of main category for learning subject, as well as, Quiz and Game icons.
2. The learner chooses “Words” category to learn its details.
3. The application shows the subcategories of “Words” for learning, as well as, song icons.
4. The learner press on one of subcategory icons.
5. The application shows a pictures of learning subject with the text in Arabic with three buttons (Next, Previous, and Play).
6. The learner press on “Play” icon to play the audio of subject’s pronunciation in Arabic.
7. The application play the pronunciation sound of subject in the shown picture.
8. The learner press on “Next” icon to go to next learning subject.
9. The application show the next picture of selected category.
10. The learner press on “Previous” icon to go back to previous learning subject.
11. The application show the previous picture of selected category.</td></tr>
<tr><td colspan="2">Actions: The application shows a pictures of learning subject with the text in Arabic with three buttons.</td><td>Expected Results: The application display the interface of learn Words.</td></tr>
<tr><td colspan="2">Pass: Yes</td><td>Fail: No</td></tr>
<tr><td colspan="3">Problem: Nil</td></tr>
<tr><td colspan="3">Notes: Successfully Executed</td></tr>
</table>

Table 6.3

Test Case 3: Learn Numbers & Colors Functionality

<table>
<tr><td colspan="2">Test Case 1: Learn Numbers & Colors</td><td>Priority (H,L): High</td></tr>
<tr><td colspan="3">Test Objective: The application display the interface of learn numbers & colors.</td></tr>
<tr><td colspan="3">Test Description: This use case deals with learning the numbers and colors in Arabic language</td></tr>
<tr><td colspan="3">Requirements verified: Yes</td></tr>
<tr><td colspan="3">Test environment: Samsung Galaxy Note 4, Android 5.1 and Eclipse IDE</td></tr>
<tr><td colspan="3">Test step/Pre Condition:
12. The application shows the main interface which has the icons of main category for learning subject, as well as, Quiz and Game icons.
13. The learner chooses “Numbers & Colors” category to learn its details.
14. The application shows the subcategories of “Numbers & Colors” for learning, as well as, song icons.
15. The learner press on one of subcategory icons.
16. The application shows a pictures of learning subject with the text in Arabic with three buttons (Next, Previous, and Play).
17. The learner press on “Play” icon to play the audio of subject’s pronunciation in Arabic.
18. The application play the pronunciation sound of subject in the shown picture.
19. The learner press on “Next” icon to go to next learning subject.
20. The application show the next picture of selected category.
21. The learner press on “Previous” icon to go back to previous learning subject.
22. The application show the previous picture of selected category.</td></tr>
<tr><td colspan="2">Actions: The application shows a pictures of learning subject with the text in Arabic with three buttons.</td><td>Expected Results: The application display the interface of learn numbers & colors.</td></tr>
<tr><td colspan="2">Pass: Yes</td><td>Fail: No</td></tr>
<tr><td colspan="3">Problem: Nil</td></tr>
<tr><td colspan="3">Notes: Successfully Executed</td></tr>
</table>

Table 6.4

Test Case 4: Learn Days & Months Functionality

<table>
<tr><td colspan="2">Test Case 1: Learn Days & Months</td><td>Priority (H,L): High</td></tr>
<tr><td colspan="3">Test Objective: The application display the interface of learn days and months.</td></tr>
<tr><td colspan="3">Test Description: This use case deals with learning the days and months in Arabic language</td></tr>
<tr><td colspan="3">Requirements verified: Yes</td></tr>
<tr><td colspan="3">Test environment: Samsung Galaxy Note 4, Android 5.1 and Eclipse IDE</td></tr>
<tr><td colspan="3">Test step/Pre Condition:
1. The application shows the main interface which has the icons of main category for learning subject, as well as, Quiz and Game icons.
2. The learner chooses “Days & Months” category to learn its details.
3. The application shows the subcategories of “Days & Months” for learning, as well as, song icons.
4. The learner press on one of subcategory icons.
5. The application shows a pictures of learning subject with the text in Arabic with three buttons (Next, Previous, and Play).
6. The learner press on “Play” icon to play the audio of subject’s pronunciation in Arabic.
7. The application play the pronunciation sound of subject in the shown picture.
8. The learner press on “Next” icon to go to next learning subject.
9. The application show the next picture of selected category.
10. The learner press on “Previous” icon to go back to previous learning subject.
11. The application show the previous picture of selected category.</td></tr>
<tr><td colspan="2">Actions: The application shows a pictures of learning subject with the text in Arabic with three buttons.</td><td>Expected Results: The application display the interface of learn days of week and months of year.</td></tr>
<tr><td colspan="2">Pass: Yes</td><td>Fail: No</td></tr>
<tr><td colspan="3">Problem: Nil</td></tr>
<tr><td colspan="3">Notes: Successfully Executed</td></tr>
</table>

Table 6.5

Test Case 5: Do Quiz Functionality

<table>
<tr><td colspan="2">Test Case 1: Do Quiz</td><td>Priority (H,L): High</td></tr>
<tr><td colspan="3">Test Objective: Learner make a quiz.</td></tr>
<tr><td colspan="3">Test Description: It is an evaluation function for the performance and quality of this application .It shows a picture with three options of answers.</td></tr>
<tr><td colspan="3">Requirements verified: Yes</td></tr>
<tr><td colspan="3">Test environment: Samsung Galaxy Note 4, Android 5.1 and Eclipse IDE</td></tr>
<tr><td colspan="3">Test step/Pre Condition:
1. The application shows the main interface which has the icons of main category for learning subject, as well as, Quiz and Game icons.
2. The learner press on “Quiz” icon to do it.
3. The application display the picture with answers options for every question.
4. The learner chooses one option as his/her answer.
5. The application shows result voice message if the answer is correct or not.
6. The learner press on “Next” icon to go to next question.
7. The application shows the next picture.
8. The learner press on “Previous” icon to go back to previous question.
9. The application shows the previous picture.
10. The learner press on “Home” icon to go back to main interface of application.
11. The application shows the home page.</td></tr>
<tr><td colspan="2">Actions: The learner chooses his/her answer and the application will play a voice message as a result of answer if the answer is correct or not.</td><td>Expected Results: A new Quiz has been made and the child has done it</td></tr>
<tr><td colspan="2">Pass: Yes</td><td>Fail: No</td></tr>
<tr><td colspan="3">Problem: Nil</td></tr>
<tr><td colspan="3">Notes: Successfully Executed</td></tr>
</table>

Table 6.6

Test Case 6: Play Game Functionality

Test Case 1: Play Game	**Priority (H,L):** High
Test Objective: The application display the interface of play game.	
Test Description: This function used for playing an educational game for learning aim. It consist of multiple squares which hide a pictures.	
Requirements verified: Yes	
Test environment: Samsung Galaxy Note 4, Android 5.1 and Eclipse IDE	
Test step/Pre Condition: 1. The application shows the main interface which has the icons of main category for learning subject, as well as, Quiz and Game icons. 2. The learner press on "Game" icon to play it. 3. The application display the game page which consist of many array of squares hide a pictures. 4. The learner press on two hidden picture to match them. 5. The application checks the selected pictures are same or not. 6. The application shows the selected pictures. 7. The learner press on "Home" icon to go back to main interface of application. 8. The application shows the home page.	
Actions: The learner guess the two pictures and the application show them in case of the two pictures are same.	**Expected Results:** The application display the interface of play game.
Pass: Yes	**Fail:** No
Problem: Nil	
Notes: Successfully Executed	

As a summary, the results of test cases (as shown in tables above) indicate that, all links for every function were properly working, and teachers as well as children were able to implement the tasks. This proves that all functionalities in the application perform as required, supporting users' tasks very well.

6.3.2 Results of Usability Test

The perceptions were gathered from teachers through utilizing the questionnaire method. The general section works as a mechanism to collect respondents' profile included gender, age and years of teaching experience at primary schools.

The user evaluation section is divided into three parts. First part is for the measurement of perceived usefulness, while the second part for the measurement of perceived ease of use, followed by the last part for the measurement of learnability. The questionnaire didn't include any names so there is not possible to relate the questionnaires to each of the teachers. The current study was utilizes SPSS version 20 software to perform the descriptive statistics analysis to analyze the data that has been collected.

A. Respondent Profile

Respondent profile refers to general information about the respondents such as, gender, age, and years of teaching experience at primary schools. A total of 30 Arabic language teachers from seven different government primary schools in Kedah, Malaysia, were participated in current study:

1. Sekolah Kebangsaan Dato' Wan Kemara.
2. Sekolah Kebangsaan Bandar Baru Bukit Kayu Hitam.
3. Sekolah Kebangsaan Bandar Baru Sintok.
4. Sekolah Kebangsaan (Felda) Bukit Tangga.
5. Sekolah Kebangsaan (Felda) Laka Selatan.

6. Sekolah Kebangsaan Bandar Baru Darulaman.
7. Sekolah Kebangsaan Jitra.

Table 6.7 and Figure 6.1 represents the percentage of the gender of the respondents. Eleven of the respondents (36.7%) are male, whereas nineteen (63.3%) of them are female.

Table 6.7

Gender of Participants

Gender	Frequency	Percent
Male	11	36.7%
Female	19	63.3%
Total	**30**	**100%**

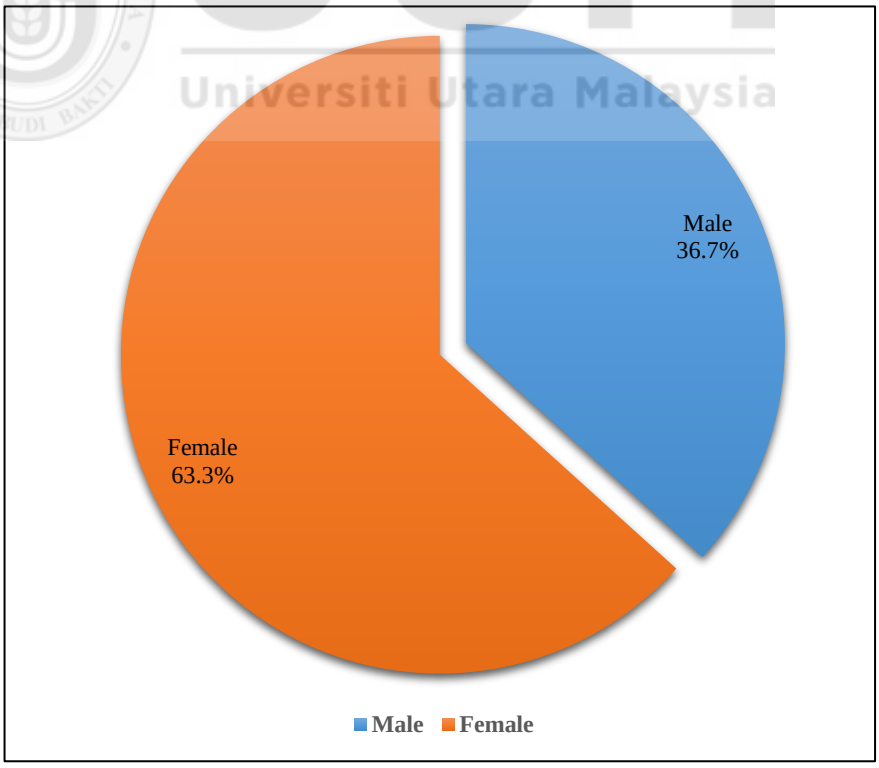

Figure 6.1: Gender of Participants

Table 6.8, represents the percentage of the age range of the respondents. Figure 6.2, illustrates that 43.3% of respondents (13) were between the ages of 37-45 years old, while 33.3% (10) participants in the 29-36 age range, followed by 16.7% (5) that are more 45 years old, whereas the least percentage reached 6.7% (2) which included teachers that aged between 22-28 years old.

