

Know Your Road Sign for kids : Development of Road Sign Learning Application Using VARK Learning Model

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Abstract: Ignorance of traffic signs is a frequent cause of car accidents. Therefore, it is important to train kids about traffic signs. Traffic signs, also known as road signs, are signs that are placed alongside or above roads to provide instructions or information to drivers. This learning application will teach kids the basic of road signs via VARK learning model. VARK elements used in this application are visual, reading, and audio. MMCD was used in order to develop this application. The target user for this application is 7 to 9 years old kids. The user acceptability test was carried out during beta testing with the participation 38 target user. As a result, almost all of the question asked received positive feedback. therefor it is proven that know your road sign for kids that uses VARK learning method are acceptable to the target user.

Keywords: Mobile Learning Application, Road Sign, VARK

1. Introduction

Traffic signs, also known as road signs, are signs that provide instructions or information to drivers. They represent rules in order to keep people safe [1]. Most people start to learn about road safety at early age. Thus, it is crucial that children were well educated about some of the most frequently encountered traffic signs

Nowadays, the advancement of technologies lead people to learn new things trough application or search engine. This learning applications will teach kids the basic of road signs via VARK learning model. VARK was created to assist anyone, including students, in learning more about their unique learning preferences. VARK learning model stands for visual, auditory, reading and kinaesthetic learning [2]. However, this application will be using reading, visual and audio element.

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Furthermore, there are some down side for physical learning approach as searching for the related information in a book may took some time. Other than that, since road safety were usually taught in elementary, there might be some student who cannot focus in class due certain reasons. As the result, many developers took this opportunity to develop a road sign learning application such as Road Sign & Driving Rules [3] but unfortunately, there is some gaps in the existing road sign application. For example, most of them were developed for adult user, therefor, have a very complicated and complex interface which can be hard for children to understand and be interested in.

The objectives of this study are to design a road sign learning application using VARK learning model, to develop an application that have learning and exercise module for android platform by implementing multimedia mobile content development on android platform and lastly, to implement alpha and beta testing to the target user. The application target user are children at the age from 7 to 9 years old. The subject matter expert (SME) involved in this project is a teacher for road safety subject at Pintas Raya elementary school, Batu Pahat.

Know your road sign application contain 2 modules which are learning and exercise module. The user will be exposed to 18 road sign that can be found in the road safety textbook. The teaching method found in this application was animation method. This method was used in order to implement the reading, audio, and visual from VARK model. The user will be given two button option, next and previous button. The exercise module contains 18 multiple choice question.

The report is divided into 5 sections. The first section discusses the introduction of the report. Next, section 2 will go into related work, section 3 and 4 will cover methodology, result and discussion. Lastly conclusion will be stated in section 6.

2. Related Work

This section discusses the study domain, technology used, and result of the comparative analysis.

2.1 Road Sign

Road signs, usually referred to as traffic signs, are signs positioned beside or above roads to advise or instruct vehicles. It also help to maintain order and reduce accidents. The majority of signs utilize pictures instead of words so that they are clear and can be read by individuals who speak a range of languages [1]. Road sign used in Malaysia have some familiarity with those used in Europe. Ignorance of traffic signs is a frequent cause of car accidents. In Malaysia, traffic and safety signs actually serve a variety of purposes and have varying meanings depending on their placement, colour, font size, form, and symbol [4].

2.2 Technology Used

There are two technologies implemented in this project which are mobile learning technology and VARK model. Mobile learning, which often known as m - learning, is a method of accessing learning content through mobile devices. With this, user can excess learning content whenever and wherever it is convenient for them. The most significant aspect of mobile learning is its emphasis on the learner's mobility [5]. Students who are learning in a classroom are frequently under pressure to grasp a certain idea or course within a set amount of time. This problem is solved with mobile learning, which gives students the freedom to learn at their own speed [6].

Secondly, the VARK learning model which stands for visual, auditory, reading and kinaesthetic learning. This model was developed by Neil Flaming who was a well-known learning style theory. This project uses visual and reading learning model as it teaching method. People who prefer reading method like their information to be shown as words. It is not unexpected that this style is preferred by many instructors and pupils [7]. The type of learner that Favors images, colours, and patterns is called a visual learner. People who learn best visually often use photos, maps, plans, and diagrams to better absorb the

information they are given [9]. thus, a mobile application that contain reading and visual media such as animation and text will provide new experience for the user and keep them invested with the learning.

2.3 Studies on Equivalent Apps

In this section, a comparison has been made between existing applications, Road Sign and Driving Rules [3], Traffic Theory Road Signs [10], Traffic & Road Sign [11], and the developed application. 5 comparisons will be discussed in Table 1. The table contain applications comparison regarding VARK model, learning module, exercise module, target user and user interface design.

