

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter discusses the methods used to achieve the objectives of the study. This chapter aims to explain the research design, data collection procedure, sampling, research instruments, quasi-experimental, research procedure, and data analysis techniques used in this research. This chapter also describes how the study was conducted to obtain the desired results. This research method is divided into three main phases namely i) the analysis phase, ii) the design development and implementation phase iii) the evaluation phase.

Phase I is an analysis phase involving the study of literature related to multimedia learning, multimedia elements, multimedia tools, learning styles and strategies, different learning styles of learners, sensory modalities in memorization, Quran memorization, Quran memorization techniques, application of Quran memorization, CTML, VARK, MI, ARCS, and usability. In this phase, requirement analysis, user analysis, and task analysis were performed using a method of survey, classroom observations, document review, interviews, and prototypes. The result of phase I is an element of the Multimedia representation learning model (EzHifz Model) for the Quran memorization technique based on VARK learning style.

Phase II is the design, development, and implementation phase which applies the elements of the Multimedia representation learning model (EzHifz Model) for the Quran memorization technique based on VARK learning style by developing a model and prototype known as EzHifz. In this phase, several activities have been implemented

namely a sketch of the EzHifz model design, final EzHifz model design, design strategy, design of multimedia materials, design of characters, and interfaces, development of flow charts and storyboards, develop multimedia elements, organize multimedia elements, implement the integration of units and implement testing and validation units.

Phase III, the evaluation phase, is the phase of validating the Multimedia representation learning model (EzHifz Model) by evaluating the usability of the prototype developed and user motivation. Usability testing is evaluated from the aspect of learnability and user satisfaction. While the evaluation of motivation is carried out from the aspects of attention, relevance, confidence, and satisfaction. Method of observation, survey, video recording, and audio recordings was used for data collection. A summary of the three main methodology phases of the study can be seen in Figure 3.1.

PHASE	METHOD	RESULT
PHASE I: ANALYSIS <ul style="list-style-type: none"> • Requirement Analysis • User Analysis • Task Analysis 	<ul style="list-style-type: none"> • Literature review • Survey • Class Observation • Document review • Interview • Prototype 	<ul style="list-style-type: none"> • Elements of Multimedia representation learning model (EzHifz)
PHASE II: DESIGN, DEVELOPMENT & IMPLEMENTATION <p>Design</p> <ul style="list-style-type: none"> • Sketch EzHifz model design • Final EzHifz model design • Design strategy • Design multimedia materials • Design characters and interfaces <p>Develop</p> <ul style="list-style-type: none"> • Develop flow charts and storyboards • Develop multimedia elements • Organize multimedia elements <p>Implementation</p> <ul style="list-style-type: none"> • Integration of units • Testing. and validation units 	<ul style="list-style-type: none"> • The implementation of the Multimedia representation learning model (EzHifz) • Low-fidelity EzHifz prototype • High-fidelity EzHifz prototype 	<ul style="list-style-type: none"> • Multimedia representation learning model (EzHifz) • EzHifz prototype

<p>PHASE III: EVALUATION</p> <ul style="list-style-type: none"> • Usability Testing (Learnability and User Satisfaction) • Motivation (Attention, Relevance, Confidence, Satisfaction) 	<ul style="list-style-type: none"> • Observation • Survey • Video recording • Audio recording 	<ul style="list-style-type: none"> • Evaluation results
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Figure 3.1 Main Phases in Research Methodology

3.2 Research Design

The research design is the fundamental structure and systematic strategy for conducting research. Through research designs, the researcher can obtain answers to the research questions more objectively, accurately, and reliably. This section describes the comprehensive methods of data collection and data analysis. In this study, the selection of methods concerned integrating the elements of the study with a reasonable. This is 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 achieve the objectives. Concerning the research objectives of designing and developing a model and prototype, this study has adopted the ADDIE model approach with a mix-method approach (Schoonenboom & Johnson, 2017).

This study employs the ADDIE Model approach (Gagne et al., 2005) to design a Multimedia representation learning model (EzHifz) and prototype. There are several instructional models are outlined by related works to develop the model namely the ADDIE model (2000,2005,2009), Dick & Carey model (1978, 1997), Dick & Reiser Model (1998), ASSURE Model (1999) (Zain et al., 2016). ADDIE model is often represented visually as a linear model the interconnected nature of the five components

means that the design process is iterative and cyclical (Trust & Pektas, 2018). Gagne et al., (2005); McGriff, (2000) declare that a development study is very systematic and organized involving a variety of quantitative and qualitative research techniques. Generally, this study has five main phases consisting of the analysis, design, development, implementation, and evaluation. The ADDIE instructional model as illustrated in Figure 3.2 was chosen because it is a fundamental and systematic model that determines the design process in product development (Dick et al., 2015). The selection of the ADDIE model in this study is generally because it is a model used in developing multimedia learning models with a systematic process in prototype development and is compatible to develop the EzHifz model design as a supportive tool. This approach is also the most common approach and the basis of most instructional design (ID) models used iteratively in developing model and application prototypes (Gagne et al., 2005). This selection is also supported by Trust & Pektas, (2018) who stated that the ADDIE model can lead to instruction that is more relevant, effective, and efficient and the most widely used model for developing learning materials.

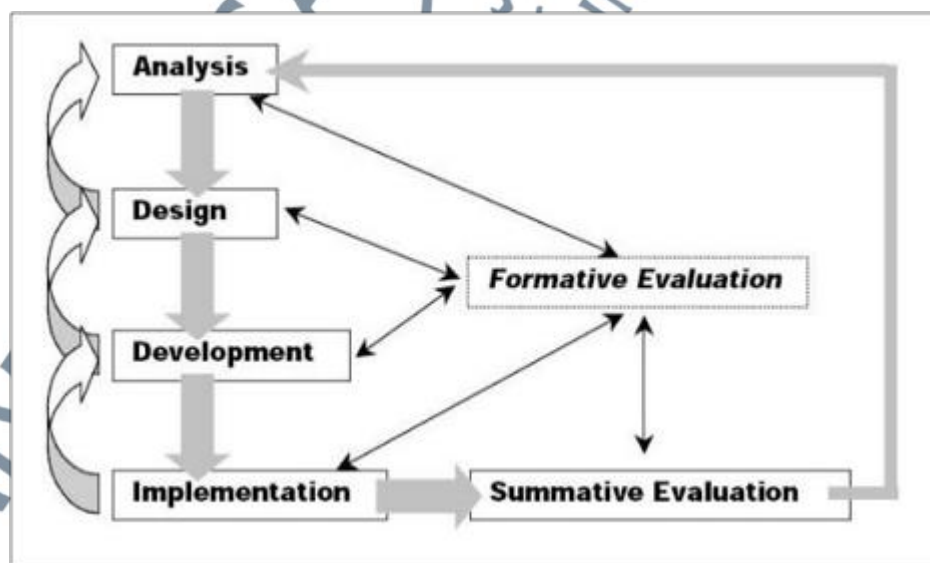


Figure 3.2: ADDIE concepts

Source: (Gagne et al., 2005)

The use of the ADDIE model approach is to ensure that this study conducted is more systematic and organized. ADDIE model is an instructional design with an iterative process of planning performance objectives, selecting instructional strategies, choosing media, and selecting or creating materials and evaluation. The ADDIE model adopts an Input-Process-Output (IPO) paradigm as a way to complete its five phases (Gagne et al., 2005). Generally, this study has five cycle phases namely the analysis phase, the design phase, the development phase, the implementation phase, and the evaluation phase.

In this study, modifications have also been implemented in some parts of the model to fit the needs of the model development process. This is in line with the claim by Papavlasopoulou & Giannakos, (2020) that the model of the application has very often been modified in practice in compliance with the different learning settings that are applied. This means that the ADDIE model needs modification to comply with and apply to design principles, and requirements for model development. This means that the ADDIE model is dynamic, offering flexible guidelines on effective construction processes and effective instruction.

3.2 Data Collection Technique

This study employed the quantitative and qualitative data collection approaches to collect the data. As the data collection was performed in several phases, careful considerations were made to ensure the method of data collection used for each phase was collected in the best way possible. To study the need and find out the correct approach to develop the model, VARK questionnaires, literature review, document review, class observation, and semi-structured interview was conducted during the

analysis phase. Apart from that, a comparison with previous studies was carried out to identify the elements to be applied in the EzHifz model design. Later, to test the application prototypes, a pilot study session and content validity were conducted during the design, development, and implementation phase using a content validity form and semi-structured interview. In the evaluation phase, quasi-experimental were conducted using questionnaires, observations list, observation tasks, and audio, and video recordings.

3.4 Research Sampling

Sampling is the process of selecting several subjects from a population to be the respondents of a study (Flick, 2018). Sampling planning facilitates the researcher to collect data, reduce measurement errors and save time and cost throughout the implementation of the study. This study selected respondents who are directly involved in the teaching and learning of the Quran memorization course. The study was conducted at the *Tahfiz* Integration School using the purposive sampling method. The research and development of the application use the quasi-experimental design with quantitative and qualitative approaches. The selection of study participants is based on their background, VARK learning style categories, the experience of memorizing the Quran for at least 1 year as well as the agreement to participate in the evaluation of usability tests for a minimum of 2 hours.

The sampling size of the study is adopted from that used by Konting (2013), who describes the sample as parts of the population studied. In the quasi-experimental research, many evaluations were part of usability tests, so the majority of the samples had less than 20 respondents (Schrepp et al., 2017). The sampling size of this study is

supported by the study of Zakaria & Abdul Nasir, (2020), which had enough used between 20 and 32 respondents in the evaluation of usability. Based on the data obtained, the population size of the school is 49 students.

The selection of respondents was based on purposive sampling, consisting of 20 students grouped into their respective categories of VARK learning styles. Purposive sampling was used in this study because based on the observations, not all students were engaged in the Quran memorization course to memorize the surah *Al-Insaan*. The small sample size is parallel to the previous studies by Baauw & Markopoulous (2004); Bekkeret et. al (2005); and Vermeeren et.al (2007) which used a small sample of 20 people. The study conducted by (Nielsen, 1993; Nielsen & Molich, 1990) also demonstrated that usability tests involved about five assessors to find 85% of usability problems. Even 15 assessors also can find about 100% usability issues. They also pointed out that evaluations that involved more than 15 people were just a waste of time because of the same and repeated usability problems encountered as new usability problems. Hence, (Nielsen, 1993; Nielsen & Molich, 1990) suggested that the evaluation can be conducted by 5 assessors only. These are the criteria for expert selection: the person must have expertise in the field studied; the person agrees to engage in the study. Therefore, this study selected six (6) experts in the fields of the Quran and Educational Technology. This is based on the views of Thiagarajan (1978), (1991) who state that putting a large number of experts in the same field can affect the evaluation of different criticisms. Therefore, only two or three experts in the same field are required in the study. In the evaluation phase, the sample size in qualitative studies was selected based on the guideline of Fraenkael et al. (2012), for example, the number

of respondents was between 1 and 20 people. To obtain in-depth information, only 7 respondents are required in the study (Spencer & Spencer 1993).

This study, the number of samples of students who responded to this study was about 35 students for the preliminary study in the analysis phase, 20 students for a pilot study in the design, development, and implementation phase, and 20 students for the evaluation phase (see Table 3.1). During the evaluation phase, the participating students for the evaluation are from the same sample group aged 10-15 years.

Table 3.1: Sample students for each phase

Phase	Method	Student Group	No. of Sampling
Analysis	Preliminary Study	aged 10-18 years	35 students
Design, Development, and Implementation	Pilot Study	aged 10-15 years	20 students
Evaluation	Quasi-experimental	aged 10-15 years	20 students

Tahfiz Integration School at Sepang, Selangor was selected for the following reasons: (i) the Quran memorization course is the only one offered in this school that implements the method of memorizing verses and translating surahs using two types of mushaf; (ii) the support, encouragement, and cooperation from *Tahfiz* Integration School, Sepang Selangor on this research effort for the continuation of memorization and comprehension of the Quran; (iii) a total of 35 students aged between 10-18 years were identified to perform this research and (iv) evaluation is conducted after obtained the permission from parents/guardians and the school principal. Table 3.2 shows the distribution of testing participants for the EzHifz application.

Table 3.2: Distribution of testing participants for the EzHifz Application

Age	Male	Female	Total
10-12 years	6	2	8
13-15 years	3	9	12
Total	9	11	20

The evaluation involved participants, using a questionnaire with a sample size of twenty (20) participants. According to Nielsen, (2020); Nielsen, (2000); Schrepp et al.,(2017), a small number of samples is sufficient and the addition of samples will only increase the cost and take a long time to perform the testing. Feedback from parents/guardians and school principals showed that usability test participants had a similar level of memorization and had used mobile devices.

The selection of this school is based on the students who learned to memorize the Quran verse and translation. The course that emphasized memorizing verses with translation was not widely practiced (Gamal, 2018; Hashim et al., 2014; Rahim et al., 2018; Shaharuddin et al., 2012). The studies of Abdussalam et al., (2019); Ahmad Rozaini et al., (2009) found that the assessment of memorization of verses with the translations of the Quran at school was limited only to the optional surah. The selection of the study location was in line with the views expressed by Khafidah et al., (2020); Salehuddin et al., (2019) that the aspect of understanding in the teaching and learning of the Quran should be supported by the aspect of practice, techniques, and familiarization as the student's readiness to memorize verses and translations of the Quran. However, the method was not fully emphasized in the current Tahfiz education environment except for the schools that offer Arabic language courses (Hashim & Tamuri, 2012; Mohamad Mutawalli & Zainuddin, 2012; Purbohadi et al., 2019; Salehuddin et al., 2019; Shaharuddin et al., 2012).

3.5 Research Instrument

The research instrument is the tool to measure the variables or items of interest to obtain data on the topic of interest from the research study. 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 the design and development and implementation as well as the evaluation phase. A research instrument is a tool that will be used to help obtain data for a research study. Three types of instruments are used in this study namely interview, questionnaire, and observation (including observation list, observation task, audio, and video recording).

3.5.1 Interview

Interviews are the most common way of conversational sessions in which knowledge is generated through interactions between interviewers and respondents interviewed individually or in groups to obtain research data (Svend & Steinar, 2015). Interviews are the most effective way to understand a user's reaction to the application being evaluated because it is more flexible to explain what is not understood during the interview process. This study conducted structured interviews. The interview instrument was validated by experts to check on the proper use of language, item, and construct. The instrument was tested for its validity and reliability to ensure that the questions are reliable and suitable for this study. The interview on requirement analysis created aimed to identify and analyze the problems faced by the students in the process of memorizing the Quran including the Quran memorizing techniques used in the school. The types of interviews used in this study were structured and adapted

according to the suitability of the study and some of the items were self-constructed by researchers with the guidelines by Myers & Newman, (2007); Svend & Steinar, (2015). The interview used in the pilot study is shown in Appendix 12.

3.5.2 Questionnaire

The VARK questionnaires by Fleming (2012) in the study aim to obtain information about their dominant VARK learning styles; user requirements that can be analyzed to develop the EzHifz model design and EzHifz prototype. The questionnaire on the VARK learning styles is an instrument used by most researchers to determine the individuals' VARK learning styles. The VARK test version 7.0 contains 16 questions developed to identify the dominant VARK learning styles of students. The VARK questionnaire used in this study is shown in Appendix 11.

The questionnaire for the real users in the evaluation phase was adapted from (Abu et al., 2007; Fatimah et al., 2019; Norizah et al., 2014; Shahrudin et al., 2012) and some of the items were constructed by the researcher, then validated by the experts. The instruments of this study consisted of Likert scale 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 EzHifz model design, the usability of the application, and the motivation of the user. In addition, the questionnaire was used to obtain quantitative data. The selection of the questionnaire was in line with the views of Schrepp et al (2017) which was suitable for experimental studies in usability tests and can show the feedback of a product satisfies the quality aspect. In this study, a set of questionnaires were developed for the students as real users. To obtain the instrument's validity, instrument experts who had been directly involved in this research

were consulted for verification purposes. The questionnaires in the evaluation phase for this study were executed after the observation list was completed. The participants will continue to answer the questionnaire that aims to obtain feedback from the participant in terms of usability of the application and motivation of the user while using the EzHifz prototype model design through the EzHifz prototype. This questionnaire was adapted and modified by the previous researcher according to the suitability of this study (Abu et al., 2007; Herianto & Wilujeng, 2021; Norizah et al., 2014; Shahrudin et al., 2012).

The questionnaire form focused on two key aspects, namely usability and motivation of the application. The researcher adapted all two aspects to the study's evaluation constructs. The questionnaire form items for the student were developed, in line with the constructs formulated. According to Nielsen & Farrell, (2014), the principles that will ensure the model design is user-centered, the process is iterative, and the users involved in the model design throughout design and development as well as refined by the user-centered evaluation to achieve specified goals in a specified context of use.

In this study, the researcher used 80 items as in the usability evaluation constructs to achieve the third research objective by answering the third research question. *RQ3: What are the responses on the usability and user motivation of Multimedia Representation Learning Prototype (EzHifz) for memorizing Quran?*

The construction of eighty (80) items in the student questionnaire form. Twenty-five items in the usability construct consist of two evaluation elements of learnability and satisfaction. Fifty-five items in the motivation construct items were used for motivation elements consisting of the evaluation construct of attention, relevance, confidence, and satisfaction. The questionnaires can be referred to in Appendix 11.

3.5.3 Observation

The observation method is used in this study to investigate problems, differences in students' VARK learning styles, techniques of memorizing the Quran memorization before, during, and after using the EzHifz model design through the EzHifz prototype. In addition during the class observations for the testing sessions, observation tasks, observation lists, and audio, and video recordings were also performed. Instrument experts also obtain the observation instruments' validity for verification purposes.

a) Observation List

The usability of the EzHifz prototype was tested in terms of learnability and user satisfaction, while motivation from the aspects of attention, relevance, confidence, and satisfaction. This observation list was developed to facilitate the researcher and make notes during the testing session. The observations list can be referenced in Appendix 5. The observation list consists of the observation list for learnability, user satisfaction, attention, relevance, confidence, and satisfaction.

b) Observation Task

Usability and motivation tests can be conducted by assigning an observation task to participants to follow or letting the tester explore the application without any observation task. Studied by Pattaraphongplin & Yasri, (2021) found that students can explore more actively, mentally, and physically when provided with an observation task list and can concentrate on testing. In this study, the student was provided with a task list to explore on their own and the researcher acts to facilitate them to perform the necessary activities. This step was chosen because the students have the skills to use the application on tablets or smartphones. The researcher uses this task list to review and ensure all activities

testing is carried out as planned. The developed observation task list can be referred to in Appendix 6.

c) Audio and Video Recording

Information was obtained when observation sessions were used in conjunction with audio recordings and video recordings to complete the data findings. Two cameras were used to record user voices and behaviors while using the EzHifz prototype in the process of memorizing the Quran. All activities were recorded. Audio and video recording allows the researcher to re-evaluate the details that may have been overlooked during the observation time. Audio and video recording not only helps to support the observation process but also provide useful ideas and deeper insights into the subsequent observations.

The audio recording aims to record every verbal feedback of views and opinions that occurs when a user uses the EzHifz prototype. A voice recorder was used to record the participant's voice during the evaluation. This recording allowed the researchers to re-analyze the reactions of test participants to the EzHifz prototype. Voice recordings are supplementary data used to support and complement the data collected obtained through observation lists and video recordings.

