

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter covers the methodology adopted to examine the proposed framework. The research method used were outlined in answering the research questions. This chapter aims at providing explanation for the research design and clarify the setting and scope for the procedure of the prototype development. In this section, research design, research framework, data collection technique, sampling and population, instrumentation, and data analysis technique used in this research are presented as well as an assessment of the reliability and validity of the instrument. The chapter closes with the chapter summary.

3.2 Research Design

This section discusses the overall methods of data collection and data analysis. In this study, the selection of methods concerned integrating the elements of the study in a logical manner. This to ensure that the study successfully addresses the research problem with a typical degree of validity and reliability of the data collection process, evaluation process and data analysis process. In addition, it is important to identify the appropriate research design to answer the research questions and meet the objectives.

According to Mark et al. (2019), several philosophies govern social science research including post positivism, social constructivism, postmodernism, feminism, and pragmatism. Each philosophy holds its own beliefs and values. This study adopted

pragmatism based on four assumptions. First, in the ontological sense, it believes that the reality is seen in what is useful, practical and what works. Second, based on epistemological assumption, pragmatism is constructed through various tools that utilized deductive and inductive evidence. Third, from axiological assumption, pragmatism believes in collaboration between researchers and participants in constructing knowledge. Finally, based on methodological assumption, pragmatism researchers have the freedom in choosing methods, techniques and procedures based on the study purpose (Mark et al., 2019). Based on this consideration, pragmatism is seen as the best paradigm for this study because of the suitability, beliefs, and methodological practices.

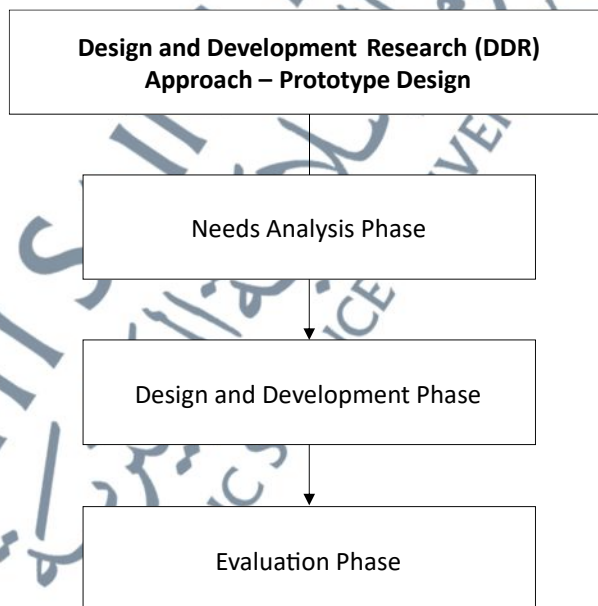
Regarding the research objectives of designing and developing a prototype, this study has adopted the Design and Development Research (DDR) (Richey & Klein, 2007) approach that determines the philosophical choice and research approach. To answer the objectives listed, this study has adopted a multi-method quantitative approach.

3.2.1 Design and Development Research (DDR)

This study employs the Design and Development Research (DDR) approach to design the proposed prototype, a semiotic icon design for reciting Quran (SIDAQ). This approach is based on Richey and Klein (2007) who assert that a development study is a very organized and systematic study covering the design, development and evaluation of the product. DDR is a broad research approach involving a variety of quantitative and qualitative research techniques (Richey & Klein, 2007, 2014). Generally, this study has three main phases consisting of:

- i. Needs Analysis phase
- ii. Design and Development phase
- iii. Evaluation phase

The rationale for using the DDR approach in this study is to satisfy the objective of the design and development of semiotic icon for reciting Quran. The design was created to assist in visualizing the genre of Surah in Quran that can motivate youth to recite the Quran. This approach is flexible and systematic and could be used to develop icon design application. The choice of the DDR approach in this study is generally because it is the most common approach used in developing information materials and is compatible with the purpose of developing an application. The next discussion will focus on the work carried out in three phases as illustrated in the research flow diagram in Figure 3.1.



Source: Ridhuan (2016)

Figure 3.1: Research Flow Chart

To strengthen and ensure that the study conducted is more organized and systematic, Figure 3.1 shows the research flow using Design and Development

Research (DDR) approach where it is divided into three phases namely the needs analysis phase, the design and development phase and the evaluation phase. The three phases involved in each phase are discussed in detail in this section.

3.2.2 ADDIE Model

This study employed the ADDIE Model (McGriff, 2000) which satisfies the Design and Development Research (DDR) approach (Richey & Klein, 2007) to design and develop the proposed prototype, Semiotic Icon Design for Motivating Youth in Reciting Quran (SIDAQ). In DDR, several instructional models are outlined by literature in order to develop the product such as ADDIE, ASSURE and the Dick and Carey model (Ab Wahid, 2019). Five phases in ADDIE have been recognized and established as a complete phase that covered the three main phases stated in DDR. Table 3.1 shows the DDR and ADDIE model relationship.

Table 3.1: DDR and ADDIE Model Relationship

Phase	Design and Development Research (DDR)	Phase	ADDIE Model
1	Analysis	1	Analysis
2	Design and Development	2	Design
		3	Development
3	Evaluation	4	Implementation
		5	Evaluation

Source: Ab Wahid (2019)

The ADDIE instructional model was chosen because it is generic and is a systematic model that demonstrates the design process in product development (Dick et al., 2012; Branch, 2018). According to Brown (2016), the ADDIE model provides a framework for a full phase of development namely analysis, design, develop, implement and evaluate. The choice of the ADDIE model in this study is generally because it is a model used in developing information materials and systematic process in product development and is compatible with the purpose of developing the semiotic icon design

application as a supportive tool. This selection is also supported by (Siemens, 2002) who stated that the ADDIE model is the best and most widely used model for developing learning materials.

The ADDIE model as in Figure 3.2 shows the model as an interactive model. Each phase in the ADDIE model involves formative evaluation and the results of each evaluation will be used in the next phase. The tasks in these phases are overlapping and interrelated according to McGriff (2000). This means that the ADDIE model is a dynamic model, offering flexible guidelines on effective construction processes and effective instruction.

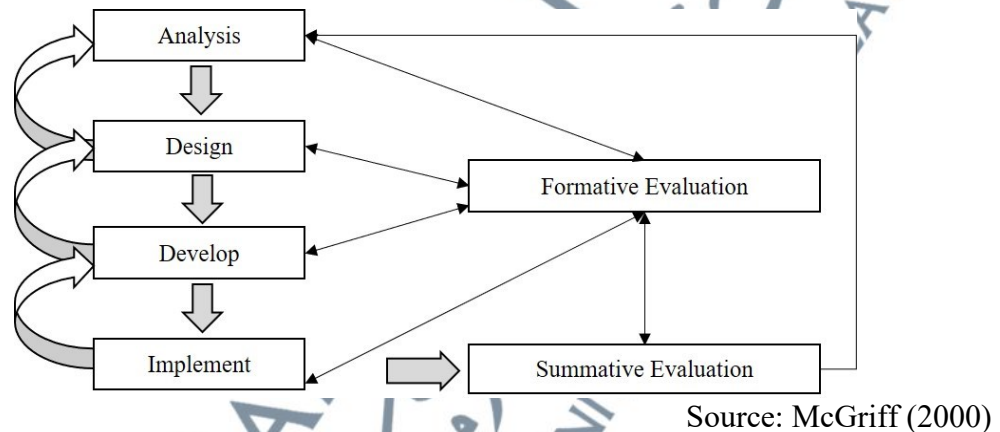


Figure 3.2: ADDIE Model

In this study, modifications have also been implemented in some parts of the model to fit the needs of the system development process. This is in line with the assertion by Reeves (1994) that the model of the application is not a law but rather a guide. This means that it needs modification to comply with and be applicable to a person or group's design principles and application requirements for application development. Accordingly, this study uses a different approach that combines the ADDIE model (McGriff, 2000) and the prototyping model (Sommerville, 2006) as a

complete application development process. The prototyping model is illustrated in Figure 2.21 and discussed in Chapter 2.

3.3 Research Framework

The research framework for Semiotic Icon Design for Reciting Quran (SIDQ) employed DDR approach was integrated with the ADDIE instructional design model (see Figure 1.1 in Chapter 1). Generally, this study involves three main phases which are needs analysis phase, design and development phase and evaluation phase. The ADDIE instructional model consists of five (5) stages namely analysis, design, development, implementation, and evaluation. The following section discusses in detail the relevant work processes in the application design and development phases described.

3.3.1 Analysis

In stage 1 (Analysis), the first step is analysis stage. The main objectives of this stage are to employ the needs analysis to analyse the necessity to develop a prototype and identify the main features that should be utilized in the newly developed prototype. The researcher initiated the research in the early stages by a research strategy in developing research questions related to the objectives of the study (see Chapter 1).

During this stage, the review on the theories, concepts, principles, and elements to support the research were undertaken to address the research questions outlined at the beginning of the research. The important concept that should be focused on are visual, graphics, theory of semiotics, Semiotic Icon Design, Quran domain and Semiotic Icon Design Application which is to identify appropriate semiotic icon design for reciting Quran. Besides, the literature on the suitable theories and models for domain

Quran were performed. This review formed the basis for the scope and module development in the application prototype. This stage will come out with proposed icon design elements for mobile application that will be used in phase 2, design and development.

In this stage as well, the researcher conducted literature review to enhance understanding of the concepts and principles related to the idea of icon design application. Through this stage, basic concepts and ideas are built for supporting the study conducted. Overview of various icon design applications was conducted to review the environment and the development of icon design. The results of this literature review will be a formula for answering the questions arising in this study.

The researcher also studied the domain of Quran as the domain of this study. Based on the literature review, limited studies have discussed the domain of Quran visually in general and the icon design application in the domain of Quran in particular. Generally, studies in the domain Quran are still limited for elaborated technique (Elhadj, 2010). The highlight of the domain of Quran also shows that Quran knowledge is evolving but only revolves around the content of Quran itself. The researcher's review also found that only limited studies concerned application development made in terms of visualizing the information in Quran. Therefore, the results of this stage are to sketch a proposed semiotic icon design element that will be subsequently used in the prototype design and application prototype.

Interviews were conducted with experts in identifying the process of achieving the feedback on Quran domain. Experts also confirmed the results of the highlights of this study which shows that there are no icon design techniques applied in the Quran particularly to describe the genre of the Surah visually. This is a recent research

approach to the field by combining it with another discipline of knowledge namely Information Technology.

Two sub-studies have been employed to answer the research questions, which are the interview with experts and youth and systematic literature review through comparative study. These two sub-studies procedures are discussed detail in this section.

a. Interview with Experts (Quran) and Youth

The interview was carried out with three Quran experts from central region higher learning institutions. They were subject matter experts in the Quranic field. Expert 1 is a senior lecturer and associate professor at the Department of Language and Literacy Education, Faculty of Education, University of Malaya with more than 20 years of experience in Quranic education field. Expert 2 is a senior lecturer at Faculty of Quranic and Sunnah Studies, Universiti Sains Islam Malaysia with more than 13 years' experience. Expert 3 is an Arabic teacher from Faculty of Major Language Studies, University Sains Islam Malaysia with more than 12 years of experience in Arabic education field. Semi-structured questions were presented and validated before the interview process. Table 3.2 shows selection of experts for research.

Table 3.2: Selection of Experts for research (Analysis stage)

No	Position	Education	Expertise	Experiences	Justification for selection
1	Lecturer	PhD	Quranic and Arabic education	17 years	Selection of experts (academic group) due to: a. Research area focused on Quran and Arabic education b. Attended seminar, workshop related to the research. c. Became supervisor and guides many PhD and master students. d. Has been appointed as leader related to the field.
2	Lecturer	PhD	Quran and Hadith	13 years	
3	Lecturer	Master	Arabic	12 years	

The interview was also carried out with three students considered as youth from the Islamic and non-Islamic education background studies from central region primary school and higher learning institutions. Youth 2 was final year students from Faculty of Quranic and Sunnah Studies, Universiti Sains Islam Malaysia. Youth 2 was Form 4 student from Sekolah Agama Menengah, Sungai Merab Luar and youth 3 was Form 4 student from Sekolah Menengah Kebangsaan Bandar Rinching.

