

The Development of an Educational Mobile and Desktop Application for Malaysian Sign Language

Faihana Neesa Sahanuan, Muhammad Fakri Othman*

Faculty of Computer Science and Information Technology,
Universiti Tun Hussein Onn Malaysia, Parit Raja, Batu Pahat, 86400, MALAYSIA

DOI: <https://doi.org/10.30880/aitcs.2021.02.02.024>

Received 31 July 2021; Accepted 08 September 2021; Available online 30 November 2021

Abstract: Due to the Covid-19 pandemic, hearing-impaired children experience challenges in learning and practicing sign languages due to the lack of educational services and learning resources available. This project targets to create educational mobile and desktop applications to aid deaf children in learning Malaysian Sign Language (BIM). The study was conducted through research-based and interview sessions with subject matter expertise. Teachers suggested that online learning is the most suitable platform in order to teach students in the current situation. This study was conducted through research-based and interview sessions with subject matter expert and followed the Multimedia Mobile Content Development (MMCD) methodology as it is proven to help speed up the development activities and also to ensure the application will work and perform as planned. The application testing has been done with the target users from Taska Istika Jaya, Puchong Jaya, Selangor through online meeting platform, Zoom.

Keywords: sign language, online learning, educational application, Malaysian Sign Language

1. Introduction

Sign language is the visual language used to communicate with the hearing-impaired community [1]. It is also known as a language that communicates using hand movements with other individuals. It is divided into two forms namely sign or 'Sign' and spelling. Deaf community is not the only one to use this medium in order to interact with people, but anyone can use this in their daily life, which includes the mute community.

In millions of people around the world, there are about 250,000 to 500,000 people who use sign language as a way for them to communicate and interact, including adults and children. Besides, other groups use this language such as those who teach, and those who experience and suffer from hearing loss [3]. In order to strengthen a skill, one must practice it occasionally to enhance their knowledge. Existing applications to practice sign language are helpful in order to achieve this skill. However, most applications do not offer Malaysian Sign Language as part of the language available [10]. Moreover,

*Corresponding author: fakri@uthm.edu.my

2021 UTHM Publisher. All rights reserved.

publisher.uthm.edu.my/periodicals/index.php/aitcs

kids especially tend to learn sign language in their mother tongue first, which in Malaysia is Bahasa Malaysia. Hence, the *Kuiz BIM* is developed in order to help people especially kids to practice their sign language skills. This study aims to design BIM application using learning application approach, to develop *Kuiz BIM* application on mobile and desktop platform and to test the acceptance of this game in the community and the industry. This quiz game will consist of two modules, which are quiz and learn modules. In quiz module, the user can choose in between spelling and sign options meanwhile in learn module it consists of three sections; alphabet, numbers, and greetings. The main target audience for this game will be the deaf children with the ages of 5 to 7 years old.

There are 5 sections covered in this paper, which are Introduction, Literature Review, Methodology, Results and Discussions, and Conclusion. The background study will be covered in Section 2 while Section 3 is where the descriptions of the methodology used for this project being presented. Section 4 discusses the testing process and results in detailed along with the data. The testing took place in Taska Istika Jaya. Finally, the last section will conclude the objective and the study's advantages and limitations along with further improvement.

2. Literature Review

2.1 Background Study

Sign Language (SL) has been one of the languages used to interact with deaf individuals. Based on the Oxford Dictionary, Sign Language is defined as *"a system of communicating using hand movements rather than spoken words, as used by people who cannot hear"* [1]. Meanwhile, according to a Meriam Webster dictionary, it is defined as *"a system of communication for people who cannot hear that uses hand and finger movements"*. Sign Languages are divided into two types of actions: (1) signs and (2) finger spellings. Signs are hand motion patterns and hand configurations [1] and finger spellings are codes which represent letters and numbers of the alphabet using fixed finger arrangements. Despite being applied in most countries in the world, signs used are not universal. Different type of Sign Languages exists; for instance, British Sign Language (BSL), American Sign Language (ASL), Japanese Sign Language (Nihon Shuwa, JSL) and Spanish Sign Language (Lengua de signos o señas española, or LSE) [4].

A variety of ways can be used to learn Sign Language. The most popular and straightforward way to learn Sign Language is by taking a class at a learning centre. However, this Sign Language can also be trained through searching online on web sites or by buying books. The current way of training and strengthening deaf children in school is through flashcards, lip-reading, writing, listening, and speaking. With the advanced technology nowadays, Sign Languages can be learned through mobile learning and computer games [9]. The alternative approach of educational games could boost active learning and motivation and also encourage the students to become more active in the class. The games can be used at both the beginning and the end of the lesson since it can gain students' interest, motivation to look forward to lessons and also to review, re-enhance, and evaluate the learned topics [3].

2.2 Sign Language comparison throughout different countries

Sign Language (SL) is often misunderstood as a universal language. However, the language differs for each country across the world. Despite the differences, all SL shares the most significant similarity which it combines hand gestures, and facial expressions. Like the normal, verbal language, SL emerge gradually as a result of individuals interacting and communicating with each other. Moreover, location and cultural play a vital role in the evolution of SL [4].

In the United States alone, it has three major forms of Sign Language which are American Sign Language (ASL), Pidgin Signed English (PSE) or Signed English, and Signing Exact English (SEE) [4]. ASL is a language that is totally different from the written or spoken English [5]. In order to enable a comprehensive communication, ASL combines hands, arms, head, face expression, and body

language [5]. ASL vocabulary and structure are completely different from the normal one. A pidgin means a simplified language formed from two or more languages. When deaf individuals sign with one another, they frequently use ASL, however, a lot of people use a combination of ASL and English. PSE is normally use among those who speak English as their first language. As for SEE, as the name implies, a system that matches a sign language to the exact English translation. It is known as one of the first sign languages to be released in 1972. It uses the visual equivalent to written and spoken English. This method also includes word endings such as 'ing', and 'ed', which is not indicated in PSE or even ASL [5].

Other than the United States, Australia also has its own SL which is named, AUSLAN (Australian Sign Language). Northern and Southern AUSLAN have various signs for things like animals, colours, and days of the week however the grammatical structure remains the same across different dialects. AUSLAN is linked to British Sign Language (BSL) and New Zealand Sign Language (NZSL). Besides, AUSLAN also uses two hands to sign alphabets which is differs from ASL which only use one hand [4]. Next is British Sign Language (BSL). BSL uses a two-handed alphabet and has several dialects that range from area to region. Then, Chinese Sign Language (CSL) uses signs to visually interpret their written Chinese characters and only uses one hand to sign the alphabets. Among the other dialects, the Shanghai dialect is the most common of the CSL dialects. As for Japanese Sign Language (JSL), it is distinct from the other SL in the world. In order to differentiate and identify signs and letters within the alphabet JSL uses mouthing method. It's also employs fingerspelling and sketching Japanese letters in the air [4].