Video recordings were used to record participants' reactions or behavior throughout the evaluation session when using the EzHifz prototype. Then, the video recording was analyzed. Any reactions and body languages namely comments, feedback, or confusion will be recorded as input for data analysis (Hasan et al., 2021). Video recordings are intended to: a) get an idea of user reactions; b) identify the techniques most preferred by the user or vice versa, and c) observe any user reaction or

behavior. The findings obtained were used to support and complement the data from the observation list and audio recording.

3.6 Research Instrument Reliability

The research instruments were tested for their validity and reliability to ensure that the questions are suitable for this study. The reliability of a research instrument refers to the degree of stability and accuracy of the research instruments (Charles, 2020; Sauro & Lewis, 2016). Validity is the accuracy of the study variables and the ability to measure accurately (Sauro & Lewis, 2016). 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 (Lawshe, 1975; Sauro & Lewis, 2016). Therefore, instrument reliability, validity, and content validity are the key factors in determining the success and accuracy of a study conducted. In the quantitative research, Pallant (2007) proposed that the ideal *Cronbach's Alpha* reliability value should exceed 0.70. Table 3.3 shows that *Cronbach's Alpha* reliability index for the questionnaire instrument constructed is above 0.70. This indicates that the research instrument has a high-reliability index and is therefore acceptable.

Table 3.3: *Cronbach's Alpha* Reliability Index

Instrument Questionnaire (Quasi-Experimental) Constructs	Number of respondents	Number of items	Reliability Index (Cronbach's Alpha)	Indicators
Usability (Learnability/User Satisfaction)	20	25	0.743	High
Motivation (Attention, Relevance, Confidence, Satisfaction)	20	55	0.809	High

3.7 Quasi-Experimental

A quasi-experiment is a type of research design that attempts to establish a cause-and-effect relationship (Cook et al., 2002). This study uses a quasi-experimental design without control groups which is the one-group posttest-only design. The one-group posttest-only design or one-shot case study is a type of quasi-experiment in which the outcome of interest is measured only once after exposing a non-random group of participants to a certain intervention. The quasi-experimental design notation of this study can be seen in Figure 3.3.

The one-group post-test-only design: X O1

Figure 3.3: Quasi-Experimental Design Notation

Based on Figure 3.3, the EzHifz prototype represents the EzHifz model intervention (X) for students in *Tahfiz* Integration School and measures the usability of the application and the motivation of the user (O1) at the end of the study to evaluate the effect of that intervention. The data collection method of this study uses a combination of several evaluation methods to evaluate the applicability of the EzHifz model through the EzHifz prototype, using usability and motivation test methods, questionnaires, and observations. The use of various data collection techniques was to strengthen the validity of the study design.

In this study, the one-group post-test-only design in quasi-experimental was implemented through an independent variable being manipulated and then a dependent variable is measured once after the treatment is implemented. The researcher employed the usability testing elements of learnability and user satisfaction (independent variable)

on the students' learnability and satisfaction toward the *EzHifz* application prototype that represents the *EzHifz* model. Then, the researcher could implement the *EzHifz* model (dependent variable) in the Quran memorization process, immediately after the testing ends, the researcher could measure students' learnability and user satisfaction with the *EzHifz* model.

3.8 Research Procedure

The research procedure is an investigation to solve the problem to create new knowledge which is systematic with a certain methodological process (Munzil & Perwira, 2021). This study aimed to propose the *EzHifz* model design as a supportive tool for the Quran memorization technique based on the VARK learning style that can assist to motivate students in memorizing the Quran. This study employed the ADDIE model approach which consisted of three main phases the analysis phase, the design, development, and implementation phase, as well as the evaluation phase. This research has been provided with a letter of permission to collect data from the school to support the research processes. This research included the following stages:

In the analysis phase, the researcher makes the literature review, comparison with previous studies, preliminary study, document review, and class observation to identify elements as an extension of Cognitive Theory Multimedia Learning (CTML) for developing the *EzHifz* Model Design. The researcher conducts the preliminary study with three (3) teachers and thirty-five (35) students through the VARK questionnaire, semi-structured interview, and class observation to gather information on the problem and student needs in memorizing Quran verses and translation. Before the class observation, student needs to answer the VARK Questionnaire and will be grouped

based on their VARK learning style categories. During the class observation, the researcher observes the techniques used by the students in memorizing the Quran. Then, the interview session was conducted between the teacher and students to get their feedback and response.

In the design, development, and implementation phase, the proposed EzHifz model design elements were employed to design the EzHifz model and EzHifz prototype for memorizing the Quran. Researcher: (i) conduct pilot testing for the Fidelity EzHifz model design. The interview was conducted with twenty (20) students at *Tahfiz* Integration School, Sepang Selangor. After the researcher implemented the improvement to the Fidelity EzHifz model design, the testing and content validity were conducted with three (3) experts in the Quran field and three (3) experts in the Educational Technology field. The content validation experts were given a consent form to review and confirm the suitability of the EzHifz model design for motivating students in memorizing the Quran. The EzHifz prototype has been iteratively improved based on the expert and student feedback received.

In the evaluation phase, the researcher: (i) evaluate the EzHifz model through the EzHifz prototype with twenty (20) students who evaluated the aspect of usability (learnability and user satisfaction) of the application and the motivation of the user. The evaluation was performed through an observation checklist and questionnaire form. The students installed the application on their mobile devices and tested the application. An audio and video recording were performed to support the evaluation and (ii) analyzed the results through descriptive analysis and the percentage of the success and satisfaction rate of this research.

3.8.1 Phase I: Analysis Phase

The analysis phase is the phase where the goals and objectives of the study are determined. In this phase, the multimedia representation learning model framework based on the principles of universal design, CTML, VARK, MI, and ARCS for students is framed. It involves activities namely analysis of the problem to be solved, the users involved, the appropriate prototype instruction, Quran memorization techniques, and selected surahs. Activities in this phase are implemented through literature review, survey methods, observations, document review, interviews, and prototypes. The four activities involved are requirement analysis, user analysis, task analysis as well as identifying the learning objectives. Figure 3.4 shows a summary of the analysis phase.

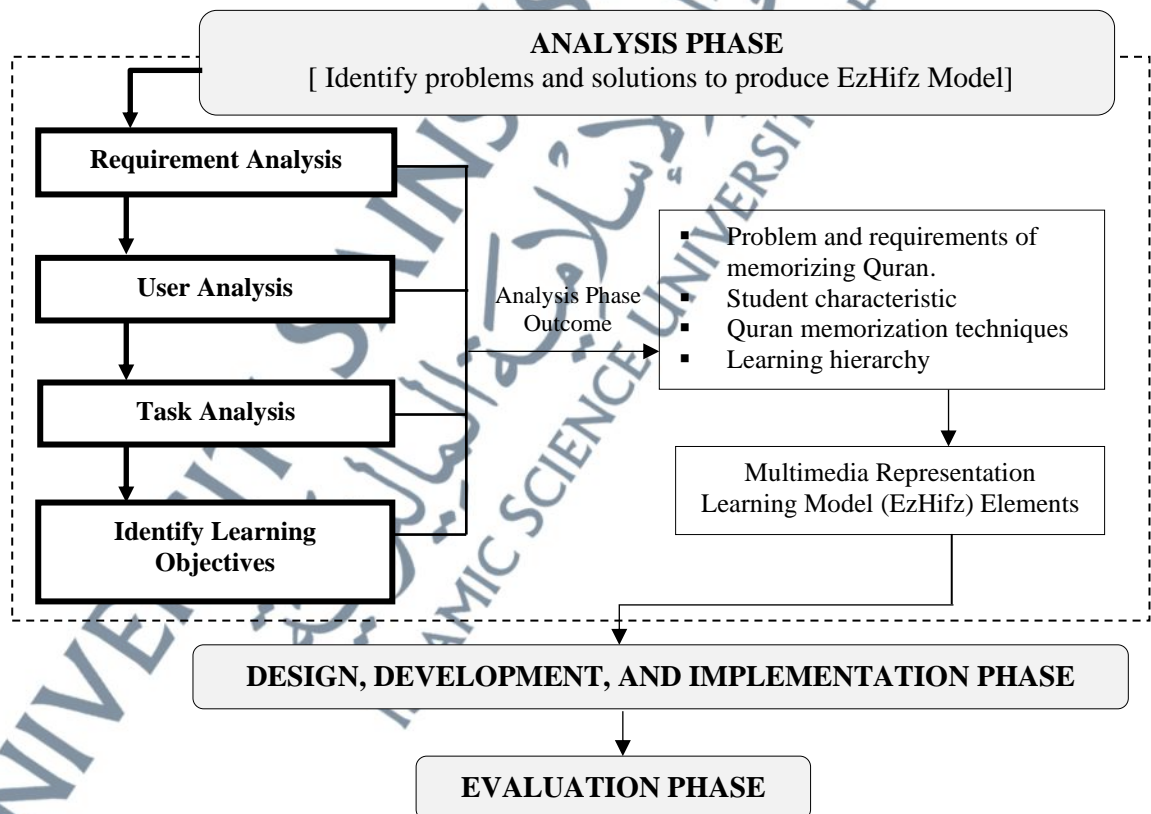


Figure 3.4: Analysis Phase

The EzHifz Model is designed based on the elements from the literature review, comparative analysis, and preliminary study in the analysis phase. The result of this phase is presented to answer the first research questions. In the analysis phase, the first objectives of this study are to identify the multimedia representation learning model elements for Quran memorization techniques based on VARK learning style that should be utilized in the model developed. The researcher started this study with a research strategy of developing research questions related to the research objectives (see Chapter 1). During this phase, the review of the theories, models, concepts, and principles was initiated to address the research questions of this study. The important concept that should be focused on is the existing elements in cognitive theory multimedia learning (CTML), VARK, MI, and ARCS, which is to identify appropriate elements of the EzHifz model design for memorizing the Quran. This review formed the basis for the scope of the EzHifz model. This phase proposed elements of the Quran memorization techniques, multimedia presentation, sensory memory, and working memory for the EzHifz model that will be used in the next phase which is the design, development, and implementation phase. In the analysis phase as well, the researcher explores a literature review related to multimedia learning, multimedia elements, multimedia tools, learning styles and strategies, different learning styles of learners, sensory modalities in memorization, Quran memorization, Quran memorization techniques, application of Quran memorization, to enhance understanding of the concepts and principles related to cognitive intelligence in multimedia learning. The results of this analysis phase will answer the first research question which was the elements for the EzHifz model as an adapted element for cognitive theory multimedia learning (CTML).

The study by Mohamad Rasyidi, (2018) stated that there were several techniques were used and a few techniques were less used by the student in memorizing the Quran. A good selection of memorization techniques in the process of memorizing the Quran give a positive impact on student's motivation. The researcher's review also found that limited studies concerned with Quran memorization techniques were made in terms of visualizing modes of the Quran either in pictures or pictures of body motion and hand gestures. However, this study will consider all four modes of the VARK learning style representing the sensory modalities in the proposed EzHifz model. Therefore, the results of this phase are to sketch the proposed EzHifz model design elements that will be then used in the EzHifz model and EzHifz application prototype. Interviews were conducted with the teachers from the *Tahfiz* Integration School to get feedback regarding the problem and requirement of memorizing the Quran as well as applying the Quran memorization techniques in the process of memorization. This phase focused on the preliminary study analysis to identify the EzHifz model design elements for memorizing Quran. The following is a detailed discussion of the analysis phase.

a) Requirement Analysis

Preliminary analysis is performed to identify the goals of the instructional development system or application to be built (Dick et al., 2015). At this stage, preliminary analyses are conducted including making readings of past studies, surveys, classroom observations, document reviews, and interviews with teachers to identify problems and needs. An interview was conducted among students and teachers. The semi-structured interviews were conducted to gain an initial understanding of the process of Quran memorization. The survey and classroom observation method is the most frequently used descriptive method in research (Cohen et al., 2017). This method can collect data

at a time to describe the current situation, identify the standards by which the current situation can be compared, and determine the relationships that exist between events. This requirement analysis also involves the process of determining the sample data analysis and student needs analysis were discussed in detail :

i. Sample Data Analysis

The objective of the analysis phase is to identify the appropriate EzHifz model design elements for motivating the student to memorize the Quran. The domain of the Quran is carefully studied by the researcher through preliminary study. In selecting the sample of data used, the teacher in the domain of the Quran was interviewed to ensure that there is a problem and need for this study in the Quran field. The syllabus for the student's third semester consists of 8 *surahs* from *juzuk* 29 in the Quran. The researcher referred to the teachers to identify a suitable *surah* sample for this study. The selection of *surah Al-Insaan* was based on teachers' suggestions and recommendations. This research concentrated on *surah Al-Insaan* as the sample of the study. The selection of *Surah Al-Insaan* is according to the syllabus content of the school related to human creation and the rules of human life in Islam. This selection was also considered with the informative content and easy to be explored as the message of human life. Informal interviews were conducted with the teachers from the school to acquire their views on the *surah* sample, problems in Quran memorization, and types of Quran memorization techniques used in the school. As a result, the scope of this study was identified and presented in the design, development, and implementation phase. The following Table 3.4 shows the summary of an interview session with the teachers, to identify the problem in Quran memorization, the types of Quran memorization techniques used, and student needs for this study.

Table 3.4: Summary of Teacher's Interview Session

Sample Data	Description
Problems in Quran memorization	(i) forgetting to recall the words in the Quran verses.
	(ii) forget to recall the words in the Quran translation.
	(iii) do mistakes to recall the Quran verse and translation.
	(iv) forget to remember the beginning word of the verse memorized.
	(v) forget to remember the beginning word of the Quran translation.
	(vi) difficult to remember and understand the translation of the memorized verse; and
	(vii) difficult to explain the whole storyline of each verse memorized.
	(viii) They easily feel bored,
	(ix) easy to feel drowsy,
	(x) lose focus and are less motivated using the learning materials provided.
Types of Quran memorization techniques taught by the school.	<i>Talaqqi</i> and <i>musyafahah</i> , repetition, segmentation, writing, comprehension.

ii. Student Needs Analysis

A group of students from *Tahfiz* Integration School at Sepang Selangor was voluntarily recruited to participate in this study. The preliminary study was conducted with 35 students aged 10-18 years from the third semester through class observation. The observation started after getting feedback on the VARK questionnaire. The VARK questionnaire was distributed to the students to determine the student preferences based on the VARK learning style. The students were grouped based on their categories of VARK learning styles. Each of the students has been observed the techniques used in memorizing the Quran within 2 hours before doing the *tasmik* session with their teacher. In this phase, identifying the student's preferred VARK learning style and techniques used by the student in memorizing the Quran was conducted to identify the problems

and needs of this study. The results of this preliminary analysis show that there are various Al-Quran memorization techniques used by the students in memorizing the Quran verse and translation. All the techniques are related to sensory modalities and their preferred VARK learning styles. There are also limited Quran memorization techniques introduced by schools which can affect their motivation in the memorization process, even though the school gives students the to memorize using their techniques. The teaching materials for Quran memorization based on the VARK learning style are also limited where many applications are involved in the form of text-based information. The researcher believed that an alternative technique in teaching materials or supportive tools that support the student differences in VARK learning style is needed to assist in memorizing the Quran.

b) User Analysis

User analysis involves user research namely identifying roles and defining user characteristics namely knowledge, experience, and skills. Analysis of students can be performed based on three elements namely learning style analysis, student background, and level of study ability (Reigeluth et al., 2016; Senan et al., 2017). This step is to ensure that the EzHifz model and prototype developed meets the needs of the target users. In addition, the way users interact with mobile devices was also identified. User analysis, in general, has been identified through literature in Chapter 2. This user analysis also involves the process of determining the student's level of memorization, student VARK learning style categories and cognitive intelligence were discussed in detail :

i. Student's Level of Memorization

All the students are placed in different classes according to their level of performance in their respective Quran memorization learning regardless of age differences. There were 35 students aged between 10 to 18 years, divided into three (3) classes separately. The class separation is according to their level of ability to memorize the Quran memorization. This may lead to the capability of teachers to control and give focus to the students in the class. The three-class level in the school was (i) Memorization class level 1 was for a new student. In this class, the teacher focuses on the skills of memorizing the Quran namely the repetition technique of memorizing the Quran in groups with the teacher, recitation of the Quran with tajwid, and exercises in question-and-answer quizzes; (ii) Memorization class level 2, the teacher emphasized on the skills of memorizing the Quran through repetition techniques individually with several Quran verses determined by the teacher in a specific time and (iii) Memorization class level 3, teacher was emphasized on the skills of memorizing the Quran through repetition techniques individually and guide the students to set their target within a time.

ii. Student's VARK Learning Style Categories

The VARK learning styles can be categorized based on the scoring results from the VARK questionnaire. There are four different modes of learning called preferred or dominant VARK learning styles models namely unimodality, bimodality, trimodality, and quadrimodality (Fleming, 2012). Each category contains different combination modes of learning that define the arrangement of the stronger mode to the weaker modes of learning. These are provided in the model to support all the possible individual differences in VARK learning styles. For example, VA is a type of learning hierarchy

in the category of bimodality, which allows the user to learn using the stronger visual mode followed by audio mode to achieve their learning objectives. The results from the VARK questionnaire show that 35 students were categorized as shown in Table 3.5.

Table 3.5: Distribution of VARK learning style categories

Age	Uni modality	Bi modality	Tri modality	Quadri modality
10-12 years	8	1	1	7
13-15 years	1	2	1	9
16-18 years	1	0	0	4
Total Students	10	3	2	20

Based on Table 3.5, the students aged between 10-18 years were categorized based on VARK learning styles namely uni-modality (10 students); bi-modality (3 students); tri-modality (2 students), and quadri-modality (20 students). The students were grouped into their categories and the researcher conducted class observation to analyze the Quran memorization techniques used by each of the students during the memorization process. Most of them show techniques that are closely related to their preferred VARK learning style.

iii. Cognitive intelligence

Cognitive intelligence in this study is the ability of the student memory uses to learn and remember the Quran memorization. The different types of intellectual individual in multiple intelligence theory (MI) that relates to cognitive intelligence and memory abilities were selected based on the characteristics that related to VARK's learning style. The researcher focused on four types of intelligence to facilitate students in memorizing the Quran within a classroom and self-learning contexts namely (i) visual-spatial intelligence-visual mode as the way and skill to recognize and perform the illustration of objects; (ii) musical intelligence-auditory mode as the way and skill to recognize the

sound and composition of rhythm as well as tone; (iii) linguistic intelligence-reading mode as the way and skill surrounding words that can be found within the context of both written and spoken language; (iv) bodily-kinesthetic intelligence-kinesthetic mode as the way and skill to craft or communicate or amend using the body and hands gestures.

c) Task Analysis

Task analysis aims to identify the learning content with appropriate approaches. Task analysis purposely produces the information necessary to plan and determine conditions of teaching (Gagne et al., 1992, 2005; Reigeluth et al., 2016). Content analysis determines what skills and knowledge should be taught, the objectives of the learning, and the relevant performance assessments and evaluations (Lee et al., 2019). It was identified by reviewing the content of the curriculum, referring the experts, and interviewing the teachers. This task analysis also involves the process of determining the Quran memorization course, types of mushaf, student performance results, time allocation for memorizing the Quran, memorization method and techniques, teaching assessment method, Quran surah sample, sensory modalities, and learning hierarchy were discussed in detail as the following:

i. Quran Memorization Course

The Quran memorization course in this school is learned by memorizing the Quran word for word. It aims to produce a student which can memorize the Quran verses with the corresponding translation. The implementation of the study at this school is in line with the J-QAF program introduced in 2005 by the Ministry of Education Malaysia (KPM) which is planned on Islamic education subjects.

ii. Types of *Mushaf*

Students are encouraged to memorize and recall the Quran verse memorized with their peers using 2 types of *mushaf* Quran as *Mushaf* Quran *Uthmani* and *Mushaf* Quran (Per word) as their teaching materials for the course. During the teaching and learning process, teachers use the same teaching materials for the process of memorization assessment or *tasmik* assessment. Memorization assessment or *tasmik* assessment was implemented face to face in front of the teacher to each of the students. The process of memorizing the Quran uses the senses of sight and hearing including the movement of body motion and gestures of some students. Through interviews, observations and surveys conducted, there was no educational application used for the course. The analysis of observation leads to the use of learning materials that support the Quran memorization courses in the classroom, and the lack of support learning material is identified. The researcher found that the process of memorizing the Quran verses and translation in this course requires additional learning materials that support their memorization using the multiple sensory memory based on their preferred VARK learning styles. The results of this analysis phase study also determine the students' preferred VARK learning style through the VARK questionnaire (Fleming, (2012). He suggested the students change their learning approach after identifying their learning styles and it improved their learning process and performance. Mirza & Khurshid (2020), also pointed out that teachers also need to understand their learning style preferences because they often use their way of learning in their teaching process to reach the student with learning difficulties. After all, the same learning materials are not necessarily can be applied to every student with a different VARK learning style to acquire knowledge (Baykan & M Naqar, 2007; Klement, 2014; Othman & Amiruddin,

2010; Pereira, 2019). Based on the results of class observation, students need to memorize several segments of words of the Quran verses with their translations. The students faced difficulty memorizing and understanding the entire meaning of the *surah Al-Insaan* but were only able to translate it per word. It's because the mushaf with the translation of the Quran is easy to understand rather than mushaf using per word (Abdul Jalal et al. 2015). Most researchers prove that memorizing the Quran with translation can help the student to memorize the Quran well and smoothly (Abdul Jalal et al., 2015; A. Abdullah et al., 2005; Rahim et al., 2018).

iii. Student's Performance Result.