Table 6.8

Age Group

Age Group	Frequency	Percent
22-28	2	6.7%
29-36	10	33.3%
37-45	13	43.3%
Above 45	5	16.7%
Total	**30**	**100%**

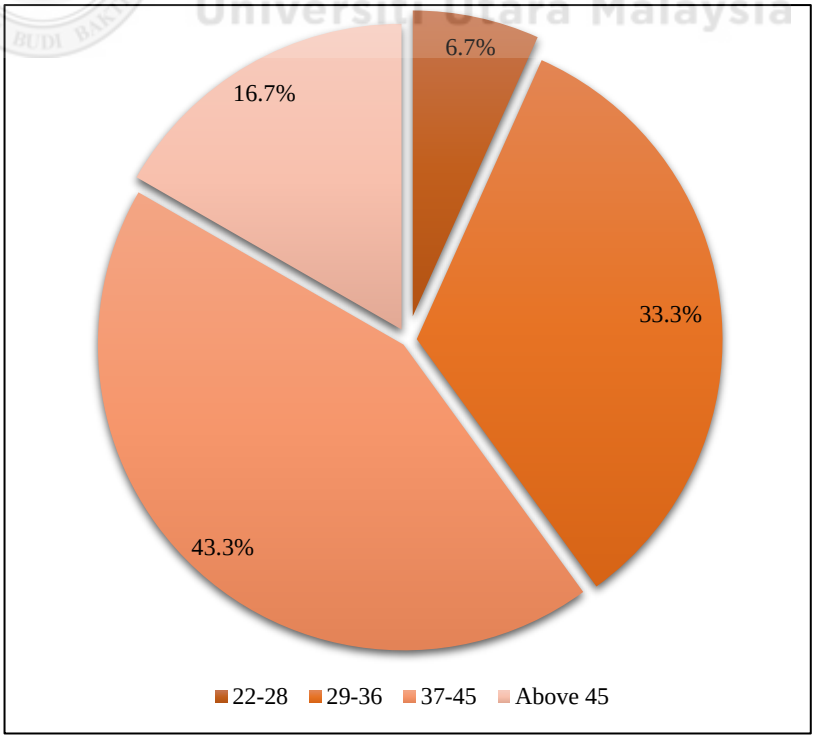

Figure 6.2: The age group of participants

As far as the experience years of the participants in teaching the children at primary school, as shown in the Table 6.9 and Figure 6.3 below, the highest percentage for the experience is 53.3% (16) for teachers who have teaching experience more than ten years, followed by 33.3% (10) of teachers that have experience between 5-10 years. On the other hand, four teachers that have lowest percentage amounted 13.3% that have experience between 2 to 5 years.

Table 6.9

Years of experience in teaching

Years of experience in teaching	Frequency	Percent
2-5 Years	4	13.3%
5-10 Years	10	33.3%
More than 10 Years	16	53.3%
Total	**30**	**100%**

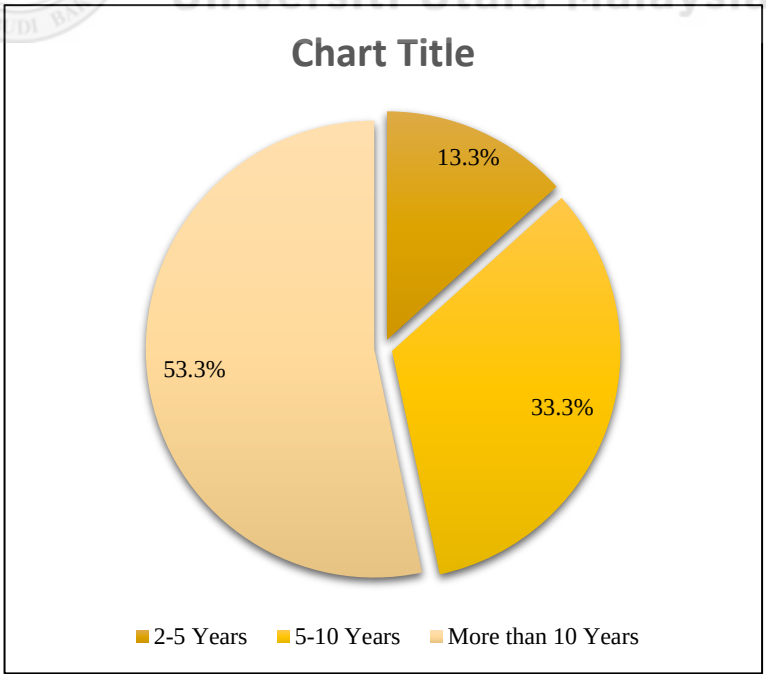

Figure 6.3: Years of experience in teaching

B. Perceive Usefulness

The second part of the questionnaire asks how much subjects perceived A4Kids as being useful. Tables 6.10 consists of four columns; the first column contains the seven questions of usefulness section. The next column represents the number of participants who answered these questions, so it is easy to note that each question was answered by all participants. The third refers to the Mean of the values answers while the last column is the Standard Deviation. In other words, the next table shows the descriptive statistics for usefulness factors. Statistics, like Standard Deviation and Mean, are utilized in the present research. Furthermore, the Standard Deviation and Mean results for every question were reviewed and investigated.

The results appear that everyone questions had a high Mean score that was near or bigger than four. Moreover, Standard Deviations were nearly one. These scores highlight the respondents' feedback obtained from the data collected through the questionnaires. Therefore, all statements regarding the A4Kids application in the questionnaire were approved by the subjects with a very small bias or a limited influence of other factors. Table 6.9 shows descriptive usefulness.

Table 6.10

Descriptive Statistics (Usefulness)

Measure	No. of Participants	Mean	Std. Deviation
Usefulness Q1	30	4.03	.809
Usefulness Q2	30	3.97	.928
Usefulness Q3	30	3.73	.868
Usefulness Q4	30	3.80	.961

Usefulness Q5	30	4.03	.850
Usefulness Q6	30	3.80	.961
Usefulness Q7	30	4.20	.714
Valid N (listwise)	30		

C. Perceived Ease of Use

Table 6.11 below shows the descriptive statistics for Ease of Use measure which is consists of seven questions, the answers of participant in the present study about Ease of Use, shows that majority answered ranged from agree and strongly agree for this statement, with a Standard Deviation score of SD=.890 and a Mean score of M=4.03. On the other hand, some respondents felt uncomfortable when using the application (SD= .884 and M=3.67).

Table 6.11

Descriptive Statistics (Ease of Use)

Measure	No. of Participants	Mean	Std. Deviation
Ease of Use Q8	30	3.97	.928
Ease of Use Q9	30	4.00	.947
Ease of Use Q10	30	3.67	.884
Ease of Use Q11	30	3.70	.952
Ease of Use Q12	30	4.03	.890
Ease of Use Q13	30	3.93	.907
Ease of Use Q14	30	3.90	.960
Valid N (listwise)	30		

D. Perceived of Learnability

The next table shows descriptive learnability which consists of nine questions. The answers of participant in the present study about learnability shows that majority answered ranged from agree and strongly agree for this statement. Standard Deviation score of SD=.691 and a Mean score of M=4.27. At the same time, some respondents felt discomfort when using the A4Kids (SD= .844 and M=3.67).

Table 6.12

Descriptive Statistics (Learnability)

Measure	No. of Participants	Mean	Std. Deviation
Learnability Q15	30	4.00	.910
Learnability Q16	30	4.27	.691
Learnability Q17	30	3.93	.868
Learnability Q18	30	4.20	.805
Learnability Q19	30	3.80	.961
Learnability Q20	30	3.67	.844
Learnability Q21	30	4.17	.747
Learnability Q22	30	3.97	.850
Learnability Q23	30	4.07	.740
Valid N (listwise)	30		

Descriptive of all Usability

Table 6.13 describes the number of the respondents, the Mean and the Standard Deviation for all different usability. The total questions were 23.

Table 6.13

Descriptive Statistics of all usability

Measure	No. of participants	Mean	Std. Deviation
Usefulness Q1	30	4.03	.809
Usefulness Q2	30	3.97	.928
Usefulness Q3	30	3.73	.868
Usefulness Q4	30	3.80	.961
Usefulness Q5	30	4.03	.850
Usefulness Q6	30	3.80	.961
Usefulness Q7	30	4.20	.714
Ease of Use Q8	30	3.97	.928
Ease of Use Q9	30	4.00	.947
Ease of Use Q10	30	3.67	.884
Ease of Use Q11	30	3.70	.952
Ease of Use Q12	30	4.03	.890
Ease of Use Q13	30	3.93	.907
Ease of Use Q14	30	3.90	.960
Learnability Q15	30	4.00	.910
Learnability Q16	30	4.27	.691
Learnability Q17	30	3.93	.868
Learnability Q18	30	4.20	.805
Learnability Q19	30	3.80	.961
Learnability Q20	30	3.67	.844
Learnability Q21	30	4.17	.747
Learnability Q22	30	3.97	.850
Learnability Q23	30	4.07	.740
Valid N (listwise)	30		

6.3.3 Reliability Analysis

Cronbach's Alpha, based on standardised items, was utilised to gauge the dependability scale of the system's usefulness. A higher Alpha indicates greater reliability (Chong, 2001). Although there is no typical cut-off, a 0.7 and higher score means the reliability is good. With regards to (Hair, Tatham, Anderson, & Black, 2006), it is quite reliable (alpha is more than 0.7).

A. Reliability for Usefulness

As per Table 6.14, the Cronbach's alpha for seven items is .804, i.e. greater than 0.7. Hence, all items are accepted during the current research.