Finally, we have Malaysian Sign Language (BIM). It is the most used SL in Malaysia among the deaf people to communicate with each other. BIM evolved in 1970 from ASL which was taught at the Penang School for the Deaf. Since then, numerous local signs have been included into the language which results in 75 percent resemblance to ASL [6].

2.3 Comparison of related applications

Subhead Comparison of each existing application between Sign Language: ASL Kids, ASL American Sign Language Fingerspelling Game, and the proposed application of this project will be discussed in this section. Variety of aspects will be compared which includes strengths, weaknesses, fonts used and a lot more. The comparison is then tabulated in Table 1.

Table 1: Comparison between the existing application

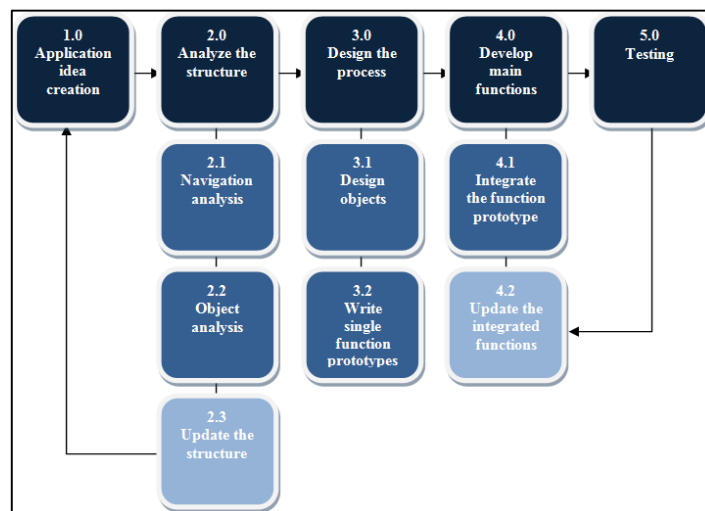
Element	<i>Sign Language: ASL Kids</i> [11]	<i>ASL American Sign Language Fingerspelling Game</i> [12]	<i>Kuiz BIM</i>
Designed for	American Sign Language (ASL)	American Sign Language (ASL)	Malaysian Sign Language (BIM)
Target user	1-12 years old	7-10 years old	5-6 years old
Release date	2016	2017	2021
Module	Learn and Play	Learn	Learn and Play
Setting	Not available	Not available	Not available
Purchasing	In-app purchase	Free to use	Free to use

Table 1: (continued)

Element	<i>Sign Language: ASL Kids</i> [11]	<i>ASL American Sign Language Fingerspelling Game</i> [12]	<i>Kuiz BIM</i>
Platform	Mobile/Android	Mobile/Android	Mobile/PC/Desktop
Button	Consistent	Consistent	Consistent
Response	No response	No response	Graphical response-colours
Font	Serif	Serif	San-serif and easy to read
Weaknesses	Instruction is insufficient Includes in-app purchase Limited signs	Not easy to use and understand	Only cover the basics
Strengths	Simple interface design Provide sign videos	Free to use	Free to use Consistent buttons Suitable fonts Suitable interface design

3. Methodology

Multimedia Mobile Content Development (MMCD) is a term used to describe the process of creating mobile learning (m-learning) applications [7]. It is made up of the MMCD Framework and the MMCD Methodology. This methodology as shown in Figure 1 is chosen to develop this project.

**Figure 1: MMCD Methodology [7]**

3.1 Application Idea Creation

This stage is the very first step of the MMCD methodology [7]. This phase is started by listing a list of check list table with information needed before starting the other phases, as shown in Table 2.

Table 2: Application Idea Creation

Item	Note
Type of application	Mobile and Desktop Learning
Target users	5-6 years old
GUI	<ul style="list-style-type: none"> • Background (main menu, modules interface, quiz interface)
Image	<ul style="list-style-type: none"> • Sign language (static)
Video	<ul style="list-style-type: none"> • Sign language video
Audio	<ul style="list-style-type: none"> • None
Application synopsis	<p><i>Kuiz BIM</i> is a mobile and desktop learning application that focuses on user who is new to sign language. The user will select either quiz or learn module. When the user select quiz, they will be redirected to the quiz interface. Meanwhile, if the user chooses learn module, they will be redirected to the learn module sections selection and they have to choose one section and then the chosen section interface will pop out. This application will only cover A-Z alphabets, 1-20, 30, 40, 100, 1000, 1000000, and basic greetings for learn module. For quiz, it will consist of 2 & 3 syllable for spelling and 10 questions for signs questions.</p>

3.2 Analyze the structure

This is the second stage in the MMCD methodology. This phase is divided into two sections which are content structure check list and continuation [7]. This phase is where the content structure lists are made in the content structure list, layers design, frame design and menu navigation were analyzed and decided. Then, it is followed by continuation where more detailed information on application idea creation in phase 1 is analyzed. Flowchart, content structure and navigational structure are attached in the Appendix A.

3.3 Design the process

This phase is mainly based on the listed checklist on the previous phases. Design objects and single function prototype scripting will be the sub components of this stage. At the end of this stage, the first prototype must be completed. Design software like Adobe Illustrator, Canva, and FlipaClip are used to compile and integrate graphics for this project. Graphic and object designs, object placement on stage, and inserted single scripting must be done in the first prototype. Then, the initial scripting writing and producing workable functions come as the next step [7]. The results of this stage which is storyboard is attached in the Appendix B.

3.4 Develop Main Functions

The main functions for this application are the navigation buttons such as home button, back button, next button and quiz answer scripting button. The ability to navigate in between one frame to another frame is the most significant navigational function in learn module. No extensive programming and

scripting are required because the learn module is merely clicking on buttons to learn alphabets, numbers and greetings. The functionality of clicking answer button will be the main focus for scripting in the quiz module.

3.5 Testing

In developing a project, testing is the most essential since it allows the developer to determine if the application will function effectively and be approved by the target users and Subject Matter Expertise (SME). SME from Malaysian Federation of the Deaf (MFD) and few children from Taska Istika Jaya, Puchong Jaya, Selangor.

The testing stage is meant to assess the application's performance in reaching the targeted users and ensuring that the application's goal is met. The comments from the targeted users and SME will be considered for future improvement.

4. Results and Discussion

This application has been successfully built on mobile and desktop by the developer. Beta testing is carried out to evaluate the application's functionality and acceptance among the target user. Meanwhile, Alpha testing is done in order to test the system's functionality which includes buttons and quiz module. A total of 7 people involved for the user testing and the target audience was Taska Istika Jaya, Puchong Jaya, Selangor.

