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Happy Español: Development of 2D Mobile Learning Application for Spanish Language

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Abstract

Happy Español is an innovative mobile learning application designed to help Malaysian children learn Spanish in a fun and engaging way. Existing language learning applications often have a broad selection of languages, making it harder for children to focus on one. This project addresses this by focusing on learning Spanish with supported language, English and Malay. Targeted for children aged 7 to 12, the application uses the Multimedia Mobile Content Development (MMCD) approach. The usability testing has resulted in an average score of 95.75 which is within the range of "Acceptable" in the Acceptability Ranges Score Scale, graded "A" on the Grade Scale, and rated "Excellent" based on the System Usability Scale (SUS). Therefore, it can be concluded that the Happy Español 2D mobile learning application is suitable for children aged between 7 to 12 years old to know and learn more about Spanish with enjoyment.

1. Introduction

Children typically learn languages far more quickly than adults do, and they also maintain their new talent for a very long time [1]. Language instruction enhances brain and memory function. It strengthens the part of the brain involved in speech, memory, and sensory perception. Lists, sequences, names, and directions are easier for bilingual people to remember. Additionally, they have higher levels of creativity, perception, and focus. As Malaysian, Malay is the main language that should be mastered by all children in Malaysia as it is the official language of Malaysia and a vital tool for communication in various aspects of daily life, including education, government, and commerce. English and Spanish are the most and the fourth most spoken languages worldwide [2]. As these two languages are among the most widely spoken globally, they open doors to diverse cultures, opportunities, and relationships. Mastering more languages will provide good job opportunities in future as bilingual or multilingual individuals are in high demand across various industries.

Android is a mobile operating system based on a modified version of the Linux kernel and other open-source software, primarily developed for touchscreen mobile devices like smartphones and tablets. Android Mobile Application Development is based on Java language which allows users to write codes in Java languages. Through Google-enabled Java libraries, these codes can control mobile devices. Android mobile OS provides a flexible environment for developers since it can also use normal Java IDEs but not only Java libraries [3].

In psychology and education, determining how individuals learn most effectively is the aim of the widely accepted idea of learning styles. Therefore, the VARK learning styles module is suitable for mobile language learning applications which include visual, auditory, reading /writing, and kinesthetic [4]. In 1987, the VARK model was developed by Neil Fleming to assist students in understanding their preferences. A preference for

visual learning includes presenting information through maps, graphs, charts, diagrams, and various symbolic elements instead of conveying the same information through written words. Auditory is characterised by a preference for information that is “heard or spoken”. People who choose the Auditory method claim that they excel in learning through group discussions, lectures, radio, mobile phone use, and engaging in verbal communication to talk through concepts. The Read/write preference involves presenting information to be shown in the form of words. Many teachers and students prefer this technique. Kinesthetic modality is "perceptual preference based on experience and practice" [5].

Many existing language learning applications have a big selection of languages, sometimes more than 10. This can be a bit overwhelming for users, making it harder for them to focus on one language. This abundance of options can overwhelm learners and hinder their ability to effectively absorb and retain new language skills. Next, there are not enough apps focused on kids in Malaysia, especially for learning the official language, Bahasa Melayu, and Spanish and English [6]. This makes it harder for Malaysian kids to get good at these languages, especially Spanish, which is important all over the world, even if it is not as popular in Malaysia. Therefore, the mobile learning application, Happy Español is proposed to be developed.

The objectives of this study are to design an interactive multimedia mobile application named “Happy Español” using a two-dimensional (2D) approach and VARK learning style, to develop a 2D child learning mobile application using Android Technology, and to test the functionality and usability of the developed application. Happy Español aims to provide an interactive language learning experience that aligns with contemporary approaches. It focuses on children between the ages of 7 to 12. The subject matter expert (SME) participating in this project is Madam Nurul Sabrina Zan who is a lecturer who teaches Spanish at UTHM. Furthermore, the VARK model that will be implemented in this project will only focus on visual and auditory learning styles. This application will help children improve their language in a relaxed and enjoyable atmosphere.