Table 6.14

Reliability Statistics Usefulness

Cronbach's Alpha	Number of Items
.804	7

B. Reliability for Ease of Use

Table 6.15 presents the reliability aspects for ease to use in the A4Kids application. The measurement carried out 7 items and the acquired end result was .816. As a result, these measures satisfy the internal reliability criterion.

Table 6.15

Reliability Statistics Ease of Use

Cronbach's Alpha	Number of Items
.816	7

C. Reliability for Learnability

The findings of the reliability check in Table 6.16 show that the Cronbach's alpha for 9 items is .826, that is larger than 0.7. Thus, the complete items are accepted during the current research.

Table 6.16

Reliability Statistics Learnability

Cronbach's Alpha	Number of Items
.826	9

6.4 Discussion

Based on the results, the guidelines for design mobile multimedia application for learn Arabic language which have been developed with predetermined scope, has been successfully utilized and accepted in the teaching and learning process among students at primary schools. It is without a doubt that teaching and learning can bring more values and be more meaningful when subjects are given the opportunity to engage in activities that require them to explore and experience a variety of exhilarating and stimulating exercises. This is proven by the responses on the questionnaire, most of the responders' answers (above 80%) has been in the range of Strongly Agree and Agree. Therefore, the proposed application was accepted by teachers and can be relied upon as a support tool in the classroom.

6.5 Summary

In current chapter, the data of the teacher's evaluation of the prototype was analysed. It summarized and described the user's perspective towards A4Kids. Perceived Usefulness, Perceived Ease of Use and Learnability have been used to evaluate the

prototype application. The prototype was reformed before the respondents test the prototype application. After that, a questionnaires were given to get their feedbacks regarding the prototype application. The conclusion of present study and recommendations for future research will be discussed in the next chapter.

CHAPTER SEVEN

CONCLUSION AND RECOMMENDATION

7.1 Introduction

This chapter describes about the study by summarizing and reviewing the finding and results, objectives achievement, limitations and future works of the current research. This study goes a long way about design, develop, and evaluate mobile multimedia application based on a scientific requirements for learn Arabic language in a simplified way in order to work on mobile devices and ensure the children could acquire Arabic language easily. In details, this research was initiated investigation by using multiple fact finding techniques, which are interviews and review of related literatures. The preliminary analysis involves interviews with expert teachers have teaching the Arabic subject for more than ten years at primary schools. On the other hand, review of related literatures has been implemented. During the literatures review stage, information, ideas, problems, and issues relevant to the current study has been gathered. The information was focused on the issues in using technology as supportive tools, teaching methods, and topics should be focused.

The findings would achieve the objective of this study, which is develop a design guideline for mobile learning application based on Cognitive Theory of Multimedia Learning CTML for primary school-age children. Then, a prototype was developed by using Adobe Photoshop CC, Java programming language environment and Eclipse tool. After that, A4Kids prototype application was tested involving real users by using test cases and usability test. The satisfactory results were appeared after testing and evaluating the prototype.

7.2 Objectives Achievement

Research Objective 1: To obtain the design requirements for mobile learning application targeting children based on Cognitive Theory of Multimedia Learning.

In achieving the first objective, appropriate requirements and guidelines were obtained by two ways. Firstly, three interviews has been conducted with expert teachers from three government primary schools in Kedah, Malaysia. Secondly, reviewing of the literature from various sources like journals, textbooks, thesis and articles that are related to the subject of this study to identify how to develop appropriate application for children at primary schools and to recognize the important requirements and components that should be focused when designing mobile multimedia application for learning Arabic language for children.

Research Objective 2: To develop mobile application for learning Arabic language based on the design requirements obtained.

The second objective is to design and develop the application. The methodology that is adapted on the design is proposed by Peffers, Gengler, and Tuunanen (2003). This methodology had four main phases: Conceptual Study, Data Collection and Analysis, Development, Evaluation. The A4Kids Application's design has been outlined based on the design requirements proposed that were compiled from Chapter 4. In addition Chapter 5 described the requirements model of this study that consists of the requirements that shows how the system will function in term of the functional and non-functional requirements.

The requirements also consists of use case diagram which described the basic functions and activities that will be performed by the user of the application. There are also the sequence diagrams in the requirements model that illustrated the objects that

participate in the use cases and the messages pass between them over time for each use case, while class diagrams are used to show the classes and the relationship among the classes that remain constant in the application over time. Finally, the activity diagrams are used to model both computational and organizational processes. After the design has been finalized, a working prototype translation was created and explained in detail in Chapter 5.

Research Objective 3: To evaluate the proposed mobile application for learning Arabic language.

The last objective in current study is to evaluate the prototype application. This prototype was used for the testing and evaluation process where the respondents can test and use the prototype application. Chapter 6 gave details about the evaluation process. The feedback from respondents are evaluated by using the Perceived Usefulness, Ease of Use and Learnability. The results of evaluation for Perceived Usefulness, Ease of Use and Learnability were .804, .816 and .826, respectively, which were in the range of Strongly Agree and Agree. The result of evaluation confirms that application is learnable, easy to use and useful for children and it is capable to help them to learn Arabic language easily, directly and successfully regardless of location and time.

7.3 Discussion

The results that achieved by this study are the proposed guidelines for design mobile multimedia application for learn Arabic language. Moreover, the A4Kids application was designed and implemented specifically for children aged between 7 and 9 years at the same time it is appropriate for most of students at primary schools in Malaysia. Based on the results of the questionnaire, the proposed guidelines has been

successfully used and accepted in the teaching and learning process among students at primary schools. This is proven by responders' answers which were in the range of Strongly Agree and Agree. A4Kids application is distinguish by the following characteristics:

1. The A4Kids application allows children to learn Arabic alphabets, Arabic vocabularies including days of week, months of year, colors, and numbers. It helps them to memorize and learn it.
2. The second feature of this application is provides the children the correct way to learn writing and pronunciation Arabic alphabets and vocabularies.
3. The third feature of this application is that supports of several of interactions for the children such as can listen to the educational song, do quizzes, playing game and etc.
4. The fourth feature is the application allows for children to learn Arabic language without the need to participate in face to face learning in the school.

7.4 Limitation and Future Works

Every study has problems and limitations (Xiao & Dasgupta, 2002), and this study is no exception. According to the results of the user evaluation on the A4kids application, it has achieved the objectives. Even though this study has made a lot of effort to develop a perfect application of Arabic language learning for children at primary schools, still there are few recommendations and suggestions that need to be considered for the future development:

1. The research range is confined as it only addressed primary schools in the state of Kedah. Further studies have to be made to include more primary schools in other states in Malaysia.

Moreover, there are several limitation in developing the education mobile application for example:

2. The current mobile application is only applicable to Android phones such as: Samsung, Sony Ericsson and Motorola in version 5.1 and above. For user that use Android phone lower version than 5.1 may be it did not work as required.
3. The content of the mobile application limited for children at primary schools. Thus, further developments have to be made to cover other ages of people.

For future work regarding the prototype application, the researcher recommend that the version of the application is applicable to all version of mobile phone whether in Android phone or iPhone. Besides that, the application also need to be kept up to date with the current issue. As for the current application, it focus only on learning Arabic language for students at primary schools. Maybe in future, the scope for learning can cover more range. In addition, the A4Kids application focused to learn Arabic language to help the children be able to read and write it. Thus, the next step is to help children how to understand the meaning of the words and sentences by Arabic language especially when they read the Quran.

The function in the present application also need to be added so that the learning process can be more interactive and attractive hence grab the attention of the user. For example the Game part need to be upgraded so that the variety mode of the games can be increased. The level of difficulty can be added in the games module so that the knowledge of the user can really be challenged level by level. If the games is too easy, then the user will get bored and will not play it again or recommend it to their acquaintance.

7.5 Summary

With wide spread use of mobile devices no one can deny the importance of the mobile technology which has become the backbone of our society. We must make the uses of the mobile technology to be more area because it makes everything easy and fast to be done. Overall, this study has achieved the research objectives which are, proposed guidelines to develop mobile multimedia application for learn Arabic language based on a scientific requirements to provide mobile learning in Arabic language in Malaysia. In conclusion, based on the research findings, it indicates that the proposed application for learning Arabic language was accepted by teachers so that it can be adopted as a support tool in the classroom.

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APPENDIX A

Interviews with Experienced Teachers

COLLEGE OF ARTS AND SCIENCE

UNIVERSITI UTARA MALAYSIA

MODELING A MOBILE ARABIC LEARNING APPLICATION FOR CHILDREN

The question for interview that related to the respondents' experience in primary school children education and usage of technology as a support tool in enhance their skill in learning Arabic language.

Teachers' signatures

Saliana binti Othman 18/11/2015

ROSHADAH BINTI YAAKUB 18/11/2015

Nurul Huda bt Husain - 18/11/15

NOR AZZUWAL BT KILA - 18/11/15

COLLEGE OF ARTS AND SCIENCE

UNIVERSITI UTARA MALAYSIA

MODELING A MOBILE ARABIC LEARNING APPLICATION FOR CHILDREN

The question for interview that related to the respondents' experience in primary school children education and usage of technology as a support tool in enhance their skill in learning Arabic language.

Teachers' signatures

HAMZAH ISMAIL

ZURAIDA ZAKARIA

Sekolah Kebangsaan Laka Selatan
06010
Changlun
Kedah

COLLEGE OF ARTS AND SCIENCE
UNIVERSITI UTARA MALAYSIA

MODELING A MOBILE ARABIC LEARNING APPLICATION FOR CHILDREN

The question for interview that related to the respondents' experience in primary school children education and usage of technology as a support tool in enhance their skill in learning Arabic language.

Teachers' signatures

SURAYYA HANIM BT AHMAD PAKRI
NOOR HAFIZA BT AHMAD
NORHAYATI BT SUBIN

SEK KEB BANDAR BUKIT KAYU HITAM
06050
BUKIT KAYU
HITAM

Interview Questions

Q1. How long have you been in the primary school education sector?

Q2. What is the range age of children attending your class?

Q3. Do you think that parents are concerned about teaching their children the Arabic language? Why?

Q4. What is the current strategies and methods to teach your students Arabic letters and vocabulary?

Q5. Could the students which you dealt with them distinguish Arabic letters? Why?

Q6. What are the children's characteristics and the activities that enjoy them in your class?

Q7. How can technology help children in early literacy development in primary school?

Q8. Are you in favor of using new technologies available to educate and entertain children?

Q9. What are the important features or contents which you would like to see more employed in applications targeting children?

Q10. In your opinion, what especially makes an application fun for children at primary schools?

Q11. Are there special usability considerations when designing Interfaces for Malaysian children?