4.1 Beta Testing

After the project was done, selected users were invited to participate in beta testing. The purpose of this testing is to obtain input from the target user based on their experience while using this application. Taska Istika Jaya children are the test subjects. A collection of questionnaires made based on user acceptance model was created using Google Form so that the auto produced figures and charts could make data analysis faster and more effective without introducing human mistake while the developer processed and calculated the data obtained. The rest of the questionnaires are attached in the Appendix C.

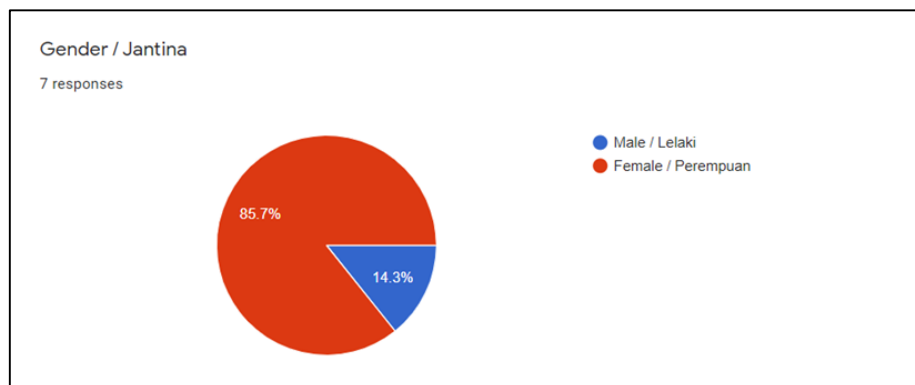


Figure 2: Gender analysis of tested users

As shown in Figure 2, 1 out of 7 respondents (14.3%) are male pupil and 6 of them (85.7%) are male pupils. All of the respondents completed the entire application during the testing process.

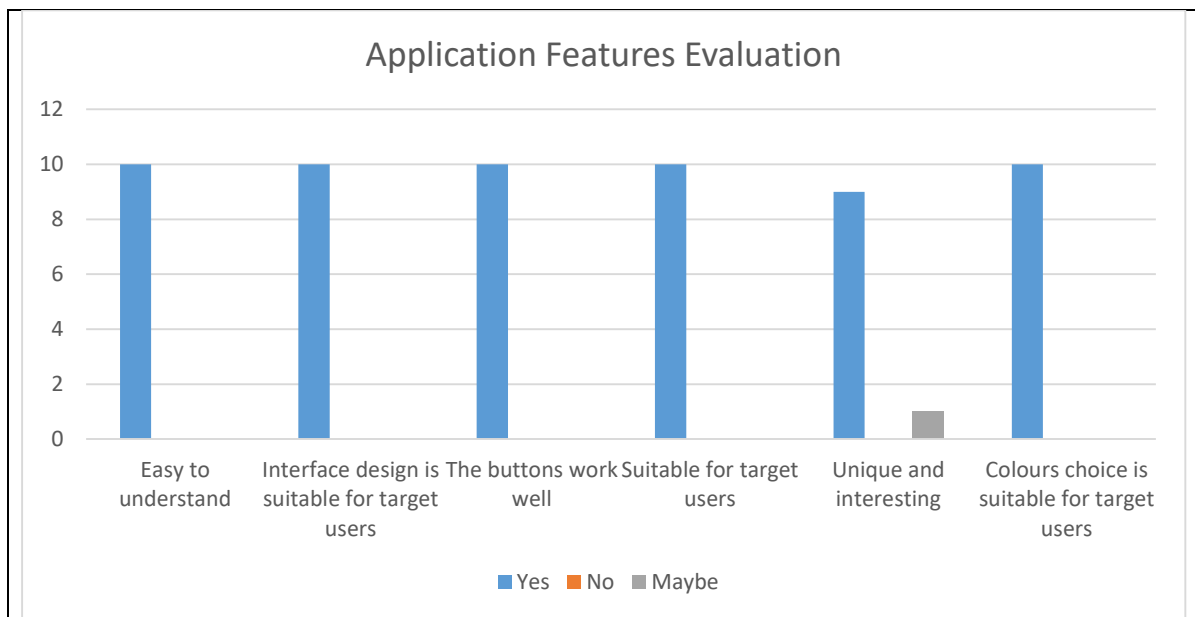


Figure 3: Analysis of Beta Testing Results

Based on Figure 3, it is shown that the users stated that this application is easy to understand. Next, they also stated that the interface design is suitable for target users which is kids between 5 to 6 years old. After that, all of the users agree that the buttons work well and suitable for target users. Besides, some of the users hesitates about the uniqueness of the application but all of them agrees that the colour choice is suitable for the target users.

The users also responded in the comments section on the improvement need to be make in this application. Figure 3 shows the comments stated by the users.

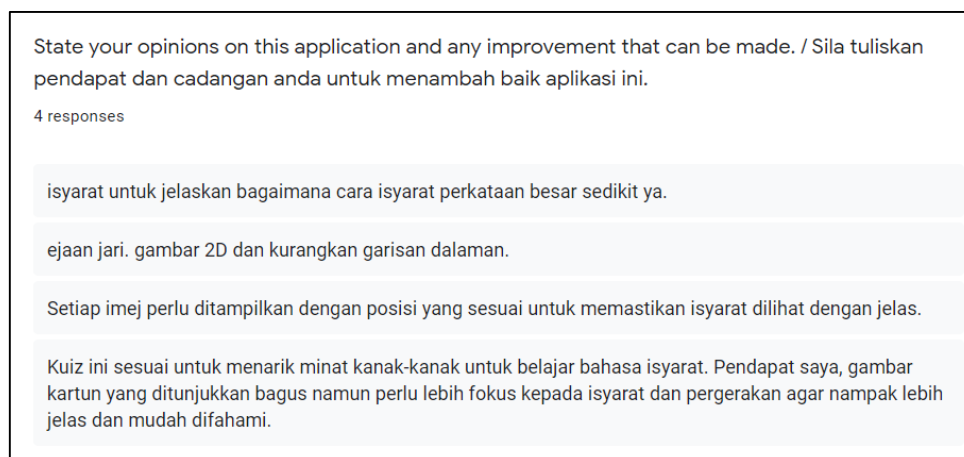


Figure 3: Analysis of Beta Testing Results

Based on Figure 3, the target users suggested to make the signs graphics clearer and easier to understand. They also suggested to increase the font size in the learning module. Next, every animation and image provided should be in the right position to provide a better understanding. Therefore, improvements have been made based on these comments in order to provide a better learning experience for the target user.