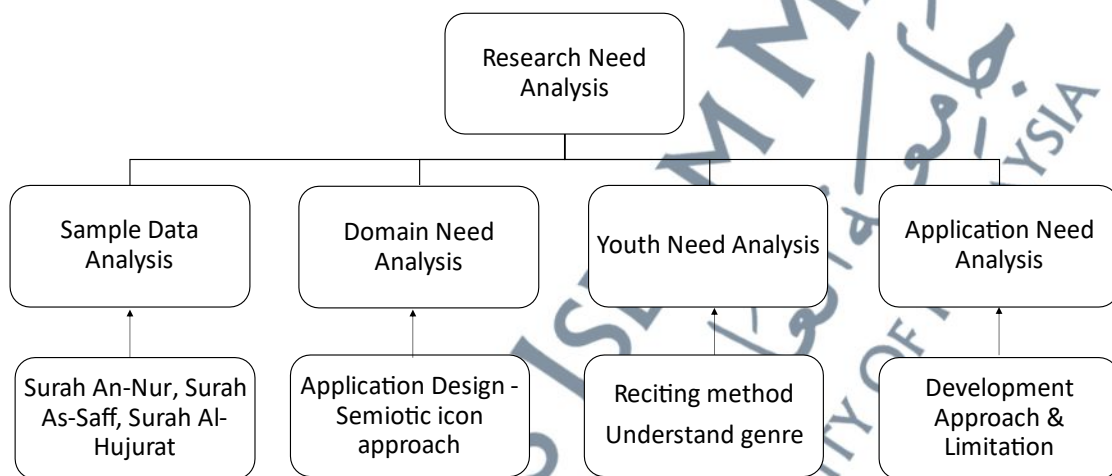


Figure 3.3: Research Needs Analysis

This stage focused on the preliminary research process prior to developing the semiotic design application for reciting Quran. Figure 3.4 shows the several areas in needs analysis stages that focused on sample data application, youth needs analysis and Quran domain needs analysis and application development needs analysis. The following is a detailed discussion of the analysis stage.

i. Sample Data Analysis

The selection of Surah An-Nur, Surah Al-Hujurat and Surah As-Saff according to the content of Surah in Quran has much to do with the laws of human life and humans as servants of God. This selection was also considered on the content of the informative

Quran to explore the messages of the verses of Surah as a living guide that are vital to humanity. In addition, informal interviews were conducted with three experts in Quran to acquire the opinion on the genre of Surah as the preliminary studies. The suggestion of Surah samples by the experts are summarized in Table 3.3.

Table 3.3: Surah sample for research

No	Expert	Suggestion Surah sample	Justification
1	Expert 1	Surah An-Nur, Surah Al-Hujurat and Surah As-Saff	Selection of Surah samples due to: a. Surah contains the rules of Islam and rules of life as a Khalifah. b. Reference to the Muslims as its verses contain the messages that have very close connection to human life. c. Basic Surah contain the guide to the Islamic community
2	Expert 2	Surah An-Nur, and Surah As-Saff	
3	Expert 3	Surah An-Nur, Surah Al-Hujurat and Surah An-Nisa'	

Through the preliminary studies that have been carried out, the experts suggested three Surah samples namely, Surah An-Nur, Surah Al-Hujurat and Surah As-Saff as the main sources of sample data of the Quranic domain. The reasons are:

- Surah An-Nur, Surah As-Saff and Surah Al-Hujurat are indeed the source of Quran that contains the rules of Islam and rules of life as a Khalifah.
- Surah An-Nur, Surah As-Saff and Surah Al-Hujurat are a reference to the Muslims as their verses contain the messages that have very close connection to human life.
- Surah An-Nur, Surah As-Saff and Surah Al-Hujurat are basic Surah containing the guide of the Islamic community.
- Visual icons can be adopted in presenting the Surah genre that can convey the message visually.

ii. Domain Needs Analysis

In the analysis stage, the domain of Quran is carefully studied by researchers. In selecting the sample of data used, experts in the domain of Quran were interviewed to ensure that there is a need for this study in the Quran field. Researchers have used few Surah samples in the Quran domain that have been approved by experts. As a result, the scope of this study was identified and presented in the phase 2 design and development phase. The Semiotic Icon Design for reciting Quran was discussed detail in Chapter 4.

iii. Youth Needs Analysis

In the analysis stage, the needs analysis of youth is important for this research. To identify the problem faced by the youth in reciting Quran, an informal interview was carried out with youth. Researchers conducted the informal interviews with three students. The semi-structured interviews were conducted to gain an initial insight into the reciting and the Surah and the complexity of the understanding the Surah genre in Quran. The detailed results of preliminary study on youth needs analysis conducted by the researcher are further discussed in Chapter 4.

iv. Application Needs Analysis

The prototype development of this application is a mobile application development that requires application and icon design guidelines. Having hardware and software compatible with development will help make the process more seamless. In this study, the development of this prototype used power Intel i5 Duo Core processing and four Gigabytes of random-access capacity. In addition, other hardware used is a hard drive with 1 Terabyte, CD-ROMs, modem, external memory devices, mouse and

keyboards. Having a higher processor and random-access capacity can further enhance the semiotic icon design.

The current technological development also facilitates development of semiotic icon design application development. A lot of software has been developed to help support development of the mobile application. However, the software developed is just an information tool and every designer and developer of the analytical application needs to adjust according to the developmental needs and objectives.

For the prototype development of this research application, the use of the software is split into two types of main software and support software. Adobe Flash software is the standard software used. Adobe Flash uses ActionScript 3.0 that offers a robust programming model that is familiar to developers with a basic knowledge of object-oriented programming for the Adobe Flash Player and Adobe AIR run-time environments. It enables interactivity, data handling, and much more in Flash, Flex, and AIR content and applications (Adobe, 2011).

The support software used is Adobe Photoshop software. This software is a powerful graphical tool for drawing and editing the graphic. It is used to create a visual interface for the interactivity environment on the mobile application. Finally, the icon developed in Adobe Photoshop software was called through the interface created with Adobe Flash software (Adobe, 2021).

b. Systematic Literature Review (Comparative Study)

To determine the suitable icon design elements to be implemented in the semiotic icon design, systematic literature review (SLR) was conducted by analyzing several selected papers. The SLR was conducted to ensure the icon design in the prototype has

considered the suitable icon design elements to be employed. SLR has four stages, which are identification, screening, eligibility, and inclusion (Nunes et al., 2016).

In this study, the fundamental aspect used to analyze the selected papers were by identifying icon design element text in the paper. In the identification stage, a total of two hundred thirty-six (236) papers were found under these four strings: mobile icon design; mobile icon design principle; mobile icon design element; apps icon design. The electronic databases ranged from numerous sources such as Google Scholar, Scopus, ProQuest, and Research Gate. Other sources include secondary data through books and reliable web pages.

In the screening step, ten papers were found to be redundant, and two hundred twenty-six (226) papers were put in the screening step. The screening test has further excluded one hundred twenty-six (126) papers, leaving hundred (100) papers for the eligibility step. In the eligibility step, the hundred (100) papers were analyzed through title and abstract analysis. After the analysis, only sixty-two (62) papers were found to have the theme of icon design elements for mobile application, and these were selected regardless of the subject and field of research. After the thorough process during the inclusion step, forty-two (42) papers were selected to represent the icon design elements for mobile application. The forty-two (42) papers were chosen based on the commonality of the icon design elements. The summarization of the SLR method is shown in Figure 3.4.

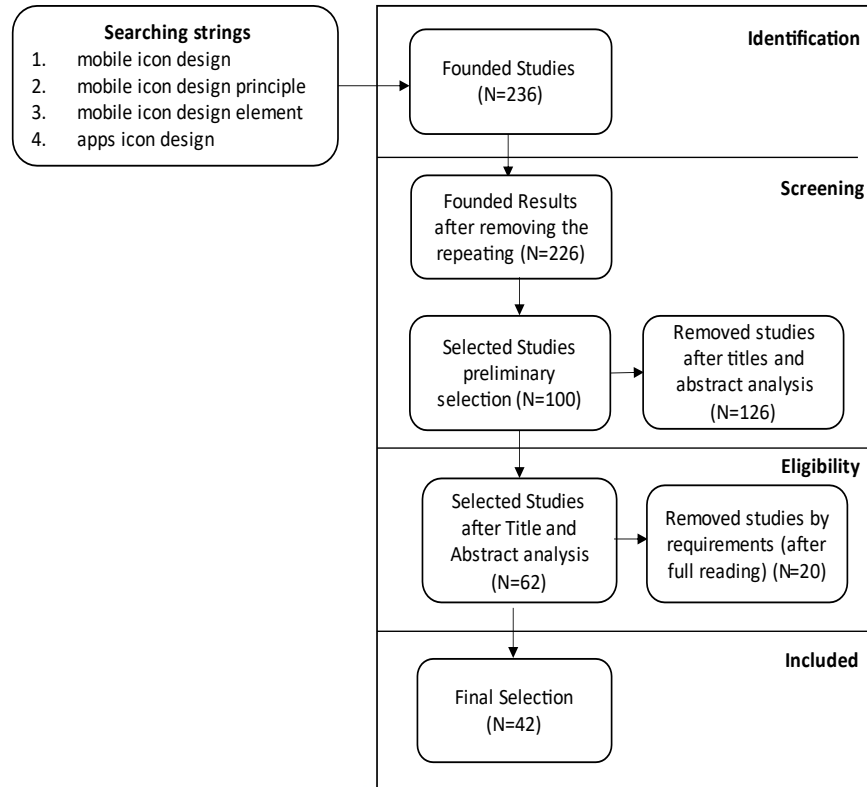


Figure 3.4: Summary of SLR Method

The reviews have resulted in the comparative study of icon design element for mobile application from various fields such as engineering, communication, advertising, and education. The comparative analysis is based on the comparison matrix and ranking procedure. The result of this study found ten common icon design elements that have been widely used in various fields and six out of ten elements are selected to be applied in the Quran domain based on the suitability of the elements to the study field. Before proceeding to the design stage, the six icon design elements were validated by the expert IT for construct validation prior to design stage. The detailed design icons using six icon design elements are further discussed in next section and Chapter 4.

i. Construct Validation for SIDQ

To determine the construct validity of SIDQ elements, expert validation was carried out to determine the suitability of the icon design elements at acceptable level. The expert validation was carried out by letting the expert validate the suitability of the icon design elements for SIDQ. Firstly, there are construct validation of semiotic icon design elements for reciting Quran by the experts in Information Technology (IT) including language and face validity. The validation is to verify the six initial elements of semiotic icon design elements for reciting Quran. This is in line with Rubio et al. (2003) that recommended the validity process specifies that at least three expert reviewers are required to conduct the validation.

The selection of experts was based on their experiences in Information Technology fields theoretically and practically as summarized in Table 3.4.

Table 3.4: Selection of Experts for construct validation (Analysis)

No	Position	Education	Expertise	Experience	Justification for selection
1	Lecturer	PhD	Education	17 years	Selection of experts (academic group) due to: a. Research area focused on IT and Education b. Attended seminar, workshop related to research. c. Became supervisor and guides many PhD and master students. d. Has been appointed as leader related to the field.
2	Lecturer	PhD	Human Computer Interaction	12 years	
3	Lecturer	Master	Information Technology	15 years	

From the table, three professional experts are lecturers in the Information Technology field and have more than ten years of experience. One of the experts is the icon design expert for mobile application. Prior to the expert validation process, the expert was given a letter of appointment. In addition, content validation and face validation were also conducted. The content validation was carried out to determine the validity of the semiotic icon design elements for reciting Quran.

3.3.2 Design

In stage 2 (Design), the design process consists of several key elements. The detailed planning was conducted to identify the design process and icon design elements. Steps taken to determine the icon design elements will be achieved, the design strategies selected, and the right media were selected to deliver the icon design. During the design phase, the processes involved in the icon design were formulated and firmly determined the whole process. All the data gathered in the needs analysis stage were considered during the icon design. In this phase a study was conducted on designing the icon and application prototype. The finalized icon design and application was produced. The design of the SIDQ was also checked for its compatibility and suitability with youth needs. The design phase of this study is divided into three steps namely: Icon Design, Application Design and Application Evaluation Design as depicted in Figure 3.5. The following is a detailed discussion of the steps.