A document review was also conducted to identify the students' achievements. The student performance results of the Quran memorization course during the 6 months semester study period, shown in Table 3.6, the student aged between 10-15 years were still weak in using memorization techniques taught by the school compared to those aged between 16-18 years.

Table 3.6: Student Performance Results of Quran Memorization Course

Age	Total student	Total student passed	%	Total student failed	%
10-12 years	17	7	20%	10	29%
13-15 years	13	9	26%	4	11%
16-18 years	5	5	14%	0	0%
Total student	35	21	60%	14	40%

Source: Tahfiz Integration School, Sepang Selangor performance report 2015

The results of the students' performance were assessed from Memorization class level 3 through a *tasmik* assessment session, conducted at the end of the semester of study.

Based on the analysis of the student's performance in Table 3.6, it was shown that 40% of the students failed the final assessment of the Quran memorization course. The

assessment of the students includes oral tests (*tasmi'*) and written tests (*tahriri*). The total passing mark set by the school was 80%. This shows that many students aged between 10 and 15 years are not able to achieve passing marks using the Quran memorization technique taught in school.

iv. Time allocation for memorizing Quran

In the process of memorizing the Quran, the school has set the class time for memorization of new verses and *tasmik assessment* every Monday to Friday from 8.00 am to 10.00 am, while Saturday and Sunday were the times to repeat their memorization of old Quran verses. Students are required to face their teacher through a *tasmik* assessment with at least two or three pages a day or according to their teacher's consent. The researcher examines the techniques of memorization and allocation of learning time at the school to evaluate the full implementation of the course. Since there is a study of the Quran memorization methodology (Ariffin & Wahid 2014; Sedek 2011) and modules for understanding the translation of the Quran (Abdul et al., 2020), the findings would be a source of reference for the researcher to formulate the memorization techniques for this course. Table 3.7 shows the weekly time allocated for the students to memorize and do the *tasmik* assessment for this course.

Table 3.7: Students' Time Allocated for Quran Memorization Course

Day	Time Allocation	
	Self- Memorizing	<i>Tasmik</i> Assessment
Monday	2 hours	
Tuesday	2 hours	2 hours
Wednesday	2 hours	
Thursday	2 hours	2 hours
Friday	2 hours	
Saturday	2 hours	
Sunday	2 hours	
Total	14 hours	4 hours

Based on an analysis of the time allocated to the students for the Quran memorization course, only two hours per day are allocated by the school for the process of memorizing while four hours a week are scheduled for the *tasmik* session. Two hours of session per day does not meet the requirement for an efficient method of Quran memorization, as suggested by Ariffin & Wahid (2014) and Aziz et al., (2019). The school should be concerned with the allocation of time for the process of memorizing the Quran, which requires regularly spaced times on a daily schedule so that the student can keep memorizing the Quran for their memory retention (Abdul Jalal et al., 2015; Aziz et al., 2019); the frequency of memorizing sessions per day also depends on the techniques used by the student to achieve the level and quality of memorization achievement (A. Abdullah et al., 2005; Azis et al., 2021; Hamiz, M. et al., 2014; Madihah, 2011; Marzuqi et al., 2020). The process of memorizing the Quran with new Quran verses memorization was implemented in five days between Monday and Friday, meanwhile, the repetition of old Quran verses memorization of the Quran is held on Saturday and Sunday. The short time allocated for a day by the school is insufficient for the students to achieve a good performance in memorizing the Quran. Therefore, the school needs to allocate three (3) specific separated times in a day for the students to memorize the Quran namely time to memorize the new Quran verses and time to repeat memorizing new Quran verses and time to repeat memorize old Quran verses. This separated time allocated the students to a process of memorizing the Quran continually in a systematic way.

Table 3.8 shows the proposed three-time implementation of the three rules of the Quran memorization method based on the page which is suggested in the book Quran memorization methodology by Ariffin & Wahid (2014).

Table 3.8: Three Rules of Quran Memorization Method

		Time 1	Time 2	Time 3
WEEK	DAY	New memorization (NM) [every day]	Repetition of new memorization (RNM) [in a week]	Repetition of old memorization (ROM) [more than a week]
Week 1	Day 1	page 1-2		
	Day 2	page 3-4	page 1-2	
	Day 3	page 5-6	page 1-4	
	Day 4	page 7-8	page 1-6	
	Day 5	page 9-10	page 1-8	
	Day 6	page 11-12	page 1-10	
Week 2	Day 7			page 1-12

(Source: Ariffin & Wahid, 2014)

The school curriculum also sets one *juzu*' Quran per semester to be memorized, based on the syllabus of the course. However, based on the performance report of the students, most students were not able to achieve the school's target. This led to their extended period to study. According to the studies of Quran memorization methodology, written by Ariffin, (2011); Ariffin & Wahid, (2014), most of the Quran memorization methods that used the conventional approaches, can memorize the Quran verses without seeing *mushaf* through the implementation of three rules of Quran memorization method in their Quran memorization process. The three rules of the Quran memorization method are new memorization (NM), repetition of new memorization (RNM), and repetition of old memorization (ROM). These three rules applied the three-time allocation per day to provide a system of the Quran memorization process.

v. Memorization Method and Techniques

There were three (3) steps of the memorization method taught by the school to memorize the Quran verse and translation in this course namely:

- i) *Talaqqi* and *Musyafahah*: *Talaqqi* is the method of learning the Quran face to face where the teaching method is directly from a teacher to a student. *Musyafahah* means receiving verbally from the movement of the lips (Yusof et al., 2018).
- ii) Recitation with tajwid: Recitation of the Quran is governed by a variety of rules with correct pronunciation called tajwid rules (Nayef & Wahab, 2018). Then, the teacher determines the number of verses the students need to memorize with the correct *tajwid*.
- iii) Memorizing Quran verses and translation: Memorizing the Quran verses with the translation using five (5) Quran memorization techniques: (i) Repetition - repeat the verse and translation memorized until remembered. The steps are explained as the following: start memorizing the first verse repeatedly (10 times or more). When the first verse is well remembered and fluent, begin to memorize the first verse repeatedly (10 times or more). Then the students will memorize the verse and translation per word repeatedly (10 times or more) until the entire verse is thoroughly memorized. Next, memorizing the second verse; the same method used in memorizing the first verse is applied to the second. When the second verse is remembered, then repeat the first verse memorized and the second verse until the student can recall both verses smoothly. Next, memorize the third verse, and repeat the rote from the first verse until the third verse. The same method is applied to the subsequent remaining verses until the student can memorize all the verses set by the teacher for that day; (ii) Listening - listen to the teacher's reading of the verse and translation; (iii) Segmentation -break up a long verse and translate it into

appropriate smaller sections; and (iv) Writing - write each of the verses and translation that has been memorized. Then revise it based on the used *mushaf*.

The class observation also indicates that each student used more than one technique in memorizing the course either from the techniques taught by the school or their techniques namely repetition, open-close *mushaf*, writing, drawing a picture of translation, and hand movements. According to Mohamud (2021), the techniques used in memorizing close related to the cognitive process that relates to sensory memory that make the student focus whether watching it visually or listening in a form of audio using all the senses. Studies by Mohamud, (2021); Muluk et al., (2020), students have their own different Qur'anic memorization styles to absorb and understand their memorization which closely relates to the use of the five senses namely taste, auditory, olfactory visual, and kinesthetic. The VARK learning style used the senses but most students do not realize their VARK learning styles and in many cases, they combine several VARK learning styles to get the best for their memorization (Muluk et al., 2020). Moreover, research by Mirza & Khurshid, (2020) shows that VARK learning styles differ significantly among different and the same disciplines. The results distribution of VARK learning style categories using the VARK questionnaires were collected from thirty-five (35) students as shown in Table 3.9.

Table 3.9: Distribution of VARK Learning Style Categories

Age	Unimodality	Bimodality	Trimodality	Quadrимodality
10-12 years	8	1	1	7
13-15 years	1	2	1	9
16-18 years	1	0	0	4
Total student	10	3	2	20

In this research, the analysis of the preferred VARK learning style provides the insight that students with the same course also have different VARK learning styles and they like to memorize differently. Felder & Brent, (2005) studies, also recommended the teacher apply a balanced instructional approach to each of the learning style dimensions in teaching and learning. Moreover, successful teaching and student learning can be achieved by recognizing the learner's style of learning and preferred learning modalities (Cabual, 2021). Most researchers prove that students' VARK learning styles that applied effective techniques would affect the quality and performance of learning (Ahmad Bazli et al., 2017; Azmil & Misnan, 2015; Fleming, 2012; Triastuti & Mauliyani, 2018). Therefore, the teachers need to understand the students' differences in VARK learning styles. Pattaraphongplin & Yasri (2021) explain that the process of learning and understanding can be different for each student. The teaching methods are especially important for students to learn the curriculum because not every student can learn the teaching material in the same way. Moreover, the use of bimodality with audiovisual (Triastuti & Mauliyani, 2018) and multimodality (Kurdekar & S, 2020) in the VARK learning style significantly influences memory retention.

The class observation continued with memorization techniques used by the students in the process of learning the course within two hours before the Tasmik assessment started. The researcher found that all the techniques suggested as guides in the learning process of this course are related to the use of various senses of memory. Observation shows that each student practiced the memorization techniques differently with their techniques instead of the techniques that have been taught by the school. All the techniques used indicated his or her preferred VARK learning style. This is because

each of VARK's learning styles involves the use of various sensory memory namely eyes, ears, and body or hand movement. The researcher categorized the memorization techniques practiced by the students based on their preferred VARK learning styles. The results of the observations are analyzed as shown in Table 3.10.

Table 3.10: Memorizing Techniques Based on The VARK Learning Style

VAR K Learning style	Memorizing Techniques
Visual	<ul style="list-style-type: none"> • Draw a picture of the verse. • Draw a mind map of each verse. • Draw the meaning of the verse.
Auditory	<ul style="list-style-type: none"> • Listen to the teacher's loud reading. • Listen to a friend's loud/slow reading. • Listen to the students' own loud/slow reading.
Reading /Writing	<ul style="list-style-type: none"> • Read aloud. • Read the verses on their own. • Point at the verse when reading. • Rewrite the verses and translations. • Mark a long verse into smaller chunks.
Kinesthetic	<ul style="list-style-type: none"> • Walk and move. • Move pen, hand, or other objects. • Open and close verses and translation alternately.

From this analysis, the researcher found that each student has a different VARK learning style in acquiring knowledge and maintaining their memorization of this course. The students' VARK (Visual, Auditory, Reading, and Kinesthetic) learning styles were introduced by Fleming, (2012). with four categories as uni-modality, bi-modality, tri-modality, and quadri-modality. In this study, the student receives knowledge well using their preferred or dominant VARK learning styles. For example, the tri-modality category was a dominant VARK learning style used by two students in the class observation. The students had their VAR and VAK learning style which consists of three types of modes. Hence, the student's learning hierarchy is based on a stronger mode of order, for example, visual followed by auditory and subsequently

reading or kinesthetic mode. They preferred to use their multiple senses of memory to reinforce their memory retention during the process of memorization.

vi. Teaching Assessment Method

Furthermore, an analysis is carried out on the teacher's assessment method used to evaluate the performance of the students in the course. The researcher found that two methods of assessment are used by the teacher to measure the performance of students namely the *tasmik* assessment and the *tahriri* assessment. The class-observation results found that each student took 15 to 20 minutes for the *tasmik* session while other students waited for their turn. The time constraint also can cause difficulty for the teacher to pay attention to the students with different abilities and needs of learning. Therefore, this problem can be overcome with the help of teaching aids that support the student's self-learning process based on their preferred VARK learning style (Ahmad Bazli et al., 2017; Azmil & Misnan, 2015; Fleming, 2012; Kamarul Azmi & Mohd Aderi, 2013; Triastuti, & Mauliyani, 2018). Then an analysis was carried out on the teacher's evaluation method in determining the memorization performance of each student. The assessment methods used by teachers are questioning, quiz, *tasmik* assessment, and *tahriri* assessment. The results of the class observations found that questioning and quiz were implemented in individual and group learning sessions in the classroom while *tasmik* and *tahriri* assessment session was held for each student individually for between 15 to 20 minutes. The *tasmik* assessment can confirm the performance status of a student's memory. It also evaluates the aspect of memorizing with *tajwid*.

vii. Quran surah sample

The selection of *surah Al-Insaan* according to the content of surah with the human creation and life can accomplish physical and spiritual development. The rewards of the good and their character and traits are also revealed in this *surah*. Based on interviews with students in the third semester, they need to memorize a specific surah from *Juzuk 29* namely *Al-Mulk*, *Al-Qalam*, *Al-Haaqqah*, *Al-Ma'aarij*, *Al-Jinn*, *Al-Muzammil*, *Al-Qiyamah* and *Al-Insaan*. Interviews were conducted with three teachers in Quran to acquire their opinion on the *surah Al-Insaan* as the preliminary studies. The teachers suggested the selection of *surah Al-Insaan* is based on the features it can be easily illustrated or visualized because it contains the human creation and human life as well as has an average number of similarities in short and long verses. *Surah Al-Insaan* is also not memorized by the students yet. Moreover, a study by Haeri (2016) mentions that *surah Al-Insaan* is an interesting text in the field of translated text to conduct the process of analysis.

Toward determining the suitable Quran memorization techniques to be implemented in the EzHifz model design, a comparative analysis was conducted by analyzing several selected papers and websites to ensure the EzHifz model design in the prototype has considered the suitable techniques to be employed in the model. The comparative analysis is implemented among Quran memorization techniques applied in the Quranic field and technology field. The fundamental aspect used to analyze the selected papers were by identifying memorizing technique used in the selected paper and websites. The reviews have resulted that all the techniques used are related to the student's cognitive intelligence and sensory modalities to memorize the Quran verses and translation. Thirteen (13) types of Quran memorization techniques proposed are

reading, listening, pointer, highlight, keyword, visual map, association, zooming, comprehension, open-close, repetition, segmentation, and movement.

viii. Sensory modalities

The EzHifz model requires elements related to the sensory modalities and human memory systems in multimedia learning. The elements of the EzHifz model were adapted from the cognitive theory of multimedia learning (CTML). A lot of Quran memorization model has been developed through the application prototype to facilitate student to memorize the Quran. However, most of the models developed a focus on the technology applied, and none of it provides the techniques with a selection of preferred VARK learning styles in memorizing the Quran verse and translation. Based on the literature review and comparative analysis, the adapted elements of cognitive theory multimedia learning (CTML) are thirteen (13) types of Quran memorization techniques (reading, listening, pointer, highlight, keyword, visual map, association, zooming, comprehension, open-close, repetition, segmentation, and movement), one (1) element of multimedia presentation (picture of body motion & hand gestures); four (4) elements of sensory memory (visual, auditory, reading, and kinesthetic), and two (2) elements of working memory (sign, gestures model). The detailed EzHifz model design using the elements is further discussed in the next section 3.8.3.

ix. Learning hierarchy

Designing the learning hierarchy in the EzHifz model based on the VARK learning style is important to ensure that the students achieved the learning objectives. Organizing and presenting the content systematically will also determine the student's performance level. The Quran memorization modules in the EzHifz prototype allowed the students

to select their preferred VARK learning styles using multiple sensory functions in memorizing the Quran verse and translation in *surah Al-Insaan*.

In the learning hierarchy, the analysis includes a learning modalities approach using multimedia technology. The content analysis is identified by reviewing the syllabus content of the Quran memorization course. Besides, researchers also consult experts' content as well as interview teachers. This analysis also involves the process of determining the scope of content, analyzing the surah, and analyzing the content. The result of this analysis is the learning hierarchy of the EzHifz prototype as that shown in Figure 3.5.