APPENDIX B

Usability Study (Questionnaire)

COLLEGE OF ARTS AND SCIENCE

UNIVERSITI UTARA MALAYSIA

Research Questionnaire

A4Kids Application for Children

I am Mohammed A. Neamah a final semester student at University Utara Malaysia doing MSc in Information Technology (MSc.IT). I am conducting this study to understand your experience when using Arabic for Kids Mobile Application (A4Kids). This questionnaire is very simple and will take only a few minutes. I request your kind assistance and valuable time to complete this questionnaire, as it will be very important to complete my study.

All your information will be held in strictest confidence and it will be used only for this study. Your participation and assistance in making this study successful is highly appreciated. If you have any queries or if you like to know the result of this study, please do contact me at 014-9719832 or through my e-mail mohammed_8690@yahoo.com.Thank you very much for your valuable time and assistance in complete this Questionnaire.

MSc. IT Candidate

Mohammed Abbas Neamah

Research Questionnaire

Note: Please answer all questions

Section 1: Demographic Profile

This part is about your background information. Please mark [√] where appropriate.

1. Please indicate your gender

☐ Male ☐ Female

2. Please indicate your age group

☐ 22-28 ☐ 29-36

☐ 37-45 ☐ Above 45

3. Years of experience in teaching Arabic language

☐ Less than 2 years ☐ 2- 5 years

☐ 5-10 years ☐ More than 10 years

Section 2: Usefulness

Please rate the usefulness of (A4Kids) by ticking appropriate boxes.

No.	Questions	Evaluation Rate				
PERCEIVED USEFULNESS		Strongly Disagree -1-	Disagree -2-	Neutral -3-	Agree -4-	Strongly Agree -5-
Q1	Using (A4Kids) in my job would increase my productivity					
Q2	Using (A4Kids) would improve my job performance					
Q3	(A4Kids) does everything I would expect it to do.					
Q4	Using (A4Kids) would enhance my effectiveness on the job.					
Q5	Using (A4Kids) would make it easier to do my tasks.					
Q6	I would find (A4Kids) useful in my job.					
Q7	It is useful.					

Section 3: Ease of Use

Please rate the ease to use of (A4Kids) by ticking appropriate boxes.

No.	Questions	Evaluation Rate				
PERCEIVED EASE TO USE		Strongly Disagree -1-	Disagree -2-	Neutral -3-	Agree -4-	Strongly Agree -5-
Q8	I learned to use (A4Kids) quickly.					
Q9	(A4Kids) is easy to use.					
Q10	I quickly became skillful with (A4Kids).					
Q11	(A4Kids) requires the fewest steps to find the specific phrase.					
Q12	(A4Kids) is easy to remember on how to use it.					
Q13	I can use (A4Kids) successfully every time and anywhere.					
Q14	(A4Kids) avoid me from doing mistake.					
Q15	(A4Kids) is user friendly.					
Q16	(A4Kids) is simple to use.					

Section 4: Learnability

Please rate the Learnability of (A4Kids) by ticking appropriate boxes.

No.	Questions	Evaluation Rate				
PERCEIVED LEARNABILITY		Strongly Disagree -1-	Disagree -2-	Neutral -3-	Agree -4-	Strongly Agree -5-
Q17	It was easy to learn to use (A4Kids).					
Q18	The information provided by (A4Kids) was easy to understand.					
Q19	The information provided in (A4Kids) helped me in teaching process.					
Q20	The grouping of menu options logical.					
Q21	Data grouping is reasonable for easy teaching.					
Q22	The ordering of information is logical.					
Q23	The command names are meaningful.					
Q24	It provides clarity of wording.					
Q25	It provides no-penalty teaching.					

Thank You for Your Time and Assistance

UNIVERSITI UTARA MALAYSIA

College of Arts and Science

School of Computing

Research Questionnaire

A4Kids Application for Children

I am Mohammed A. Neamah an MSc in Information Technology (IT), final semester student at University Utara Malaysia. I am conducting this questionnaire to help me of gain an understanding of the user who will use Arabic for Kids Mobile Application (A4Kids). I request your kind assistance and valuable time to complete this questionnaire, as it will be very important to complete my study. Please take a few minutes to complete the questionnaire.

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MSc. IT Candidate

Mohammed A. Neamah

1

UNIVERSITI UTARA MALAYSIA

College of Arts and Science

School of Computing

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SEK. KEB. DATO' WAN KEMARA 06010 CHANGLUN KEDAH

MSc. IT Candidate

Mohammed A. Neamah

UNIVERSITI UTARA MALAYSIA

College of Arts and Science

School of Computing

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School of Computing

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Thank you very much for your valuable time and assistance in complete this Questionnaire.

MSc. IT Candidate

Mohammed A. Neamah

SEK. KEB. BANDAR BUKIT KAYU HITAM 06050 BUKIT KAYU HITAM

UNIVERSITI UTARA MALAYSIA

College of Arts and Science

School of Computing

Research Questionnaire

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Thank you very much for your valuable time and assistance in complete this Questionnaire.

SEKOLAH KEBANGSAAN BANDAR BARU SINTOK

MSc. IT Candidate

Mohammed A. Neamah

1

UNIVERSITI UTARA MALAYSIA

College of Arts and Science

School of Computing

Research Questionnaire

A4Kids Application for Children

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Thank you very much for your valuable time and assistance in complete this Questionnaire.

MSc. IT Candidate

Mohammed A. Neamah

1

APPENDIX C

Interfaces in Malay Language

Figure 1: Main interface of A4Kids

Figure 2: Learn Letter Interface

Figure 3: Learn Words Interface

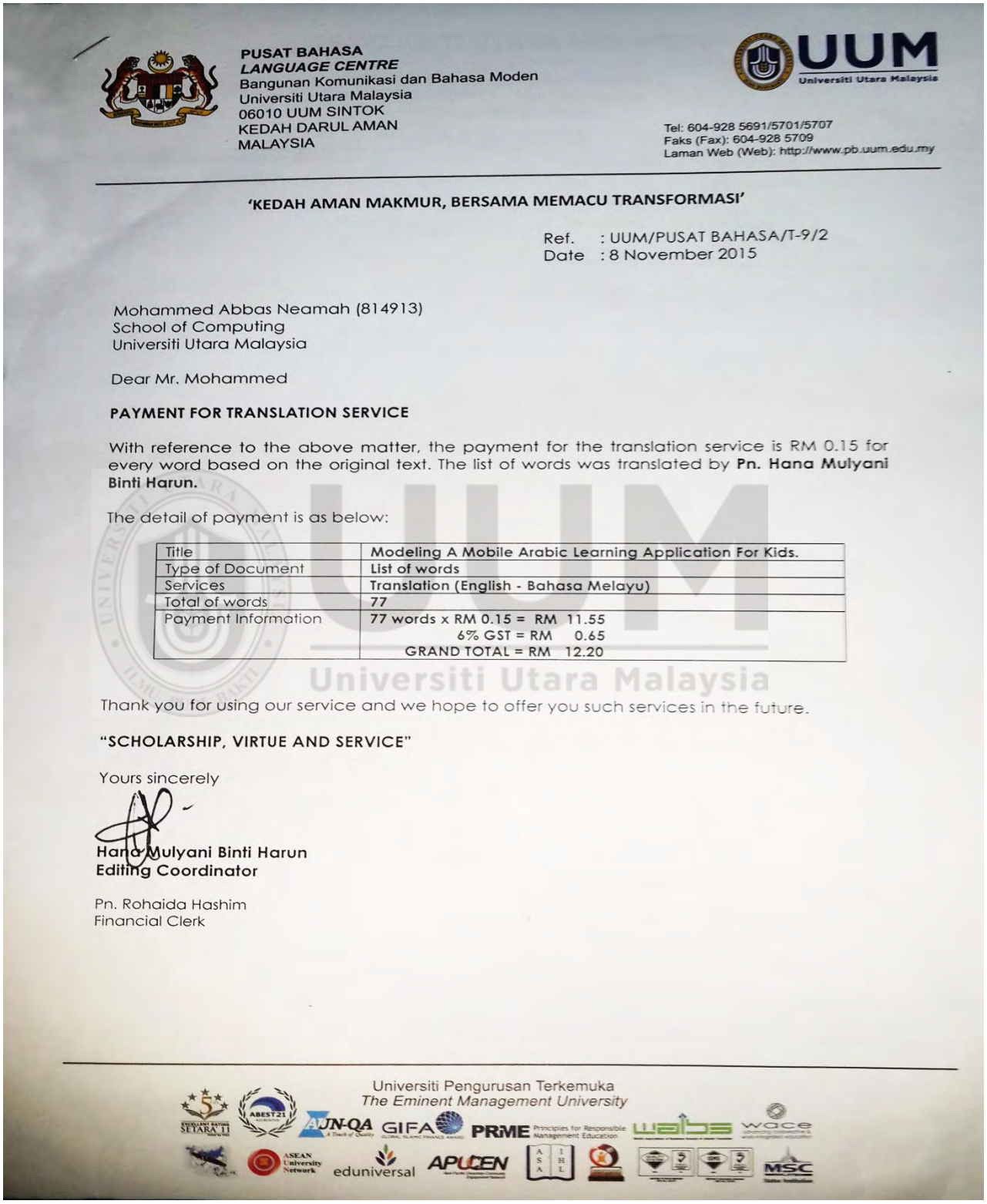
Figure 4: Learn Numbers & Colors Interface

Figure 5: Learn Days & Months Interface

Figure 6: Do Quiz Interface

APPENDIX D

Translation of Application Words (English – Malay Language)



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Universiti Utara Malaysia
06010 UUM SINTOK
KEDAH DARUL AMAN
MALAYSIA

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Tel: 604-928 5691/5701/5707
Faks (Fax): 604-928 5709
Laman Web (Web): http://www.pb.uum.edu.my

'KEDAH AMAN MAKMUR, BERSAMA MEMACU TRANSFORMASI'

Ref. : UUM/PUSAT BAHASA/T-9/2
Date : 8 November 2015

Mohammed Abbas Neamah (814913)
School of Computing
Universiti Utara Malaysia

Dear Mr. Mohammed

PAYMENT FOR TRANSLATION SERVICE

With reference to the above matter, the payment for the translation service is RM 0.15 for every word based on the original text. The list of words was translated by **Pn. Hana Mulyani Binti Harun.**

The detail of payment is as below:

Title	Modeling A Mobile Arabic Learning Application For Kids.
Type of Document	List of words
Services	Translation (English - Bahasa Melayu)
Total of words	77
Payment Information	77 words x RM 0.15 = RM 11.55 6% GST = RM 0.65 GRAND TOTAL = RM 12.20

Thank you for using our service and we hope to offer you such services in the future.