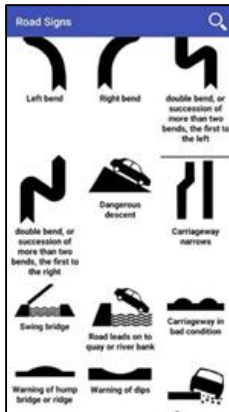


Figure 1(a): Road sign and driving rules [3]



Figure 1(b): Traffic theory road signs [10]



Figure 1(c): Traffic & road sign [11]

The first app is the Road Sign and Driving Rules [3]. This application has 4 modules: quiz module, learn module, driving rules module and violation modules which will be displayed in the main interface. In the quiz module, random road sign will be displayed over and over again. The learning option have 141 sign language available to be learned by the user. The amount of road sign needs to be learned on this application is only suitable for adult especially the one who need to take their driving test and not for children. Next, we have the driving rules modules. The interface is the same with the learning module where user need to scroll down and read all the rules available. Lastly there is a violation module where the interface displays the consequences for driver when they don't follow the traffic rules. There are 138 violations listed in this module. This application advantages are that it covers most of the road sign while the disadvantage for this application is its text ration where there are too many texts in one page.

The second app is Traffic Theory Road Signs [10]. The quiz modules have 42 total of question available. on top of the screen also have the current number off question and the total of how many questions user got right and wrong. The fact modules contain 40 random facts about traffic and driving topic. There is a next and back button for the user to go to the next fact or the previous one. The advantage available in this apps are that they have question indicator where they show the current number of question and how many answer did the user get it right or wrong. For the disadvantage does not provide the user with a learning module.

The third app is Traffic & Road Sign [11]. This application has signs learning module, test 1 and test 2. the signs module contains a massive number of road sign with a total of 440 selection of road sign. Test 1 module will give the user 2 minutes for them to answer as many questions correctly. For the test 1, the question is in a picture form and the answer are in a text form while for the test 2, the question given are in text form and the answer are in an image form. The pros provide in this application is that there are 17 different language that can be selected for. The quiz that contains a timer and score makes it more interesting for the target user to involve with the modules. Other than that, the cons are not having a search button for the signs.

Table 1: Comparison between existing applications and developed application

Features	Road Sign and Driving Rules	Traffic Theory Road Signs	Traffic & Road Sign	Know Your Road Sign for Kids
VARK model	Reading	Reading	Reading	Visual, audio and reading
Learning module	Have 141 scrollable road sign image and description	Does not provide learning module but do give random facts about traffic topic	Have 440 scrollable road sign image	Contain 18 road sign animation
Exercise module	Provide randomize question based on the 141-road signs in the learning module	Provide 42 question to the user	Provide 2 minutes for the user to get points by answering correctly	Provide 18 multiple answer question
Target user	Targeted for teenager and older	Targeted for teenager and older	Targeted for teenager and older	Targeted for kids
User interface design	Crowded and too much text in one place	Simple and easy to navigate trough	Crowded but can easily navigate trough	Simple and suitable for kids

Based on Table 1, we can see the target user for the developed application are for kids meanwhile for the other application are for teenager and above. The developed application used VARK in order to make is suitable for the target user to use while other 3 application design are specifically for adults that would not need any animation or sound to learn effectively.

The 3 existing applications contain huge amount of road sign to be learned for while the developed application only use basic road sign to be learned by kids. Lastly, the interface for the developed application is simple and suitable for kids, but the other application might not be suitable for kids to use as there might be too much text and information in one interface.

3. Methodology

Know your road sign for kids is a learning application, thus the most suitable methodology for the application is Multimedia Mobile Content Development (MMCD). MMCD structure can be referred in Figure 2. The MMCD involved 5 phase which are Application Idea Creation, structure analysis stage, process design stage, main function development stages and lastly the testing stage.

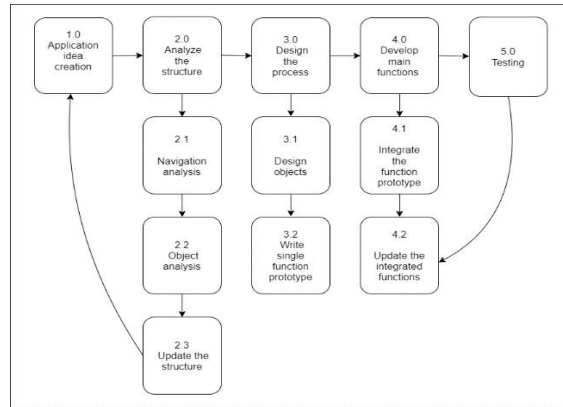


Figure 2: MMCD methodology [12]

3.1 Application Idea Creation

Application idea creation stage is the first stage available in this methodology. This stage helps to gather the information required for designing and developing the road sign learning application for kids. In order to start the application idea creation stage, an interview session was conducted with a Subject Matter Expertise (SME), Teacher Subree. Other than that, the application idea checklist was also prepared in this section.