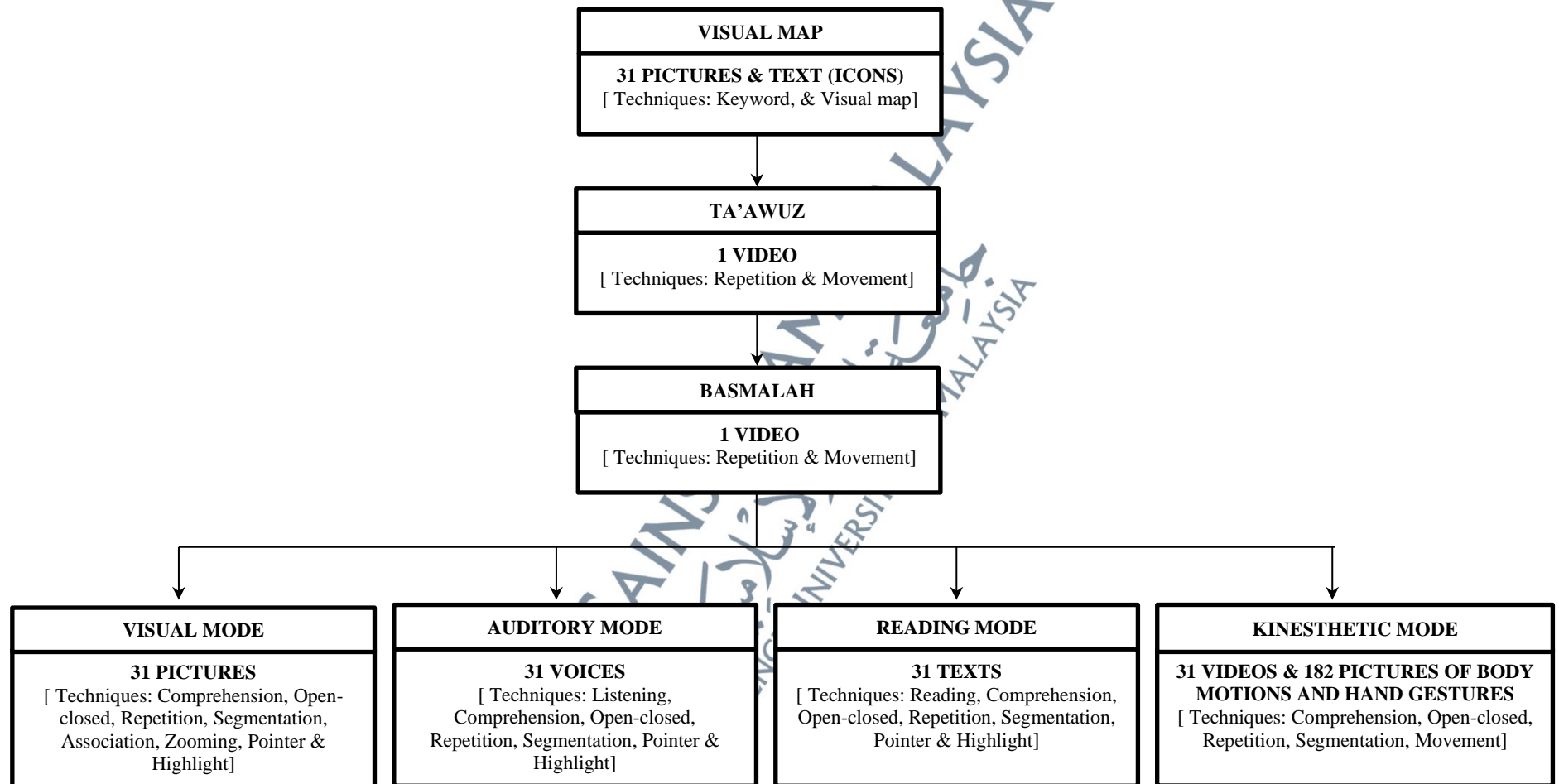


Figure 3.5: Learning Hierarchy of *EzHifz* Prototype

Based on Table 3.5, The learning hierarchy shows how the students will study *surah Al-Insaan* in the prototype i) thirty-one verse in the visual map module (in the form of icons with pictures and text representing each verse) using keyword and visual map techniques; ii) one verse in *Taawuz* module (in the form of video) using repetition and movement techniques; iii) one verse in *Basmalah* module (in the form of video) using repetition and movement techniques; iv) thirty-one verse in visual mode (in the form of pictures) using comprehension, open-closed, repetition, segmentation, association, zooming, pointer & highlight techniques; v) thirty-one verse in audio mode (in the form of voices) using listening, comprehension, open-closed, repetition, segmentation, pointer & highlight techniques; vi) thirty-one verse in reading mode (in the form of texts) using reading, comprehension, open-closed, repetition, segmentation, pointer & highlight techniques; and vii) thirty-one verse in kinesthetic mode (in the form of videos and pictures of body motions and hand gestures) using comprehension, open-closed, repetition, segmentation, movement techniques. This learning hierarchy is implemented in the prototype design to formulate learning objectives.

d) Learning Objectives

Learning objectives are slightly specific to be achieved (Rieckmann, 2017) and can be determined in cognitive, affective, psychomotor, and intuitive, as a sequence to be followed for the characteristics of the model or application (Sönmez, 2017). Learning activities are designed to coincide with learning objectives and referred to the teachers for improvement. The EzHifz prototype that represents the EzHifz model provides learning activities that require the student to learn the skill of memorizing through recognizing and imitating multimedia elements. Objectives are expressed as measurable

learning outcomes. Table 3.11 shows the learning outcomes of the EzHifz model design or EzHifz prototype based on the curriculum plan provided by the school.

Table 3.11: Learning Outcome of EzHifz Prototype.

CONTENT	LEARNING OUTCOME
<i>Surah Al-Insaan</i>	<ul style="list-style-type: none"> • Memorize the verse and translation based on the preferred VARK learning style through an individual selection of modes of learning namely visual, auditory, reading, or kinesthetic: <ul style="list-style-type: none"> (i) Recognize the pictures/object colored represents the verses using Quran memorization techniques through the visual mode of learning. (ii) Recognize the voice of recitation represents the verses using Quran memorization techniques through the auditory mode of learning. (iii) Recognize the Arabic and Malay text represents the verses using Quran memorization techniques through the reading mode of learning. (iv) Imitate the videos or pictures of body motion and hand gestures representing the verses using Quran memorization techniques through the kinesthetic mode of learning.

3.8.2 Phase II: Design, Development, and Implementation

The design, development, and implementation phase are the process of interpreting all the findings from the analysis phase, covering all the elements that need to be implemented into the Multimedia representation learning model (EzHifz model) and EzHifz prototype. The design phase covers the tasks of designing the EzHifz model (sketch model design and final model) and designing the EzHifz prototype (strategies, multimedia materials, characters, and interfaces). During the design phase, the processes involved in the EzHifz model design were formulated and firmly determined the whole process. All the data gathered in the analysis phase were considered during the EzHifz model design. The EzHifz model design was also checked for its compatibility and suitability with the student's needs and characteristics. The final

EzHifz model was designed until produced the Fidelity EzHifz model was designed for memorizing Quran. The development, phase covers the tasks of developing flowcharts, and storyboards, and organizing multimedia elements for the development of the EzHifz prototype. In the implementation phase, this research is continuous with an integration unit, testing, and validation units. The processes involved in the design, development, and implementation phase of this study are shown in Figure 3.6. The following is a detailed discussion of the steps.

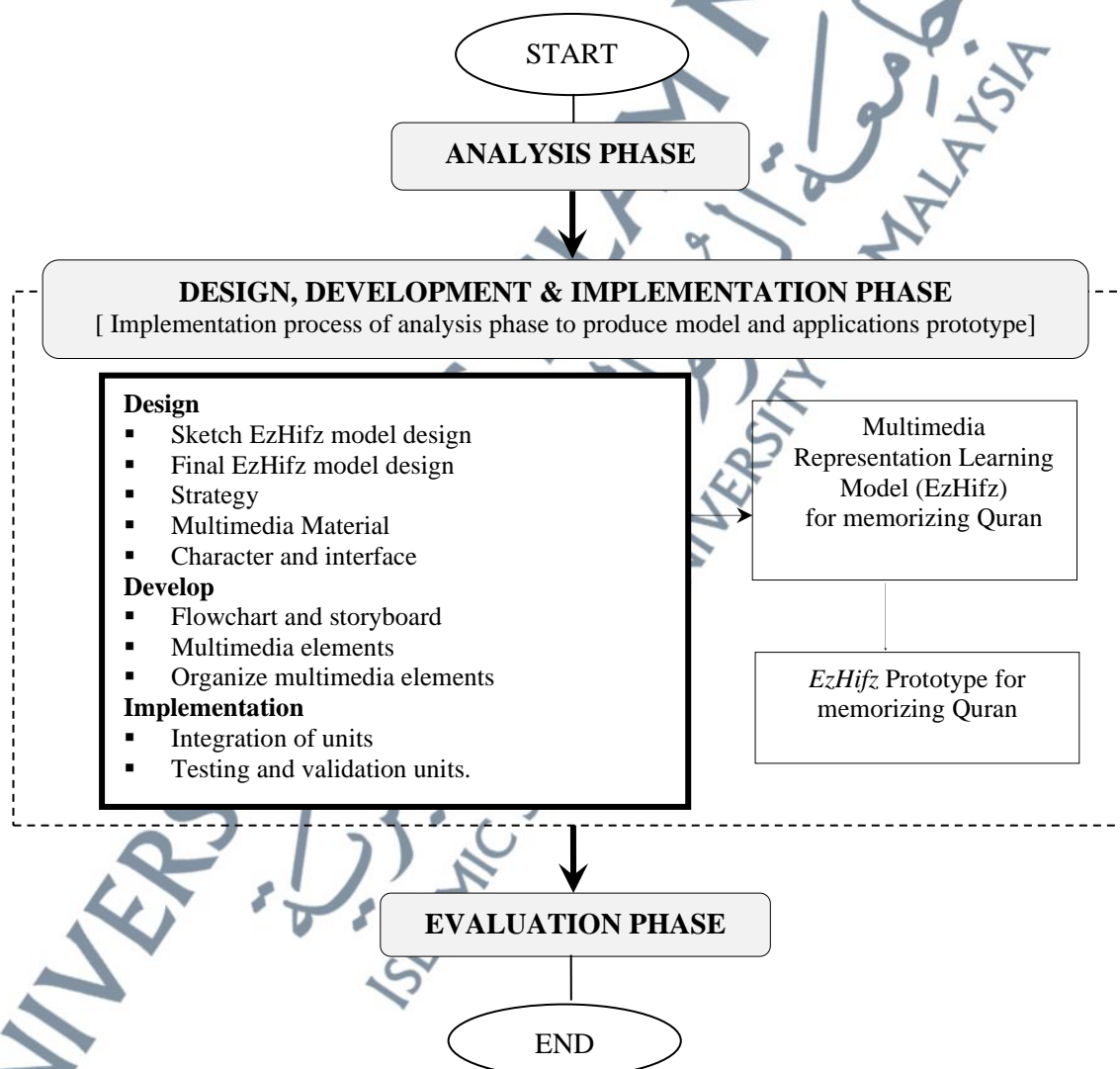


Figure 3.6: Design, Development, and Implementation Phase

3.8.3 EzHifz Model Design

This section discusses the process involved in designing the EzHifz model for memorizing Quran. This step is important to provide an effective EzHifz model design that is aligned with the development of learning objectives. The EzHifz model was developed using the selected elements from the related literature review, comparative analysis, document review, and preliminary analysis. In this study, several elements were identified for the EzHifz model design as an adapted element of Mayer's model namely Quran memorization techniques (reading, listening, pointer, highlight, keyword, visual map, association, zooming, comprehension, open-close, repetition, segmentation, movement), multimedia presentation (pictures of body motions and hand gestures), sensory memory (visual, auditory, reading, kinesthetics) and working memory (signs, gestures model) as discussed in Chapter 2.

Designing the EzHifz model is important in several aspects: (i) as a guideline for developing supportive tools for memorizing Quran; (ii) providing suitable Quran memorization techniques to memorize the Quran verse and translation and (iii) providing a selection mode of learning the based on individual preferred VARK learning style. Difficulties in memorizing the Quran verse and translation can be assisted using Quran memorization techniques based on the selection of individual preferred VARK learning styles. This is because the selection modes of learning namely visual, auditory, reading, and kinesthetic are based on the individual strength of sensory modalities. The process flow of the EzHifz model design involved three steps as illustrated in Figure 3.7. The process starts with one step from the analysis phase and is followed by two steps from the design phase.

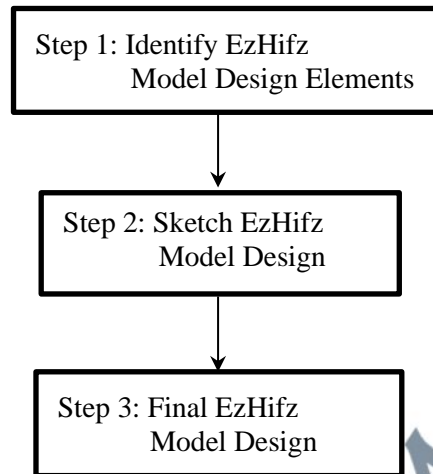


Figure 3.7: Process Flow of EzHifz Model Design

i. Step 1: Identify EzHifz Model Design Elements

The EzHifz model design was based on the integration of previous elements in Mayer's model and the proposed adapted elements of the EzHifz model design in Mayer's Model as shown in Figure 3.8. The adapted elements of the EzHifz model design are thirteen (13) Quran memorization techniques (reading, listening, pointer, highlighting, keyword, visual map, association, zooming, comprehension, open-close, repetition, segmentation, movement), one (1) multimedia presentation element (pictures of body motion & hand gesture), four (4) sensory memory (visual, auditory reading, and kinesthetic), and two (2) working memory elements (sign and gestures model). The elaboration of each EzHifz model element was discussed detailed in Chapter 2.

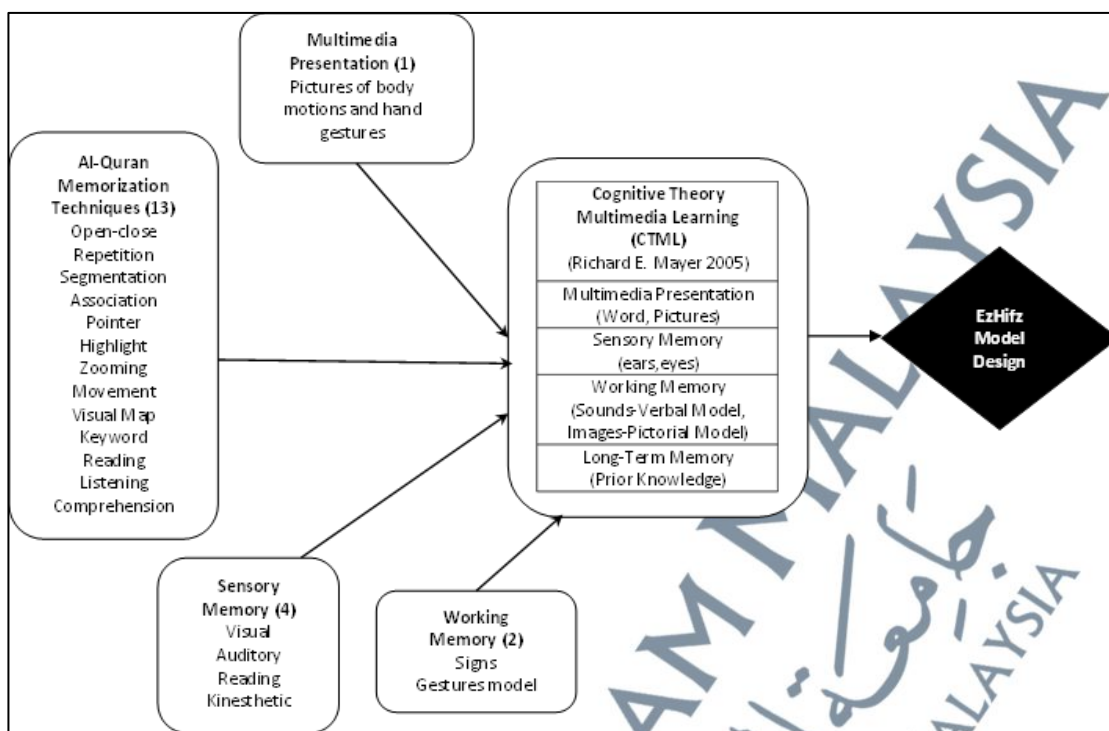


Figure 3.8: Adapted elements of EzHifz Model Design in Mayer's Model

The EzHifz model design elements that adapt Mayer's model or Cognitive Theory Multimedia Learning (CTML) represent the human information systems with a selection of preferred VARK learning styles related to multimedia learning on how the brain processes information. The adapted elements were integrated and mapped with an existing element of Cognitive Theory Multimedia Learning (CTML) employed in the EzHifz model design. The design of the EzHifz model also integrated with the ARCS motivation elements to maintain student interest. The student's attention needs to be emphasized in the EzHifz model design with relevant information to build confidence to use it and be satisfied. The elements of motivation from the ARCS motivational model that have been employed in designing the EzHifz model are attention (need to use different ways of VARK learning style to memorize Quran verses and translation); relevance (multimedia learning content that is useful to memorize); confidence

(individual self-control over their memorization process to their success) and satisfaction (feel pleasure and appreciate with the experiences of memorizing process).

ii. Step 2: Sketch EzHifz Model Design

This step involved paper-based sketches of the model. To create the sketch EzHifz model design, the information from the analysis phase was gathered and converted into design concepts in the form of sketches. The sketches of the EzHifz model design were drawn on paper. The focus of the sketches was to illustrate the EzHifz model design with the integration of proposed adapted elements and the existing elements in Mayer's model or Cognitive Theory Multimedia Learning (CTML) using a paper-based including the relation between elements. The sketching started with a discussion of the detailed elements of an existing Mayer's Model or Cognitive Theory Multimedia Learning (CTML) and was followed by the EzHifz Model design elements which were adapting of Mayer's Model or Cognitive Theory Multimedia Learning (CTML).

Mayer's Model of Cognitive Theory Multimedia Learning (CTML) comprises four main components namely multimedia presentation, sensory memory, working memory, and long-term memory. Cognitive Theory Multimedia Learning (CTML) is the theory proposed by Mayer, (2005) that claims that humans possess separate information processing channels for visually and auditory represented material known as a dual-channel assumption. These assumptions are incorporated into the Cognitive Theory Multimedia Learning (CTML) by proposing the human information-processing system. There are four main components created in CTML that have arrows connected to each of them. There are two information-processing channels contained in the model namely an auditory or verbal channel and a visual or pictorial channel. Four components in the model represent the modes of information presentation. The first component in

the model is multimedia presentation consisting of words and pictures elements. The word presentation is a text and/or auditory while pictures presentation is an image or video. These two multimedia presentations are called physical representations. The second component is sensory memory contains the ears and eyes elements. There is an arrow between these two-component which represents cognitive processing. The arrow from words to ears represents the processing of the spoken word by the ears while the arrow from words to eyes is for printed text and pictures are processed by the eyes. From the sensory memory component to the third component of the model is working memory, the arrows selecting words and images indicate that the learner is selecting specific words and images to be considered or focused on. Then these selected words and images are organized into a logical verbal and pictorial model presentation. Moving from working memory which is limited in storage and temporally to the last component long-term memory which is no limitation in storage, the learner integrates the verbal and pictorial model with relevant prior knowledge.

In the context of this study, the Cognitive Theory Multimedia Learning (CTML) process can be understood through the explanation of the following example: Once the learner starts looking at multimedia learning to memorize the Quran, the learner uses their ears and eyes to access the sensory memory representations. Learners then select the word elements (or audio elements) and image elements to put into working memory. The learner determines what words (or audio) and images will be stored in long-term memory. For the learner to process and integrate written words and image visualizations, the written words, or visuals that the learner looks at first need to be held in working memory as the learner looks at the second source that did not seem to be the

first look. The learner will then integrate these selected words and image elements with relevant prior knowledge.

iii. Step 3: Final EzHifz Model Design

The final EzHifz model design was illustrated in digital format using Adobe Photoshop software in *.png file format. The existing elements of Mayer's model were integrated with the proposed adapted elements of the EzHifz model design in Mayer Model to form the final EzHifz model design.

The next section discussed the pilot study on the EzHifz model design using the low-fidelity EzHifz Model.