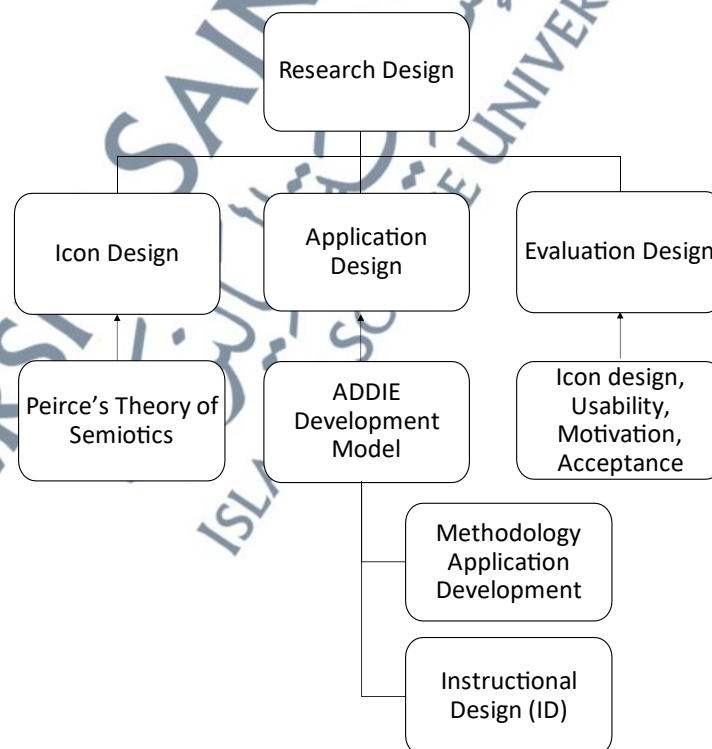


Figure 3.5: Research Design Chart

a. Semiotic Icon Design for reciting Quran (SIDQ)

This section discusses the process involved in designing of the fidelity semiotic icon design for reciting Quran. This step is important in providing a meaningful icon design. Among the important aspects of this study are icon design and application design. Design that aligned with the development objectives is an effort to provide a good icon design interface. The design of the icon was developed based on the icon design elements from the literature. These elements are selected based on the most usable icon design elements used in the previous studies and other fields. In this study, the six icon design elements of recognizable, color, simple, semantic, familiarity and consistency are used for icon design as discussed in Chapter 2.

The use of icon is to assist in improving youth understanding on the surah genre. The icon design is an important aspect and icon design can help in several aspects such as:

- i. Reducing time by exploiting visual perception. Users can understand the information faster using visual icon.
- ii. Provide a supportive tool to visualize genre of verse in Surah. The complexity of understanding of verse can be assisted by exploiting visual icons for Surah genre.
- iii. Visualize the information effectively.

b. Process Flow for Designing Semiotic Icon Design for Reciting Quran (SIDQ)

The process flow of the fidelity semiotic icon design of SIDQ involved seven steps as illustrated in Figure 3.6. The process starts with two steps from analysis stage and is followed by five steps from the design stage. It consists of three parts of fidelity icon design (low fidelity, medium fidelity, and high fidelity).

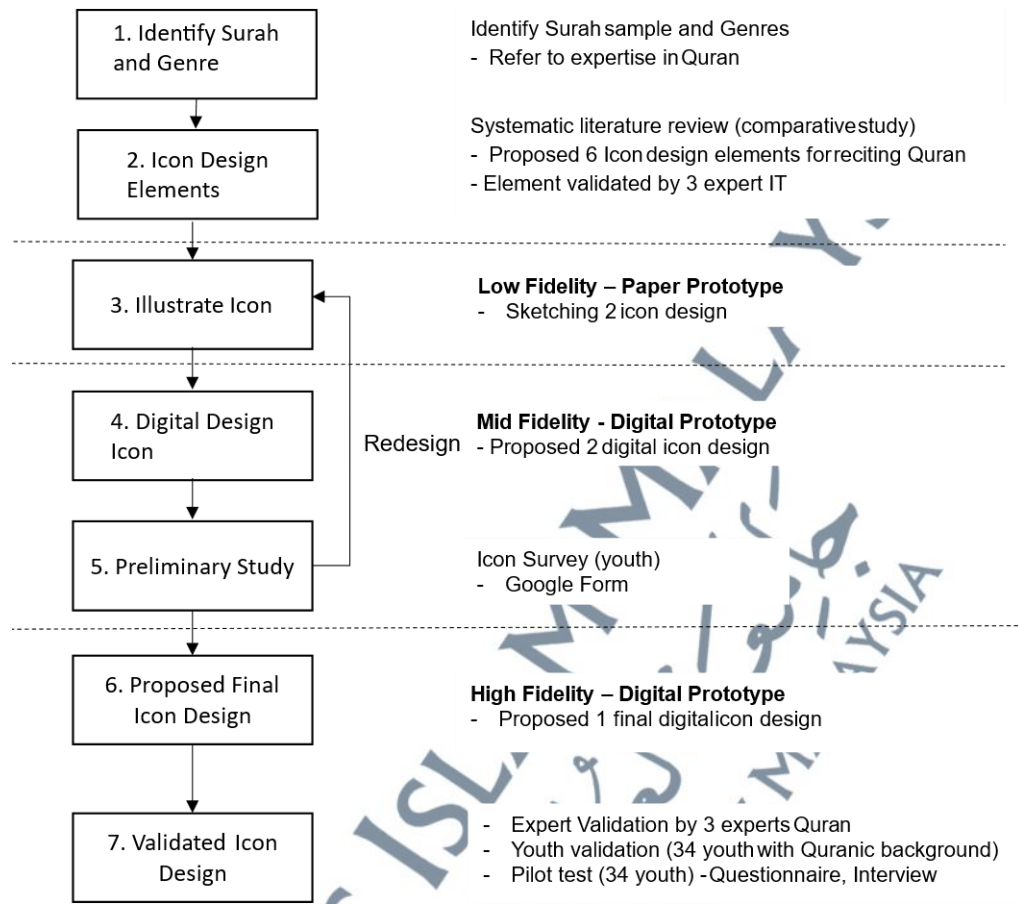
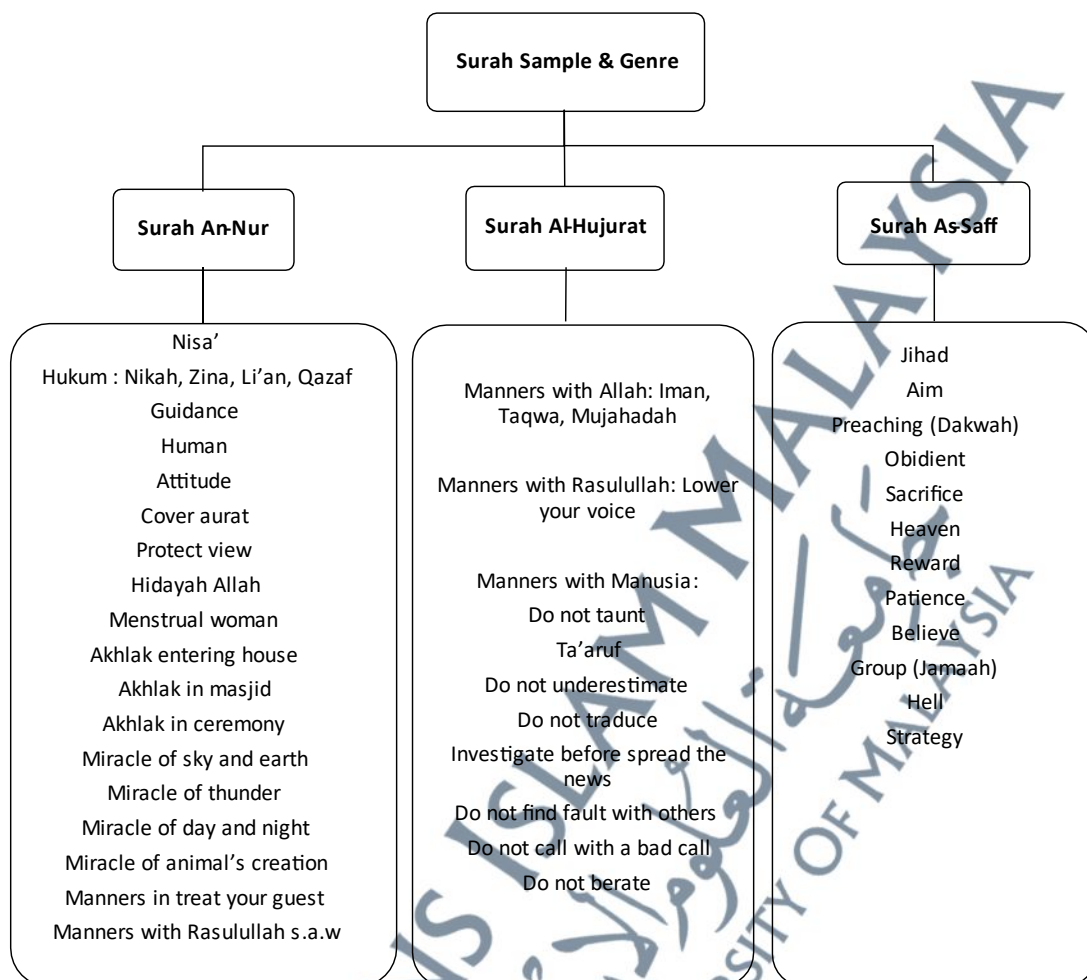


Figure 3.6 Process Flow for Fidelity Semiotic Icon Design (SIDQ)

i. Identify Surah and genre (Step 1)

The process started with identification of the Surah sample and identification of the surah genre as summarized in Table 3.7. The researcher referred to the experts in Quran studies to understand and familiarize with the theme and interpretation of the Surah.



Source: Tafsir Pimpinan Ar-Rahman, Sheikh Abdullah Basmeih (2016)

Figure 3.7: Surah sample and genre

ii. Icon Design Elements (Step 2)

The icon design was based on the icon design elements proposed from literature review in Chapter 2. The six icon design elements are: recognizable (ability to be recognized or identified from previous knowledge), simple (ability to be recognized from previous knowledge), color (property owned by object in producing diverse perceptions on eye that returns or produces light), semantic (related to meaning in language or logic); familiarity (close acquaintance with something) and consistency (way in which a substance holds together) (Press, 2020).

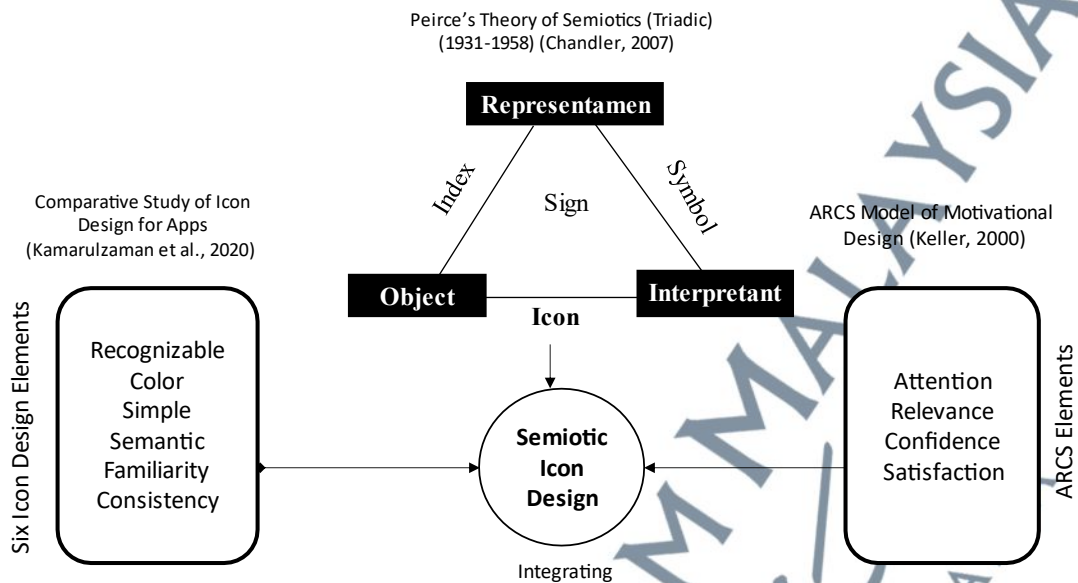


Figure 3.8: Icon Design Elements Integration for SIDQ

Figure 3.8 shows the integration of the icon design element studies with the Peirce's Theory of Semiotics (triadic) and ARCS Model of Motivational Design (see Chapter 2). The icon design elements, representamen, object and interpretant are related to each other to generate a meaningful icon design to the user. The sign of icon from Peirce triadic is the focus and output for this study. The icon design elements were integrated and mapped with elements of sign in the Peirce triadic model that employed in icon design. The detailed findings in icon design are discussed in Chapter 4.