The Happy Español application contains three modules, a learning module, a quiz module, and an activity module. Within the learning module, users can choose from different categories to learn Spanish words and vocabulary. The activity module consists of two categories which are scrambled word and line matching. The scrambled word activity consists of different categories. The user needs to select a category for the scrambled word activity. It will provide an image as the reference for each scrambled word. It will change to the next Spanish word when the user succeeds in rearranging the scramble word. The next activity is line matching. The user needs to match the image with the corresponding Spanish word. The quiz module offers two options for users multiple-choice and drag and drag-and-drop quizzes. The multiple-choice section comprises 20 multiple-choice questions for Spanish words. For the drag-and-drop quiz, where the user must place the correct text into the designated location. All interactive buttons within the application will guide the user to their respective learning content. The application can be a flexible mobile tool for children to practice Spanish anywhere. By adding interactive features, the application can make learning Spanish more engaging and effective for children, satisfying their interests and needs.

The remaining part of the paper is arranged as follows: Section 2 discusses the study domain, the technique used, and the results of the comparative analysis. Section 3 outlines the Multimedia Mobile Content Development (MMCD) methodology used in this project, as well as the results of the project's analysis and design phases. Section 4 further describes the result and discusses the current progress, followed by the conclusion in Section 5.

2. Related work

This section will discuss the study domain, the technology used, and comparative analysis.

2.1 Spanish Language

After Mandarin Chinese, Spanish holds the position as the second-most spoken native language globally. Spanish (Español) is a Romance language of the Indo-European language family that originated from Vulgar Latin, spoken on Europe's Iberian Peninsula. learning Spanish is considered relatively easy because many Spanish words are similar to English, and the written form is almost phonetic, distinguishing it from other European languages. In Malaysia, learning Spanish allows Malaysians to gain a better understanding of the varied cultures of Spain and Latin America. Spanish is considered an important tool for Malaysians in a globalized world. Spanish is valued in customer service and sales roles, especially in areas with large Spanish-speaking populations. Including Spanish among the languages spoken in the country increases linguistic diversity and fosters a multicultural environment. Companies and organizations value language-skilled staff in a globalized society. Learning Spanish may enhance one's professional reputation and expand work chances, especially in industries with ties to Spanish-speaking regions. Learning a new language can improve children’s cognitive function and increase their attention. It helps children easier to learn additional languages in the future. In addition to direction, providing appropriate gratitude and encouragement is critical in children's language development path. This encouragement is critical for keeping them motivated even when they face obstacles along the way [7].

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2.2 Technology Used

There are a total of three technologies used in this project which included the mobile language learning application, android technology for mobile applications and the VARK learning style. Mobile language learning (MLL) applications use mobile learning characteristics such as spontaneity, portability, interactivity, accessibility, and so on to provide an environment for learning a language with the assistance of mobile technology [8]. Mobile applications are a new format for studying languages from other countries. They are great as an extra method for learning [9]. A mobile language learning application is a software program designed for smartphones and tablets that helps users learn a new language or improve their language skills. It aims to make it easy and fun to learn new languages and consists of a variety of features to enhance the learning experience. One of the advantages of mobile language learning applications is users can learn and practice new vocabulary through quizzes, word games, and activities.

Out of all the mobile operating systems available, Android boasts the largest market share, making it the most widely used and prevalent platform among smartphone and tablet users globally [10]. Therefore, Android technology is widely used for mobile application development. Android application development services consistently generate programs that are filled with innovative features by expertly using cutting-edge technologies. This dedication to embracing the most recent advances guarantees that Android remains the leader of innovation, always pushing the boundaries of what is possible in the dynamic stage of mobile applications. When someone uses a device with strong hardware requirements and runs Android, they can run many apps at the same time. This means users can listen to music while checking messages, and downloading, or uploading data from their storage or device. Many companies that specialise in Android application development make quite useful apps for everyday use [11].

The proposed application, Happy Español, is proposed to suit the learning preferences of both visual and auditory learners, aligning with the principles of the VARK learning style model. For those who learn best through visuals, the app includes written text, images, and simple animations to illustrate Spanish vocabulary and phrases. This is particularly beneficial for individuals who find visual aids helpful in understanding new words and expressions. On the other hand, for those who thrive on learning through listening, Happy Español provides clear pronunciations of Spanish words and phrases, catering to the needs of auditory learners. By incorporating these features, the app aims to create an inclusive and engaging language learning experience, accommodating a variety of learning styles to make the process enjoyable and effective for all users.

2.3 Comparative Analysis

This section will discuss the comparison between the existing applications, such as Learn Spanish for beginners [12], Learn Spanish - 11,000 Words [13], and Learn 33 Languages – Mondly [14]. Fig. 1 shows the main menu of the three existing applications. Table 1 shows the result of the comparative analysis.