3.8.4 Pilot Study (Low-Fidelity EzHifz Model Design)

The pilot study was conducted to find unexplored issues that were not detected during the previous process and to determine the reliability of the measurement of the Low-fidelity EzHifz Model Design developed. The low-fidelity EzHifz model design was illustrated through sketching interfaces using paper-based to visualize the content of *Surah Al-Insaan* that was validated by experts from the Quranic field. Then, the high-fidelity of EzHifz model design was designed in digital design using Adobe Photoshop software. The Low-fidelity EzHifz model design is used to evaluate the content design of the Low-Fidelity EzHifz prototype for the student who was grouped based on their VARK learning style category. A group of twenty (20) students aged between 10-15 years (8 females and 12 males) from the *Tahfiz* Integration School, Sepang Selangor volunteered to be a participant in this study. The evaluation provides two interfaces of memorization modules in the application to obtain feedback through the interview instrument. Video recording is used to record faces, body language and any reactions

as well as any technical problems that may exist during the testing process. Audio recordings were also used to record the activities of the study participants as well as to detect technical problems when using the application. The results of the pilot study found that video and audio recordings could record participants' expressions, feedback, voice intonation, and participants' behavior. Participants were more likely to explore each screen and perform the task list activities provided. Participants were found to be able to perform the tasks in the task list smoothly.

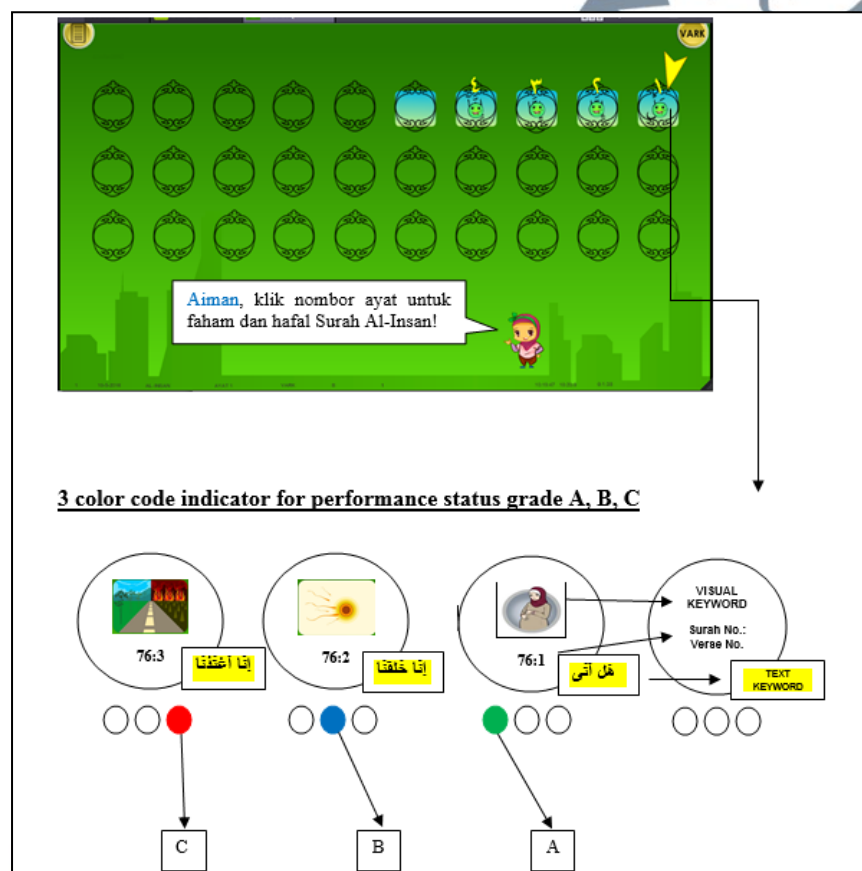


Figure 3.9: Visual map interface

The first interface of the Low-fidelity EzHifz model design in the memorization module is the visual map interface as shown in Figure 3.9. It provides clear navigation of the Quran verses next to each other verses. The user may navigate freely and select

any verse that he/she wishes to start or continue with the verse started in the previous session. It is combined with the text keyword and image. A text keyword is used to show the verse number and the Arabic text keyword, while images symbolize the verse. The main purpose of this design is to promote easy recall of the Quran verses memorized. For the performance grade, there are three colors used namely red color indicates more than one mistake; blue color only one mistake, and green color indicates that there is no mistake when the user recites during the *tasmik* process (assessment of Quran memorization). The second interface of the Low-fidelity EzHifz model design is VARK memorization as shown in Figure 3.10.



Figure 3.10: VARK Memorization Module

Based on Figure 3.10, shows four main areas that can be marked on the main interface. The upper right corner of the design shows the visual styles from the VARK learning modes using graphical images, while the upper left corner shows the kinesthetic style, which is represented in the video mode. The middle area of the main interface shows the reading mode (represented in Arabic fonts) as well as the translation

of the Quran in the Malay language. The inclusion of the Quran translation may assist the user to speed up the memorization process. Finally, the bottom area of the main interface displays the auditory style, which is the sound mode. This design is implemented to display all the VARK learning modes simultaneously (quadri-modality mode) when it is first loaded. Then, the user can freely select any of their preferred learning style or modes either in unimodality, bimodality, trimodality, or quadrimodality mode by selecting the button V, A, R, or K on the right hand of the main interface. This type of design covers the unimodality, bimodality, trimodality, and quadrimodality categories of the VARK learning styles as mentioned in Chapter 2.

This VARK memorization interface design also integrates the Quran memorization techniques. Some examples of the implemented Quran memorization techniques are also mentioned in Chapter 2. Repetition techniques which were the common techniques used in Quran memorization were applied in each VARK learning style mode. The Quran verses and translations can be repeated using the playback and pause buttons. For each loop, the selected learning style (either one or a combination of V, A, R, and K) mode will be played repeatedly. While for the long verses, the Arabic texts and the translation are segmented into small chunks to facilitate the memorization process. The pointer or highlight technique is implemented so that the student can focus on the text of verse and translation when using the reading mode of learning.

i. Evaluation Result of Pilot Study

This pilot study design study aims to provide an innovative solution to the students' problems and give them a better learning experience in memorizing the Quran. The VARK questionnaire forms were distributed to the participating students. The purpose of the survey is to find out the students' VARK learning styles as well as

understand the students' way of memorizing the Quran. The strengths of the student's preferences were analyzed based on the scores from the VARK questionnaire.

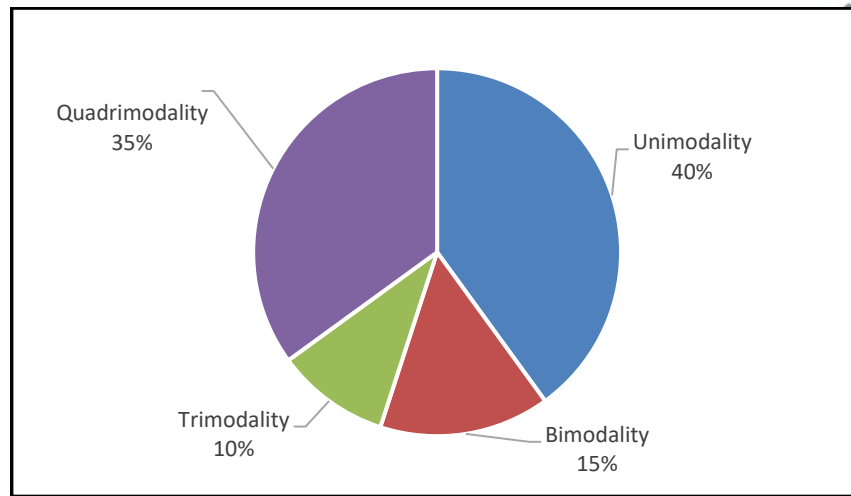


Figure 3.11: Distribution of the VARK learning style categories

Figure 3.11 shows the distribution of VARK learning style categories based on the analyzed scoring results from the completed questionnaire forms. The students' most preferred VARK learning style is the unimodality category with the highest score of 40% (8 students); this is followed by multi-modality learning with 60% (bi-modality, tri-modality, and quadri-modality). The finding shows that each of the students can be categorized into four different modes of learning called preferred or dominant VARK learning styles.

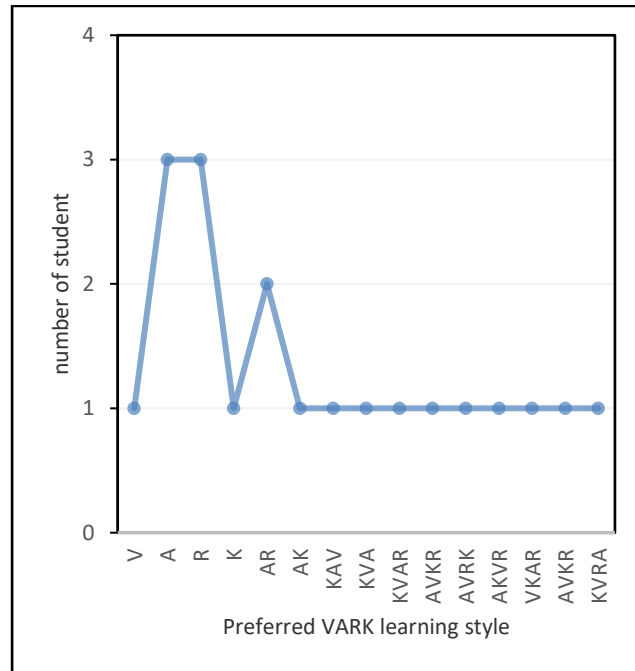


Figure 3.12: Distribution of students' preferred VARK learning style modes

Figure 3.12 shows the distribution of the students' preferred VARK learning styles. This preferred VARK learning styles refer to the strength of preferences as mild, strong, or very strong depending on the different series combinations of the preferred VARK learning style modes. For example, there are two types of preferred VARK learning styles, which are the AR and AK modes of the bi-modality combination. The first alphabet 'A' is a stronger preference than the second alphabet of 'R' and 'K' modes. It is found that most of the students (12 out of 20 students) prefer using a combination of learning styles in memorizing the Quran. This shows that combinations of learning styles may potentially help the students speed up their memorizing process.

The feedback from interviews is important to find out if it is worthwhile for the proposed Low-fidelity EzHifz model design to be further developed. Before the interview started, the students were presented with the Low-fidelity EzHifz model design one-by-one student. The features and functionalities were explained so that the

students are aware of the Low-fidelity EzHifz model design, features, and characteristics when it is fully developed and used in the real world. Observing the students in the classroom was also done during the two-hour class session. Observation results had been reported in the study of Mustafa et al. (2018). Three questions were asked during the interview sessions with the students. The interviews were conducted in the Malay language. Their responses were transcribed and translated into English. The outcomes of the interviews are presented:

Question 1:

Do you think the features and functionalities offered in this design may help you in memorizing the Quran?

Most of the students provided encouraging feedback on the features and functionalities presented. The features may potentially help them memorize and recall the Quran verses memorization easily based on their preferred VARK learning styles. Some extracts of their feedback are as follows:

[Respondent SH1]: *“Yes, for me the Quran alone is enough but if there is an extra assistant like this, it may strengthen my memory to recall quicker. But it’s better to provide the way on how to use it [the application]. It will be more helpful.”*

[Respondent SH2]: *“Yes, for the first time I saw this application, it was very helpful for us to understand and remember the word and help me better memorize and understand the meaning of the verses.”*

[Respondent SH3]: “Yes, the repetition technique in this application is the same as that we learn in class. It starts with reading and looking at the translation before memorizing it. If it's hard to remember, I will always repeat the process.

[Respondent SH4]: “In memorizing the verse and translation of the Quran, we need to read the word about 10 times or more. Then we use a ruler, to cover the word and read it again. If we do not remember, we refer to the mushaf [the written pages of the Quran]. This application provides an easier way by simply clicking the button to open and close the techniques”.

[Respondent SH5]: “For me, this application provides a simple and relaxing technique to memorize and understand the surah of the Quran, but I cannot follow the kinesthetic in the video ... the movement of the sign was too fast for me to keep an eye on. It's better to have a step-by-step movement from the video with Quran verse to follow.”

- Implications for future work

It seems that most respondents provided positive feedback. It is worth noting that the application should come with a step-by-step instruction manual so that it is easy for potential users to use the application. The ability of the application to repeat the verses and translations in any mode should be given high consideration when developing the application for real. For the video mode, it was suggested that the application should show a step-by-step movement following the Quran verses. This is to allow the potential users of the application to have ample time to follow and remember the position and movement of the body motion and hand gesture parts during the memorization process.

Question 2:

Do you think that this design is useful and may allow you to memorize the Quran anywhere and at any time?

Most of the students agreed that the memorization techniques applied with VARK learning styles were useful for memorizing the Quran independently or in a group during their available time and place. Some students wish to memorize the Quran outside of class, although they have been provided with a schedule by the school. Their feedback includes the following:

[Respondent SH1]: *“Yes, this application is really useful and suitable for me because I like to memorize when my friends are not with me...means in silent situations in my dormitory rooms or outside the classroom away from friends who memorize aloud.”*

[Respondent SH2]: *“Yes, I prefer memorizing the Quran after dawn in an hour, at that time I could remember more sometimes in the dorm or the classroom. I also memorized an hour before the class begins, with my friends in a group.”*

- Implications for future work

The proposed design of this Quran memorization tool seems to work well. Respondents appreciate the readiness of the application to be used anywhere and at any time. It is worth pointing out that the initial idea of designing this application is to fulfill the individual's need of memorizing the Quran. The outcomes from the evaluation show that the application may be suitable to be used within a group.

Question 3:

Do you think that the application may have the potential to improve your Quran memorization performance if it is implemented?

Most of the students are looking forward to using the application that may help them in the process of memorizing the Quran.

[Respondent SH1]: *“Yes, this application is good to use as it can attract me and my new friends who still do not know how to memorize the Quran easily. It can be our additional reference instead of using the mushaf Quran.”*

[Respondent SH2]: *“Yes, I do not feel sleepy, do not feel tired because it has sound, pictures and there are steps of movement for me to remember. It also can attract us to learn the Quran without feeling bored.”*

- Implications for future work

It is noted that the application design may have the potential to encourage the respondents to learn the Quran memorization. Although the respondents agreed that this application might improve their Quran memorization performance, this improvement can only be evaluated when the application is ready.

The feedback from the pilot study requires meticulous attention from the researcher to fulfill the user's needs. This research continues with the improvement and moves to the next evaluation phase. After the conducted pilot test, the improvement will be made, and the completed prototype is then evaluated with an actual user.

The interview was also conducted in the pilot study with twenty (20) students from the *Tahfiz* Integration School, Sepang Selangor from the third-semester study. This phase focused on the pilot test of the Low-fidelity EzHifz model design for memorizing the Quran. This structured interview instrument was adapted according to the suitability of the study (Abu et al., 2007; Fatimah et al., 2019; Norizah et al., 2014; Shaharuddin et al., 2012), and some of the items were self-constructed by researchers with the guidelines by Myers & Newman (2007); Svend & Steinar (2015).

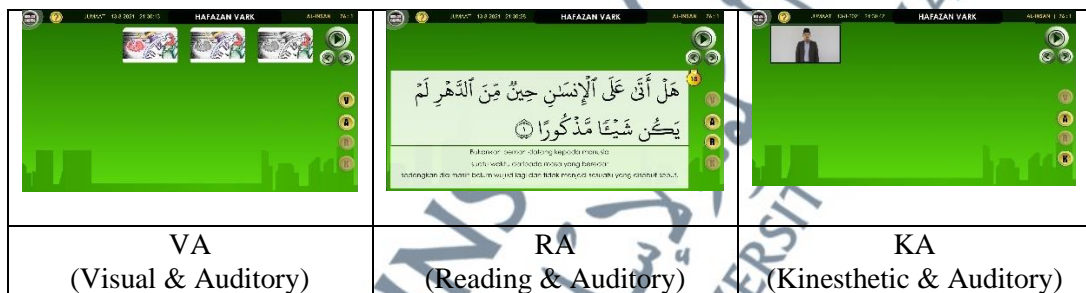
3.8.5 EzHifz Prototype

The EzHifz prototype was developed using all elements in the Final EzHifz model design in a mobile user interface. The selection of the VARK learning style enables the student to interact with the prototype effectively. The following guidelines from Morrison et al., (2019) were implemented in the EzHifz prototype as instructional objectives that provide a map for the learner to achieve the objectives and get good performance with suitable strategies and assessments used; content sequencing which provides the orderly information presented to help the learner understand and learn the information effectively; designing the message which selects and create the pattern and arranges the words and pictures to communicate and encourage the learner's attention to enhance readability and understanding; development of the instruction which the process involves putting all the parts together to produce instructional materials and evaluation instruments that are used to assess the learner's mastery of the objectives.

The EzHifz prototype also applies universal design principles in each interface as the following:

Principle 1 (Equitable Use): The EzHifz prototype is designed with the same content for the users to select using buttons that can be recognized with the acronym VARK. The selection modes of learning are identified through the VARK questionnaire, to provide the users with the easiest way to explore and recognize the process of memorizing the Quran. For example, the selection modes of learning in the EzHifz prototype are based on bi-modality categories (VA, RA, and KA) as shown in Figure 3.13. The interface design has optimized the use of buttons by allowing users to select modes of learning using their preferred VARK learning style which depends on users' strength of sensory modalities to avoid cognitive load.

Figure 3.13: Selection Modes of VARK Learning Style (Bi-modality)



The basic color of the screen in the EzHifz prototype is green because these colors are said chromatic colors and can provide a stimulus that enhances the memorization of the displayed information learning with a sense of positive energy and growth (Moulana, 2017; J. É. Pelet & Papadopoulou, 2009). Buttons back to the main menu, visual map, and exit are always placed in the upper left of each screen module with an icon that fits in a small size, does not disrupt the main interface as well as avoids user confusion with the various navigation button options.

Principle 2 (Flexibility in use): The EzHifz prototype emphasizes the need for the use of variety and flexibility in approach through a diverse use of graphics, audio, text reading, and video material. Teaching approaches in this prototype are also considered to be changing between four modes of learning based on the individual selection of preferred VARK learning styles and not relying on one learning style that will exclude some learners. This is because not all learners can learn the same approach with their different VARK learning styles. It also allows students to memorize Quran in a way that suits their preferred VARK learning style which will increase engagement and improve performance as well as motivation (Munzil & Perwira, 2021; Wanna & Simões, 2021).

Principle 3 (Simple and intuitive): This EzHifz prototype provides the outlines of assessment and ease of use concerning module multimedia learning content and assessment methods before choosing or beginning a module. It also provides students with a clear marking rubric to ensure that they know how each of their assessments will be graded through the information and tasmik module.

Principle 4 (Perceptible Information): The EzHifz prototype design serves information effectively to the user, regardless of ambient conditions or the user's sensory modalities or sensory memory using different modes of learning namely visual or pictorial, verbal, and gestures for the same material learning with integration of Quran memorization techniques to support learning. This is referred to as multimodal learning. Multimodal learning is defined as information being presented in multiple and often simultaneous ways. It is the belief that when multiple learning modes are effectively used together, the learner will gain a better understanding of the concept.

Principle 5 (Tolerance for error): This EzHifz prototype also allows students to track their progress throughout a module using the performance module. This may help students to be aware of their progress performance and can help them to focus on areas that need improvement.

The process flow of the EzHifz prototype involved eight steps as illustrated in Figure 3.14. The process starts with three steps from the design phase, three steps from the development phase, and followed by two steps from the implementation phase.