The design of the SIDQ also integrated the motivation elements to maintain youth interest by employing the ARCS Model of Motivational design by Keller (2000) for motivating the student. The youth attention needs to be created with a relevance to the future use through which the student feels confident and satisfied. The elements of motivation employed in designing the SIDQ using related elements of the ARCS model are: Attention (variability to grab the attention of the youth, need to use different ways of learning (reciting) methods); Relevant (goal orientation by giving the usefulness of

the topic for youth to get interest to learn or use). Confidence (personal control where learners need to get control over their learning process so that they can feel that their success does not totally depend on external factors). Instead, they have internal factors affecting their success; Satisfaction (intrinsic reinforcement by encouraging intrinsic enjoyment of learning experience so that youth have fun, continue the learning process without expecting reward or other kind of external motivational elements) (see Figure 2.19).

Table 3.4 shows the summary of the semiotic icon design for reciting Quran by integrating the proposed six icon design elements with the Peirce's Theory of Semiotics (Triadic) and ACRS model of motivational design. The proposed six icon design elements and four elements of ARCS Model of Motivational Design are then validated by the experts in IT. The icons are confirmed and recognized by the expert in terms of icon design elements suitability and motivational elements for Quranic field. This step received positive feedback from the experts to ensure the icon is properly designed and conveys the right message to the user. The results of expert validation for icon design elements and motivational elements are summarized in Chapter 4.

iii. Illustrate Icon (Step 3)

This first part proposed low-fidelity icon design that involved the paper-based sketches of icons. To create the low fidelity icon design, the information from the analysis stage and the preliminary study and literature were gathered, brainstormed, and converted into design concepts in the form of sketches. Two sketched icons for each Surah genres were illustrated. The sketches of icon design were drawn on paper (see Table 3.4 and Appendix 4). The focus of the sketches was to illustrate the icons and compare different design concepts.

iv. Digital Icon Design (Step 4)

To be able to explore the design ideas further, a medium-fidelity icon design was developed. The second part focused on the medium-fidelity prototype of icon which was designed using Adobe Photoshop to form two different digital icon designs. The software was used to create appropriate color and effects for the icons based on the icon design elements. The results from the low fidelity step were then transformed into two digital icons (see Table 3.4 and Appendix 4).

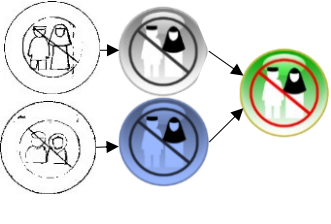
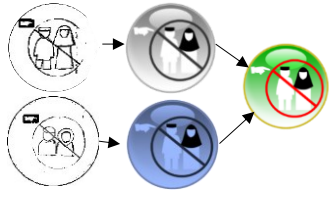
v. Preliminary Study (Step 5)

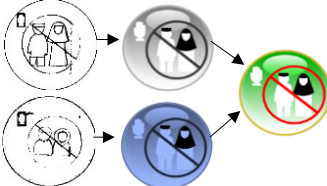
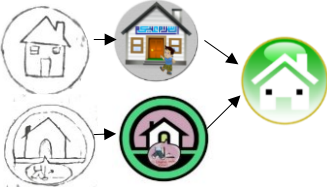
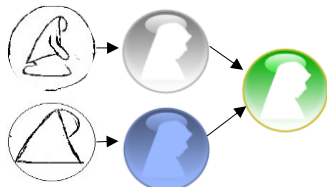
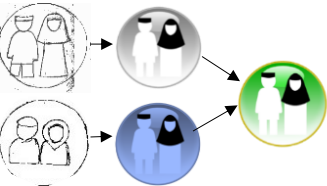
The set of two illustrated digital icons are then tested by the user using the google survey form (survey sheets). The icon survey was performed with youth to choose the preferred design of icon for the genre of Surah. The results of the icon survey are summarized in Chapter 4.

vi. Proposed final icon (Step 6)

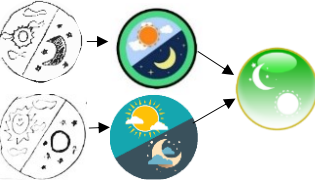
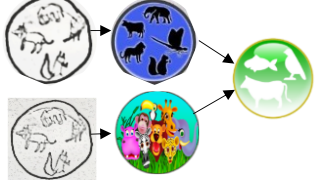
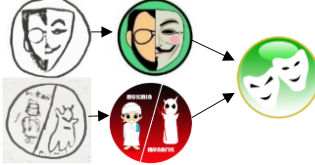
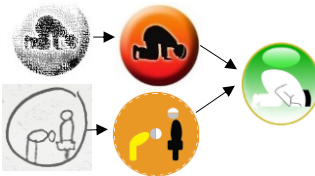
The third part focused on the high-fidelity icon design that is close to the working icon. The choice of icon in medium fidelity part from youth survey was then improvised and redesigned based on the feedback received. The same Adobe Photoshop software was used to form one digital icon design. At this stage, several design concepts and ideas had been explored which resulted in a final version of the high-fidelity icon design (see Table 3.5 and Appendix 4).


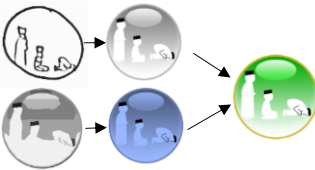
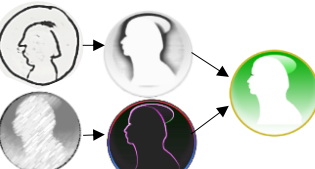
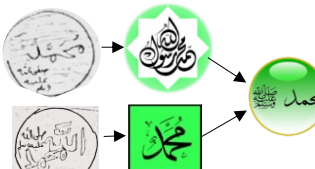
Table 3.5: Designing Semiotic Icon Design for Reciting Quran (SIDQ)

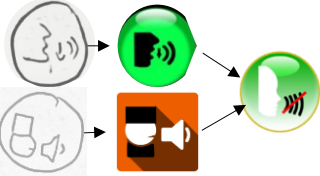
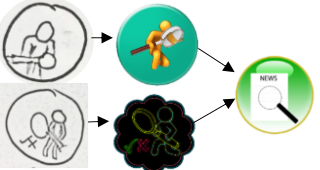

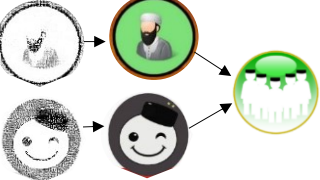
	Low Fidelity Icon (LF) Medium Fidelity Icon (MF) High Fidelity Icon (HF)	Proposed Six (6) Icon Design Elements (Kamarulzaman et al., 2020)						Peirce's Theory of Semiotics (Chandler, 2007)		ARCS Model of Motivational Design (Keller, 2000)			
	Genres / Element Definition	Recognizable Familiar/ Common Image	Color Bright Warm Contrast	Simple Simple, one message	Semantic Close to meaning	Familiarity Frequent seen, familiar	Consistency Style, shape, size, uniformity	Object	Interpretation	Attention Ability to grab attention	Relevance Usefulness	Confidence Self-control	Satisfaction Intrinsic enjoyment
	LF MF HF												
1	Zina 	Man & woman with prohibited sign	Medium Fidelity icon (3-4 color per icon), few set color icon (green, blue, red, yellow, grey, black, white, orange) (See Appendix 4)	Used simple two-dimensional (2D) image to represent message	Used image close to icon meaning. Low semantic distance	Used frequently seen image for easy recall	Applied flat style, round shape same size, closed-ended circle	Man & woman prohibited sign	Zina	Applied variability to grab attention, need to use different ways of learning (reciting) technique through visual icon. SIDQ	Goal orientation by giving usefulness of topic to get interest to use.	Get control over learning process. feel that their success	Encourage intrinsic enjoyment of learning experience fun, continue learning process without expecting reward. SIDQ makes Quran recitation more interesting. Provide
2	Qazaf 	Man & woman with prohibited sign (accuse)					Man & woman prohibited sign (accuse)	Qazaf					

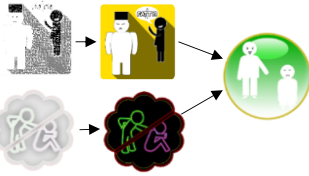
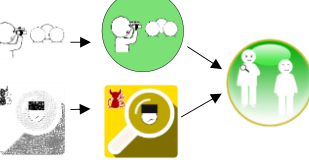
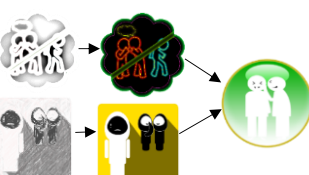
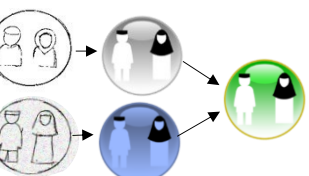
3	<p>Lian</p> 	Man and woman with prohibited sign (swear)	High Fidelity icon (4 color per icon green for background (hope, life, nature) white for image (purity) black for image (serious) gold/brown for border (natural) (See Appendix 4)					Man and woman prohibited sign (swear)	<i>Lian</i>				
4	<p>Adab Masuk Rumah</p> 	House						House	<i>Enter Rumah</i>				
5	<p>Tundukkan pandangan</p> 	Woman lower gaze						Woman lower gaze	<i>Tundukkan pandangan</i>				
6	<p>Nikah</p> 	Married couple						Married couple	<i>Nikah</i>				

7	<p>Hidayah</p>	Man asks guidance						Man asks guidance	Hidayah				
8	<p>Langit dan bumi</p>	Sky and earth						Sky and earth	Langit & bumi				
9	<p>Adab dalam Masjid</p>	Mosque						Masjid	Adab dalam masjid				
10	<p>Kejadian hujan dan kilat</p>	Rain and lightning						Rain and lightning	Kejadian hujan & kilat				

11	Kejadian siang dan malam 	Day and night					Day and night	Kejadian siang malam				
12	Kejadian haiwan 	Animals					Animals	Kejadian haiwan				
13	Munafik 	Hypocrite face					Hypocrite face	Munafik				
14	Taat 	Obey man					Obey man.	Taat				

15	Taqwa 	Man doa						Man doa	<i>Taqwa</i>				
16	Solat 	Muslim prays						Muslim prays.	<i>Solat</i>				
17	Perempuan taat 	Obedient woman						Obedient woman.	<i>Perempuan taat</i>				
18	Adab dengan Rasulullah 	Rasul name						Manners toward Rasul	<i>Adab dengan Rasulullah</i>				

19	<p>Larangan tinggi suara</p> 	Prohibition of high voice						Prohibition of high voice	<i>Larangan tinggi suara</i>				
20	<p>Siasat</p> 	Magnifying glass to find						Magnifying glass to find	<i>Siasat</i>				
21	<p>Iman</p> 	Man with faith						Man with faith	<i>Iman</i>				
22	<p>Mukmin</p> 	Mukmin						Mukmin	<i>Mukmin</i>				

23	Panggilan buruk 	Man calls other bad name						Man calls others bad name	<i>Panggilan buruk</i>				
24	Mencari salah 	Man finds other fault						Man finds others fault	<i>Mencari salah</i>				
25	Larangan mengumpat 	Men gossip						Men gossip	<i>Larangan mengumpat</i>				
26	Lelaki dan perempuan 	Man and woman						Man and woman	<i>Lelaki dan perempuan</i>				

27	Jihad 	Man hold sword						Man hold sword	Jihad				
28	Jihad di jalan Allah 	Man donates his wealth					Man donates his wealth	Jihad di jalan Allah					

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vii. Validated Icon Design (Step 7)

The set of illustrated digital icons are then validated by the experts in Quran. The icons are confirmed and recognized by the expert in terms of icon suitability with the verses in the Surah. This step received positive recommendation and feedback from the experts to ensure the icon is well designed and conveys the right message to the user. The results of expert validation are summarized in Chapter 4.

Overall, each stage of fidelity prototype of icons was designed based on proposed icon design elements (see Chapter 2). Each stage uses 3 samples, namely surah An-Nur, Al-Hujurat and As-Saff as a study to get further design feedback from the potential users. The outcomes of this design stage are the twenty-eight (28) semiotic icons designed for Surah An-Nur, Al-Hujurat and As-Saff that has been validated by the experts in Quran. The findings of this section will be further discussed in Chapter 4.

a. Validation of SIDQ

To determine the validity of icon design for SIDQ, expert validation was carried out to determine the usability of the icon design at acceptable level. There is content validation of semiotic icon design for reciting Quran by the experts in Quranic and two experts for language and face validity. The content validation was carried out by letting the expert validate the suitability of the fidelity semiotic icon design (SIDQ). The validation is to verify the semiotic icon design for reciting Quran. This is in line with Rubio et al. (2003) that recommended the validity process specifies that at least three expert reviewers are required to conduct the content validation.