5. Conclusion

In conclusion, *Kuiz Game* has been developed by using Unity3D and Visual Studio Code by following a well-planned Multimedia Mobile Content Development (MMCD) methodology. This application is focused on assisting target users to learn and improve their sign language skill especially during online learning. During the testing phase, the application was approved and acknowledged by the SME and gained feedbacks through user testing. Then, the advantages and limitation of the application has also been identified. The suggested improvements are mainly on the hand design issues which has been corrected and approved once again by the SME. Finally, suggested improvements for future work has been received in order to ensure this application can continue to be better in the future.

Acknowledgement

The authors would like to thank the Faculty of Computer Science and Information Technology, Universiti Tun Hussein Onn Malaysia for its support and encouragement throughout the process of conducting this study.

Appendix A

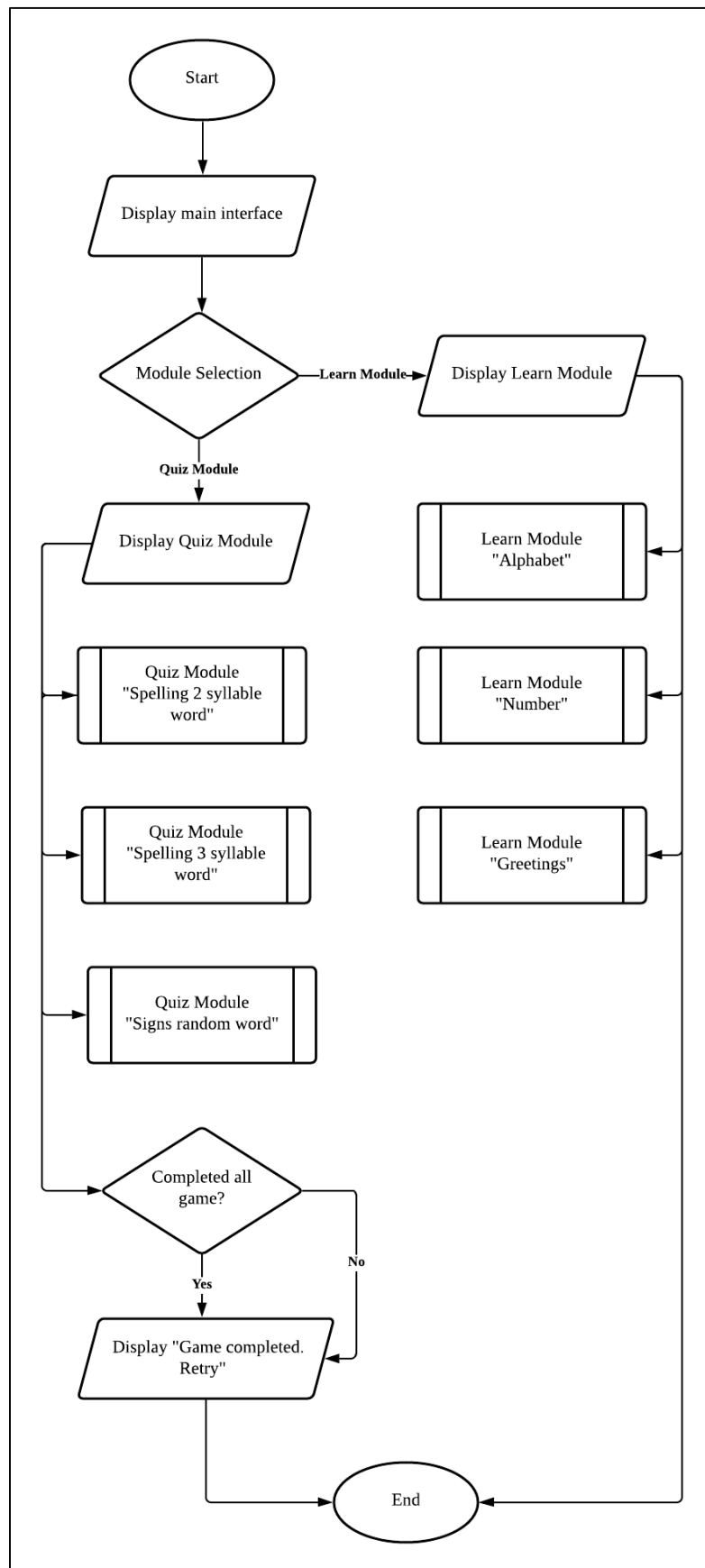


Figure 4: Flowchart

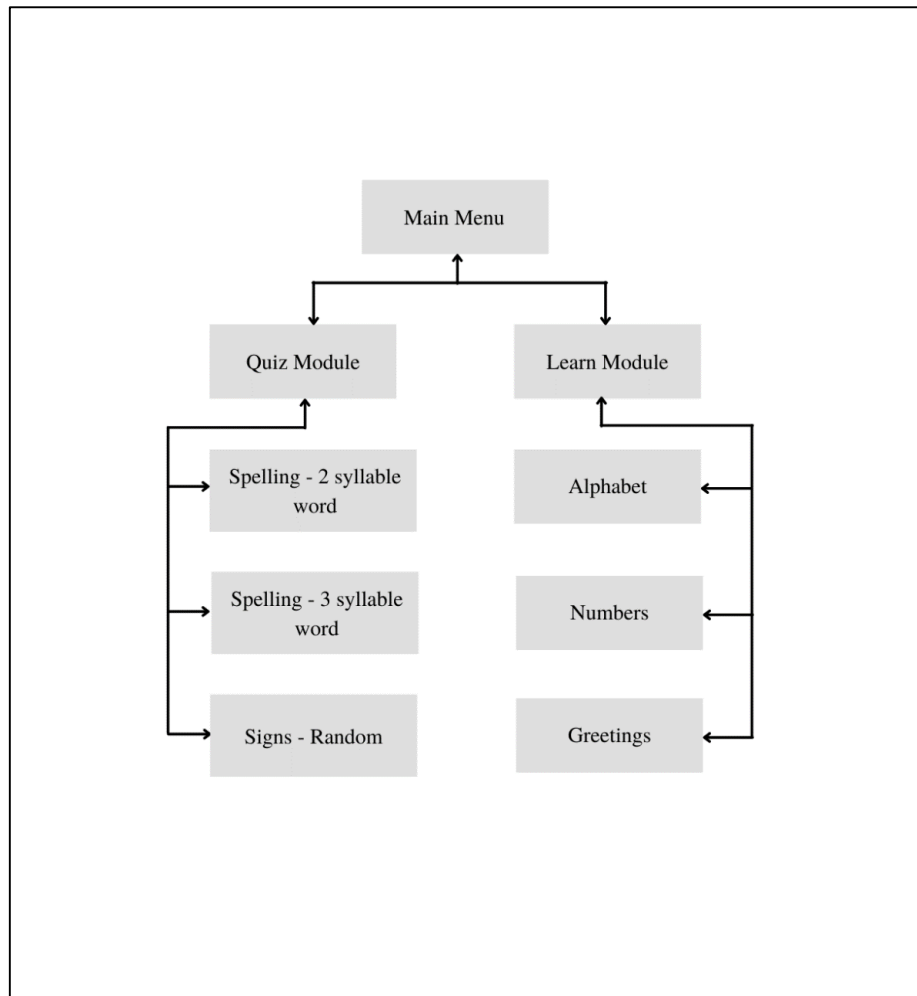