"SCHOLARSHIP, VIRTUE AND SERVICE"

Yours sincerely

Hana Mulyani Binti Harun
Editing Coordinator

Pn. Rohaida Hashim
Financial Clerk

APPENDIX E

5.3.2 Use Cases Specification

This part exhibits the specifics of each use case like characteristics of use case, description of cases, pre-condition flow of events, post-condition, constraint sequentially and rules of use case.

5.3.3 LEARN LETTER (A4Kids_1)

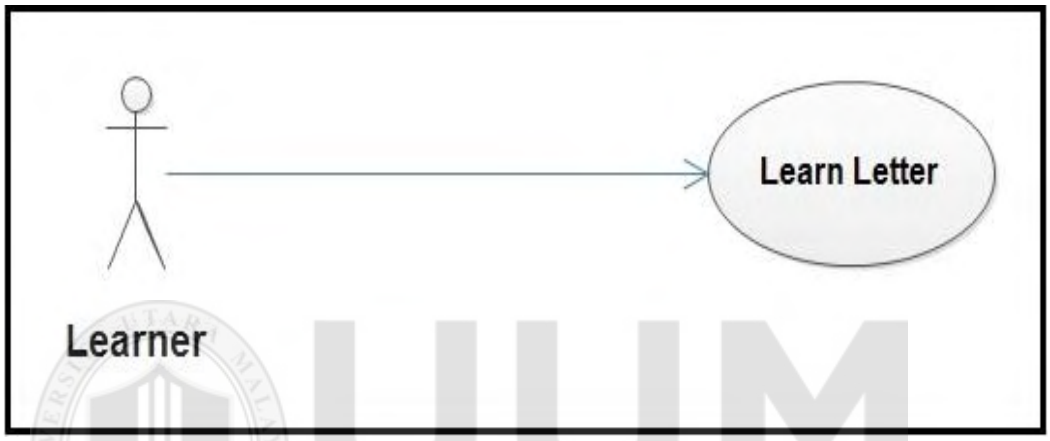

Figure 7: Use Case Diagram for Learn letter.

i. Brief Description

This use case is the main function of application which provides interfaces for learn the Arabic alphabet. There are many categories of learning letters such as Alphabet, Writing, and Song. It offers a pictures and sounds for learning.

ii. Pre-condition

The learner presses on “Letters” icon and selected his/her presenting language.

iii. Characteristic of Activation

The learner presses on “Letters” icon and chooses a specific category for learning.

iv. Flow of Events

a) Basic Flow

1. The application shows the main interface which has the icons of main category for learning subject, as well as, Quiz and Game icons.
2. The learner chooses “Letters” category to learn it is details.
3. The application shows the subcategories of selected category for learning, as well as, Song icon.
4. The learner press on “Alphabet” icons.
5. The application shows a pictures of teach subject (Letters) with three buttons (Next, Previous, and Play).
6. The learner press on “Play” icon to play the audio of subject’s pronunciation in Arabic.
7. The application play the pronunciation sound of subject in the shown picture.
8. The learner press on “Next” icon to go to next learning subject.
9. The application show the next picture of selected category.
10. The learner press on “Previous” icon to go back to previous learning subject.
11. The application show the previous picture of selected category.
12. The learner press on “Home” icon to go back to main interface of application.
13. The application show the main interface of application.

b) Exceptional Flow

Not Applicable.

v. Post-condition

The actor learns the letters of Arabic language.

vi. Rules

Does not apply.

vii. Constraints

Does not apply.

5.3.4 LEARN WORDS (A4Kids_2)

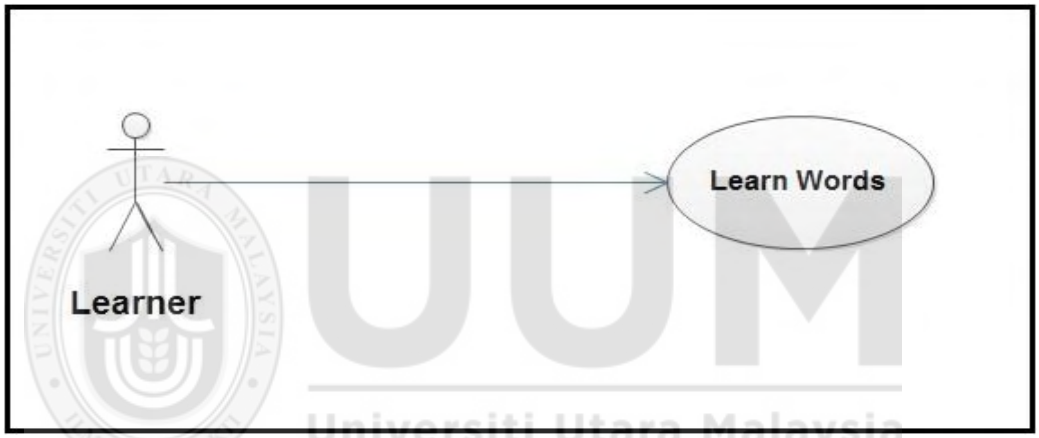

Figure 8: Use case Diagram for Learn Words

i. Brief Description

This use case provides interfaces for learning many Arabic vocabulary. There are many categories of learning such as Fruits, Classroom, Clothes, Transport, and Song. Also it is offers images and sounds for learning.

ii. Pre-condition

The learner presses on "Words" icon and selected his/her presenting language.

iii. Characteristic of Activation

The learner presses on "Words" icon and chooses a specific category for learning.

iv. Flow of Events

a) Basic Flow

1. The application shows the main interface which has the icons of main category for learning subject, as well as, Quiz and Game icon.
2. The learner chooses “Words” category to learn its details.
3. The application shows the subcategories of “Words” for learning, in addition to Song icon.
4. The learner press on one of subcategory icons.
5. The application shows a pictures of learning subject with the text in Arabic with three buttons (Next, Previous, and Play).
6. The learner press on “Play” to play the audio of subject’s pronunciation in Arabic.
7. The application play the pronunciation sound of subject in the shown picture.
8. The learner press on “Next” icon to go to next learning subject.
9. The application show the next picture of selected category.
10. The learner press on “Previous” icon to go back to previous learning subject.
11. The application show the previous picture of selected category.
12. The learner press on “Home” icon to go back to main interface of application.
13. The application show the main interface of application.

b) Exceptional Flow

Not Applicable.

v. Post-condition

The actor learns some words of Arabic language.

vi. Rules

Does not apply.

vii. Constraints

Does not apply.

5.3.5 LEARN NUMBERS & COLORS (A4Kids_3)

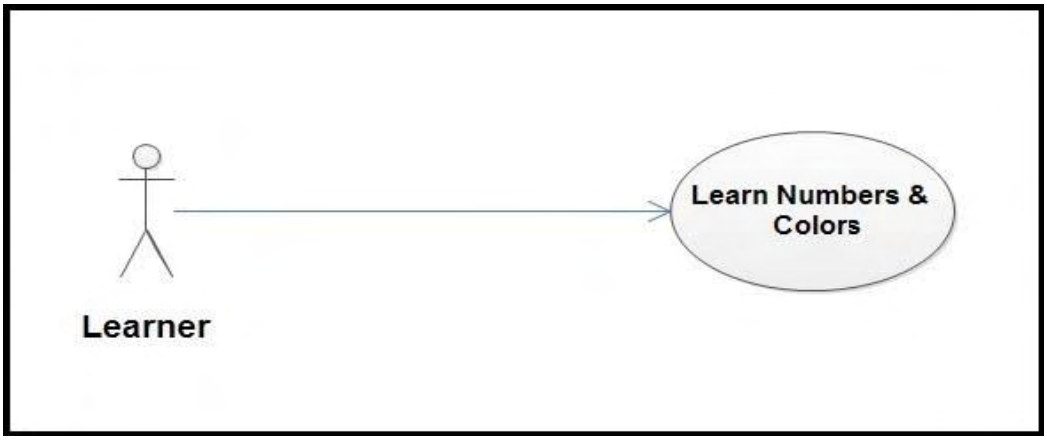

Figure 9: Learn Numbers and Colors Use case Diagram.

i. Brief Description

This use case deals with learning the Numbers and Colors in Arabic language. It is offers many pictures and sound for learning.

ii. Pre-condition

The learner presses on "Numbers & Colors" icon and selected his/her presenting language.

iii. Characteristic of Activation

The learner presses on "Numbers & Colors" icon and chooses a specific category for learning.

iv. Flow of Events

a) Basic Flow

1. The application shows the main interface which has the icons of main category for learning subject, as well as, Quiz and Game icons.

2. The learner chooses “Numbers & Colors” category to learn it is details.
3. The application shows the subcategories of “Numbers & Colors” for learning, as well as, Song icons.
4. The learner press on one of subcategory icons.
5. The application shows a pictures of learning subject with the text in Arabic with three buttons (Next, Previous, and Play).
6. The learner press on “Play” icon to play the audio of subject’s pronunciation in Arabic.
7. The application play the pronunciation sound of subject in the shown picture.
8. The learner press on “Next” icon to go to next learning subject.
9. The application show the next picture of selected category.
10. The learner press on “Previous” icon to go back to previous learning subject.
11. The application show the previous picture of selected category.
12. The learner press on “Home” icon to go back to main interface of application.
13. The application show the main interface of application.

b) Exceptional Flow

Not Applicable.

v. Post-condition

The actor learns the numbers and colors in Arabic language.

vi. Rules

Does not apply.

vii. Constraints

Does not apply.

5.3.6 LEARN DAYS & MONTHS (A4KIDS_4)

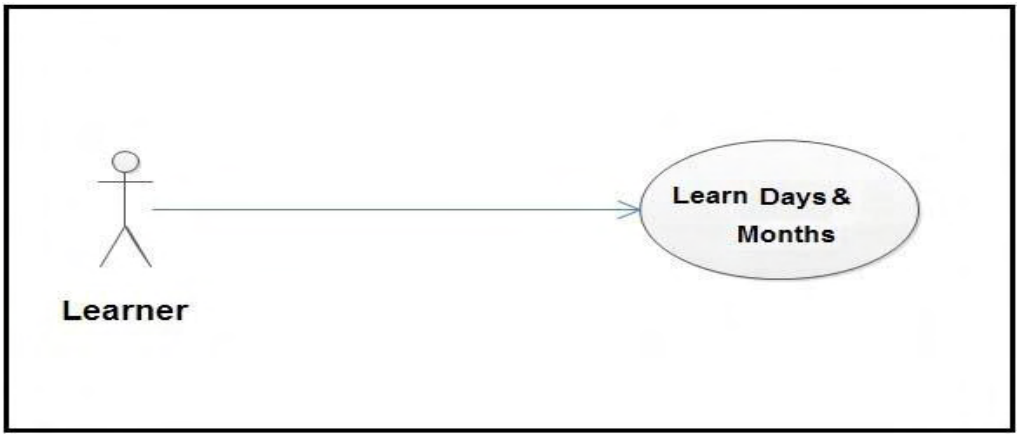

Figure 10: Learn Days and Months Use case Diagram

i. Brief Description

This use case deals with learning the Days of week and Months of year in Arabic language. It is offers many pictures and sound for learning.

ii. Pre-condition

The learner presses on "Days & Months" icon and selected his/her presenting language.

iii. Characteristic of Activation

The learner presses on "Days & Months" icon and chooses a specific category for learning.

iv. Flow of Events

a) Basic Flow

1. The application shows the main interface which has the icons of main category for learning subject, as well as, Quiz and Game icons.
2. The learner chooses "Days & Months" category to learn its details.