The selection of experts was based on their experiences in Quranic fields theoretically and practically as summarized in Table 3.6. Three professional experts are

lecturers in the Quranic field and have more than ten years of experience. Prior to the expert validation process, the expert was given a letter of appointment. In addition, content validation and face validation were also conducted. The content validation was carried out to determine the validity of semiotic icon design elements for reciting Quran.

Table 3.6: Selection of Experts for content validation (Design)

No	Position	Education	Expertise	Experience	Justification for selection
1	Lecturer	PhD	Quranic and Arabic education	17 years	Selection of experts (academic group) due to: e. Research area focused on Quran and Arabic education f. Attended seminar, workshop related to research. g. Became supervisor and guides many PhD and master students. h. Has been appointed as leader related to the field.
2	Lecturer	PhD	Quran and Hadith	13 years	
3	Lecturer	Master	Arabic	12 years	

The selection of experts was based on their experiences in Quran and Arabic fields theoretically and practically as summarized in Table 3.7. Three professional experts are lecturers in the Arabic and Quran field and have more than ten years of experience. One of the experts is the Quran expert for translation. Prior to the expert validation process, the expert was given a letter of appointment. In addition, content validation and face validation were also conducted. The content validation was carried out to determine the validity of the SIDQ contents. The content validation was carried out by professionals and field experts based on their expertise.

The questionnaire for the expert validation was adapted based on Yang (2015). The questionnaire items for the validation were first validated by the expert (construct validation). Scale rating was used to evaluate the validity and the recommendation by the experts. The calculated value of the rating would describe the level of validity of the developed prototype. The result was then calculated using percentage calculation

method (PCM) by Tuckman and Waheed (1981) and the content validity is deemed acceptable if the value is exceeding 70 percent.

b. Application Design

The icon design application was developed to combine all icons designed in a mobile user interface. The selection of icon enables youth to interact within the application effectively. Detailed design of the application is discussed in Chapter 4.

Sketching and storyboarding are important to create the samples to illustrate the icon design and to specify the instructional strategies used in the prototype. Therefore, a storyboard that outlines the presentation of the proposed Semiotic Icon Design for Reciting Quran (SIDQ) and Semiotic Icon Design Application for Reciting Quran Application (SIDAQ) was sketched and designed with details of text, graphic, sound, and descriptions. The storyboard was prepared using PowerPoint with each slide representing a screen in the SIDQ and SIDAQ. The content of the presentation aimed at youth at all levels of students. During this phase, the icon design was focused on the icon design process and physical features of the icon design and application. The sample format of storyboard for icon design and application is given in Table 3.5. (See details of application design storyboard in Appendix 3).

Table 3.7: Sample of Storyboard design for application

Title:	Page No
Page:	
Description:	
Sketch	Details: Image/ Graphic Sound/ Narration Animation Video Actions

The content of this application is content of Quran which is selected for 3 surah as the sampled surah. The content of three Surah is also a collection of Quran that

contains the guide of life. Using the semiotic icon design elements, the surah content is designed, and the result of this phase is an icon design for three surah in Quran namely, Surah An-Nur, Surah Al-Hujurat and Surah As-Saff; the content design in this study is known as the Semiotic Icon Design for Reciting Quran (SIDQ).

c. Evaluation Design

Application evaluation is performed to evaluate the application in the aspect of icon design, usability, motivation, and acceptance of application. Chapter four will discuss more details on the application evaluation.

3.3.3 Development

In stage 3 (Development), the finalized icon design application prototype was produced. The development of SIDQ was determined by its suitability with the youth needs. The development phase is to design and develop the content of the icon design in mobile application platform. Once the storyboard was completed, a discussion was held with the graphic designer to determine the best method to develop the Semiotic Icon Design Application (SIDAQ) within the time frame. The content of applications is developed using the software proposed namely Adobe Flash and Adobe Photoshop software.

a. Prototyping

The prototyping model by Sommerville (1996) has been applied in this stage as illustrated in Figure 2.22. The following discussion on prototyping model consists of four steps namely define prototype SIDAQ, define prototype SIDAQ functionality, develop prototype SIDAQ and prototype SIDAQ evaluation. Figure 3.9 summarizes the prototyping process for SIDAQ.

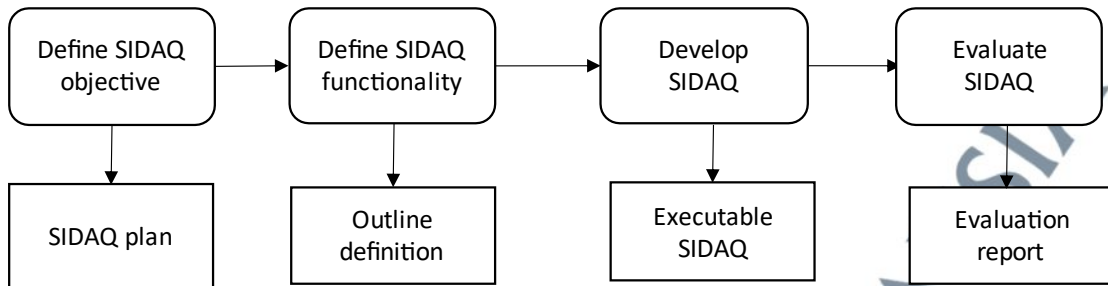


Figure 3.9: Prototyping model for SIDAQ

i. Define prototype SIDAQ objectives (Step 1)

The first step in creating an application was to build a clearly defined goal and objectives for the Semiotic Icon Design Application for Reciting Quran (SIDAQ).

ii. Define prototype SIDAQ functionality (Step 2)

This step visually conceptualized the key features and a rough layout and structure of the SIDAQ. Sketches for the proposed layout and structure of the SIDAQ were drawn. In this study, the quick design of SIDAQ, the interface design of application was sketched through storyboard.

iii. Develop Prototype SIDAQ (Step 3)

This step is to develop the semiotic icon design application for reciting Quran for Android devices. Clear picture of the structure and a storyboard for the SIDAQ was established. The storyboard produced the basis for the initial version of the SIDAQ. Each screen content was designed with high-resolution version SIDAQ. When the screen designs finished and implemented, the real app concept was complete. The new ideas and comments were used to improve the app.

iv. Evaluate Prototype SIDAQ (Step 4)

The next step involved prototype testing. Users are the experts who assisted to review the prototype. They were requested to test the app and give truthful feedback during pilot study and evaluation. Based on feedback, the prototype was revised. The

aim was to ultimately identify the SIDAQ before going into the implementation step. The IT experts and youth tested and evaluated the application. The SIDAQ app was subsequently installed on Android devices and tested for functionality in a real environment.

In this study, the icon design of application prototype is developed using the fidelity technique and based on the Prototype model (Somerville, 2006) illustrated in approach as a complete application development (see Figure 2.22). The application was developed using Adobe Flash and Adobe Photoshop software.

b. Flowchart

Flowcharts were used as a guide in developing the applications to show the overall process of the application to be developed. Flowcharts are diagrams that show how users move from one page to another. The flowchart outlines the user's journey through the content to show the sequence of steps to accomplish a task within the interface and to identify the usability steps (Jackson & Ciolo, 2017). This is supported by Holtzblatt (2017) who stated that process flow and storyboards are necessary to reflect the early application of developed applications. The development phase involved process flow for prototype development. From the process flow, the relationship among steps can be seen. A few purposes of flowchart include:

- Assist the designer or developer to plan and implement the design and development process.
- Allow the developer to evaluate the overall concept from visual perspective.
- Ease the communication using visuals between the developer with the user.

The sample process flow of the SIDAQ is summarized in Figure 3.10.

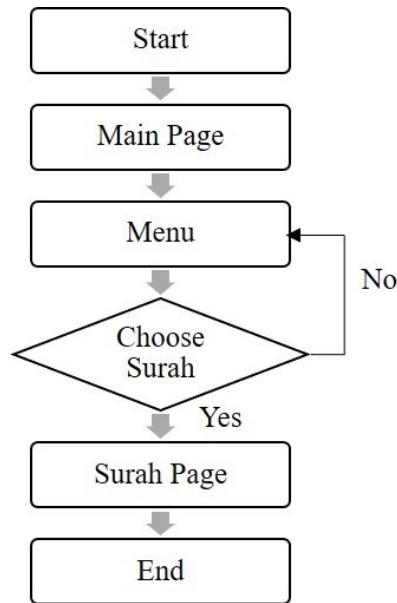


Figure 3.10: Process Flow for SIDAQ

As a conclusion, all phases in developing the application are important to ensure that the icon is designed properly, and the application can fulfil user needs and requirements. All phases are interrelated and interdependent. The phase one must be done first then continued by the next phase.

Overall, the analysis, design and development are important in this research and important for the body of research. Without this framework the research cannot be initiated. The next chapter will discuss the findings from this research. This evaluation phase will also be described in in chapter five as the development report presented in this study.

3.3.4 Implementation

Once the SIDQ has successfully undergone the expert validation process and was acceptable to be used, the study moved to the next phase, implementation phase. SIDQ was first tested in a pilot study before its real implementation. Since this study applied the DDR Type 1, a pilot study was included and considered as the phase in the

implementation phase (Richey, 1994; Richey et al., 2004). After the test result is satisfying, the prototype was implemented to the real samples of user (Koneru, 2010). The pilot study was carried out to find undiscovered issues that were not detected during the previous process and to determine reliability of the measurement of the prototype designed and developed. The details of pilot study are discussed in section 3.6.3.

In the implementation phase, formative evaluation was carried out to ensure all the activities can be conducted as planned. Formative evaluation is a measurement of learning outcomes during the learning process (Almomen et al., 2016; Koneru, 2010). In this study, the formative evaluation was carried out in session using the experimental list prepared earlier. The formative evaluation was utilized for two reasons, to reflect on each session and to be used as an insight for future modification on the execution of the study.

3.3.5 Evaluation

The last phase in the ADDIE model is evaluation. The evaluation in this phase is considered a summative evaluation. Summative evaluation is the measurement of learning outcomes after the teaching and learning process (Almomen et al., 2016; Koneru, 2010). The online evaluation form was answered by the students, and the ratings were recorded. For the quantitative part, the summative evaluations were based on the ratings from post-test.

For the qualitative part, the evaluations were based on the results from the open-ended questionnaire and interview procedure. An open-ended questionnaire was distributed to get student feedback on the SIDQ and SIDAQ. Three youth were randomly selected to be interviewed. Next, the data were analyzed to draw a conclusion

for the evaluation phase. A summative evaluation provides insight into the icon design, usability of application, motivation and acceptance of the SIDAQ.

The evaluation phase is the final phase in the developmental methodology used. This phase involves the evaluation of semiotic icon design application proposed in this study adapted from Chandler (2007), Davis (1989), Harrison et al. (2013), Keller (2000), Sommerville, (2016) and Yang (2015). To evaluate the applicability of the application several evaluation elements were developed in the distributed questionnaire. This evaluation process involves the following four aspects:

- i. Icon design
- ii. Usability of the application
- iii. Motivation
- iv. Acceptance of the application

The evaluation phase involved respondents completing the questionnaire. The respondents will then be selected at random for the interview. This evaluation phase will determine the weaknesses and strengths of these developed applications. Based on the comments and insights from this evaluation process, application purification can be done to enhance strengths and minimize the weaknesses. This phase will be detailed in chapter five. Evaluation is done for 74 students from Central Region (Selangor and Negeri Sembilan) from secondary schools and higher learning institutions and the total of six 6 experts from Quran and Information Technology who understand the Quran and IT Islamic studies. This is in line with Nielsen (1993, p. 156) who recommended about three to five evaluators for evaluation, which can identify about 66-75% of the usability problems in the application interface. Table 3.7 summarizes the selection for experts for application design evaluation.

Table 3.8: Selection of Experts for Application Design (Evaluation)

No	Position	Education	Expertise	Experiences	Justification for selection
1	Lecturer	PhD	IT and Quran	17 years	Selection of experts (academic group) due to: <ol style="list-style-type: none"> Research area focused on Quran and IT education Attended seminar, workshop related to the research. Became supervisor and guides many PhD and master students. Has been appointed as leader related to the field.
2	Lecturer	PhD	IT Multimedia	12 years	
3	Lecturer	Master	IT	15 years	
4	Lecturer	Master	Arabic	12 years	

The survey shows that various evaluation approaches are based on icon design, usability of application, motivation, and acceptance of the application. The evaluation is used to determine the suitability of the method in the research study. The element of evaluation based on each method adapted was based on the suitability of the icon and application development. Figure 3.11 shows a summary of methods and strategy involved in this research which executed ADDIE using DDR Type 1.