Based on Table 2, 10 questions were asked to the involved SME. The questions asked were mostly related with the application’s development. From the interview, the application uses Malay language and 18 road signs gained from the elementary school’s textbook. Based on table 3, this learning application can be accessed through mobile devices especially Android devices. Road signs commonly learned by elementary children through road safety subject. The target user for this application is specifically for 7- to 9-year-old kids. In order to develop this application, Unity software will be used. This software contains multiple templates and editors to be chosen from. The objects designed such as buttons and background design were mainly created in IbisPaintX mobile application and Canva website. The user interface consists of a main interface, learning module, exercise module, and the settings interface. Images used in the application were road signs, cars, characters, and backgrounds. Some images might be static and some will have animation. For the audio, there will be button sound effects, background music, and teaching narration.

Table 2: User analysis

Question	Answer
1. What is the teacher’s name	Mohd Subree Bin Ikhsan
2. What subject did the teacher teach	Malay language (contain road safety), Physical and health education
3. How many road signs should be inserted in this application	10 should be appropriate
4. What kind of road sign image should be used	You can take any road sign available in the road sign textbook used in this school: - Year1: https://online.anyflip.com/bhloo/yqbk/mobile/ Year2: https://online.anyflip.com/yaxmt/akzc/mobile/ Year3: https://anyflip.com/vrvwo/wrxs/basic
5. Exercise answering method	Drag and drop, miss ad match seem to be more interesting for kids to answer the question

Question	Answer
6. Situational idea should be used (first- or third-person point of view)	You can implement the first-person view in the learning module
7. What character should be used in this application	A kid so that user can relate with the character
8. Is it relevant for kids to learn road sign at young age	In my opinion, yes.it is very important for them to keep them save
9. what language should be used (Malay or English)	Malay, since the road sign used is Malaysian road sign
10. Should we use encouraging word in the exercise module	Yes, display it at the end of the activity

Table 3: Application idea checklist

Item	Note
Type of application	Learning application
Target device	Mobile phone (android)
Target user	7-9 years old
Unity 2021	Version:2021 Resolution: 2400x1080
IbisPaint X version 10.0.1	Design 2D background Design 2D object Design button
2D asset	Placing object into one interface Storyboarding
Images	Road sign(static), character (animation)
Video	18 Road sign animation in video form
Audio	Button sound effect, background music, road sign teaching
Application synopsis	This application involves teaching basic road for children by implementing VARK models. User can choose to learn and to do exercise by clicking the button option in the main menu. Both learn and exercise module will involve a situational animation.

3.2 Analyse the Structure

Structure Analysis is the second stage of the MMCD process. This step analyses two components: navigation analysis and object analysis. The functional and non-functional requirement are listed in Table 4 and 5 while Figure 3 will show the navigational structure and Figure 4 shows the system flowchart.

Table 4: Functional requirements

Functional requirement	Description
User interaction	<ul style="list-style-type: none"> • When user open the application, the app's homepage will be displayed • When user pressed the learn button, user will be led to road sign selection interface • When user choose which road sign to learn, involved animation will be displayed • During the learning animation when the user presses next button, user will go to the next road sign • During the learning animation when the user presses previous button, user will go to the previous road sign • After the user finished the learning module, congratulation message will appear • When user clicked the setting button, setting interface shall be displayed • When user click home button in the setting interface, user will go to the main menu interface • When user click exit button in the setting interface, are you sure interface will appear • When user choose exercise button in the homepage, question will be displayed • When user answer correctly, user can go to the next exercise • When user answer wrongly, user need to try again • When user finish all exercise, congratulation message will appear
Autonomous system activities	<ul style="list-style-type: none"> • During the exercise, the system will make sure that the user answers the question correctly or they would not be led to the next question
Provide learning content	<ul style="list-style-type: none"> • The application should allow user to learn 18 sign language

Table 5: Non-functional requirements

Non-functional requirement	Description
Operational	<ul style="list-style-type: none"> • The application must be compatible with the Android mobile platform.
Performance	<ul style="list-style-type: none"> • The navigation button should respond in no more than 2 seconds. • The animation should be displayed no more than 5 second after start button was pressed • Loading screen should take no more than 5 seconds.
Security	<ul style="list-style-type: none"> • Users can only view the information contained in the application and cannot modify or edit it.
Cultural	<ul style="list-style-type: none"> • The language of the application would be Malay as the road sign used are road sign available in Malaysia and mostly taught by Malay language teachers.