3. The application shows the subcategories of “Days & Months” for learning, as well as, Song icons.
4. The learner press on one of subcategory icons.
5. The application shows a pictures of learning subject with the text in Arabic with three buttons (Next, Previous, and Play).
6. The learner press on “Play” to play the audio of subject’s pronunciation in Arabic.
7. The application play the pronunciation sound of subject in the shown picture.
8. The learner press on “Next” icon to go to next learning subject.
9. The application show the next picture of selected category.
10. The learner press on “Previous” icon to go back to previous learning subject.
11. The application show the previous picture of selected category.
12. The learner press on “Home” icon to go back to main interface of application.
13. The application show the main interface of application.

b) Exceptional Flow

Not Applicable.

v. Post-condition

The actor learns the Days of week and Months of year in Arabic language.

vi. Rules

Does not apply.

vii. Constraints

Does not apply.

5.3.7 DO QUIZ (A4KIDS_5)

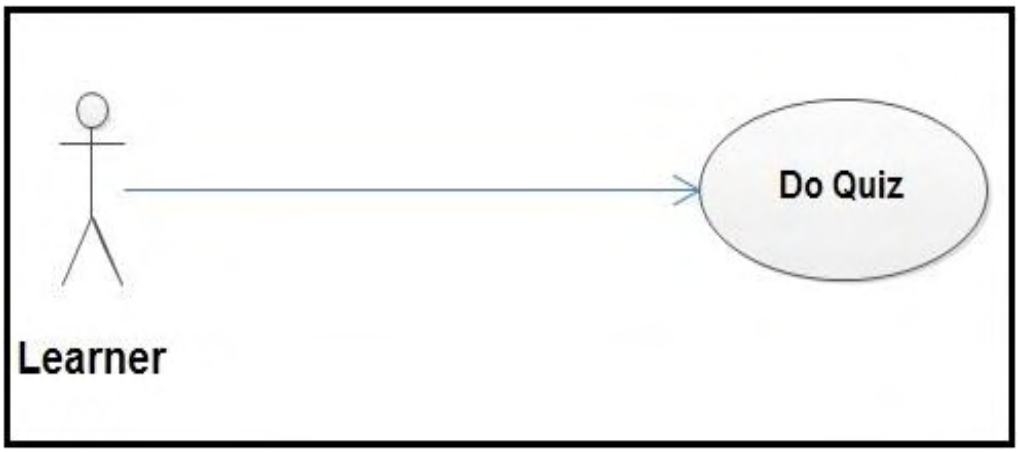

Figure 11: Use case Diagram for Do Quiz

i. Brief Description

It is an evaluation function for the performance and quality of this application. It is shows a picture with three options of answers. The actor chooses his/her answer and the application will play a voice message as a result of answer if the answer is correct or not.

ii. Pre-condition

The actor chooses the "Quiz" icon from home page.

iii. Characteristic of Activation

The actor chooses the "Quiz" icon from home page.

iv. Flow of Events

a) Basic Flow

1. The application shows the main interface which has the icons of main category for learning subject, as well as, Quiz and Game icons.
2. The learner press on "Quiz" icon to do it.
3. The application display the picture with answers options for every question.
4. The learner chooses one option as his/her answer.
5. The application shows result voice message if the answer is correct or not.

6. The learner press on “Next” icon to go to next question.
7. The application shows the next picture.
8. The learner press on “Previous” icon to go back to previous question.
9. The application shows the previous picture.
10. The learner press on “Home” icon to go back to main interface of application.
11. The application shows the home page.

a) Exceptional Flow

Not Applicable.

i. Post-condition

A learner have done a test to measure his/her learning the Arabic language.

ii. Rules

Does not apply.

iii. Constrains

Does not apply.

5.3.8 PLAY GAME (A4KIDS_6)

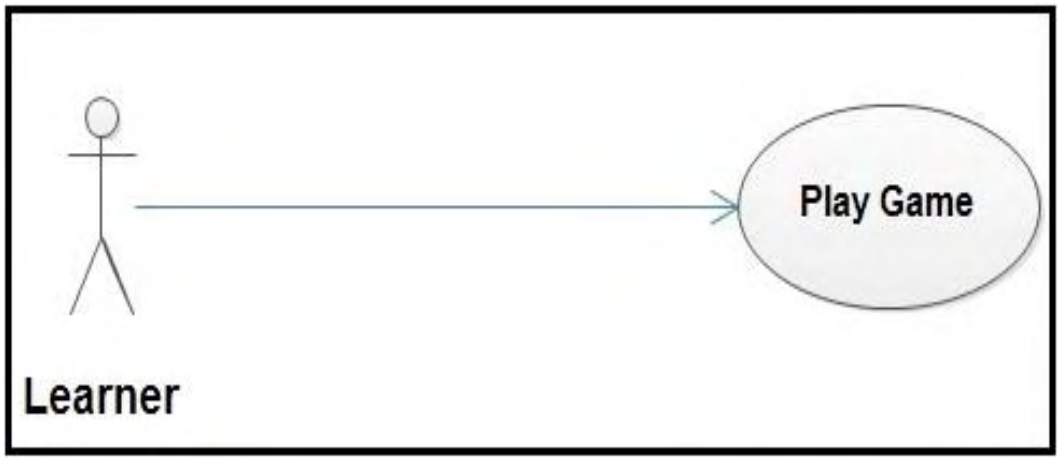

Figure 12: Use case Diagram for Play Game

i. Brief Description

This function used for playing an educational game for learning aim. It is consist of multiple squares which hide a pictures. The actors guess the two pictures and the application show them in case of the two pictures are same. If the two pictures matched, the brown block will disappear. If not match, the block will close again and remain the same.

i. Pre-condition

The actor press on "Game" icon from home page.

ii. Characteristic of Activation

The actor press on "Game" icon from home page.

iii. Flow of Events

a) Basic Flow

1. The application shows the main interface which has the icons of main category for learning subject, as well as, Quiz and Game icons.
2. The learner press on "Game" icon to play it.
3. The application display the game page which consist of many array of squares hide a pictures.
4. The learner press on two hidden picture to match them.
5. The application checks the selected pictures are same or not.
6. The brown block will disappear if the two pictures matched, the block will close again and remain the same if selected pictures not match.

7. When the learner ends their game, the trials number to match the pictures will be appeared and they may tap on “New Game” icon shown to start a new game.
8. The application shows the selected pictures.
9. The learner press on “Home” icon to go back to main interface of application.
10. The application shows the home page.

b) Exceptional Flow

Not Applicable.

i. Post-condition

The new actor was done the educational game.

ii. Rules

Does not apply.

iii. Constrains

Does not apply.

5.6 Sequence Diagram

The sequence diagram illustrates how objects in A4Kids interact with each other to execute the use case (Semertzidis, 2013; Gomaa, 2001). In the other word, the sequence diagrams are used to explain the objects that participate in a use case and the messages passed between them over time for one use case.

5.6.1 Learn Letters Sequence Diagram

The learning process starts when a child selects the presenting language of home page. The actor selects a category from A4Kids. The application displays the subcategories of learning. The learner presses on specific subcategory to display the pictures. Later, A4Kids displays the picture of Arabic alphabets and plays the pronunciation.

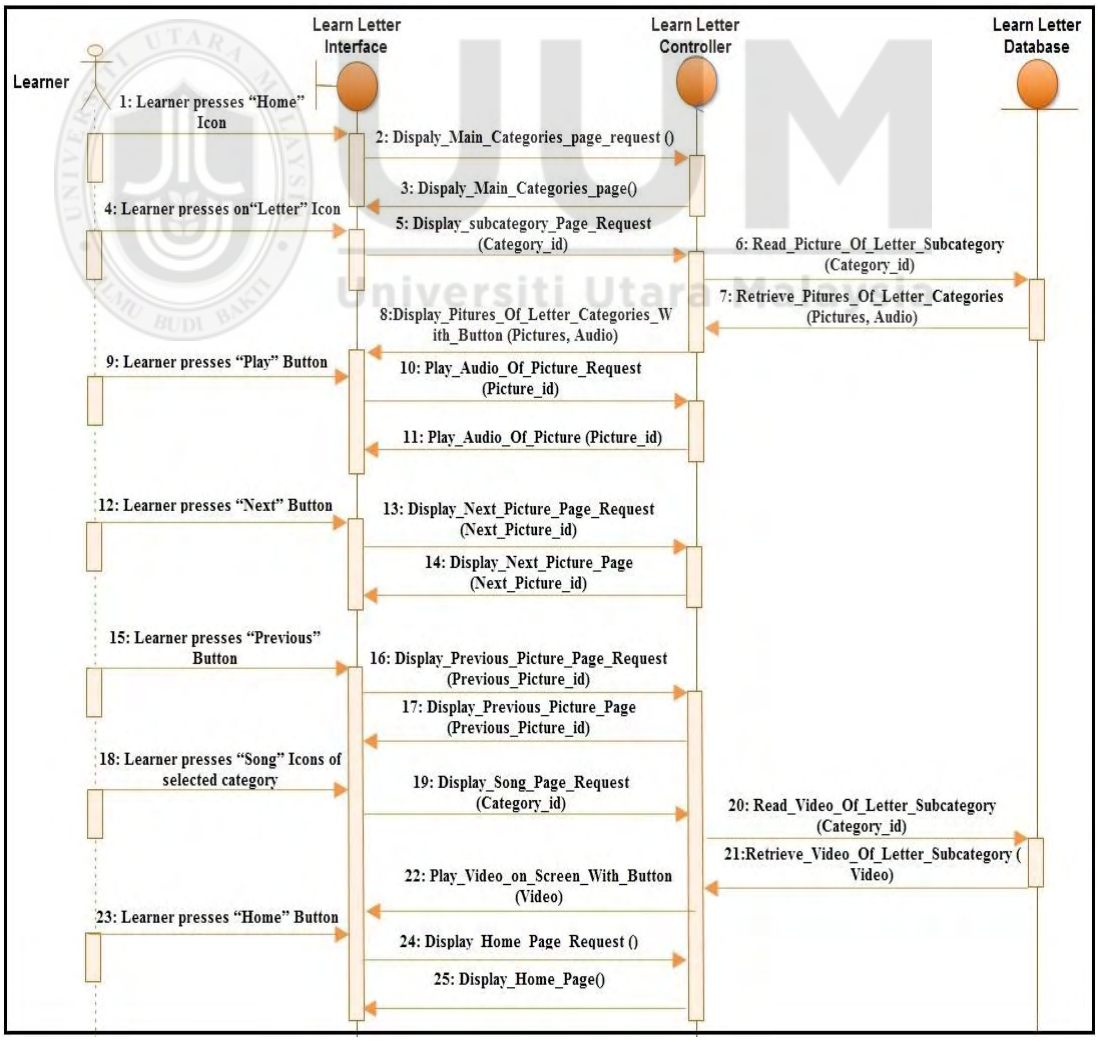

Figure 13: Learn Letters Sequence Diagram

5.6.2 Learn Words Sequence Diagram

The learning process starts with choosing the presenting language of home page. The actor selects a category from A4Kids. The application display the subcategories of learning. The learner presses on "Words" subcategory to display the pictures. Later, the A4Kids displays the pictures of the vocabulary and plays the pronunciation. The actor moves among the pictures using "Next" and "Previous" buttons.