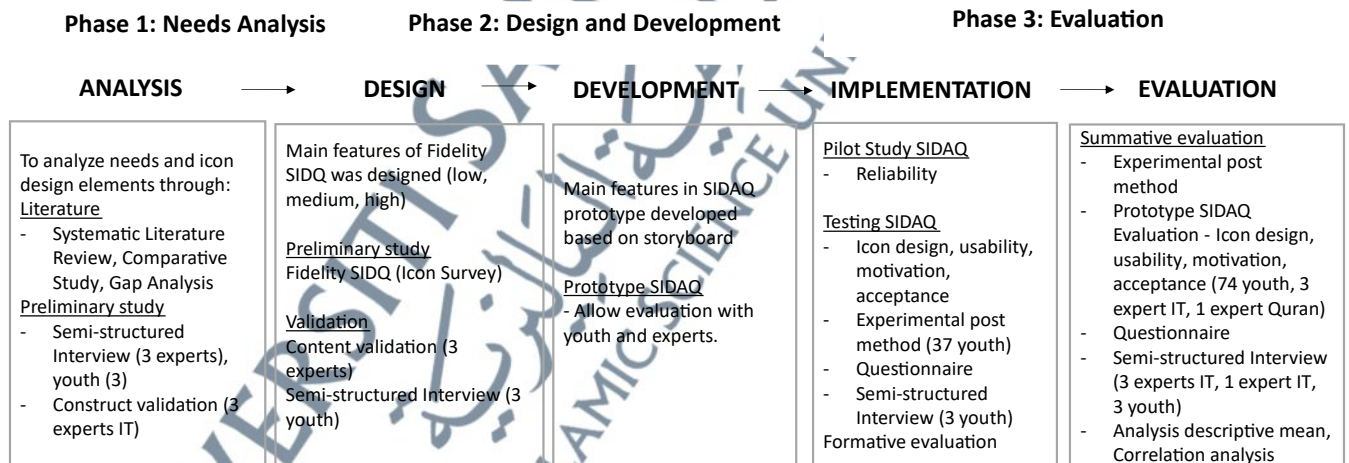


Figure 3.11: ADDIE-DDR Type 1 (Phase Summary)

3.4 Data Collection Technique

This study employed the quantitative and qualitative data collection approach to collect the data. As the data collection was performed in several phases, the careful and insightful consideration were made to ensure the best method of data collection was used for each phase. This is to ensure the data were collected in the best way possible. To study the need and find out the best approach to develop the prototype product, a semi-structured interview was conducted during the analysis phase. Apart from that, a comparative study was carried out to determine the icon design elements to be applied in the icon design. Later, to test the fidelity icon design validity and reliability, a pilot study session was conducted during the design and development phase using questionnaire and semi-structured interview.

The quantitative data in this study were collected through the questionnaire during the experimental post evaluation. To further clarify the experimental results, this study also conducted a short interview with youth randomly to support the study by getting the responses on the open-ended questionnaire upon completion of the experimental process. Table 3.8 shows the research method conducted on each phase adapted from Alias et al. (2013) and Figure 3.11 with executed ADDIE using DDR Type 1.

Table 3.9: Data Collection Method for SIDQ using ADDIE-DDR Type 1

	DDR Phase	ADDIE Stages	Method
Phase 1	Needs Analysis	Analysis	Systematic Literature Review Comparative Study, Gap Analysis Preliminary Study (Semi-structured Interview)
Phase 2	Design and Development	Design Development	Fidelity Icon Design (Low, Medium, High) Preliminary Study (Icon Survey) Questionnaire Semi-structured Interview
Phase 3	Evaluation	Implementation Evaluation	Experimental post method Evaluation (icon design, usability, motivation, acceptance) Questionnaire Semi-structured Interview

3.5 Sampling and Population

Sampling is the selection of a subset of the population of interest in a research study (Turner, 2020). Sampling is a procedure in which a smaller group of the population is selected to answer the survey questions; the information gathered can be generalized to the whole population of interest. The main purpose of sampling is to obtain a sample that has the general characteristics of the population, especially the characteristics that need to be investigated.

In this study, a simple random sampling method was used to select seventy-four (74) youth. This sample was selected to allow the researcher to conduct the study quickly and timely. A simple random sampling method was used to eliminate bias while selecting the participants (Turner, 2020). While applying the simple random sampling method, every participant was given an equal chance of being selected. The small samples was used because based on Roscoe (1975), minimum of 30 or more (30 to 500) respondent is sufficient in most experimental studies (Muslimin, 2018). The sample population involved youth aged 15 to 30 years old. The selection of participants is based on their background as well as their willingness and cooperation to participate this study. The sampling procedure for this study involved five steps: identify the population of interest (target population), select the sampling frame, specify the sampling technique, determine the sample size, and execute the sampling plan (Amrita Akhouri, 2018).

In step 1, identify the population of interest (target population). The population of interest in which the researcher wants to generalize the result of the study (Amrita Akhouri, 2018). The population of youth in Malaysia is about 9.1 million between 15 to 30 years old in 2018 where female contributes about 4.4 million (48.4 percent) and

male 4.7 million (51.6 percent) (Institute for Youth Research Malaysia, 2018). In this study, the population focused on youth aged 15 to 30 years from Islamic and non-Islamic education background in two secondary school and two higher institutions in Central Region from Selangor and Negeri Sembilan. The age was categorized by three sub-groups based on education level which are age 15 to 17, age 18 to 22 and age 23 to 30 years. The target population for this study were youth from SMK Bandar Rinching, SAM Sg Merab Luar, Faculty of Alam Bina (FKAB), Universiti Kebangsaan Malaysia and Fakulti of Quran and Sunnah Studies (FPQS), Universiti Sains Islam Malaysia. The total population from the two selected secondary schools were 2000 youth and the total population from the two selected higher institutional were 500 youth.

In steps 2, select the sampling frame. Sampling frame is the group of individuals or objects from which researcher will draw the sample. It is the list of all units in a study population from which the sample is taken (Amrita Akhouri, 2018). In this study, the samples were from Form 3 to Form 5 students from two (2) secondary schools and final year students from two (2) higher institutions near to researcher's house in sampling frame to conduct the study.

In steps 3, specify the sampling technique. Sampling can be done through probability (random selection) or non-probability (non-random) technique. In this study, the sampling technique is through probability (random selection) technique. Simple random sampling is used as sampling technique for this study. Simple random sampling enables researchers to ensure that all participants had equal chances of being selected for the study (Morrison et al., 2007; Turner, 2020).

In step 4, determine the sample size. The sample size is simply the number of units in the sample. Sample size determination depends on many factors such as time, cost, facility (Amrita Akhouri, 2018). Sampling from the population is often more

practical and allows data to be collected faster and at a lower cost than attempting to reach every member of the population (Turner, 2020). In this study, the number of samples of youth who responded for this study was about hundred and thirteen (113) youth for survey in phase 2, thirty-seven (37) youth for pilot study in phase 2 and seventy-four (74) youth for evaluation in phase 3 (see Table 3.9 and 3.10). The total youth involved in this study is about 221 from phase 1 to phase 3. This number is sufficient for this study using experimental method. This in line with Roscoe (1975) explained that the number of samples in most experimental studies is a minimum of 30 or more (30 to 500) is sufficient while experimental studies using experimental research design using paired experimental study design had enough samples of between 10 to 20 people (Muslimin, 2018).

Table 3.10: Simple Random Sampling for Phase 2

Institution	Group	Population	No. of Sampling	Method
FPQS, Universiti Sains Islam Malaysia	Youth aged 15 to 30	300 youth (undergraduate students)	113 youth (undergraduate students)	Survey
FPQS, Universiti Sains Islam Malaysia/ SMK Bandar Rinching	Youth aged 15 to 30	300 youth (undergraduate students) 1800 youth (secondary school students)	37 youth (undergraduate students and secondary school students)	Pilot Study

During phase 3, the evaluation phase, the participating youth for the evaluation are from a sample group of 74 respondents from populations of youth from age 15 to 30 in secondary school and higher institutions in central region Malaysia. The sample for this research is 18 youth from age 15 to 17, 41 youth from age 18 to 22, and 15 youth from age 23 to 30. The total number sampled is seventy-four (74) youth from three different age groups summarized in Table 3.10. From the population of one thousand and eight hundred (1800) students from Form Three to Form Five, SMK Bandar Rinching and population of two hundred (200) students from Form Three to

Form Five, SAM Sg Merab Luar, eighteen (18) youth are selected randomly as the sample size for the study from youth aged 15-17 through random sampling method. From the total student's population of one hundred (100) students from Faculty of Alam Bina (FKAB), Universiti Kebangsaan Malaysia, and three hundred (300) students Faculty of Quran and Sunnah Studies (FPQS), Universiti Sains Islam Malaysia, 41 students are selected randomly as the sample size for the study from youth aged 18-22. From the total student's population of one hundred final year students from Faculty of Alam Bina (FKAB), Universiti Kebangsaan Malaysia, and three hundred (300) final year students from Faculty of Quran and Sunnah Studies (FPQS), Universiti Sains Islam Malaysia, 18 students are selected randomly as the sample size for the study from youth aged 23-30.

Table 3.11: Simple Random Sampling for Phase 3

No.	Institution	Group	Population	No. of Sampling	Method
1	SMK Bandar Rincing/ SAM Sg Merab,	Youth aged 15 to 17	1800 youth/ 200 youth (secondary school student)	18 youth (secondary school student)	Experiment Interview Questionnaire
2	FKAB, UKM FPQS, USIM	Youth aged 18 to 22	100 youth 300 youth (undergraduate students)	41 youth (undergraduate student)	Experiment Interview Questionnaire
3	FKAB, UKM, FPQS, USIM	Youth aged 23 to 30	100 youth 300 youth (undergraduate students)	15 youth (postgraduate student/working)	Experiment Interview Questionnaire
Total Sampling				74 youth	

In Step 5, execute the sampling plan. Once population, sampling frame, sampling technique and sample size are identified, researcher can use all that information to choose the sample (Amrita Akhouri, 2018). In this study, the process to collect the data from the sample youth through the icon survey, pilot study and evaluation through post experimental. In phase 2, in design stage, icon survey involved hundred and thirteen

(113) youth through online survey. In implementation stage, a pilot study was performed with sample of thirty-seven (37) youth to test the semiotic icon design application through experiment and questionnaire. The data collection and method applied were summarized in Table 3.10. In phase 3, in evaluation stage, the evaluation was performed with sample of seventy-four (74) youth to evaluate on the semiotic icon design application through online experiment and questionnaire. The data collection and method applied were summarized in Table 3.11.

Before implementing the pilot test and evaluation of the application, the researcher takes into consideration of the sampling bias in for the samples selected for this study. According to Alchemer (2018), sampling bias, also referred to as sample selection bias, refers to errors that occur in research studies when the researchers do not properly select their participants. Ideally, people participating in a research study should be chosen randomly while still adhering to the criteria of the study. When researchers fail to select their participants at random, they run the risk of severely impacting the validity of their results and findings because their sample does not accurately reflect the population of interest.

In this study, the pilot study samples of the USIM students were taken to get an initial picture of the suitability of icon design or genre by considering the metacognition mapping with understanding. Flavell (1979) defined metacognition is one's ability to use prior knowledge to plan a strategy for approaching a learning task, take necessary steps to problem solve, reflect on, evaluate results, and modify one's approach as needed. It helps learners choose the right cognitive tool for the task and plays a critical role in successful learning (Scanlon, 2010). Therefore, youth with Quranic knowledge and experience were needed for the pilot study in order to get their insight on prior

knowledge that may assist for reaching an understanding of genre of the of icon design for reciting the Quran.

According to Alchemer (2018), one of the most effective methods that can be used by researchers to avoid sampling bias is simple random sampling, in which samples are chosen strictly by chance. This provides equal odds for every member of the population to be chosen as a participant in the study at hand. The great thing about simple random sampling is that no effort is required by potential participants. For example, a computer can be used to randomly select names from a master list, and the selected names can become participants in the study.