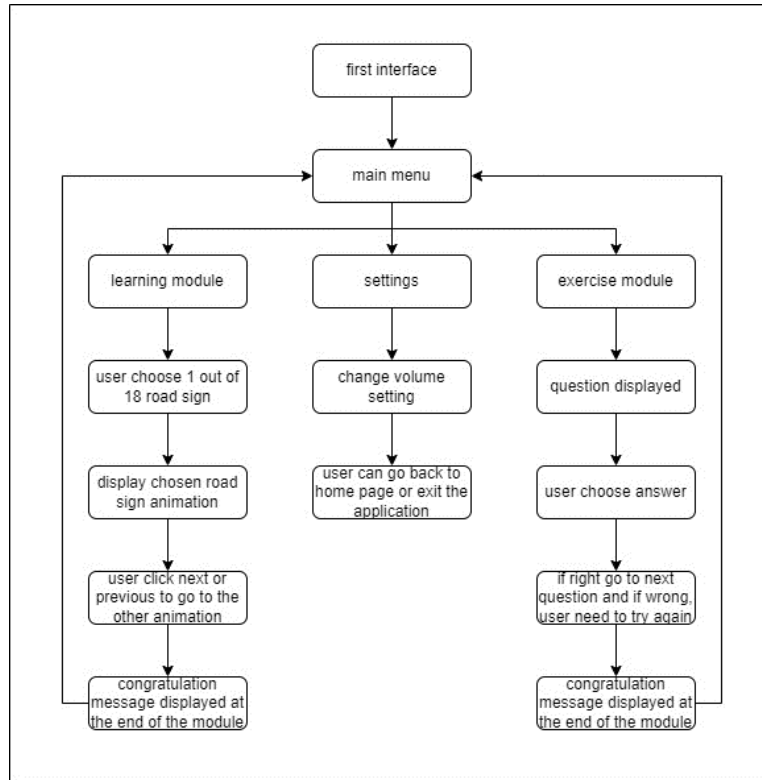


Figure 3: Navigation structure

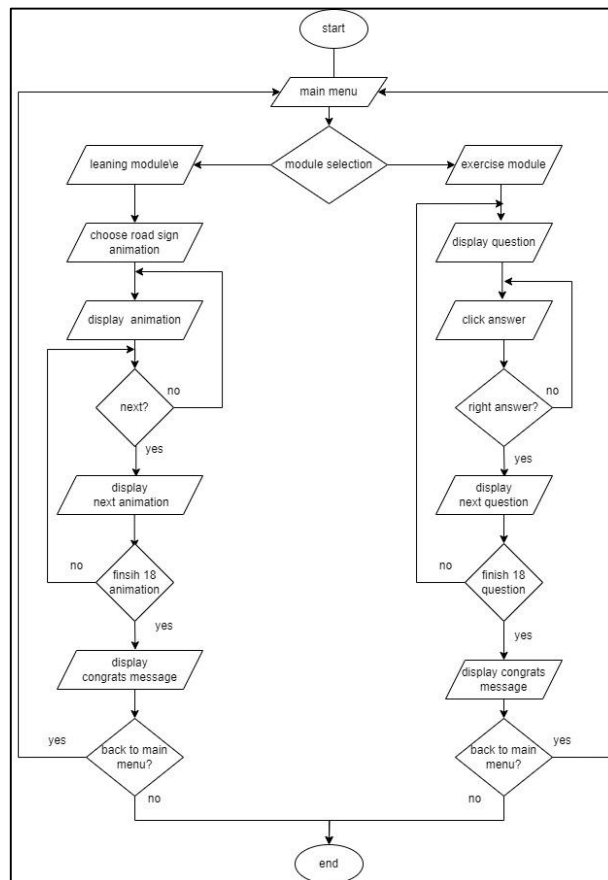


Figure 4: System flowchart

3.3 Design the Process

This phase covers the design of applications in terms of user interactions. The overall effectiveness of an application is also determined by the user's requirements. This project will be using multiple software and application such as Unity for the scripting and compiling all of the needed assets, IbisPaintX and Canva for the graphic design and illustration. Buttons with navigational functions are essential to the user. Rather than a textual button, the iconic button was chosen as the design approach which can be referred in table 6, while Table 7 will show the interface design used.

Table 6: Button design

















Button	Description	Button	Description
	<ul style="list-style-type: none"> Setting button 		<ul style="list-style-type: none"> Exit button
	<ul style="list-style-type: none"> Yes button 		<ul style="list-style-type: none"> Next button
	<ul style="list-style-type: none"> No button 		<ul style="list-style-type: none"> Next button
	<ul style="list-style-type: none"> Home button 		<ul style="list-style-type: none"> Return button

Table 7: Interface design

Interfaces	Description	Interfaces	Description
	This is main menu interface which contain 2 buttons, learning and exercise button		This is setting interface where it contains sound setting, home and exit button
	This is the exit confirmation interface. If user want to exit, they can click the '✓' symbol and if they want to cancel, they can press the 'X' button		The purpose of this interface is to let the user to choose the road sign that they want to learn. When they click next, they will go to next page of road sign list and if the pressed the previous button they will go to the main menu

Interfaces	Description	Interfaces	Description
	<p>This is the learning interface, the animation displayed contain its own audio and text narration. Press next to go to the next animation and previous for the previous one. Total of animation is 18</p>		<p>This interface was will be displayed once the user finish learning all road sign. Return button will lead the user to the main menu</p>
	<p>This is the interface for exercise module. There will 3 answer option for the user to choose for. They need to select correct answer in order to go to the next question</p>		<p>This interface will be display to congratulate the user for answering all question. return button will lead the user to the main menu</p>

3.4 Develop Main Function

Main function development phase depicts the application's development, which involves the integration of the application functionality. The previous phase which is design the process phase ensure that the development of this application run smoothly. The animation creation, unity function and scripting are involved in this phase. For the objects and assets used are all designed and created in the design and process phase. The animation used implemented the VARK learning by exposing the user to the visual, Audio and reading. The visual used in the animation involve a car or a person movement in order to represent and teach the user about road sign. Animation displayed are situational animation which relate to the road sign. taking an example for traffic light a head's sign, the animation will display a car that will stop when the traffic light turns red. this method will give more depth and understanding for the user compare to just reading it from a book.in order to build this application, multiple features are used in the Unity.