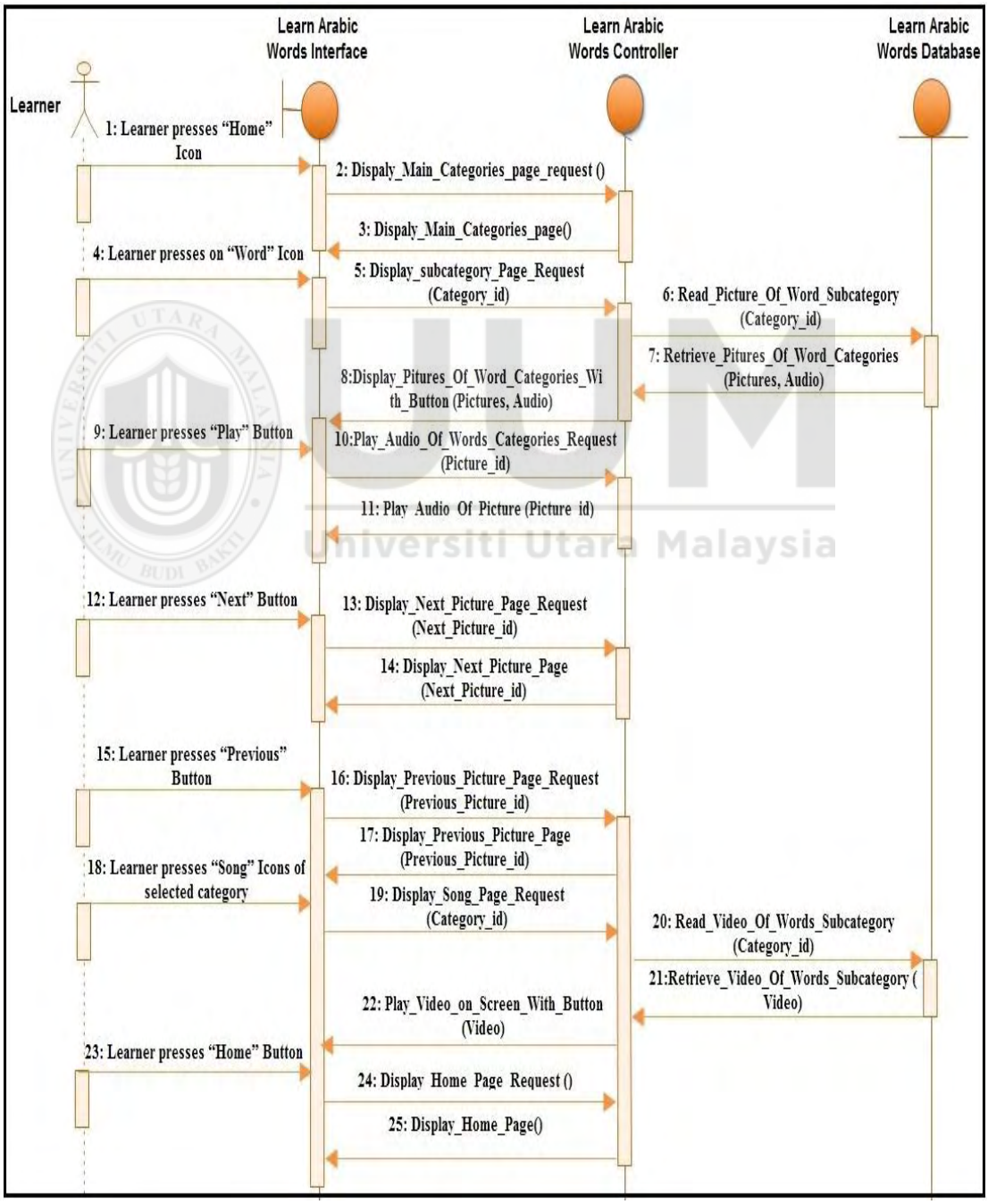

Figure 14: Learn Words Sequence Diagram

5.6.3 Learn Numbers and Colors Sequence Diagram

The learning process starts with choosing the presenting language of home page. The actor selects a category from the application. A4Kids displays the subcategories of learning. The learner presses on “Numbers” or “Colors” subcategory to display the pictures. Later, the application displays the picture of number or color and plays the pronunciation. The actor moves among the pictures using “Next” and “Previous” buttons.

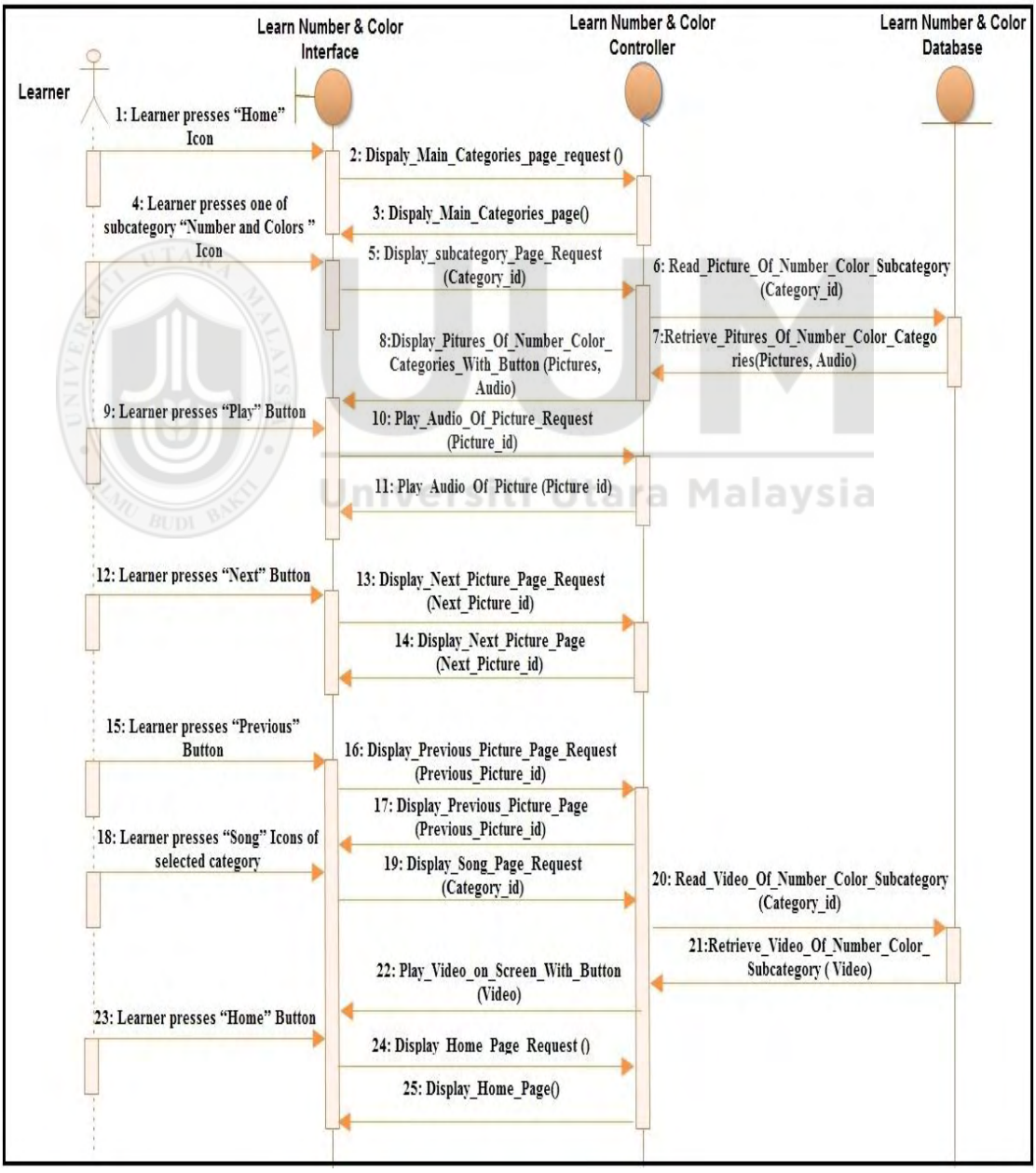

Figure 15: Learn Numbers and Colors Sequence Diagram

5.6.4 Learn Days and Months Sequence Diagram

The learning process starts with choosing the presenting language of home page. The actor selects a category from the menu option. A4Kids displays the subcategories of learning. The learner presses on “Days” or “Months” subcategory to display the pictures. Later, the application displays the picture of day or month and plays the pronunciation. The actor moves among the pictures using “Next” and “Previous” buttons.