In this study, to avoid bias when the study is conducted, the study uses the method of random sampling to few types of school, where involved previous schools from National Secondary School (SMK), Boarding School (SBP / MRSM), National Islamic Secondary School (SMKA), Arabic School (SAR/SMA/SAM), Islamic Boarding School (SBPI / MRSM Ulul Albab) and others (Private School). Therefore, the sample of this study was covered for both categories of youth from non-Islamic educational and Islamic educational backgrounds to get the initial picture of the suitability of icon design or genre metacognition mapping with understanding from both categories of youth.

3.6 Instrumentation

Instrumentation refers to the tools or means by which the researcher attempts to measure the variables or items of interest to obtain data on the topic of interest from the research subject. It is related to instrument design, selection, construction, and evaluation. This section discusses the instrumentation related to the data collection process which divides into two parts; instruments used in design and development phase

and instrument used during the evaluation phase. The questionnaire was adapted from Catalina Vaquero and Morales López (2016), Guo (2016), Kamarulzaman et al. (2020), Qiang & Fei (2016), Yang (2015), Yew (2015), Zender and Mejia (2013) and validated by the experts.

The instruments of this study consisted of Likert scales questions and open-ended questions. Interviews were used as a guide for the researcher to obtain respondent feedback individually. The instrument was based on application evaluation in the aspect of icon design, usability of application, motivation, and acceptance of the application. In addition, the questionnaire was used to obtain quantitative data. The selection of the questionnaire was in line with the views of Ary et al. (2010) who found that questionnaire was suitable for studies involving large, broad, and comprehensive respondents. The questionnaire can generate facts and information while the cross-tabulation process in statistical methods can be used to diversify the findings of a study.

For this study, three (3) sets of questionnaires were developed, namely questionnaire for youth as the youth respondents, content validation for Quran expert and evaluation for IT experts. To obtain the questionnaire validity, the three (3) experts in IT was consulted for verification purposes. Then the questionnaire for the youth respondents was tested through a pilot study of thirty-seven (37) youth to obtain reliability. During the pilot process the researcher also used interview methods to get feedback on the questionnaire form with three (3) youth. Here is a complete description of the questionnaire constructed:

3.6.1 Instrument for Prototype Icon Design

a. Needs Analysis Interview

Two (2) sets of questions were constructed based on the literature review to get feedback on the need for icon design application for youth. A semi-structured interview was used to collect data. During the semi-structured interview, the researcher took the role of an instrument to elicit the information. Semi-structured interviews are superbly suited for a number of valuable tasks, particularly when more than a few of the open-ended questions require follow-up queries (Adams, 2015). The questions were constructed to guide the conversation as shown in Appendix 5 and 6.

b. Survey Form

A survey form was used to evaluate the semiotic icon design suitability for Quran. The survey was done to get feedback from youth on the user's preference for the semiotic icon. The survey form was constructed as shown in Appendix 15.

c. Questionnaires for Validation and Reliability

An instrument is a tool used to measure a study's phenomenon or variables. The research instruments need to go through a process of validity and reliability to ensure the quality of the data obtained. The validity is the accuracy of the variables in the instrument to measure what should be measured in each study. The reliability refers to replication and consistency during the research project (Mark et al., 2019). Therefore, instrument validity and reliability are the key factors in determining the success and accuracy of a study conducted. In this study, three sets of questionnaires were prepared for expert validation processes which are construct validation, content validation, and language validation. The reliability for the SIDQ instrument was then performed during the pilot test.

Construct validity refers to the extent to which a set of questions (known individually as scale items, measures the presence of the construct we intended them to measure (Mark et al., 2019). In this study, the construct validity of the questionnaire was conducted by referring to three (3) experts in Information Technology (IT). This panel of referrals is required to determine the construct validity including the suitability of the items as well as the face validity of language used. A list of the constructs and items has been distributed to the panel. The experts reviewed the items in the instrument and agreed that the instrument is suitable to be used in this research. The questionnaire for construct validation is shown in Appendix 14.

Content validity is the process of confirming that the items used in the instrument are suitable to represent the areas of knowledge to be evaluated (Mark et al., 2019; Rubio et al., 2003). In this study, the content validity of the questionnaire was conducted by referring to three (3) experts in Information Technology and three (3) experts in Quran in design to determine the suitability of the content of the instrument for semiotic icon design. The questionnaire for content validation is shown in Appendix 8 and Appendix 14.

d. Reliability of the instrument

Determination of reliability values is important in determining the consistency of the items built into the study instrument. To determine the reliability of the SIDQ, a pilot test was done with thirty-seven (37) youth from Faculty of Quran and Sunnah, Universiti Sains Islam Malaysia. The youth answered the questionnaire for giving feedback on icon design and application. The questionnaire for reliability is shown in Appendix 7.

Mark et al. (2019) stated that Cronbach alpha is a statistic used to measure the consistency of responses across a set of questions (scale items) designed together to

measure a particular concept (scale). Cronbach's alpha is a statistic commonly quoted by researchers to demonstrate that tests and scales that have been constructed or adapted for research projects are fit for purpose (Taber, 2018). The reliability of each instrument was obtained using the internal stability technique using Cronbach's alpha coefficient.

According to Mark et al. (2019), alpha coefficient is the reliability used by most researchers in a study. The researchers used alpha values based on Cronbach's coefficient alpha that consists of an alpha coefficient with a value between 0 and 1. Many researchers suggest alpha values above .70 for an instrument indicate a high level of reliability and its acceptance for use as a research instrument and indicate the questions in the scale are internally consistent (Al-Marouf & Al-Emran, 2021; Mark et al., 2019; Taber, 2018). Table 3.11 shows the classification of the reliability for this study.

Table 3.12: Classification of Reliability

Indicators	Cronbach's alpha value
Very high	.90-1.00
High	.70-.89
Medium	.30-.69
Low	.00-.30

In this study, Statistical Packages for the Social Sciences (SPSS) for Windows version 26.0 software was used to obtain the coefficients. The results of the questionnaire reliability analysis can be seen in Table 3.13. Cronbach's alpha scores for the student questionnaire ranged from .70-1.00 in all assessment components, while the overall construction shows very high value of .98. This indicates that the questionnaire has high reliability for use in this study. This represents the questionnaire as highly reliable.

Table 3.13: Cronbach's alpha values for youth questionnaires

Components of Assessment	Questionnaire	Indicators
Icon Design	.90	High
Usability,	.89	High
Motivation	- .95	Very High
Acceptance	.96	Very High
Overall	.98	Very High

e. Validation form

Validation form was used to validate the evaluation sheet questions. Using the validation form, experts reviewed items and ticked on the validity section. There is a column for five-point Likert scale on agreement and disagreement. The form was completed with comment space for improvement and suggestions from the experts. The validation form used is shown in Appendix 8 and Appendix 14.

In phase 2, the online survey form is distributed to the sample group of one hundred thirteen (113) youth for their feedback on the appropriate semiotic icon for the Quran. In phase 3, the sample group of seventy-four (74) youth for semiotic icon design application evaluation was selected through a simple random sampling method. Detail on sampling procedure was discussed in section 3.5. The questionnaire form link is distributed to the sample group for evaluating the semiotic icon design application for reciting Quran. The sample group is given ten to twenty minutes to answer the online questionnaire form and submit the questionnaire. This method is chosen to avoid an unreturned questionnaire. The interview session is conducted for three (3) students from the sample group. The respondents were selected randomly for an interview session through simple random sampling procedure. The simple random sampling procedures was discussed detail in section 3.5.

3.6.2 Implementation for Evaluation Semiotic Icon Design for Reciting Quran

a. Evaluation Form (Youth)

The questionnaire was developed based on the aspect of icon design, usability of application, motivation, and acceptance. In total, the questionnaire consisted of 30 questions based on a Likert scale. It was chosen because it is easy to build and is widely used in research. The Likert type rating scales are an important source of data in research (Weijters, Cabooter, & Schillewaert, 2010). The questions used a five-point Likert scale from 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree). Table 3.14 shows the distribution of item by Likert Scale.

Table 3.14: Distribution of Items by Likert Scale

Statement	Summary	Score
Strongly disagree	SD	1
Do not agree	DA	2
Moderately Agree	M	3
Agree	A	4
Strongly agree	SA	5

The questionnaire is divided into six sections:

i. Section 1: Respondent Background

The question consisted of two parts which are demographic profile and quran recitation interest. Part A covered respondents' demographics namely gender, age previous school and highest educational level. Part B covered scale of one to five questions related to the basic youth recitation interest.

ii. Section II: Icon Design

This section covered 30 questions related to six construction elements on icon design namely recognizable, color, simple, semantic, familiarity and consistency. All these questions should be answered on the scale of one to five that is strongly disagree, disagree, moderately agree, agree, and strongly agree. The questionnaire aimed at

evaluating the user's feedback on the icon design of semiotic icon design application for reciting Quran.

iii. Section III: Usability of Application

Section III covered a set of 10 questions related to the usability of application developed. This section is made up of two construction elements of effectiveness and satisfaction. All these questions should be answered on a scale of one to five that is strongly disagree, disagree, moderately agree, agree, and strongly agree. The questionnaire aimed at evaluating the learner's feedback on the usability of semiotic icon design application in reciting Quran.

iv. Section IV: Motivation

Section IV covered a set of 20 questions related to the motivation aspect of application developed. This section is made up of four construction elements of attention, relevance, confidence, and satisfaction. All these questions should be answered on a scale of one to five that is strongly disagree, disagree, moderately agree, agree and strongly agree. All the feedback are collected, analyzed and used for further improvement. The questionnaire is aimed at determining the motivation in using semiotic icon design application for reciting Quran.

v. Section V: Acceptance of Application

Section V covered set of 15 questions related to the acceptance of application developed. This section employed acceptance elements of perceived usefulness perceived ease of use and actual use as suggested in Davis (1989). All the questions should be answered on a one-to-one scale that is strongly disagree, disagree, moderately agree, agree and strongly agree. The questionnaire aimed at evaluating the user's feedback on the acceptance of semiotic icon-based mobile application in reciting Quran.

The sample questionnaire is included in Appendix 7.

vi. Interviews

For the interview, the researcher acted as the main instrument to collect data. Interview questions were used since they also answer the evaluation form for the application. During interview, the students were required to give the reasoning behind their answers in the evaluation form.

b. Evaluation Procedures

The study involved different groups of respondents, students from Islamic and non-Islamic education background. A total of 74 respondents comprising youth from three age groups of 15 to 17, 18 to 22, 23 to 30 years were randomly selected. The evaluation process was performed in online platform due to the COVID-19 pandemic from March to June 2020. The evaluation was done through online platform and the respondents answered the questions through online google forms. Although there was some difficulty in communicating the information fully through online platform only, the respondents gave positive support and responses that assisted this evaluation successfully.

The evaluation involved three (3) experts from the field of Quran and three experts from Information Technology. Seventy-four (74) respondents were randomly selected for the purpose of evaluating the application and they were youth with the similar characteristics of real respondents through simple random sampling method (see section 3.5). The number of experts and respondents selected in this process is based on the suggestions provided by Nielsen (1993) which suggest that at least three respondents of various levels of knowledge and skills are needed for this assessment purpose and that involving more respondents in the assessment process is increasingly encouraged.

During the evaluation process, respondents were provided with information before using the application. Questionnaire form (google form) was provided to get respondents' feedback on the application being developed. In addition, the evaluation also involved four experts to evaluate on the application. Based on the findings from the evaluation process, the researcher will update the application and refine it to ensure that any errors in the system are minimized. The next sections will detail the data analysis part.

3.6.3 Pilot Study

Prior to the actual study, a pilot test was conducted to identify the validity of the items in terms of error, the appropriateness of the terms and the structure of the sentences included in the questionnaires. The survey was conducted to avoid confusion and misinterpretation in the actual respondents to the questionnaire distributed. Similarly, interviews were conducted in the pilot study to enable the support of tests built to meet validity and reliability.

The pilot study was conducted involving the University Sains Islam Malaysia. The pilot study involved a set of questionnaires based on 37 students under the Bachelor of Quran Multimedia program. According to Johnson et al. (2014, p. 298), the minimum number of respondents that can be used in a pilot study is 5 to 10 people.

All these instruments were given to respondents who had similar characteristics to the actual respondents of the study. The pilot study was conducted to identify the weaknesses and strengths of the questionnaire used in this study. This pilot study determined the research instrument reliability and validity.