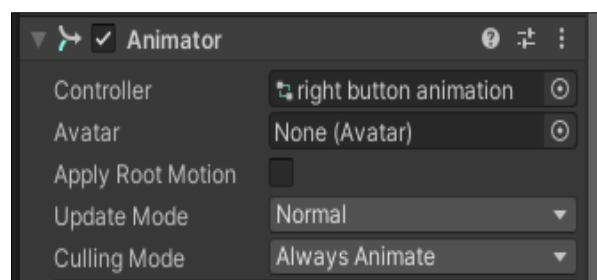


Figure 5 :Button animation function

Based of Figure 5, Applying animation into a button will make more aesthetically pleasing. Other that it also have its own perpose by giving feedback to the user, letting them know that they are now pressing the button and knowing that the button is currently working as intended. In exercise module, certain action have its own animation.when the user hover over the button,the button will become smaller and when the user select the button, right or wrong feedback will be given. Giving right anwer, the button will turn green and red if the anwer are wrong.

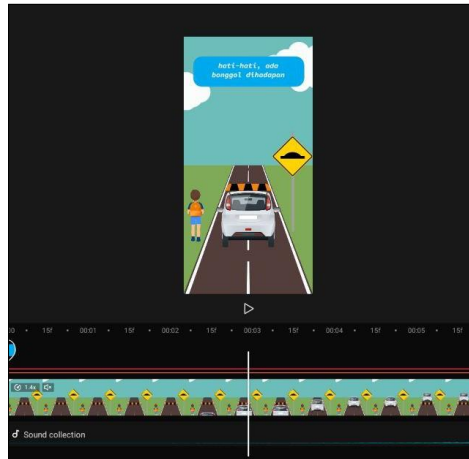


Figure 6: Animation creation

The animation were created in CapCut mobile applicatio.based on Figure 6,the animation are done by combining all frame into 1 short video.Narattion sound effect Audio and text were then inserted into the video.

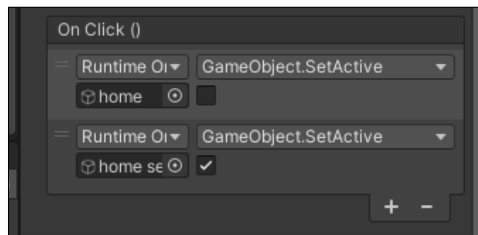


Figure 7 : Clickable button function

Clickable button function are applied in the application’s button in order to make it perform its own task as it is clicked by the user.based on Figure 7 above,once the user click the button they will be navigated to the homepage setting.

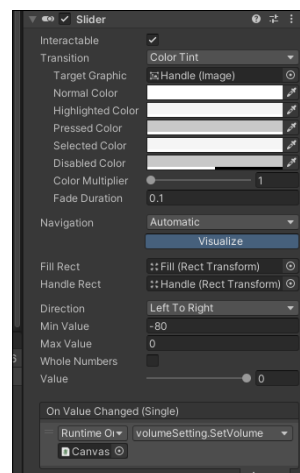


Figure 8 :Volume slider function

```

using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.UI;
using UnityEngine.Audio;

public class volumeSetting : MonoBehaviour
{
    public float volume;
    public AudioManager mixer;

    public void SetVolume(float volume)
    {

```

Figure 9: Volume setting source code

Based on the Figure 8 and Figure 9 the purpose of this function is to manage the application background music. The source code is attached to the volume slider. When the user moves the slider to the left, the background music will be less loud compared to the previous volume. If they were slid to the right, the volume will become louder.

```

using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class buttonsfx : MonoBehaviour
{
    public AudioSource audio;
    public void button()
    {
        audio.Play();
    }
}

```

Figure 10: Button sound effect source code

In Figure 10 the code was used to give button sound effect in exercise module. This code was attached to the answer button in that module and the audio source was attached to the button. When the user selects the right answer, a bell sound will be played. If they answer the question wrongly, a buzzer sound will be played.

```

using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class quit : MonoBehaviour
{
    public void quitapp()
    {
        Application.Quit();
    }
}

```

Figure 11 : Quit app source code

From Figure 11 ,quit app source code were used to to quit the application once the user are done using the application.the code were attacehd to the exit confirmation interface.in that interface the user need to click the yes button in order to quit the app and no if they want to cancel the action.

3.5 Testing

Testing is an important stage in the creation of any programmed, software, or game, mostly for problem identification and ensuring that the system runs as smoothly as possible. Testing stage can be divided into two parts: alpha testing and beta testing. Alpha testing is the first step in determining whether a new product will function as anticipated or not. Alpha testing is performed in the early development of the application which will be followed by the beta testing. Beta testing were carried out by distributing google form to the target user in order to test the user acceptance on the effectiveness and performance of the application.