Based on Table 1, the proposed Happy Español application has several strengths that set it apart from the language learning application. Its ability to operate with Android 4.4 and above ensures that it is available to a large user base. The integration of learning, quizzes, and activity modules especially responds to the needs of Malaysian children aged 7 to 12, providing a specialised and age-appropriate educational experience. Background music improves the user interface, producing an engaging and enjoyable setting for language learning. compared to other existing applications, Happy Español is free of advertisements and in-app purchases, promoting a seamless and cost-free user experience. Furthermore, the focus on English and Malay as native languages for learning Spanish gives a culturally relevant and relatable context for Malaysian users. Overall, the proposed application combines technological compatibility, age-appropriate content, engaging features, and a user-friendly approach to provide a comprehensive and appealing platform for Spanish language learning.

(a) (b) (c)

Fig. 1 *Main menu interface (a) Learn Spanish for beginners; (b) Learn Spanish - 11,000 Words; (c) Learn 33 Languages – Mondly*

Table 1 *Comparison between existing application and proposed application*

Element	Learn Spanish for beginners	Learn Spanish – 11,000 Words	Learn 33 Languages - Mondly	Happy Español
Platform	Android 4.4 and up	Android 8.0 and up	Android 5.0 and up	Android 4.4 and up
Modules	Vocabulary, Quizzes, Test	Android 8.0 and up	Lesson, conversation, vocabulary	Learning modules, Quizzes, Activity
Background music	No			Comfortable background music
Language used	Spanish, English	Can choose up to 62 types of native languages	A total of 33 languages can learn	Spanish, English, Malay
Multimedia elements	Text, images, audio			
Strength	Easy to use, a lot of categories	Good user interface	Virtual chatbot	Good user interface, easy to user
Limitation	The title of categories is using Spanish	Only free for beginners but not free for intermediate and advanced	Only free for three topics, and too many languages	No
Internet connection	Not necessary		Need for leaderboard	Not necessary
Advertisement	Update premium to remove ads	Update premium to unlock more feature	Update premium to unlock more topics	No
In-App purchase				

3. Methodology

Multimedia Mobile Content Development (MMCD) methodology has been chosen for developing Happy Español mobile language learning applications. With the advancement of mobile technology and the widespread usage of mobile devices today, m-learning has the potential to dominate distance education in the same way that electronic learning (e-learning) has done for the past two decades [15]. The MMCD methodology that is shown in Fig. 2 comprises five main components which are the application idea creation stage, structure analysis stage, process design stage, main function development stage, and testing stage. Each phase of the MMCD methodology is discussed in the following sub-sections.

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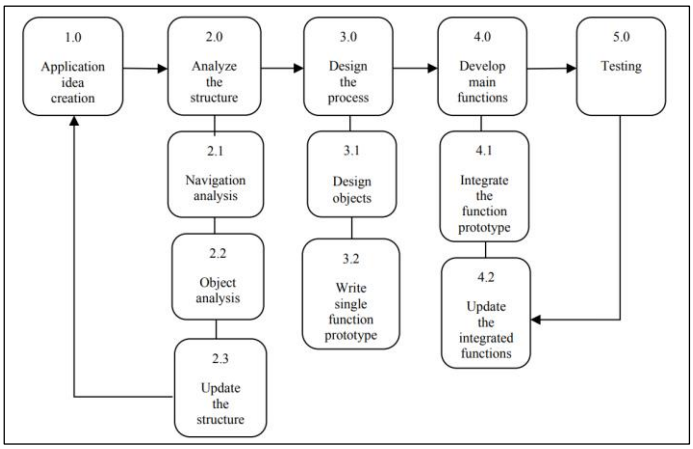


Fig. 2 *MMCD Methodology* [15]

3.1 Application Idea Creation

Application idea creation is the first stage of MMCD methodology. This stage begins with the preparation of the checklist table and the information required before the design and development of the application begins [15].In this stage, the application idea creation checklist for Happy Español is shown in Table 2. Additionally, the process of analysing and determining end-user requirements for the application will be discussed. The data retrieval procedure involves two individuals which are the Subject Matter Expert (SME) and the target users through the questionnaire. Madam Nurul Sabrina Zan, a Spanish language lecturer at the University Tun Hussein Onn Malaysia (UTHM), was chosen as the project's Subject Matter Expert.

The questionnaire is divided into two sections with a total of 12 questions. The first section discusses the demographics of the respondents, while the second section covers the user analysis. A total of 20 responses from target users were collected, and the questionnaire results were processed and shown in Appendix A. According to the analysis based on the Subject Matter Expert and the questionnaire data, a comprehensive user analysis is tabulated as follows, shown in Table 3.