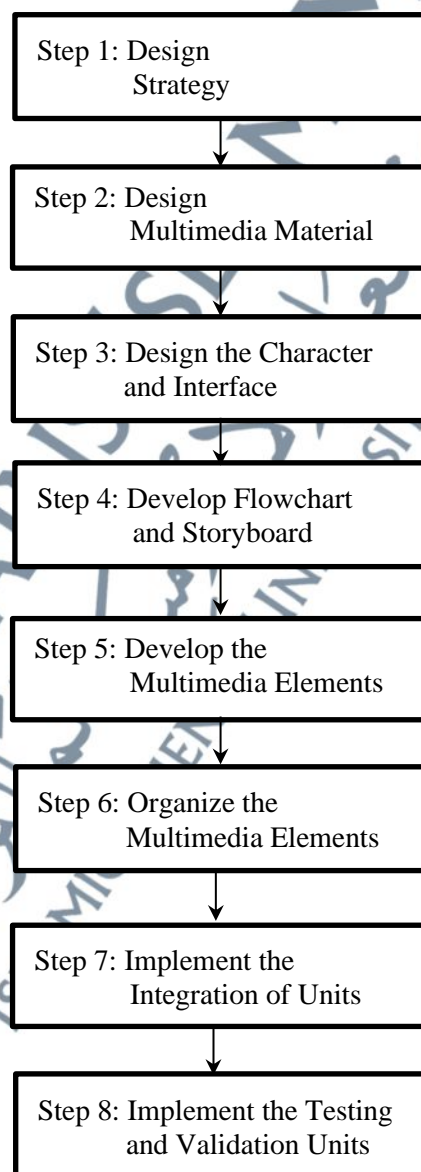


Figure 3.14: Process Flow of Designing EzHifz Prototype

i. Step 1: Design Strategy


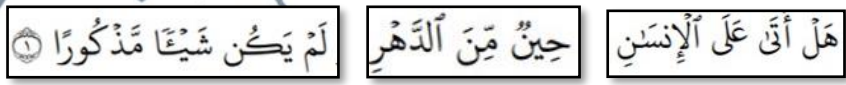
Designing strategies that are easy to understand the multimedia learning content and meet the student's needs is important to ensure the effectiveness of the teaching and learning process. It aims to determine the teaching methods to be delivered in the application developed (Baldwin & Ching, 2020). The important criteria for application design are intuitive navigation, chunked content, and accessibility for all learners (Baldwin et al., 2018). Various strategies can be used, including problem-solving, games, discussions, drills, tutorials, case studies, simulations, demonstrations, and projects. The selection of an appropriate strategy depends on several factors, including the purpose, students, situations, facilities, infrastructure, method as well as teaching and learning activities (Khafidah et al., 2020). The teaching strategies used in this study were drills and demonstrations.

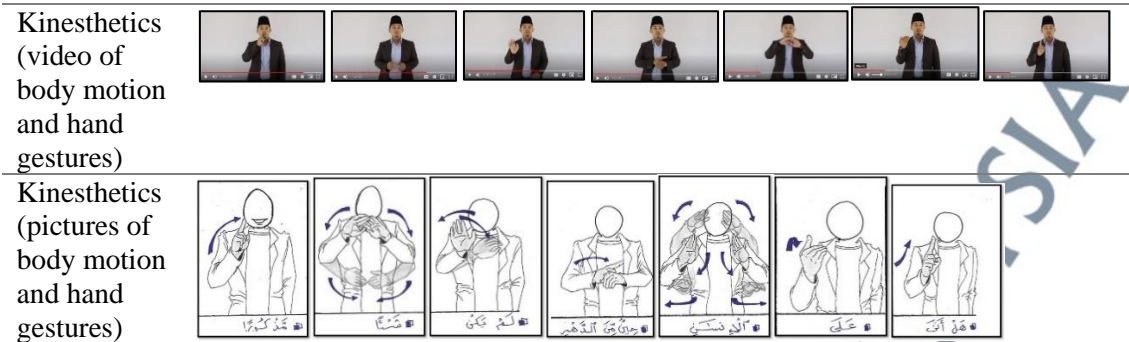
ii. Step 2: Design Multimedia Material

Designing multimedia materials involves designing multimedia learning content used to convey information and knowledge. In this study, the content is identified and detailed based on the selection of Surah Al-Insaan in the analysis phase of the course syllabus. Surah Al-Insaan is segmented into smaller units of verses, a selection of thirteen (13) types of Quran memorization techniques, formation of simple objects and images, drafting body motion and hand gesture, recording voice recitation, formation of Arabic and Malay text, segmenting all the multimedia elements, design activities, and evaluation. Guideline of Baldwin & Ching, (2020) stated the criteria and standard design components that need to consider when designing multimedia materials for EzHifz prototype development namely device compatibility that can test the application

on multiple mobile devices namely smartphones and tablets; content readability that divide content into small, manageable chunks that easy-to-read; format optimization which use mobile-friendly font sizes and typefaces to accommodate mobile users. A larger typeface requires less focus, enhances readability, and provides a stronger emotional connection; and mobile-friendly navigation that minimizes the number of clicks to reach content provides a clear navigation roadmap, and simplifies. In this study, the content modules produced in the EzHifz prototype are memorization, performance, tasmik, profile, information, and help modules can be referred to in Appendix 15. However, the EzHifz model design was applied only in the memorization module. The memorization module is a design based on the surah Al-Insaan (as multimedia learning content), which divides the memorization module interface according to four (4) modes of VARK learning style with the integration of the segmentation technique as shown in Table 3.12. Each mode will represent each of the verses and translations from surah Al-Insaan. User may select their preferred modes of VARK learning style in the interface designed.

Table 3.12: Content of VARK Memorization with Segmentation Technique

MODES	SEGMENTATION TECHNIQUES
Visual (pictures)	
Auditory (audio)	Voice of recitation in the form of audio
Reading (words or text)	
	<p><u>Bukankah pernah datang kepada manusia</u> <u>suatu waktu daripada masa yang beredar</u> <u>sedangkan dia masih belum wujud lagi dan tidak menjadi sesuatu yang disebut-sebut.</u></p>



iii. Step 3: Design Character and Interface

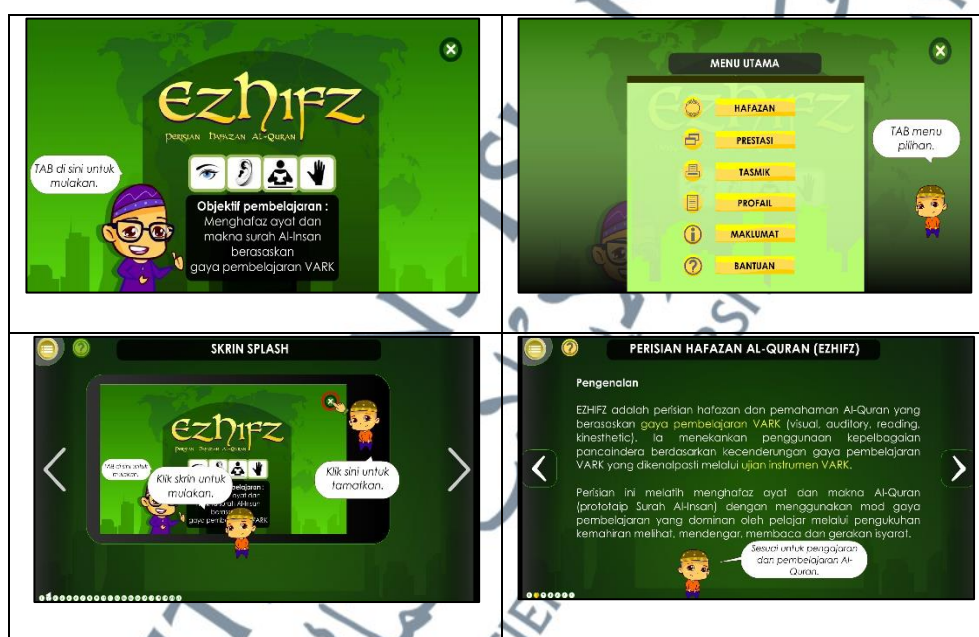
The next step is to design suitable characters. Before developing the characters, the main basis is by understanding the nature of the student and the nature of the education environment (Suprani, 2019). In this study, *tahfiz* students and Quran memorization need an Islamic character in the learning environment in a good manner. A good understanding of the nature of *tahfiz* student school and character education will guide the students in developing good character in terms of intention, feeling, and mindset, and shape their identity (Suprani, 2019; Syed Azmy et al., 2021). Characters are selected after several characters are developed and tested for their suitability for the character to use in the EzHifz prototype. Table 3.13 shows the characters that were developed before for *Hafiz* character and the selected EzHifz prototype interface.

Table 3.13: Selection of Hafiz's Character

			
√ selected Hafiz1	√ selected Hafiz2	X not selected	X not selected

Hafiz's character was chosen because the name *Hafiz* in Arabic means memorizer. It is also easy to pronounce and concise. Two characters were chosen to be more formal and suitable for Islamic educational learning compared to other characters that do not reflect Islamic characteristics and good manners in Quran memorization learning. Two characters were chosen named Hafiz dressed indifferently in outfits, with and without glasses. The *Hafiz* character is used in the main interface, main menu, information, and help interface as shown in Table 3.14.

Table 3.14: Hafiz's character in the EzHifz Interface



iv. Step 4: Develop Flowchart and Storyboard

The flowchart is a sequence of steps in a learning process. The production of a flowchart can show logic applications developed. It is a flow diagram map that describes the movement of users who use multimedia materials from one part to another part in a developed multimedia application or system (Alessi & Trollip, 2001; Sinaga

et al., 2019). The developed flowchart for the EzHifz prototype of each module can be referred to in Appendix 9.

Storyboard development considers the position of graphics, text, video, sound, and function of each object to illustrate each step that will be implemented during the development of the EzHifz prototype. It is the step of rewriting the information to be displayed on the computer screen on sheets of paper. The storyboard visually presents the design shapes and details included in the built prototype (Alessi & Trollip, 2001). Storyboards and flowcharts serve as a guide for designers, programmers, graphics experts, video experts, and audio-visual experts to develop a prototype. An example of a storyboard developed for the EzHifz prototype can be shown in Appendix 1.

v. **Step 5: Develop Multimedia Elements**

The EzHifz prototype development process uses software application support to produce multimedia elements namely graphics, sound, video, and text before being integrated, compiled, and edited using authoring software. Authoring software plays a role in designing interactivity and user interface (Nicholas et al., 2018; Vaughan, 2014). The multimedia element was developed by referring to the *Surah Al-Insaan* including the Quran memorization techniques based on VARK learning style.

Pictures element that visualizes the meaning of the *Surah Al-Insaan* also plays an important role in this prototype for the visual mode of learning. Some pictures are designed directly in Adobe Flash software, but some picture elements are drawn on paper and edited using Adobe Illustrator CS3 and Adobe Photoshop CS3 software first, before being imported into Adobe Flash software. The purpose is to get good quality and size; for example, the drawing pictures in visual and kinesthetic modes of learning within the VARK memorization module.

The sound element that recites the *Surah Al-Insaan* is recorded in a soundproof recording studio intended to produce a good sound quality for an auditory mode of learning. Sound elements have been recorded and edited using Garage Band software before importing into Adobe Flash software.

The text element that writes the *Surah Al-Insaan* is displayed on the interface for reading modes of learning. Text elements of Quran translation are generated directly using Adobe Flash software.

The video element was developed by recording the movement of a real human model while pictures of body motion and hand gesture elements provide step-by-step movement representing the *Surah Al-Insaan* verses and translation for the kinesthetic mode of learning. Meanwhile, the video elements were edited using Adobe Premiere CS6.

Animation element in EzHifz prototype. Preparation of animation elements for this application using Adobe Flash Professional software. Almost every screen has an animated element intended to provide information in a visual form that can be seen and perceived by the user. The animation is available in EzHifz prototype namely *Hafiz* character animation, all Quran memorization techniques (reading, listening, pointer, highlight, keyword, visual map, association, zooming, comprehension, open-close, repetition, segmentation, movement), changing the counting of repetitions, changing the color of pictures and grades button in *tasmik* and performance module, as well as changing icons button in a visual map.

x. **Step 7: Integration of Units**

Multimedia elements that are ready to be edited are imported and integrated into a multimedia presentation which is the EzHifz prototype. These elements were imported

into Adobe Flash Professional software and used the language JavaScript programming. JavaScript is used because of its many advantages namely file download speed, increase interactivity, allowing control against visuals and voice, and the use of libraries that allow images, animations, text, and video used and manipulated repeatedly at the same time can speed up the development process. When this process is completed, the EzHifz prototype is tested and evaluated before being used by real users. This will create the EzHifz prototype with an interactivity element in the interface developed for all modes of learning for the users' engagement within their selection of preferred VARK learning styles.

xi. Step 8: Implement Testing and Validation Units

Testing and validation units of the EzHifz prototype are carried out continuously with iterative evaluation throughout the process of development until the application prototype was completed (Lauff et al., 2019). This testing and validation unit aims to trace any syntax, or logic errors and improved immediately to ensure the EzHifz prototype meets the goals of prototype development. Testing usually involves testing concepts, peer surveys, and prototype evaluation. The testing concept is usually carried out in the early stages of development for ensuring that the prototype is built to meet the learning application development goals (Barnum, 2020; Camburn et al., 2017). The iterative evaluation of the prototype was performed to obtain feedback in terms of the operations and interfaces being developed. While the peer survey is an assessment involving colleagues with similar expertise and fields to improve the prototype that has been developed. This phase has involved experts and students. Iterative evaluation can produce a prototype that can meet the needs of target users through evaluation steps and continuous improvement. In this study, to determine the validity of the EzHifz

prototype, expert validation was considered to test and validate the usability of the EzHifz prototype that represents the EzHifz model and user motivation at an acceptable level. The validity process specifies that at least three (3) expert reviewers are required to conduct the content validation test (Arip et al., 2016). Therefore, this study has employed three experts for content validity from the Quran field and three (3) experts from educational technology fields. The selection of experts was based on their experiences as summarized in Table 3.15.

Table 3.15: Experts for research (Design and Development phase)

No.	Institution	Specialist	Experiences	Field Area
1.	UPSI	Pedagogy in Quran Education, Pedagogy in Islamic Education, Curriculum in Islamic Education, Philosophy of Islamic Education	>20 years	Quran education
2.	KUIS	Transliteration and Quran Education	>20 years	Quran Tafseer
3.	USIM	Quran and Al-Qiraat	>20 years	Quran
4.	UiTM	Instructional Design and Technology, Online Learning, Motivation, Design and Development Research	>20 years	Educational Technology
5.	UIAM	Teaching Technology, E-Learning Design, TASL	>20 years	Educational Technology
6.	KUIS	Multimedia in Education, Educational Games, and Computers in Education	>20 years	Educational Technology

The content validity form for the expert validation was adapted according to the suitability of the study (Abu et al., 2007; Fatimah et al., 2019; Norizah et al., 2014; Shaharuddin et al., 2012) and some of the items were constructed by the researcher. The content validation was carried out to determine the validity of the EzHifz prototype contents that represent the EzHifz model. The content validation was carried out by the experts based on their expertise. The content validity form items for the validation were

first validated by the instrument experts. The 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 content validity form was constructed with twenty-five (22) items for experts in the Quranic field and forty-five (45) items for experts in Educational Technology. It is constructed to obtain the validation of the EzHifz prototype that represents the EzHifz model in the context of usability (learnability, satisfaction) and motivation (attention, relevance, confidence, satisfaction). Each attribute was measured and analyzed based on the index of agreement using the Fleiss kappa coefficient (κ) which was an extension of Cohen's kappa introduced by Cohen, (1960). The Fleiss' kappa (Fleiss, 1971; Fleiss et al., 2003; Fleiss & Cuzick, 1979) is a measure of inter-rater agreement between two or more raters using data on a nominal scale to determine the level of strength of agreement. The ratings are divided into five categories as shown in Table 3.16.

Table 3.16: Classification of Cohen's kappa

Value of κ	Strength of Agreement
< 0.21	Poor
0.21-0.40	Fair
0.41-0.60	Moderate
0.61-0.80	Good
0.81-1.00	Very good

Source: Cohen, (1960)

The expert's result was then calculated using Fleiss's Kappa Index method in determining the expert consent index of the evaluated constructs. The strength of agreement are divided into five (5) classification: <0.21 (poor); 0.21-0.40 (Fair); 0.41-0.60 (Moderate); 0.61-0.80 (Good) and 0.81-1.00 (Very Good) (Charles, 2020; Fleiss et al., 2003; Fleiss & Cuzick, 1979; Landis & Koch, 1977). The analysis result of experts in the Quranic field using a scale of agree (Yes) and disagree (No)

shown in Table 3.17.

Table 3.17: Analysis Result of Experts in the Quranic Field

No	Item	Agreement			
		Yes	%	No	%
<u>Learnability</u>					
1.	Modes of learning in the prototype allow users to memorize different VARK learning styles.	3	100	0	0
2.	Prototype. provides clear words for easy learning.	3	100	0	0
3.	Prototype uses pictures that facilitate learning.	3	100	0	0
<u>Satisfaction</u>					
1.	Clear words to read.	3	100	0	0
2.	Prototype is easy to use.	3	100	0	0
3.	The interface allows users to integrate existing knowledge of memorization into prior knowledge.	0	0	3	100
4.	Prototype that used various multimedia elements makes it easy for users to explore applications.	3	100	0	0
<u>Attention</u>					
1.	The screen design is attractive.	3	100	0	0
2.	The pictures used are interesting.	3	100	0	0
3.	The audio used does not interfere with the focus.	3	100	0	0
4.	Audio recitation is a great learning experience to memorize the Quran.	3	100	0	0
<u>Relevance</u>					
1.	Prototype open-close button gives users the option to select the modes of the VARK learning style.	3	100	0	0
2.	The ezHifz application makes it easy for the user to memorize the next Quran verses.	3	100	0	0
3.	The speed of content presentation in the prototype. can be controlled by the user.	3	100	0	0
4.	A controlled audio reading of text facilitates user control of learning	3	100	0	0
<u>Confidence</u>					
1.	The 'colors association' techniques used are effective for learning purposes.	3	100	0	0
2.	The overall user interface encourages users to use the prototype.	3	100	0	0
3.	Prototype offers consistent learning of Quran verses and translation when users interact with it.	3	100	0	0
4.	The 'movement' technique using videos is easy to follow with the help of pictures of body motions and hand gestures provided.	2	66.7	1	33.3
<u>Satisfaction</u>					
1.	Prototype provides users to use Quran memorization techniques based on the selection of modes of learning.	3	100	0	0
2.	Prototype makes it easy for the users to memorize based on preferred VARK learning styles.	3	100	0	0
3.	Users can exit the prototype at any time.	3	100	0	0
Average of Percentage (%)		93.9		6.1	
Value of <i>k</i>		0.757			
Strength of Agreement		Good			

The percentage and value of k that represents the strength of agreement of each item in the content validity form are shown in Table 3.17. The value of k indicates the kappa value to measure inter-rater reliability or experts in the Quranic field for qualitative items. The experts' items are divided according to the constructs of usability (learnability, satisfaction) and motivation (attention, relevance, confidence, satisfaction). Twenty-two (22) items from the instruments indicate the strength of agreement of experts is at a good interpretation level (0.61-0.80) based on the value of $k = 0.757$ (Cohen, 1960) in Table 3.16. The analysis result of experts in the Educational Technology field using a scale of agree (Yes) and disagree (No). The entire content validity form consists of 45 items used by the experts to validate the elements of the EzHifz prototype that represents the EzHifz model design. The experts' items are divided according to the constructs of usability (learnability, satisfaction) and motivation (attention, relevance, confidence, satisfaction) as shown in Table 3.18.