First, the pilot study was administered to students who have similar characteristics with the experimental group. The total number of 37 undergraduate students from

Faculty of Quran Sunnah in Quran Multimedia, University Sains Islam Malaysia were chosen through random sampling method. The SIDAQ was used to assist youth in visualizing the genre of Surah when reciting the Quran. The pilot study was performed in thirty-minute sessions to complete the procedure. During the pilot study, the face validation process was carried out whereby the students were also requested to give comments verbally about the SIDAQ and to rate it using an evaluation form. All the comments and suggestions provided by students were jotted down for future improvements.

The online assessment questionnaire consisting of 75 items was distributed to all participating youth using Google form. The questionnaire consists of five sections:

- i. Section I consists of Respondent Background and Quran Recitation Interest questions.
- ii. Section II consists of Icon Design questions
- iii. Section III consists of Usability question.
- iv. Section IV consists of Motivation questions.
- v. Section IV consists of Acceptance questions.

The questionnaire session was conducted after the activities were completed. Respondents were asked to answer the questionnaire by rating the statements in the questionnaire to measure the reliability of the SIDAQ.

The module reliability is vital to be determined to ensure that the module can produce consistency when applied to a different group of students. The reliability value is calculated using Cronbach's alpha statistical analysis. Cronbach's alpha is considered as a sufficient reliability test for almost all types of research (Sekaran & Bougie, 2016).

The Cronbach alpha coefficient value should be at a minimum of at least .7 for internal

consistency of the instrument. Reliability analysis was carried out on the perceived task values scale comprising 75 items.

a. Pilot Study Results

The following are the results of discussions and observations made during the pilot study. In terms of application, students are very interested in the application, giving positive feedback, and looking forward to the real application and suggesting additional information. Other comments are students understand the term semiotic icon design techniques and suggest additional information in the questionnaire. Total five students had no problems answering the explanation questions provided.

Based on the student comments, it was found that overall the icon designed was simple but some of the icons they were not easily understood. Suitable amendments were made to address the feedback given in the pilot study. Aside from the icon design issue, no other major issue was reported, and it was found that 25 out of 37 students have given positive comments and noted that the icon design is the better medium to understand the Quran genre.

The pilot results showed high Cronbach alpha reliability as a means of measuring the reliability of the questionnaire used in this study. Cronbach's alpha showed the application to have acceptable reliability ($\alpha = .98$). Most items appeared to be worthy of retention, resulting in no decrease in the alpha if deleted. Hence, with the value of $\alpha > .7$ obtained from the pilot study, the module was fit to be used in the main data collection. The overall result for Cronbach's alpha is shown in Appendix 12.

3.6.4 Research Procedure

Research is a common phenomenon to investigate the resolution of existing problems and generate the new dimension of knowledge. Research is highlighted as an investigation to solve the problem or create new knowledge which is systematic and scientific in nature with certain methodological process (Bist, 2014). This study aimed at proposing semiotic icon design as a supportive tool and technique for reciting Quran using icon by visualizing the genre of Surah that can assist to motivate youth in reciting Quran. It is challenging to design the icon and adapt the suitable icon design elements to convey the message to the user. Since there were lack of studies in icon design that focus on icon meaning and limited studies conducted on reciting Quran using icon, this study proposed a semiotic icon design to visualize the genre of Surah that can assist in motivating youth in reciting Quran.

This study employed the design and development research (DDR) approach which consisted of three main phases of needs analysis, design and development and evaluation. In this study, a few processes are involved. Before starting the research, the researcher has been provided with a letter of permission to collect data by the university to support the research processes. This research included the following steps: In phase 1, (1) conducting the literature review on icon design to identify the research gap of the icon design studies and the appropriate icon design elements for mobile application, (2) conducting the preliminary study with three experts and three youth through semi-structured interview to gather the information on need for the study and the problems faced by youth. The selection of the icon design elements was based on the literature, comparative study, preliminary study on needs analysis and recommendations by the experts and youth.

In phase 2, (3) six proposed icon design elements were employed to design the semiotic icon to visualize the genre of Surah. Next, (4) conducting icon survey with a hundred and thirteen youth through online Google form to survey on the youth choice and suitability of the icon design for visualizing the genre of Surah using two digital icon designs. The survey results were utilized for further improving the icon design and to redesign the final digital icon. (5) Validating the final semiotic icons with three experts in Quran. The content validation experts were given a form to review the icon to confirm the suitability of icon design for reciting Quran. The youth validation had also been performed with thirty-seven (37) youth with Quranic background to review on the suitability of the icon design for reciting Quran using questionnaire delivered through Google form. (6) The semiotic icon design application was then developed to incorporate icons in a mobile application as a working prototype.

(7) A pilot study was performed with thirty-seven (37) youth to test the semiotic icon design application through mobile device with the installed application. They assessed the application on the aspect of icon design, usability, motivation and acceptance using questionnaire delivered through Google form. Three youth were randomly selected for a semi-structured interview to give feedback on the application. In phase 3, (8) evaluation was done on semiotic icon design application with seventy-four youth respondents and three experts in IT and one in Quran evaluated on the aspect of icon design, usability, motivation, and acceptance of application. The evaluation was performed through online platform due to the COVID-19 pandemic in 2020. The respondents installed a short application in their mobile device and tested the application. The questionnaire form was then given

through Google form for evaluating the application. As for experts, the Questionnaire form was emailed to experts for them to evaluate the application with a short application installer to test it. A semi-structured interview was performed to support the evaluation. Lastly, (9) the results were then analyzed through descriptive analysis and correlation analysis and write up reports were provided on the research.

3.7 Data Analysis

There are two (2) types of data acquired in this study:

- i. Quantitative data: after the completed questionnaires have been collected, the resulting data were tabulated and entered a spreadsheet in the SPSS version 26.0 program. Then, the data were summarized using descriptive statistics. Descriptive statistics have been used to describe the demographics of respondents and the feedback on the icon design, usability of application, motivation, and acceptance of the application.
- ii. Qualitative data: the interview texts are classified into several categories according to the aspect of icon design, usability of application, motivation and acceptance. Table 3.15 shows the summary of quantitative and qualitative technique analysis applied in this study.

The percentage value of Semiotic Icon Design (SIDQ) that has been assessed by an expert was evaluated using the percentage calculation method (PCM) formula, as suggested by Tuckman and Waheed (1981) as following:

$$\text{(Total expert score (x) / Total maximum score) X (100\%)} = \text{Content validity level}$$

The total expert score is the score that assesses the scale of the questionnaire to be calculated. The total expert score is then divided by the total maximum score. The

questionnaire uses a 5-point scale consisting of 28 items, and the maximum score for each item is 5. The total maximum score is calculated based on the product of the number of items with a maximum score. Then, the value will be multiplied with one hundred (Ab Wahid, 2019; Wong & Sing, 2015). As a result, those values are called as content validity measurement achieved by SIDQ. All the content validation data will be analyzed using the same formula. On the other hand, the reliability value of the SIDQ was calculated based on statistics by calculating Cronbach's alpha coefficient.

Table 3.15: A Summary of Data Analysis Technique applied

Research (RO)	Objectives	Research Questions (RQ)	Hypothesis	Analysis
RO1: To identify appropriate semiotic icon design elements for reciting Quran		RQ1: What are the appropriate icon design elements for reciting Quran?		Comparative Analysis Gap Analysis Thematic Analysis Atlas.ti
RO2: To design fidelity of semiotic icon for motivating youth in reciting Quran.		RQ2: How to design fidelity semiotic icon design for motivating youth in reciting Quran? RQ3: How to validate fidelity semiotic icon design for motivating youth in reciting Quran?		Descriptive Analysis (Percent, Mean, Standard Deviation), Percentage Calculation Method (PCM) Cronbach Alpha Thematic Analysis Atlas.ti
RO3: To develop a prototype of semiotic icon design application for motivating youth in reciting Quran		RQ4: How to design the prototype of semiotic icon design application for motivating youth in reciting Quran? RQ5: How to develop the prototype of semiotic icon design application for motivating youth in reciting Quran?		Reliability Analysis
RO4: To evaluate the icon design, usability, motivation, and acceptance of Semiotic Icon Design Application for reciting Quran (SIDAQ) using PACMAD Usability model, ARCS Model of Motivational Design and Technology Acceptance Model (TAM).		RQ6: What are the responses on the icon design, usability, motivation, and acceptance of the SIDAQ? RQ7: Does the semiotic icon design element influence youth's motivation in reciting Quran? RQ8: Does the acceptance of Semiotic Icon Design Application for reciting Quran (SIDAQ) influence youth's motivation in reciting Quran?	There is a significant influence between the Semiotic icon design (SIDQ) elements and youth's motivation in reciting Quran There is a significant influence between the acceptance Semiotic icon design application (SIDAQ) and youth's motivation in reciting Quran	Descriptive Analysis (Percent, Mean, Standard Deviation), Correlation Analysis, Thematic Analysis Atlas.ti

All the scores from the evaluation were analyzed using IBM SPSS Statistics 26.0 to examine the significant relationship between icon design element and application acceptance with the youth's motivation in reciting Quran. The scores of the post experiment were also subjected to an effectiveness test. Semiotic Icon Design elements were analyzed using correlation analysis.

Figure 3.12 shows the outline of research methodology for this study discussed in Chapter 3. The theory, models, method, instrument, and samples used in this study are summarized.

	Theory/Model	Research Design/ Method	Instrument	Sample
Need Analysis (Phase 1)	Peirce's Theory of Semiotic	<ol style="list-style-type: none"> Literature Review Systematic Literature Review (Comparative study) Preliminary Study/Interview (Expert & Youth) Element/Construct Validation 	<ol style="list-style-type: none"> Journal Comparative Matrix Interview Question Thematic Analysis ATLAS.ti 8 	<ol style="list-style-type: none"> 42 elements from 40 studies Proposed Icon Design elements for Quran (6 elements) Interview (3 Experts Quran, 3 youth)
Design & Development (Phase 2)	Proposed Icon Design Elements ARCS Model of Motivational Design Prototype Model	<ol style="list-style-type: none"> Fidelity Icon design (Low, Medium, High) Preliminary study/Survey Questionnaires Content Validation Pilot Test Interview (Youth) Validity & Reliability 	<ol style="list-style-type: none"> Papers, Digital Sheets, Final Digital Sheets Survey form Questionnaire Interview Question SPSS 26.0 Thematic Analysis ATLAS.ti 8 	<ol style="list-style-type: none"> 3 Surah Samples (As -Saff, Al-Hujurat An-Nur) Preliminary Study/ Survey (113 youth) Content Validation (3 Experts Quran) Pilot test (37 youth)
Evaluation (Phase 3)	PACMAD Usability Model ARCS Model of Motivational Design TAM Model	<ol style="list-style-type: none"> Experimental Post Method Evaluation (Icon Design, Usability of application, Motivation and Acceptance) Interview (youth) Data Analysis SPSS 26.0 	<ol style="list-style-type: none"> Questionnaires Interview Question SPSS 26.0 Thematic Analysis ATLAS.ti 8 	<ol style="list-style-type: none"> Evaluation (3 Experts IT, 1 Quran) Evaluation (74 youth) <ol style="list-style-type: none"> Age 15-17 (18) Age 18-22 (41) Age 23-30 (15)

Figure 3.12: Summary of Research Methodology

3.8 Chapter Summary

The chapter outlines the methodology used to determine the approach to fulfil the research objectives and answering the research questions. Firstly, this chapter has discussed the research design of this study that has been conducted using the Design and Developmental Research (DDR) approach which involved three main phases of needs analysis, design and development, and evaluation phase integrated with the ADDIE instructional model. For the first phase, needs analysis involved preliminary study, systematic literature review, comparative study, and construct validation by the experts. For the second phase, the design and development phase involved the design process using fidelity icon design, prototyping technique, and content validation by the experts. The third phase, the evaluation phase involves the evaluation of the application based on the icon design, usability, motivation, and acceptance of the application.

Secondly, the research framework for Semiotic Icon Design for Reciting Quran (SIDQ) was discussed based on five (5) stages of the ADDIE instructional model namely analysis, design, development, implementation, and evaluation. SIDQ was developed through rigorous process in ADDIE stage. Data was collected through semi-structured interviews and self-administered questionnaires during experimental post-test. To determine the validity of SIDQ, experts' consensuses were performed and for reliability, one pilot test was conducted involving 37 youth with equal characteristics. The validated SIDQ was tested to confirm the proposed hypotheses and answered the research questions. Analysis of the data would include using statistical analysis software package SPSS version 26.0. The descriptive and correlation analysis would be used to answer the research questions. The next chapter will discuss the findings of the research in Chapter 4: Icon Design and Prototype Development.