3.5.1 Alpha testing

Functional testing is carried out to examine the applications and button functionality. A functional testing result is created as shown in Table 8 to verify that each button performs as intended. During the testing, if there is an error or a button is unable to complete the task, then it will be fixed and improved

Table 8: Result table of functional testing

Test	Expected Result	Actual Result	Correction Action
Setting button	Navigates to setting page	Works as expected	Not needed
Learning button	Navigates to learning module	Works as expected	Not needed
Exercise button	Navigates to exercise module	Works as expected	Not needed
volume slider	Change background music loudness	Volume setting not saved	Not needed
Home button	Navigates to main menu	Works as expected	Not needed
Quit button	Navigates to exit conformation page	Works as expected	Not needed
Cross button	Navigates to the previous interface	Works as expected	Not needed
Road sign button	Plays associated video animation when clicked	Display delayed	Not needed
Next button	Navigates to next interface	Display delayed	Not needed
Previous button	Navigates to previous interface	Display delayed	Not needed
Return button	Navigates to main menu	Works as expected	Not needed
Yes button	Exit the application	Works as expected	Not needed
No button	Navigates to main menu	Works as expected	Not needed
Right answer button	Navigates to the next question	Works as expected	Not needed
Wrong answer button	Display wrong answer feedback	Works as expected	Not needed

4. Results and Discussion

In this section, know your road sign for kids is entirely completed and ready to be tested by the tithe result of the beta testing were collected from the target user and will be further discussed in this section.

4.1 Beta testing

The user acceptability test will be carried out during beta testing with the participation of the intended user. To determine the level of acceptability of the application, a collection of questionnaires in google form was distributed to a total of 38 target users. The questionnaire was done in order to evaluate the application's responsiveness, appearance and familiarity. The application acceptability was evaluated by gaining positive feedback from the respondent. Figure 12 shows the age analysis of the respondent.

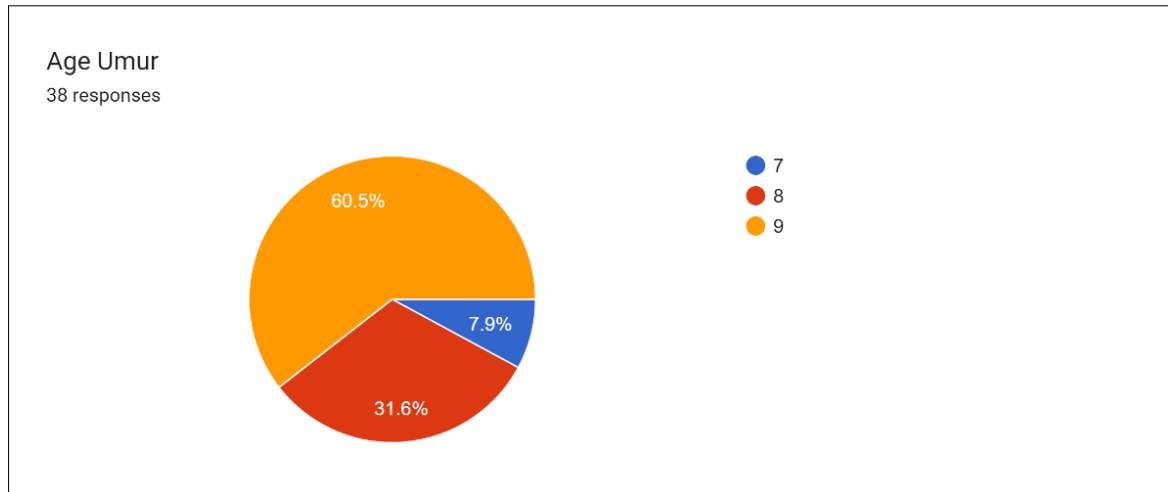


Figure 12: Age analysis of respondent

Age analysis were divided into 3 category which are 7,8, and 9 years old. Based on Figure 12, out of 23 out of 38 respondents (60.5%) are 9 years in age,12 (31.6%) of them are 8 years old and 7 of them (7.9%) are 7 years old.



Figure 13: Navigation button responsiveness analysis

Based on Figure 13 shown, Navigation button responsiveness analysis were divided into 2 parts, one being 'yes' and the other being 'no'. this analysis was done to investigated is the application button responsive and function as its intended and all of the respondent (100%) agree that the button in this application is indeed working.