Table 3.18: Analysis Result of Experts in the Educational Technology Field

No	Item	Agreement			
		Yes	%	No	%
<u>Learnability</u>					
1.	The 'Segmentation' technique in words, pictures, audio, and video makes memorization easier.	3	100	0	0
2.	The 'Keyword' technique on visual maps helps users to arrange and connect in Quran memorization.	3	100	0	0
3.	The 'movement' techniques help students to understand the verses that are memorized through the pictures of body motions and hand gestures.	3	100	0	0
4.	The 'segmentation' technique of the Quran verse makes it easier for students to memorize verses and translations of the Quran.	3	100	0	0
5.	The 'open and close' technique of memorizing verses helps students to memorize the Quran verses and translations.	3	100	0	0
6.	The 'color association' technique in the picture makes it easier for students to memorize the Quran	3	100	0	0
7.	The 'keyword' technique on the visual map helps the process of memorizing Quran verses and translations.	3	100	0	0

8.	The 'zooming' technique in one picture makes it easier for students to remember the Quran verses and translations	3	100	0	0
9.	The 'repetition' technique in the prototype helps the student to memorize Quran verses and translations.	3	100	0	0
10.	The 'pointer and highlight' technique contributes to the user's focus and motivation.	3	100	0	0
<u>Satisfaction</u>					
1.	Prototype provides a memorization technique for memorizing the Quran verse and translations.	3	100	0	0
2.	Prototype helps visual students memorize Quran verses through pictures.	3	100	0	0
3.	Users can practice memorizing self-study in the prototype.	0	0	3	100
4.	Prototype provides a kinesthetic learning style environment to memorize the signs using the gestures model.	3	100	0	0
5.	Users are easy and fun to follow the learning based on visual, auditory, reading, and kinesthetics in the prototype.	3	100	0	0
<u>Attention</u>					
1.	The multimedia presentation with synchronized elements draws attention to learning.	3	100	0	0
2.	The various learning styles in the prototype motivate the learner.	3	100	0	0
3.	The size and type of words are interesting.	3	100	0	0
4.	The color of the pictures is appropriate and interesting.	3	100	0	0
5.	Readable words correspond to the target.	3	100	0	0
6.	The use of pictures of body motion and hand gestures is interesting.	3	100	0	0
7.	The use of color association is interesting.	3	100	0	0
8.	Audio recitation is appropriate and interesting.	3	100	0	0
<u>Relevance</u>					
1.	The content of the prototype meets the syllabus of learning Quran memorization courses.	2	66.7	1	33.3
2.	The content of the prototype is arranged regularly.	0	0	3	100
3.	The content prototype helps the students to practice their Quran memorization skills.	3	100	0	0
4.	The multimedia presentation of content in the prototype is organized in order.	3	100	0	0
5.	The multimedia presentation of content in the prototype is easy for students to understand during a lecture class.	3	100	0	0
6.	Content delivery according to different categories of VARK learning style students.	3	100	0	0
7.	The content delivery is based on students' different VARK learning styles in memorizing the Quran.	3	100	0	0
<u>Confidence</u>					
1.	Prototype is free from the error in the words of the Quran verses and the translation of Surah Al-Insan.	3	100	0	0
2.	Prototype is free from the error of audio of the Quran verse and translation from Surah Al-Insan.	3	100	0	0

3.	Prototype is free of error in the pictures and the translation of Surah Al-Insan.	3	100	0	0
4.	Prototype is free from the error of pictures of body motion and hand gestures in the Quran verses and the translation from Surah Al-Insan.	3	100	0	0
5.	The consistent presentation style of the prototype helps users understand.	3	100	0	0
Satisfaction					
1.	Prototype provides students to memorize in a structured and systematic way.	3	100	0	0
2.	Prototype provides students to memorize the Quran and its translation using multiple senses namely eyes, ears, body, and hands gesture.	3	100	0	0
3.	Users can choose their VARK learning style in the prototype.	3	100	0	0
4.	Prototype facilitates student learning independently.	3	100	0	0
5.	Synchronized presentation of multimedia elements facilitates memorization.	3	100	0	0
6.	Words, pictures, audio, and video using the open-close technique help to make memorization easier.	3	100	0	0
7.	Prototype facilitates user learning through exploration.	3	100	0	0
8.	Users can memorize using sign language as much as they can when using the prototype.	3	100	0	0
9.	The 'Color association' technique on pictures makes it easier for users to associate learning.	3	100	0	0
10.	Visual maps make it easy for students to connect memorized verses.	3	100	0	0
Average of Percentage (%)			97.0	3.0	
Value of k			0.836		
Strength of Agreement			Very Good		

The percentage and the value of k represent the strength of agreement of each item and represent the elements of the EzHifz model design shown in Table 3.18. The value of k indicates the kappa value to measure inter-rater reliability or experts in the Educational Technology field for qualitative items. The experts' items are divided according to the constructs of usability (learnability, satisfaction) and motivation (attention, relevance, confidence, satisfaction). Forty-five items from the instruments indicate the strength of agreement of experts is at a very good interpretation level (0.81-1.00) based on the value of $k = 0.836$ (Cohen, 1960) in Table 3.16.

Based on the κ value , Table 3.19 shows the summary analysis of the expert's feedback from the attributes provided in the instruments using the EzHifz prototype that represents the EzHifz model. The results show that most experts from the Quranic field and Educational Technology field agreed with the EzHifz prototype is meet the requirement of the study based on the attributes evaluated. The experts in the Quranic field show Fleiss's kappa value of ($\kappa = 0.757$) with a good level of strength of agreement and experts in the Educational Technology field show Fleiss's kappa value of ($\kappa = 0.836$) which is the strength of agreement with a very good level. The analysis results show that most of the experts provide a good level of agreement of attributes for all the items evaluated.

Table 3.19: Analysis Results of Experts Feedback.

Expert	Attributes	Items	Fleiss's kappa coefficient (κ)	Strength of Agreement
Quranic Field	Learnability	3	0.757	Good
	Satisfaction	4		
	Attention	4		
	Relevance	4		
	Confidence	4		
	Satisfaction	3		
	Total	22		
Educational Technology Field	Learnability	10	0.836	Very Good
	Satisfaction	5		
	Attention	8		
	Relevance	7		
	Confidence	5		
	Satisfaction	10		
	Total	45		

Based on the informal interview with experts, feedback has been given to improve some of the EzHifz prototypes that represent the EzHifz model in the aspect of strengths, and weaknesses as the following:

Experts mention the strengths of the EzHifz prototype are that the researcher has successfully introduced the new Quran memorizing techniques in the application prototype to speed up the memorizing of the Quran with its translation based on the users' preferred VARK learning styles; the illustrations of the Quran verses also indirectly generate the interpretation of the verses memorized; the new features utilized namely an illustration of pictures as well as body motions and hand gestures are particularly relevant and useful to the visual and kinesthetic learners; suitable for all ages using mobile devices with an android platform, through which the users can access it easily; can be opened and accessed easily on mobile devices without having to open the *mushaf* for the Quran memorization (Per Word) course requirements; the reading mode features are helpful to the users as the reading function ease for the learning process of the Quran memorization; and the systematic and structured content of the EzHifz model, can make the Quran memorization ease to achieve the learning objectives.

The experts also give feedback on the aspect of the weaknesses, they emphasized that the EzHifz model was only recently introduced, and there are challenges to face; the signs of the movement technique used in the kinesthetic mode of learning are different from the standard sign languages namely the Malaysian sign language. there is a need to provide well-organized modules, and skilled instructors to train a comprehensive training module for an instructor that is responsible for the daily teaching plan tailored to the student's ability and different levels of users' backgrounds.

Moreover, the experts suggested that the teaching objectives should emphasize the affective elements when teaching the meaning of the Quran; should incorporate the cognitive, psychomotor, and affective elements in teaching and learning the Quran

memorization; the content can be expanded to include another *surah* in the Quran, for example, *Surah Al-Fatihah*, and continue with *Juz Amma*. The experts also recommend that the researcher submit the EzHifz model for innovation competitions namely ISLIID, MTE, and PECIPTA because the EzHifz prototype is ready to use. Therefore, the improvements and modifications of the EzHifz prototype need to be implemented based on the experts' feedback within the scope of research before evaluating it with the real user in the next evaluation phase. This EzHifz prototype that represents the EzHifz model meets the usability of the application and user motivation in memorizing the Quran.

The suggestions and improvements that have been implemented during the iterative assessment process are: text size and font type should use century gothic because it is clear and easier for students to understand; video element shows the movement of body motion and hand gesture developed was added with another sub-modules containing with pictures of body motion and hand gesture (movement) and text for a kinesthetic mode of learning because the used of videos only are difficult to follow in the kinesthetic mode of learning; help and main menu buttons are placed on each screen interface module to facilitate user access using the application and provides clarity on the usage and guidelines module with quick access while using the prototype by the user. Then, the improved EzHifz prototype was evaluated in the evaluation phase with the real user.

3.9 Phase III: Evaluation

Evaluation of usability and motivation tests was conducted to ensure that the EzHifz prototype that represents the EzHifz model achieved the development

objectives. In this phase, usability and motivation tests were implemented to validate the EzHifz prototype that represents the EzHifz model. Testing involves several activities namely determining test objectives, test planning, test preparation, test implementation, reports, and data analysis.

The evaluation phase aims to determine the usability of the EzHifz prototype and user motivation in memorizing the Quran. In this study, evaluation was conducted using a selected research sample and conducted after continuous (iterative) testing and improvements were made. The evaluation phase was conducted at *Tahfiz* Integration School, Sepang Selangor. The tests involve students aged between 10-15 years. The usability tests were conducted to test the construct of learnability and user satisfaction using the EzHifz prototype. While the motivation tests conducted include the constructs of attention, relevance, confidence, and satisfaction towards the EzHifz prototype. Figure 3.15, shows the evaluation phase of usability and motivation for the EzHifz prototype.

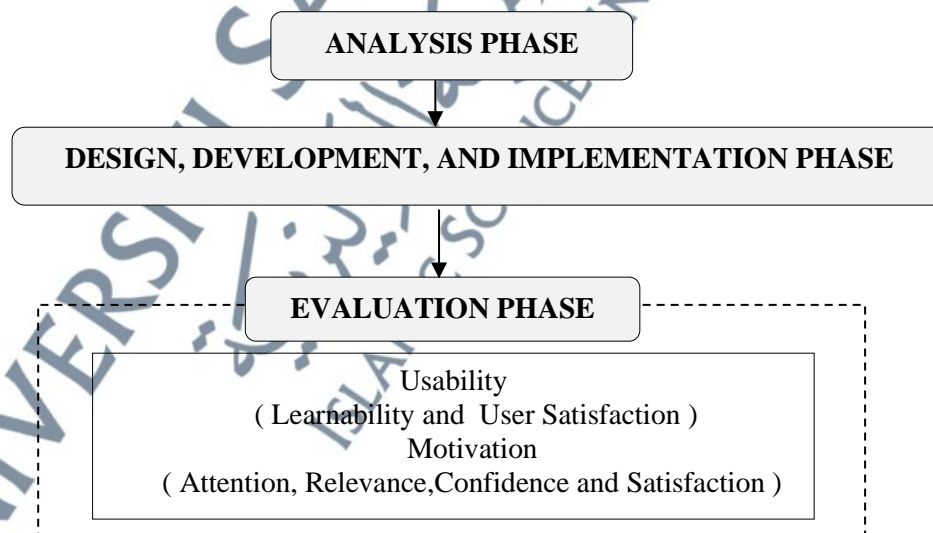


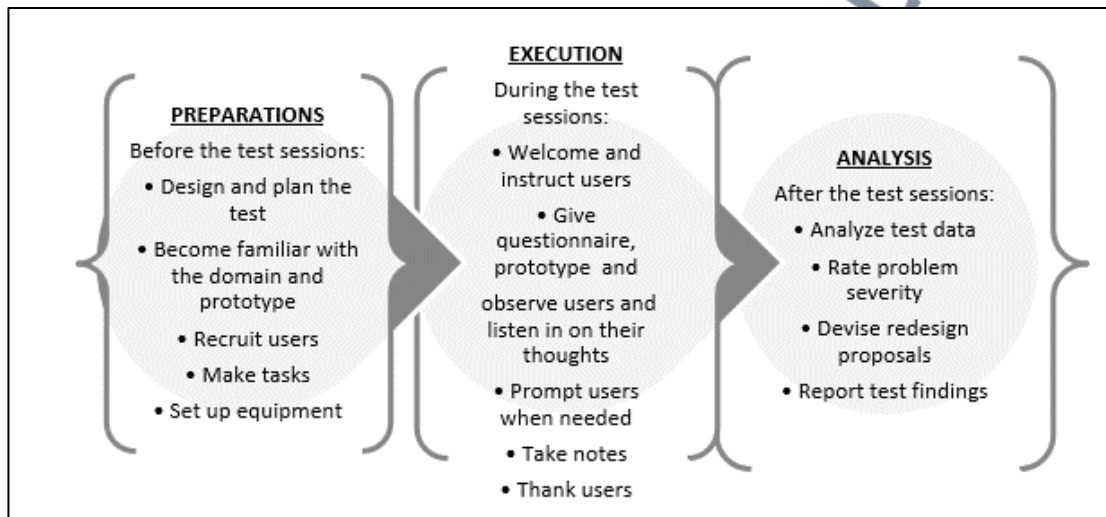
Figure 3.15: Evaluation Phase of EzHifz Prototype

Usability application for the students is when they can use the product as useful, easy, functional, and understandable (Sukmasetya, Arumi, et al., 2020). While the motivation of users is when they are interested and have fun (Shah & Chiew, 2019) using the application. The usability of the EzHifz application interface can be assessed through usability for example, through the construct of learnability and user satisfaction (Nielsen, 2020; Petersen et al., 2019). The usability and motivation testing of this EzHifz prototype use observation and survey methods. According to Sharp et al., (2019) observation involves the act of observing and listening to user activities as they use the application to be tested to help designers understand the users' context, tasks, and goals. These methods can provide information about (i) what they do with the application; (ii) the context used by the tester in performing a task; (iii) how the application helps the task and (iv) what form of help the user needs. While survey involves approaching users with a positive experience, gather opinions on a range of topics at an event through playful and engaging interaction of the prototype developed.

3.9.1 Testing Design

There are many testing designs for usability and motivation for students that have been proposed by previous researchers. The testing design for the EzHifz prototype was adapted from the framework proposed by Hertzum (2020) and (Sharp et al., 2019). The purpose of usability tests is to inform design (Sharp et al., 2019) while motivation tests inform the desire to achieve a task or goal (Fadzli et al., 2020). These testing designs have proven as a valuable method for informing redesign efforts that consist of having product testing and thinking aloud about user experience, while an evaluator observes the users and listens in on their thoughts (Hertzum, 2020). There are three phases

involved in testing design that performing the usability tests and motivation tests on the EzHifz prototype which are the preparation phase (before the test session); the execution phase (during the test sessions), and the analysis phase (after the test sessions). Figure 3.16 shows the testing design for usability and motivation of the EzHifz prototype.



Source: Adapted from (Hertzum, 2020)

Figure 3.16: Testing Design of Usability and Motivation for the EzHifz prototype.

Based on Figure 3.16, the first phase involves preparations for focusing on designing and planning the usability and motivation tests of the EzHifz prototype. The purpose of testing is to ensure that the EzHifz prototype complies with the Multimedia representation learning model (EzHifz). This phase determines the objective of the tests that involve the process of setting the testing goals. The objective of testing for the EzHifz prototype is to ensure that it meets the aspect of usability and user motivation in the context of multimodal learning. Multimodal learning is when information is presented in multiple and often simultaneous ways. Multimodal learning includes the universal design principle which believes that when multiple learning modes are effectively used together, the learner will gain a better understanding of the concept.

According to Nielsen, (1996); Nielsen & Farrell, (2014), usability is a quality attribute that measures how easy user interfaces are to use. Usability also refers to methods for improving ease of use during the design process. While Keller, (2010, 2016), mentions that the evaluation can adapt the elements provided in the ARCS motivational model design based on the suitability of the model development. Therefore, this EzHifz prototype was developed multimodal learning that presented information (Quran memorization techniques) in multiple learning modes namely visual (pictures, pictures of body motions, and hand gestures), auditory (voices), reading (words), kinesthetic (video of sign) to support individual preferred VARK learning style. This prototype contains memorization modules that need to be tested for usability (learnability and user satisfaction) and motivation (attention, relevance, confidence, and satisfaction). Therefore, to facilitate the evaluation of usability and motivation, the memorization module has been categorized according to the function and objective of the screen as the following: Visual map screen; *Ta'awuz* screen; *Basmalah* screen; VARK Memorization screen; VA Modes Screen; Sub-Visual screen; RA modes screen; KA modes screen and Sub-Kinesthetic screen.

Before the test sessions, the researcher needs to define and identify a sample study consisting of twenty (20) students aged between 10-15 years. Students are selected through purposive sampling. The activities are focused on the design and planning of the test, concentrating on the EzHifz prototype, categorizing students based on their preferred modes of VARK learning style (using the VARK questionnaire), creating the tasks, setting up tools, and equipment, determining methods of tests, location, and the appropriate time to perform the test.

. The second phase involves an execution to ensure the testing process performs well and perfectly during the test sessions. This process involves activities namely welcoming, giving instruction to the student, giving task lists, questionnaires, distributing prototypes, observing, listening to the student's experience, listening to the student's feedback, quickly assisting the student when needed, taking notes of the students' feedback, enquiring about the post-task, and appreciate the student with thanks greet. Once testing is conducted, students need to be appreciated and encouraged so that they feel comfortable during the test session. In addition, establishing a close relationship with the students before the test session is also important. Researchers must build good communication and relationships with the students. This phase also involves activities namely preparing research instruments, determining facilities testing, providing test material, providing configuration for users, explaining themselves with application and hardware technologies as well as conducting pilot tests, usability tests, and motivation tests. These activities namely test room preparation, test participant preparation, performing tests, collecting data, and providing souvenirs were conducted at *Tahfiz* Integration School, Sepang Selangor. The method implemented is one-by-one students using the prototype, answering questionnaires, observing, and listening to their feedback (Alturki & Gay, 2017; Chalil Madathil & Greenstein, 2017; J. Wang et al., 2019). The researcher observes the student's preferences for the VARK learning style and listens for their thoughts or feedback, while the student completes each task using the EzHifz prototype. The tests include identifying problems and finding opportunities to improve the prototype design, and their learning behavior (Hertzum, 2020).

Lastly, the third phase was analysis. This phase analyzed the test data and made a test report. It turns test data into usability and motivation findings. Researchers need to study that parameter relate, analyze findings, explain results and report test results. The data collected were in quantitative and qualitative form and analyzed using descriptive analysis methods described further in Chapter 5. Figure 3.17 is a summary of the evaluation process for the EzHifz prototype.