Figure 5: Navigational Structure

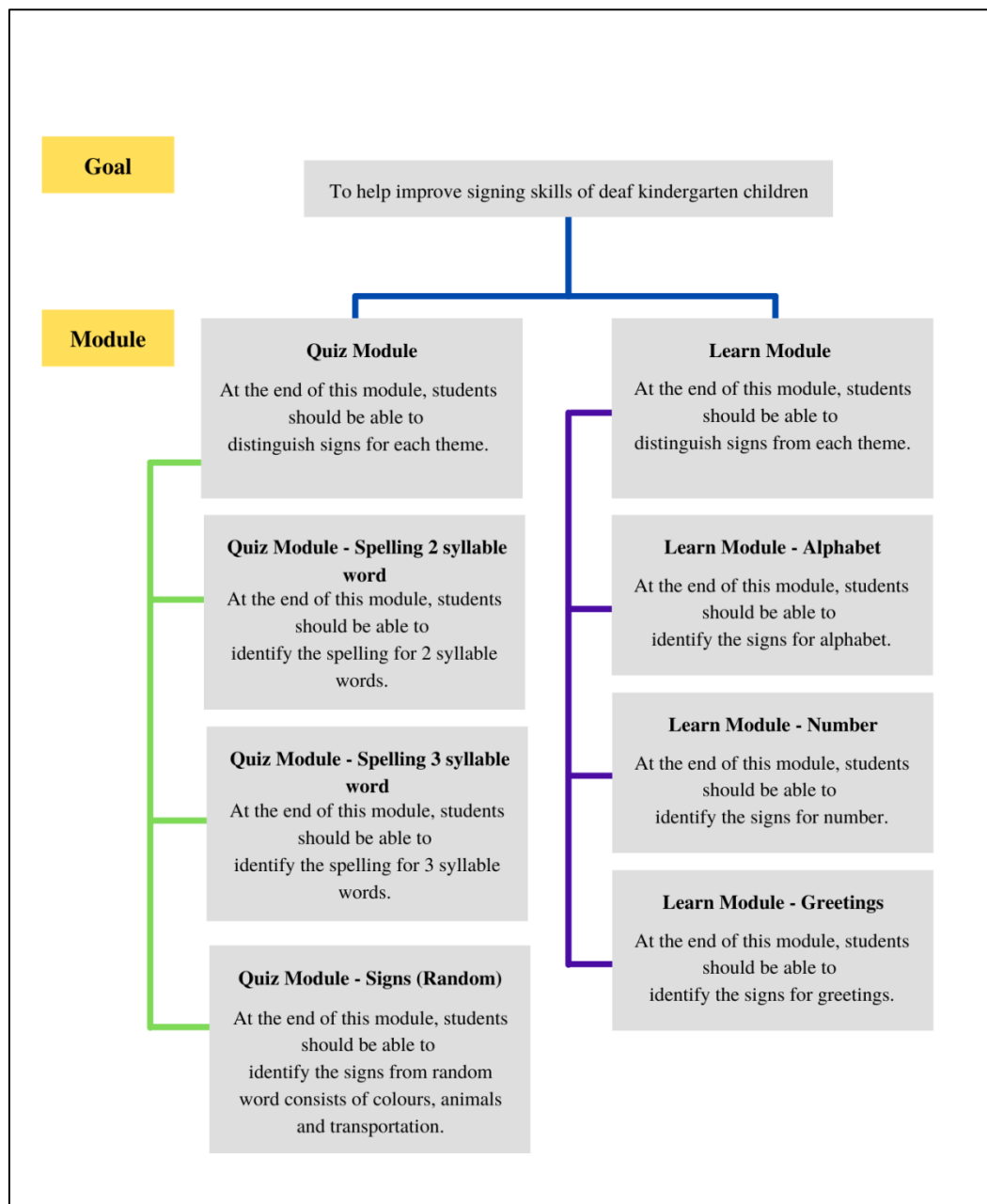


Figure 6: Content Structure

Appendix B



Figure 7: Storyboard Design of Home Page

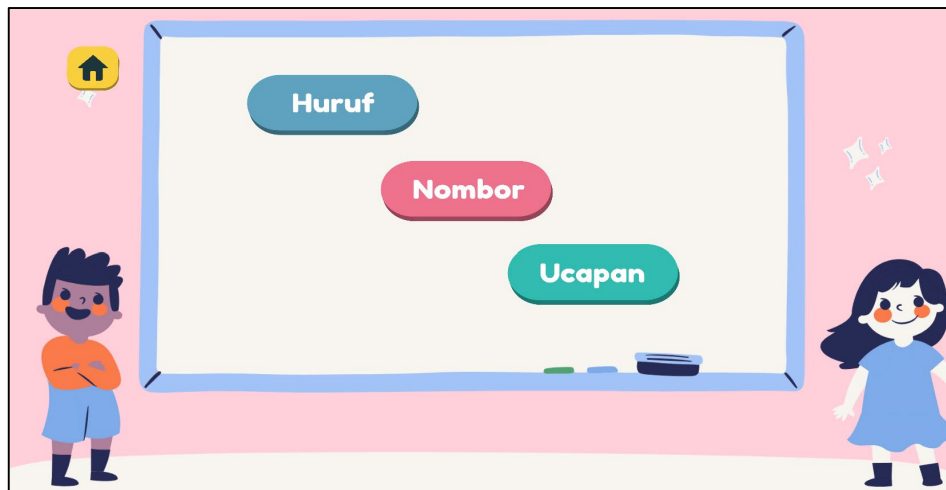


Figure 8: Storyboard Design of Learn Module Selection Page

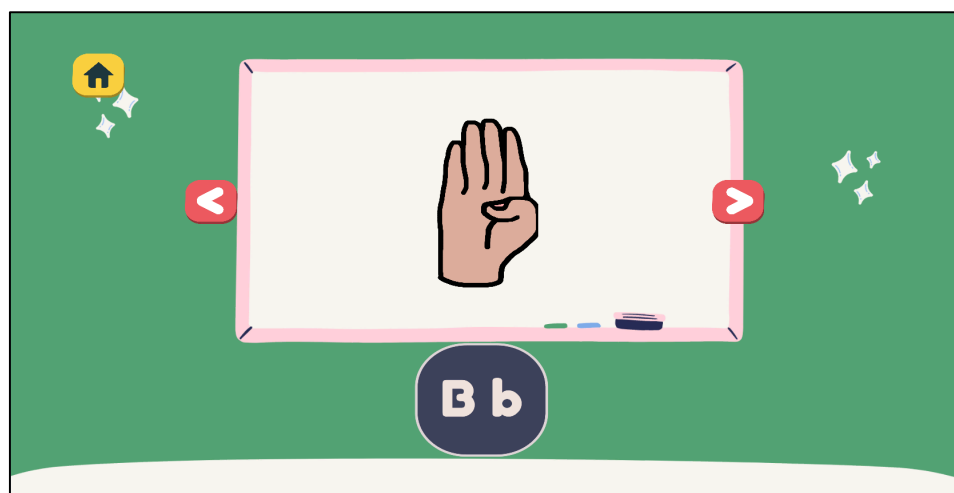


Figure 9: Storyboard Design of Learn Module – Alphabet Page

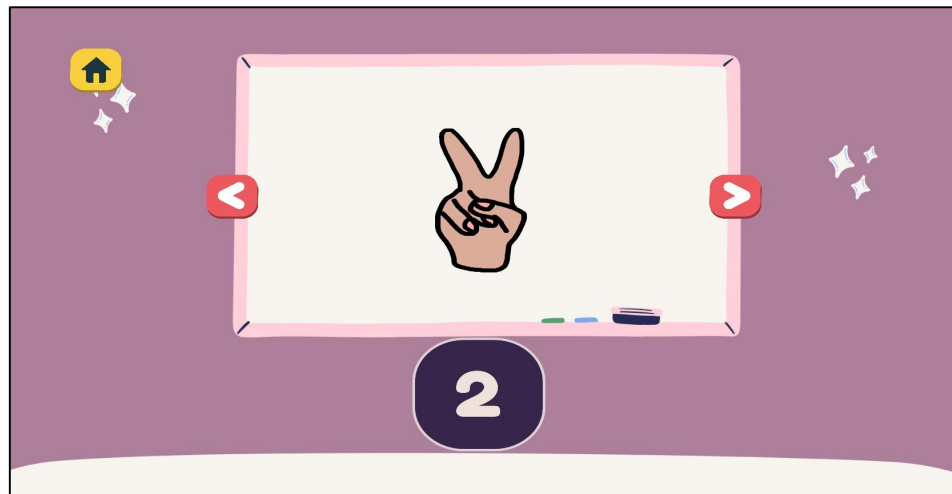


Figure 10: Storyboard Design of Learn Module – Number Page

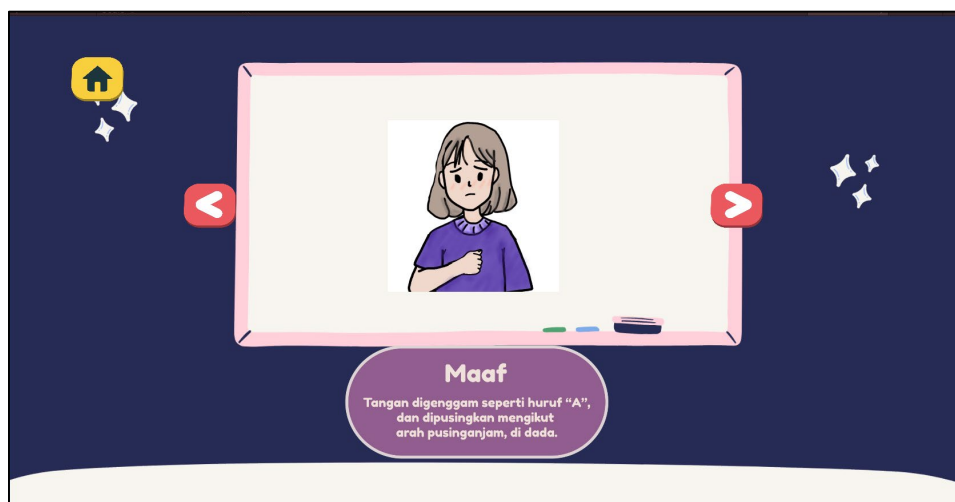


Figure 11: Storyboard Design of Learn Module – Greetings Page

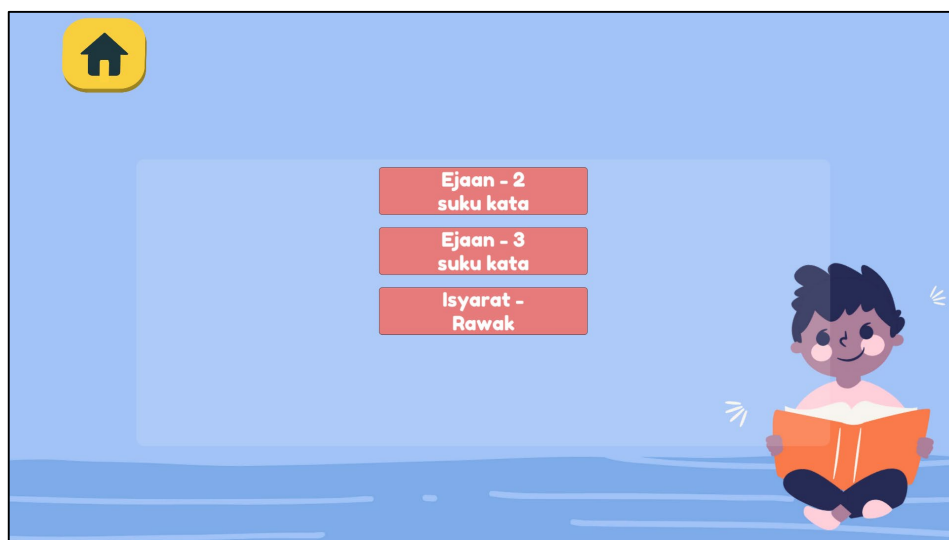


Figure 12: Storyboard Design of Quiz Module – Selection Page



Figure 13: Storyboard Design of Quiz Module – Signs Random



Figure 14: Storyboard Design of Quiz Module – Spelling 2 Syllable word



Figure 15: Storyboard Design of Quiz Module – Spelling 3 Syllable word

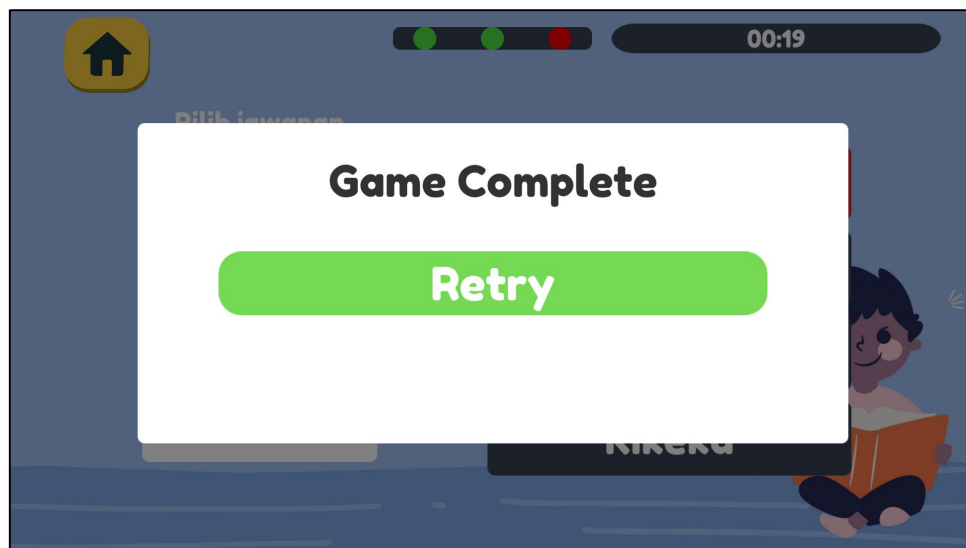


Figure 16: Storyboard Design of Game Complete – Retry

Appendix C

Gender / Jantina *

☐ Male / Lelaki

☐ Female / Perempuan

I can understand how the application works / Saya dapat memahami bagaimana permainan ini berfungsi. *