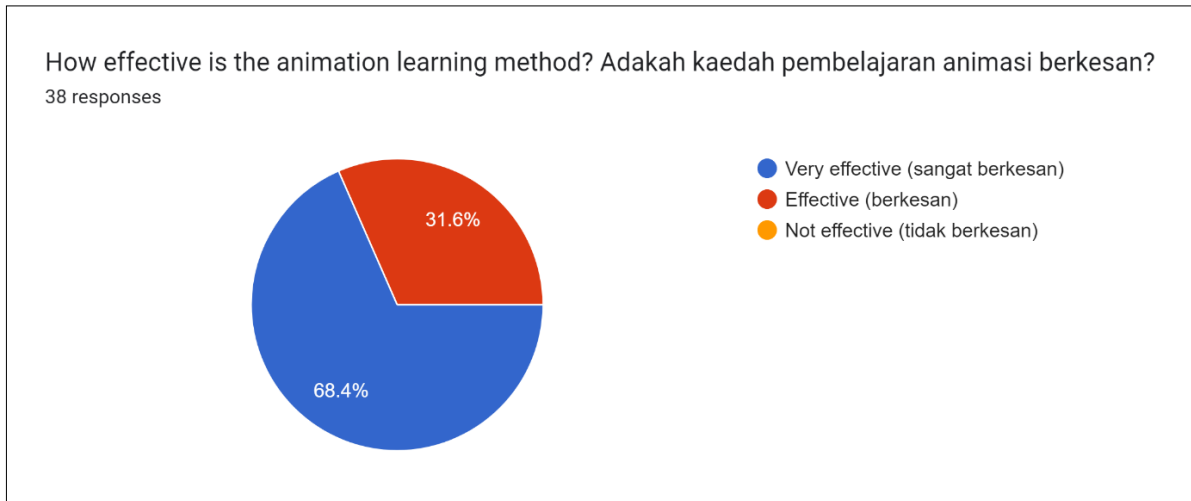


Figure 14: Animation learning effectiveness analysis

Figure 14 shows, how effective is the animation learning method? We asked to the respondents were given 3 different choices first being very effective, effective and lastly, not effective. Based on the chart displayed, 68.4% stated that animation as teaching mediums is very effective while the others (31.6%) think that the animation teaching is just effective. None of the respondent stated that the learning method is not effective.

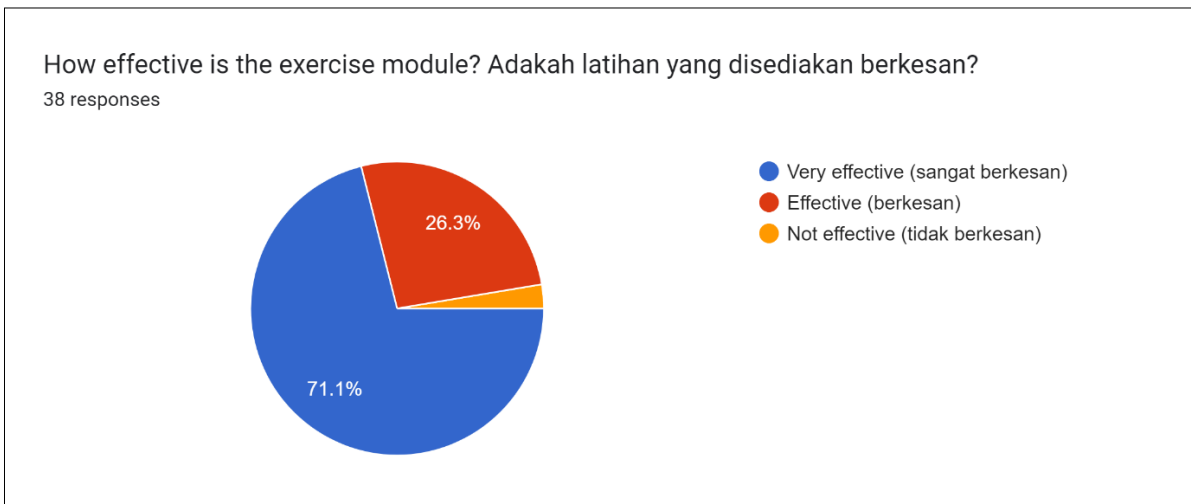


Figure 15: Exercise module effectiveness analysis

Based on Figure 15, the analysis was investigated by giving 3 options to the user to choose for. First, we have very effective, second, we have effective and the last one is not effective. so how effective is the exercise module?. 27 out of 38 respondents (71.1%) stated that it is very effective. 10 person (26.3%) stated that it is effective and 1 person choose that the exercise module is not effective at all.