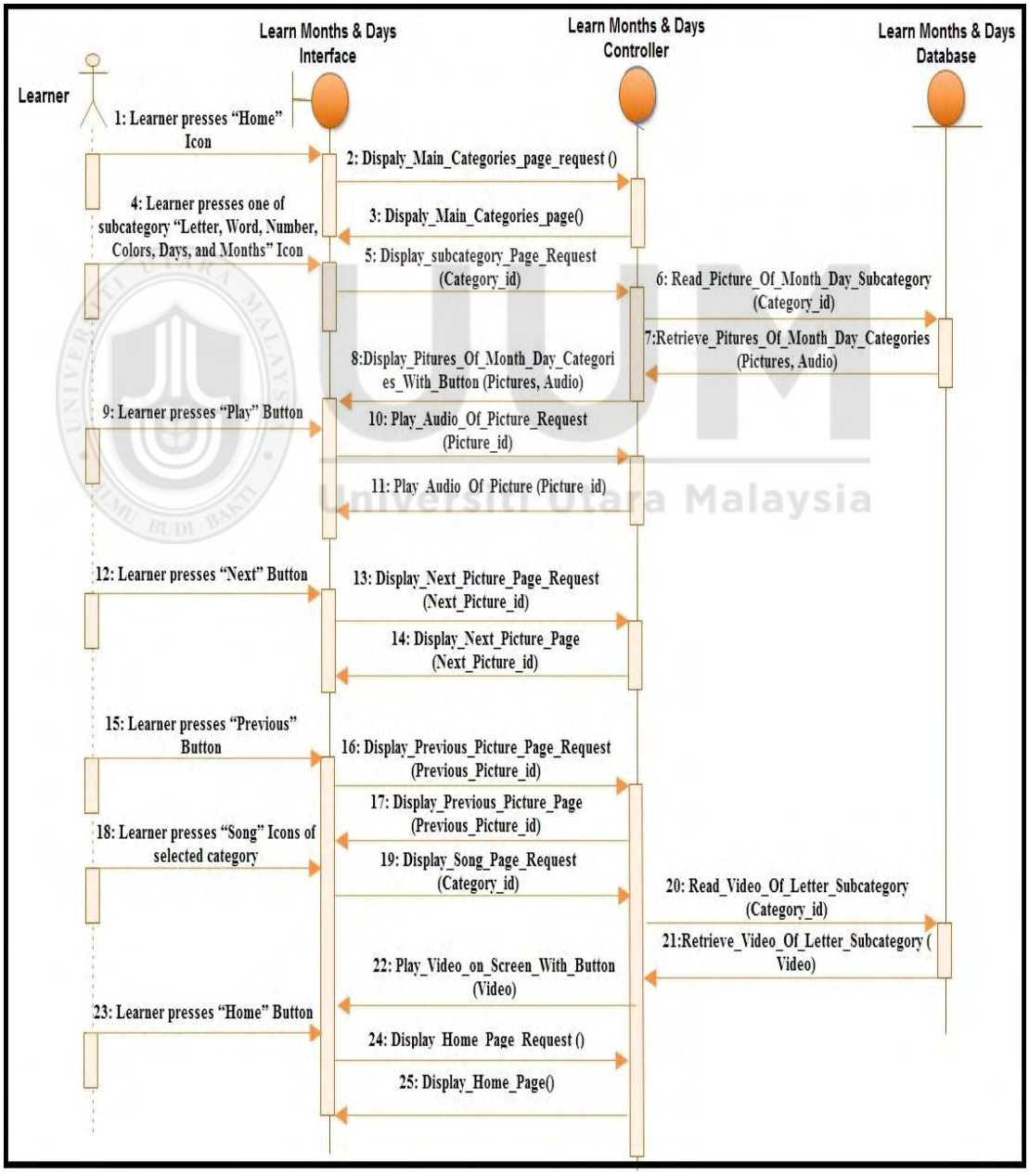

Figure 16: Learn Days and Months Sequence Diagram

5.6.5 Do Quiz Sequence Diagram

The do quiz process is one of the main functions in A4Kids, which deals with measuring performance and quality. It starts with pressing on “Quiz” icon. The application retrieves some pictures from the database involving different categories and displays them with three options of answers and some buttons. The actor chooses appropriate answers and the application will check the correctness of answer. The application plays a voice message for the result. The actor presses on “Next” icon to go to the next question or press on “Previous” icon to go back to the previous question.

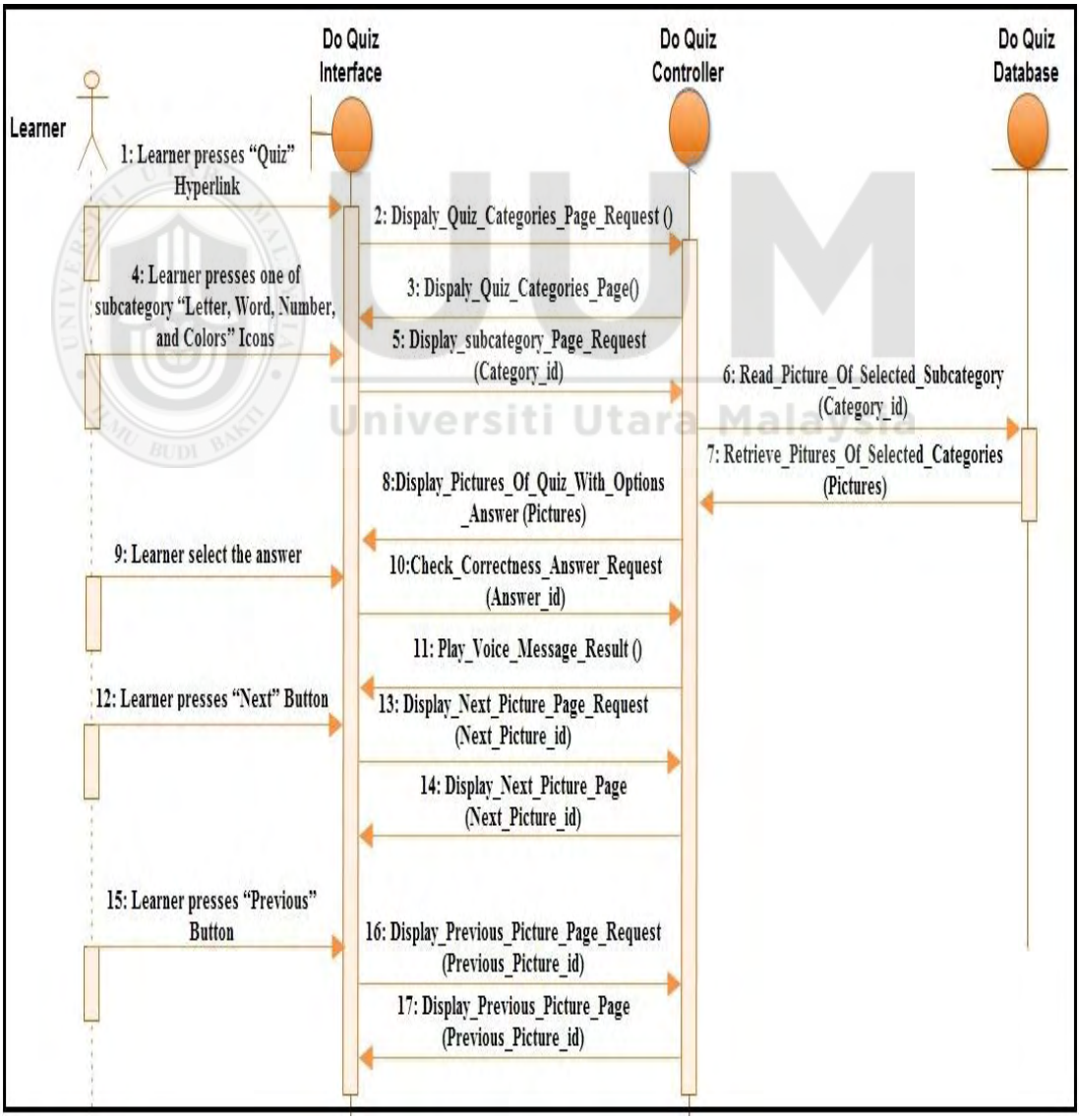

Figure 17: Do Quiz Sequence Diagram

5.6.6 Play Game Sequence Diagram

The learner plays a matching game with Arabic alphabet pictures. When the learner clicks "Game" button, the game window appears. Then, the learner clicks on the blocks to view the image. If the two photos match, the block will vanish. If they do not match, the blocks will close again and stay the same.

The process continues until all blocks vanish. After the user finishes the game, the number of trials in matching the photos appears. Then, "New Game" button that allows the learner to start a new game appears.

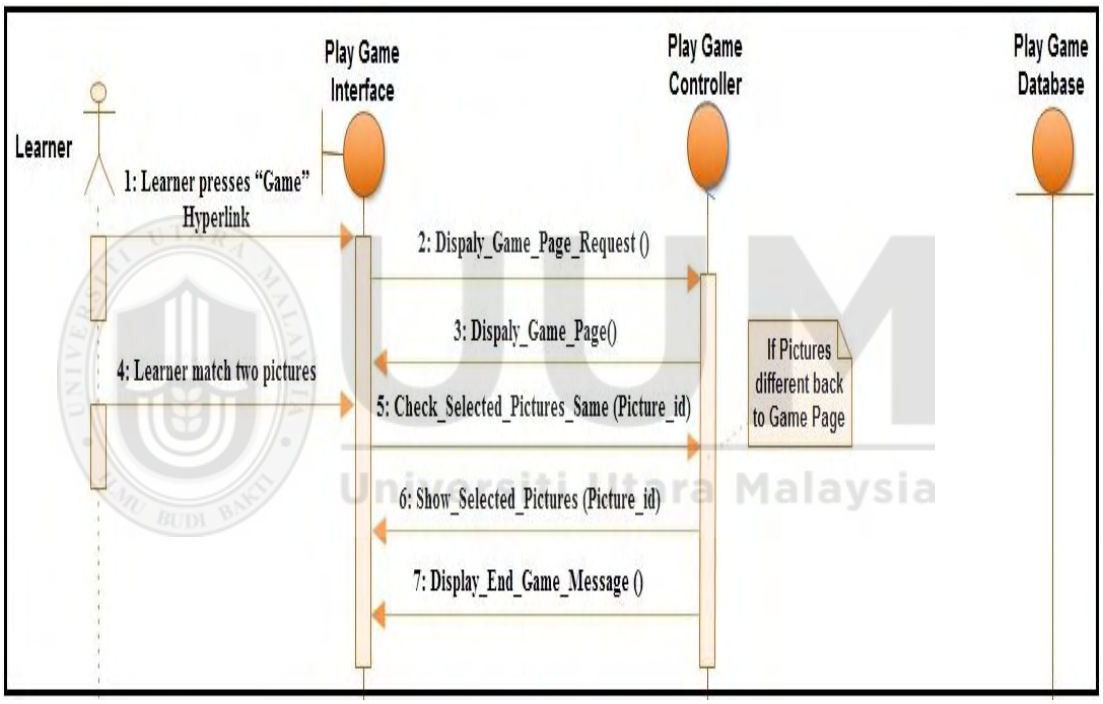

Figure 18: Play Game Sequence Diagram