☐ Yes / Ya

☐ No / Tidak

☐ Maybe / Tidak pasti

Figure 17: Questionnaires Section 1

I can understand how to play this quiz game. / Saya dapat memahami bagaimana untuk bermain permainan ini. *

☐ Yes / Ya

☐ No / Tidak

☐ Maybe / Tidak pasti

I think this application can help people to learn Sign Language better. / Saya rasa aplikasi ini dapat membantu untuk belajar Bahasa Isyarat dengan lebih baik. *

☐ Yes / Ya

☐ No / Tidak

☐ Maybe / Tidak pasti

Figure 18: Questionnaires Section 2

The game method is easy to understand and is suitable for beginner. / Kaedah permainan mudah difahami dan sesuai untuk mereka yang baru mula belajar Bahasa Isyarat. *

☐ Yes / Ya

☐ No / Tidak

☐ Maybe / Tidak pasti

I think this game is suitable for kids. / Saya rasa permainan ini sesuai untuk kanak-kanak. *

☐ Yes / Ya

☐ No / Tidak

☐ Maybe / Tidak pasti

Figure 19: Questionnaires Section 3

I think this application is Unique and interesting. / Saya rasa permainan ini unik dan menarik. *

☐ Yes / Ya

☐ No / Tidak

☐ Maybe / Tidak pasti

I think the colour palette used is suitable for kids. / Saya rasa warna yang digunakan sesuai untuk kanak-kanak. *