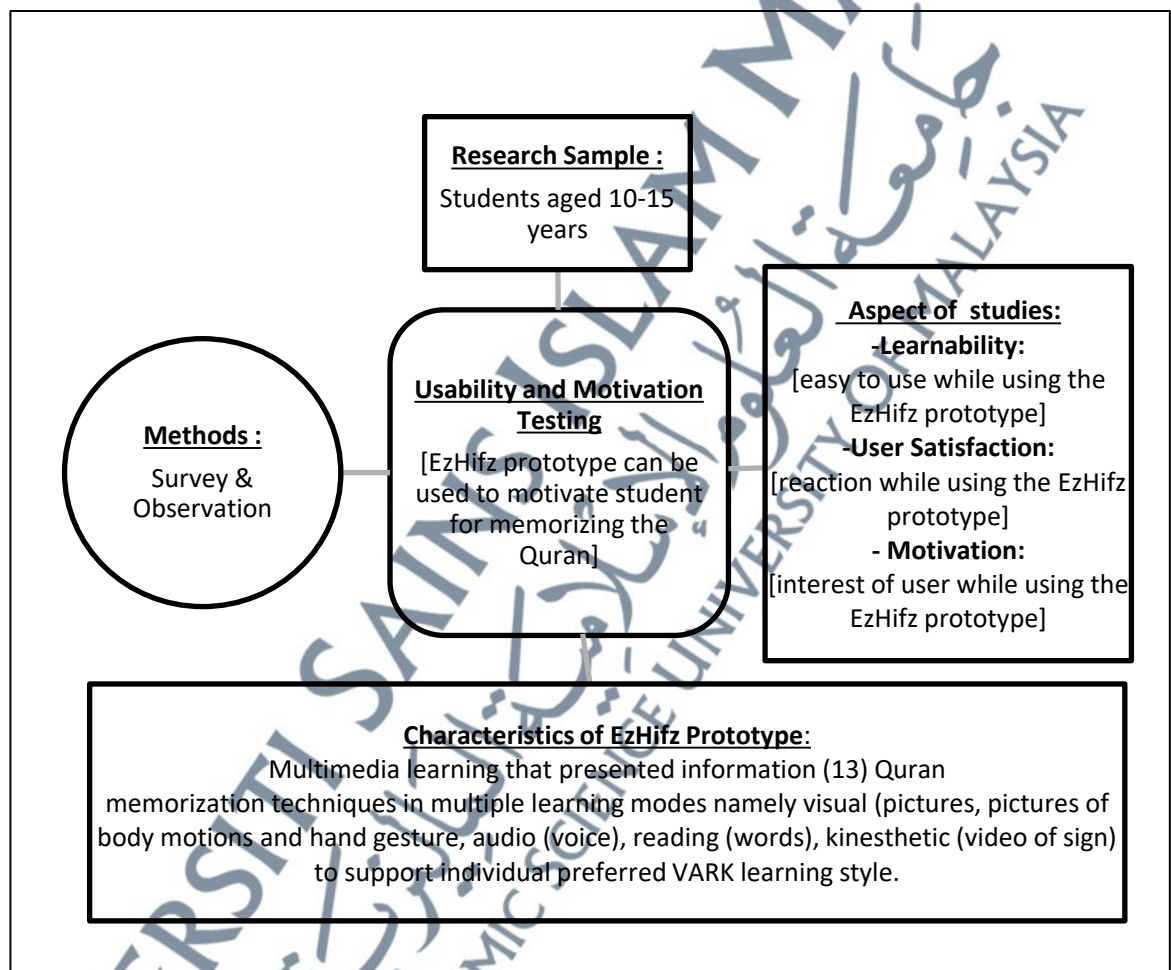


Figure 3.17: Summary of Evaluation Process for EzHifz Prototype

3.9.2 Memorization Module

The EzHifz prototype that represents the Multimedia representation learning model (EzHifz) was developed in the memorization module. During the survey and

observation, the usability and motivation test of the EzHifz prototype was tested based on the screens developed. Table 3.20 shows the total screens of the memorization module tested for verse 1. The total number of screens for 31 verses in the memorization module is 181 screens.

Table 3.20: Total screens of memorization module tested for verse 1

No.	Screen Categories	Number of screens tested
1	Visual map	1 screen
2	Ta'awuz	1 screen
3	Basmalah	1 screen
4	VARK Memorization	1 screen (1 verse only)
5	VA Modes	4 screens
6	Sub-visual	3 screens
7	RA Modes	4 screens
8	KA Modes	1 screen
9	Sub-kinesthetic	7 screens
	Total of screen-tested	23 screens

The memorization module consists of a screen with elements Multimedia representation learning model (EzHifz) for Quran memorization techniques based on the VARK learning style. The screen provides the student with the selection of the VARK button in the interface of the EzHifz prototype. To facilitate the testing on the screen of the memorization module, the researcher classified it into 9 screen categories as shown in Table 3.20. This screen classification was used to simplify the analysis process because the VARK memorization applied different types of Quran memorization techniques for each mode of the VARK learning style. Table 3.21 shows the memorization module screen that applied the types of memorization techniques in four (4) modes of VARK learning style with memorization techniques in the VARK memorization interface screen.

Table 3.21: Modes of learning and Quran Memorization Techniques.

Category screen	Mode Screen	Quran Memorization Techniques
Module	Visual	Repetition, Comprehension, Segmentation, Association, Zooming, Pointer, Highlight, Open-close
	Auditory	Listening, Comprehension, Repetition, Segmentation, Open-close
	Reading	Reading, Comprehension, Repetition, Segmentation, Open-Close, Pointer, and Highlight
	Kinesthetic	Repetition, Comprehension, Segmentation, Movement, Open-Close
Sub-module	Visual map	Keyword, visual map
	<i>Taawuz</i>	Repetition, Movement
	<i>Basmalah</i>	Repetition, Movement

The testing is performed on every 23 screens of the memorization module. The 23 screens evaluated, consists of the screens of one verse of *surah Al-Insaan* in the VARK memorization screen and one (3) screen of the sub-module. The student might explore other twenty-nine (29) verses as an option. However, the twenty-nine (29) verses in the memorization module have the same approach as verse 1, but with different content. Each of the screens was divided into four (4) modes of VARK learning style with the integration of memorization techniques to be selected by the student based on their preferred VARK learning style, while the screen of the visual map that provides icons represents a collection of thirty-one (31) verses of *surah Al-Insaan*. The visual map facilitates the participants to link all thirty-one (31) verses of *surah Al-Insaan* memorized using keyword techniques in the form of visuals and text. The evaluation activities are divided the VARK memorization interface into three types of bi-modalities categories as the first step of using the EzHifz prototype namely VA, RA,

and KA while including sub-module of a visual map, *taawuz*, and *basmalah* interface as the following:

i. Visual map Screen

The visual map screen contains visual (pictures) and reading (words) learning modes integrated with keyword and visual map techniques. The visual map represents the form of 31 icons of verses from *surah Al-Insaan* arranged sequentially in one interface. Table 3.22 shows the evaluated visual map screen.

Table 3.22: Visual Map Screen
Code: VM1



VARLK Learning style/ Multimedia presentation:	Visual (picture), Reading (word)
Memorization Techniques:	Keyword and Visual map

ii. Ta'awuz Screen

The *Ta'awuz* screen contains auditory (voice), reading (text), and kinesthetic (video-sign of body motion and hand gesture) learning modes integrated with reading, listening repetition, and movement techniques. Table 3.23 shows the evaluated *taawuz* screen.

Table 3.23: *Taawuz* Screen
Code: T1




VARLK Learning style/ Multimedia presentation:	Auditory (voice), Reading (text), and Kinesthetic (video-sign of body motion and hand gesture)
Memorization Techniques:	Reading, Listening, Comprehension, Repetition, and Movement,

iii. Basmalah Screen

The *Basmalah* screen contains auditory (voice), reading (text), and kinesthetic (video-sign of body motion and hand gesture) learning modes integrated with reading, listening repetition, and movement techniques. Table 3.24 shows the evaluated *basmalah* screen.





Table 3.24: *Basmalah* Screen

Code: B1	
	
VARK Learning style/ Multimedia presentation:	Auditory (voice), Reading (text), and Kinesthetic (video-sign of body motion and hand gesture)
Memorization Techniques:	Reading, Listening, Comprehension, Repetition, and Movement.

iv. VARK Memorization (VA Modes) and (sub-VA Modes) Screen




The VARK Memorization (VA Modes) screen with the selection of visual (pictures) and auditory (voices) learning modes represents verse 1 from *surah Al-Insaan* integrated with listening, comprehension, open-close, repetition, segmentation, association, pointer, and highlight techniques. Table 3.25 shows the evaluated VARK Memorization (VA Modes) screen

Table 3.25: VARK Memorization (VA Modes) Screen

Code: VA1	Code: VA2
	
Code: VA3	Code: VA4
	
VARK Learning style/ Multimedia presentation: Memorization Techniques:	Visual (pictures), Auditory (voices) Listening, Comprehension, Open-close, Repetition, Segmentation, Association, Pointer, and Highlight

The VARK Memorization (sub-VA Modes) screen with the selection of visual (pictures) and auditory (voices) learning modes represents verse 1 from *surah Al-Insaan* integrated with zooming, segmentation, and movement techniques. Table 3.26 shows the evaluated VARK Memorization (sub-VA Modes) screen.





Table 3.26: VARK Memorization (sub-VA Modes) Screen

Code: sVA1	Code: sVA2
	
Code: sVA3	
	
VARK Learning style/ Multimedia presentation: Memorization Techniques:	Visual (pictures), Auditory (voices) Repetition, Zooming, and Association

v. **VARK Memorization (RA Modes) Screen**

The VARK Memorization (RA Modes) Screen with the selection of reading (words) and auditory (voices) learning modes represents verse 1 from *surah Al-Insaan* integrated with reading, listening, comprehension, open-close, repetition, segmentation, pointer, and highlight techniques. Table 3.27 shows the evaluated VARK Memorization (RA Modes) screen.

Table 3.27: VARK Memorization (RA Modes) Screen

Code: RA1	Code: RA2
	
Code: RA3	Code: RA4
	
VARK Learning style/ Multimedia presentation:	Reading (words) Auditory (voices)
Memorization Techniques:	Reading, Listening, Comprehension, Open-close, Repetition, Segmentation, Pointer, and Highlight

vi. **VARK Memorization (KA Modes) and (sub-KA Modes) Screen**







The VARK Memorization (KA Modes) Screen with the selection of kinesthetic (video-sign of body motion and hand gesture) and auditory (voices) learning modes represents verse 1 from *surah Al-Insaan* integrated with listening, comprehension, open-close, repetition, and movement techniques. Table 3.28 shows the evaluated VARK Memorization (KA Modes).


Table 3.28: VARK Memorization (KA Modes) Screen

Code: KA1	
VARK Learning style/ Multimedia presentation:	Kinesthetic (video-sign of body motion and hand gesture) Auditory (voices)
Memorization Techniques:	Listening, Comprehension, Open-close, Repetition, and Movement

The VARK Memorization (sub-KA Modes) Screen with the selection of kinesthetic (pictures-sign of body motion and hand gesture) and reading (words) learning modes represents verse 1 from *surah Al-Insaan* integrated with reading, comprehension, zooming, segmentation, and movement techniques. Table 3.29 shows the evaluated VARK Memorization (sub-KA Modes) screen.

Table 3.29: VARK Memorization (sub-KA Modes) Screen

Code: subKA1	Code: subKA2
	
Code: subKA3	Code: subKA4
	
Code: subKA5	Code: subKA6
	

Code: subKA7	
	
VARLK Learning style/ Multimedia presentation:	Kinesthetic (pictures-sign of body motion and hand gesture) Reading (words)
Memorization Techniques:	Reading, Comprehension, Zooming, Segmentation, and Movement

3.9.3 Testing Measurement

The testing measures include usability application (learnability and user satisfaction) and motivation (attention, relevance, confidence, satisfaction) as discussed in Chapter 2. The learnability referred to how easy it is for a user to complete the tasks for the first time using the EzHifz prototype. User satisfaction referred to knowing the user's reaction when using the EzHifz prototype. The motivation referred to knowing the interest of the user while using the EzHifz prototype. The dimension of usability and motivation test for the EzHifz prototype through questionnaire observation method (quantitative) as shown in Table 3.30 while observation method (qualitative) as shown in Table 3.30.

Table 3.30: Dimension of Usability and Motivation Test (Quantitative)

No	Metrics	Descriptions
1	Learnability	EzHifz application trains users to memorize verses using a visual learning style mode by looking at the pictures of verses and the translation of <i>Surah Al-Insan</i> .
		EzHifz application trains users to memorize verses using auditory learning style mode through listening to the audio of verses and the translation of <i>Surah Al-Insan</i> .
		EzHifz application trains users to memorize verses using reading learning style mode through words of verses and the translation of <i>Surah Al-Insan</i> .
		EzHifz application trains users to memorize verses using kinesthetic learning style mode with body motions and hand gestures of verses and the translation of <i>Surah Al-Insan</i> .
		The EzHifz application trains users to memorize verses using one or more of the VARK learning style modes.

		<p>EzHifz's application teaches me the technique of memorizing the Quran verses using the VARK learning style.</p> <p>Visual map trains users to use keyword techniques in the form of words and pictures to help them memorize <i>Al-Insaan</i> verses and their translations.</p> <p>The VARK button on the EzHifz application trains users to use the open and close technique in memorizing <i>Surah Al-Insaan</i> verses and translations.</p> <p>EzHifz application trains users using the association technique of the colored objects in one picture to assist in the process of memorizing Quran verses and translation.</p> <p>EzHifz application trains the user to memorize using zooming techniques of pictures to represent the verse and translation of the Quran.</p> <p>EzHifz application trains users to memorize the segmentation of objects and images representing Quran verses.</p> <p>EzHifz application trains users to memorize by repeating segments of translation in the words of reading.</p> <p>EzHifz application trains users to memorize through a segmentation technique of pictures body motions and hand gestures.</p> <p>EzHifz application trains users to use the segmentation technique for the words, pictures, audio as well as body motions, and hand gestures in memorizing Quran verses and translation.</p> <p>The ezHifz application allows users to memorize verses by repeating highlight techniques through the segmentation of words.</p>
2	User Satisfaction	<p>The interface of the EzHifz application is easy to operate.</p> <p>The video of the EzHifz application can be controlled to facilitate the learning process.</p> <p>The ezHifz application provides users with the freedom to choose their preferred VARK learning style.</p> <p>The navigation button in the EzHifz application gives the user the freedom to move to the desired interface.</p> <p>The ezHifz application helps students repeat the verses independently</p> <p>EzHifz application interface design is user-friendly.</p> <p>Users enjoy the fun of learning in different environments according to their VARK learning styles</p> <p>The use of a graphical display or verse illustration speeds up the learning process of memorizing the Quran verses.</p> <p>The EzHifz application is easy to use.</p> <p>Users can exit the EzHifz application at any time as needed.</p>
3	Attention	<p>The screen design is attractive.</p> <p>Memorizing is interesting by listening to an audio of Quran verses and translation using the EzHifz application.</p> <p>The EzHifz application attracts students to memorize the Quran.</p> <p>The pictures of the EzHifz application attract the users to memorize the <i>Surah Al Insan</i>.</p> <p>The audio of the EzHifz application attracts users to memorize the <i>Surah Al Insan</i>.</p> <p>The video of the EzHifz application attracts users to memorize the <i>Surah Al Insan</i>.</p> <p>The pictures used are interesting</p> <p>The visual maps of the EzHifz application attract users to memorize through arranging and connecting one verse to another.</p> <p>EzHifz's application has increased my interest in memorizing the Quran.</p>

		I am interested in memorizing the Quran using the VARK learning style in the application.
4	Relevance	<p>Clear words to read.</p> <p>EzHifz application content meets the syllabus of the Quran memorization (Per Word) course.</p> <p>Visual maps provide surah and verse numbers to facilitate students' ability to memorize the Quran.</p> <p>I find the EzHifz application has a selection of modes of VARK learning style.</p> <p>EzHifz application supports the user to memorize the Quran using a variety of senses namely eyes, ears, body motion, and hand gestures.</p> <p>The EzHifz application provides support materials for the students.</p> <p>Controlled audio memorization in the EzHifz application facilitates memorization.</p> <p>The speed of content presentation in the EzHifz application can be controlled by the user.</p> <p>Visual maps provide icons of words and images of keywords that allow students to recall memorized verses.</p> <p>EzHifz application contains visual maps that help users to get an overview of the surah memorized.</p>
5	Confidence	<p>Visual maps make it easy for students to compose and link one verse to another.</p> <p>Knowing my right VARK learning style makes memorizing process effective and enjoyable.</p> <p>The selection of the VARK learning style in the EzHifz application reinforces my memorization in memorizing the Quran.</p> <p>I can use the EzHifz application on my own.</p> <p>EzHifz application can enhance my understanding of the translation of the Quran.</p> <p>The use of the EzHifz application improves my ability to memorize the Quran.</p> <p>The selection of the VARK learning style in the EzHifz application reinforces my understanding of memorizing the <i>Surah Al Insaan</i>.</p> <p>The EzHifz application has enabled me to easily identify the VARK learning styles that I am interested in.</p> <p>EzHifz application makes learning easier to memorize the Quran verses and translations.</p> <p>EzHifz application makes learning easier to master the Quran memorization.</p> <p>EzHifz application makes learning easier to memorize the words of the Quran.</p> <p>The ezHifz application supports my VARK learning style.</p> <p>The technique of memorizing in the EzHifz application helps my memorization process.</p> <p>The EzHifz application helps me master VARK's learning style in memorizing the Quran.</p> <p>Learning to use a combination of graphics, text, sound, and video can speed up my Quran memorization learning process.</p>
6	Satisfaction	<p>I find the EzHifz application useful.</p> <p>The content of the EzHifz application arranged facilitates student learning.</p> <p>The EzHifz application is easy for me to use.</p>

The EzHifz application makes it easy for me to understand the translation of the Quran.
Pictures in the application help users learn the Quran.
The videos used help to make active learning.
The visual map of the EzHifz application makes it easy to access the desired Quran verse.
The graphics used help the users understand the content of learning.
Users can memorize and recall verses using their learning styles.
Users can use the EzHifz application anytime and anywhere.
The EzHifz application can be read at any time.

Table 3.31: Dimension of Usability and Motivation Test (Qualitative)

Learnability	User Satisfaction
<ul style="list-style-type: none"> • Easily click (select) VARK's learning style mode. • Easy to use Quran memorization technique based on VARK's learning style mode. • Simply click (select) the correct button - the first time • Know the function of the buttons on the interface. • No need for help • Not confused/misguided/error 	<ul style="list-style-type: none"> • Reaction to button clicks • Reaction to the interface • Reaction to multimedia elements (graphics/sound/text/kinesthetic) • Reaction to Quran memorization technique using VARK learning style mode.
Attention	Relevance
<ul style="list-style-type: none"> • The appeal of learning activities • The appeal of learning materials • The attractiveness of learning resources/learning media used • Can focus on materials • Have curiosity 	<ul style="list-style-type: none"> • Have a feeling of wanting to succeed in learning • Feel that the learning material meets/ according to the needs
Confidence	Satisfaction
<ul style="list-style-type: none"> • The feeling of being able to learn the content of the material. • 2. Have a simple feeling of remembering the material/content of the lesson • 3. Have a feeling of being successful in testing 	<ul style="list-style-type: none"> • Have a happy feeling about the lesson • Have a sense of satisfaction with the lessons learned • Feel happy about learning design

The evaluation of this study was accomplished by applying quantitative and qualitative methods. After completing the evaluation phase, the data from the post-test were recorded and analyzed using SPSS 23.0 for descriptive analysis. Besides that, qualitative data were analyzed using the percentage of success and satisfaction rate.

3.10 Conclusion

This chapter has discussed the research design of this study that has been conducted using the ADDIE model approach which involved three main phases analysis phase, design, development, and implementation phase as well as the evaluation phase. The researcher also presented the data collection procedure, research sampling, research instruments, quasi-experimental, research procedure, and data analysis techniques used in this research. The next chapter will discuss the Multimedia representation learning model (EzHifz) based on VARK learning style in detail.