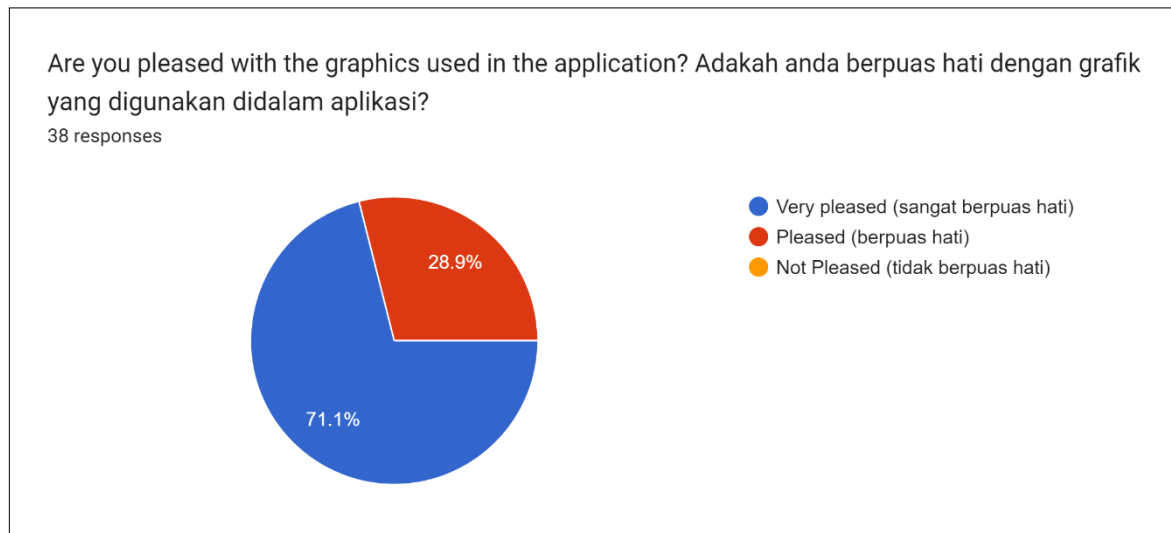


Figure 16: pleasantness of graphic used analysis

In Figure 16, the respondents were asked if they are pleased with the graphic used in the application which they were given 3 answer to choose for.71.1% of the respondent ae very pleased with the graphic used meanwhile 28.9% are pleased.in figure 17 analysis about how quickly can the user adapt to the application were asked and 60.5% of respondents agree that they adapted very quickly while the other39.5% stated that their adaptability with the application is just a normal phase

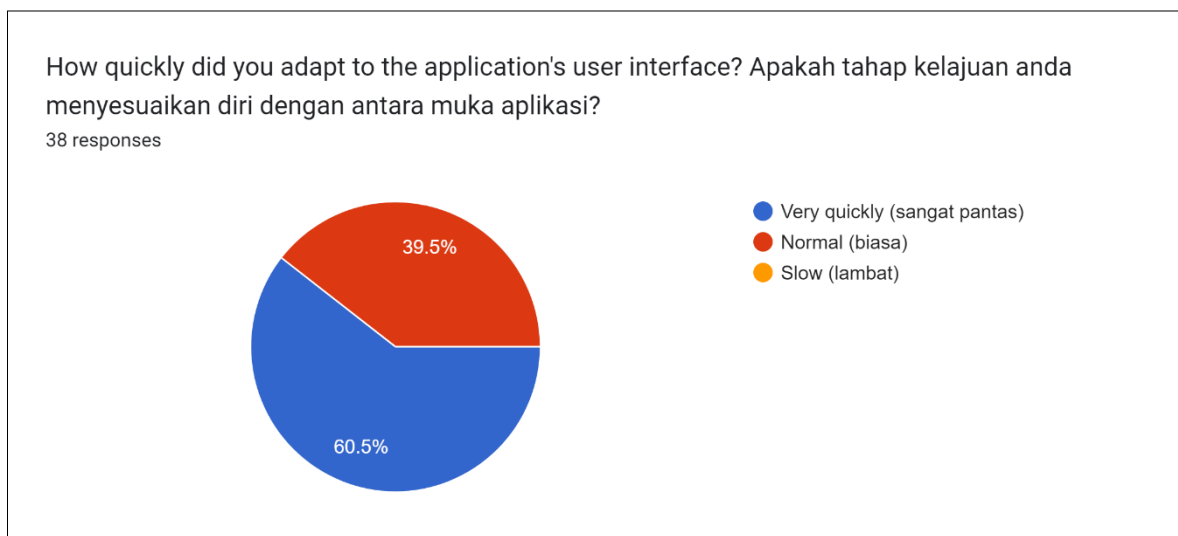


Figure 17: interface adaptability analysis

Based on the acceptance test questioner, almost all of the question asked received positive feedback.100% agree that the button is responsive,71% agree for application’s graphic and exercise module effectiveness.68% stated that the animation learning method are very affective. Lastly a total of 60% agree that they are able to quickly adapt to the application interface. therefor it is proven that know your road sign for kids that uses VARK learning method are acceptable to the target user.

5. Conclusion

The purpose of this project was to develop a road sign learning application named ‘Know Your Road Sign for Kids’. This apps uses visual and reading learning based on the VARK learning model. The target user for this application is for kids at the age from 7 to 9 years old.

Based on table 1 which compared the proposed app with other 3 existing application that can be found in Google Play Store. The road sign learning application are mostly were targeted for teenagers and older. Nearly all of the application contains compact and detailed description regarding road sign which are not suitable for kids. Thus, the proposed application was expected to have simple and suitable interface for kids to learn road sign. Other than that, the VARK model used in the app are audio, reading and visuals

In conclusion, know your road sign for kids have successfully developed. The learning module contain 18 road sign animation. The first objective is to design a road sign learning application using VARK learning model, while the second and third objectives which are to develop an application that have learning and exercise module for android platform by implementing multimedia mobile content development on android platform and lastly, to implement alpha and beta testing to the target user will be done in develop main function phase and testing phase in MMCD.

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