☐ Yes / Ya

☐ No / Tidak

☐ Maybe / Tidak pasti

Figure 20: Questionnaires Section 4

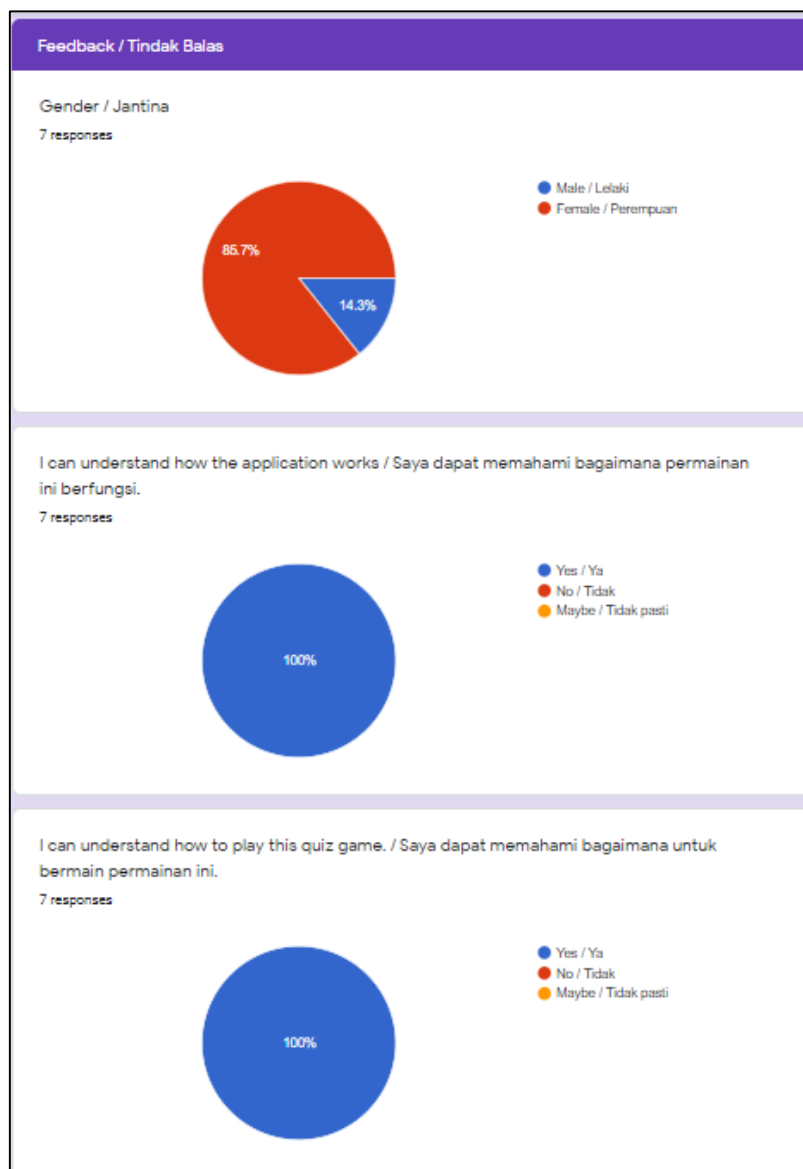


Figure 21: Questionnaires feedbacks

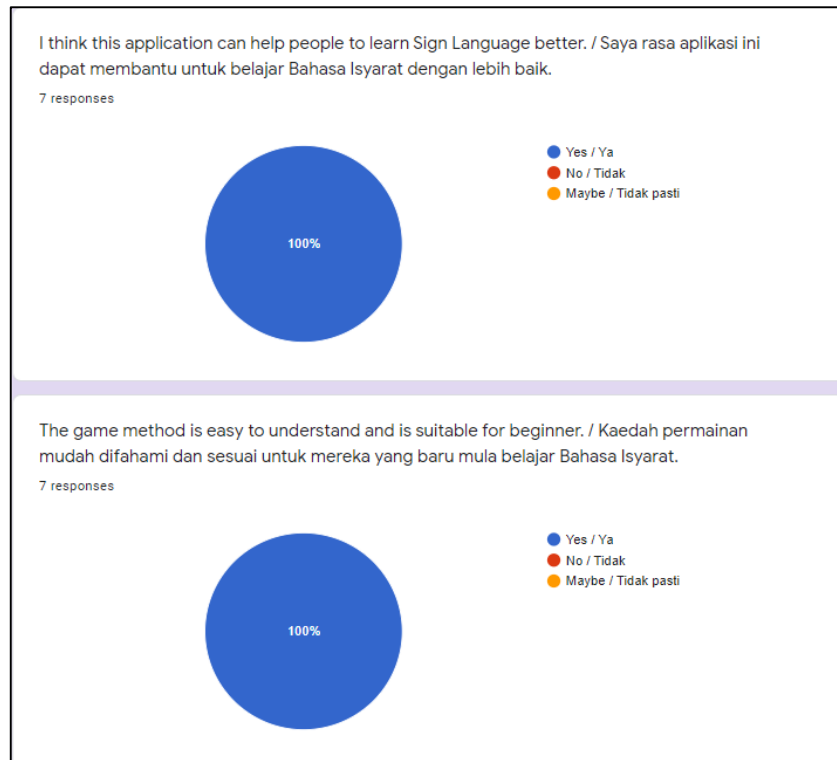


Figure 22: Questionnaires feedbacks

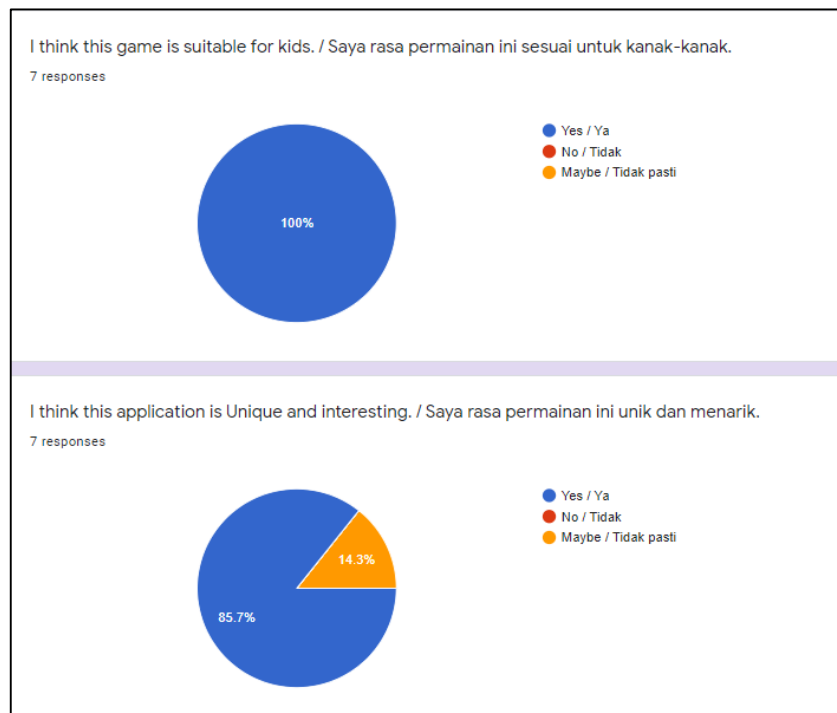


Figure 23: Questionnaires feedbacks



Figure 24: Questionnaires feedbacks

References

- [1] Sign language. (n.d.). [Online]. Available: Meriam-Webster, <https://www.merriam-webster.com/dictionary/sign%20language> [Accessed July 27, 2021].
- [2] Sign language. (n.d.). [Online]. Available: Oxford Learners Dictionary, <https://www.oxfordlearnersdictionaries.com/definition/english/signlanguage?q=sign%20language> [Accessed July 27, 2021].
- [3] Y. Bouzid et al., "Using Educational games for sign language learning-a signwriting learning game: Case study," *Journal of Educational Technology & Society*, vol. 19, no. 1, pp. 129-141, 2016.
- [4] Sign languages – ASL, See, PSE, Cued Speech. (n.d.) [Online]. Available: <https://signlanguageco.com/sign-languages-asl-see-pse-cued-speech/> [Accessed July 27, 2021].
- [5] R. Brooks, "A guide to the different types of sign language around the world," October 8, 2020. [Online]. Available: The Language Blog, <https://www.k-international.com/blog/different-types-of-sign-language-around-the-world/>. [Accessed July 27, 2021].
- [6] H. M. Hurlbut, (n.d.), Sign Languages of Malaysia. [Online] Available: https://www.signwriting.org/archive/docs6/sw0593_SignLanguages_Malaysia_Hurlbut.pdf. [Accessed July 27, 2021].
- [7] W. S. N. S. Saifudin et al., "Multimedia mobile content development framework and methodology for developing M-Learning applications," *Journal of Technical Education and*

- Training*, vol. 4, no. 1, 2012. [Online]. Available: <https://core.ac.uk/download/pdf/268561782.pdf>. [Accessed July 27, 2021].
- [8] Sign language. (n.d.). [Online]. Available: Oxford Learners Dictionary, <https://www.oxfordlearnersdictionaries.com/definition/english/signlanguage?q=sign%2Blanguage> [Accessed July 27, 2021].
- [9] World Federation of the deaf. (n.d.). [Online]. Available: Wfdeaf, <http://wfdeaf.org/>. [Accessed July 27, 2021].
- [10] H. Hafit et al., "Malaysian sign language mobile learning application: a recommendation app to communicate with hearing impaired communities," *International Journal of Electrical & Computer Engineering* (20888708), 9. 2019.
- [11] Sign language: Asl kids - apps on google play. February 16, 2016. [Online]. Available: Play Store, <https://play.google.com/store/apps/details?id=com.basvanderwilk.aslkids&hl=en&gl=US>. [Accessed July 27, 2021].
- [12] ASL American sign LANGUAGE FINGERSPELLING game - apps on Google Play. April 5, 2017. [Online]. Available: <https://play.google.com/store/apps/details?id=com.teachersparadise.aslamericansignlanguage&hl=en&gl=US>. [Accessed July 27, 2021].