Table 2 *Application Idea Checklist*

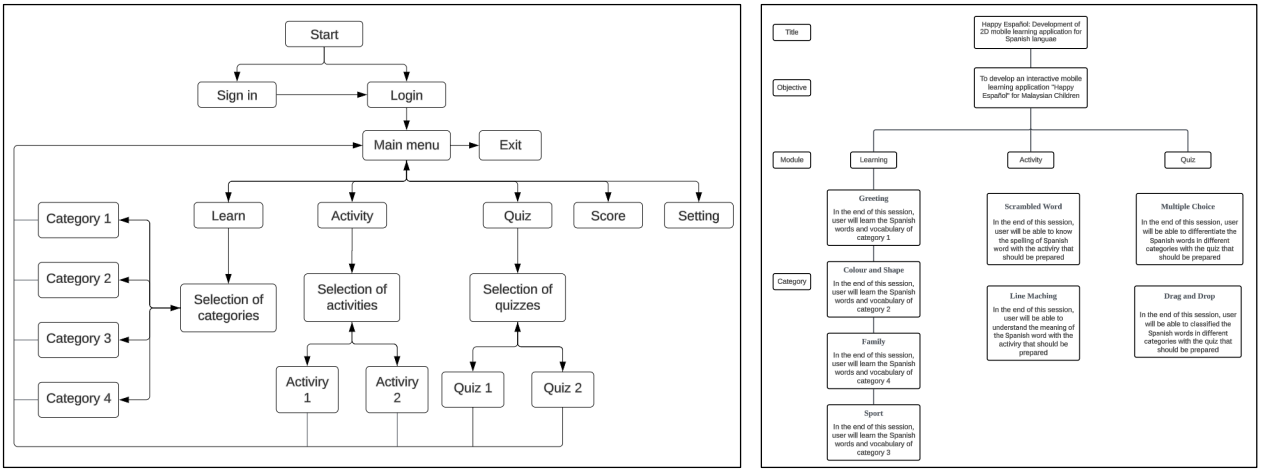
Element	Learn Spanish for beginners
Type of application	Mobile learning
Platform	Android mobile
Target users	Children aged 7 to 12
Graphical User Interface (GUI)	Main menu background, register and log-in interface, learning module, quiz module, activity module
Subject Matter Expert (SME)	Madam Nurul Sabrina Zan, Spanish language lecturer at UTHM
Images	Graphic for Spanish vocabulary and verbs, buttons, backgrounds
Video	None
Animation	Application title, on-click buttons, score
Audio	Background music, sound effects, pronunciation of Spanish vocabulary and verbs
Application Summary	Happy Español is a 2D mobile learning application for the Spanish language that was developed for children in Malaysia aged 7 to 12 to learn Spanish support both English and Malay. The application includes learning, quiz and activity modules to help children improve their basic Spanish.

Table 3 *User Analysis*

Stakeholder Category	Role in Application	Design Implication	Action Needed
Subject Matter Expert (SME)	Content consultant expert in Spanish language learning	It is simple to navigate between interfaces	• Navigation and functional buttons should be visible and easy to identify. • Use icon-based buttons rather than text-based buttons to improve comprehension of button functions.
		Content that is suitable for children	• For the learning module, use simple words, vocabulary, and images. • Use some fun quizzes to help children to learn more. • Can refer to primary school syllabus in several languages.
		Interface design	• Include some Spanish-related features, such as the colours of the Spanish flag. • Avoid complex interface design, keep it basic to avoid misunderstanding among children.
General User	End-user of the proposed application	Sign up feature	• User should sign up for an account via email before logging in to the application.
		Easy to use	• The application should help children learn Spanish by assisting them with English and Malay. • The application should be mobile-based, include an offline mode so can use it at anytime and anywhere.
		modules	• The application should have an activity module and a quiz module for the user • The application should have multimedia elements including text, images, and audio.

3.2 Analyse the Structure

The second phase of the MMCD methodology discusses the structure of the proposed application. The navigation analysis of objects has been conducted. Fig. 3 (a) shows the navigation structure, while Fig. 3 (b) presents the content structure. Both of these structures will also attached in Appendix B. System flowcharts are shown in Fig. 4 (a); (b) and Fig. 5 (a); (b). Additionally, the functional and non-functional requirements are listed in Table 4 and Table 5 as attached in Appendix C.



(a) (b)

Fig. 3 *(a) Navigation structure; (b) Content structure*

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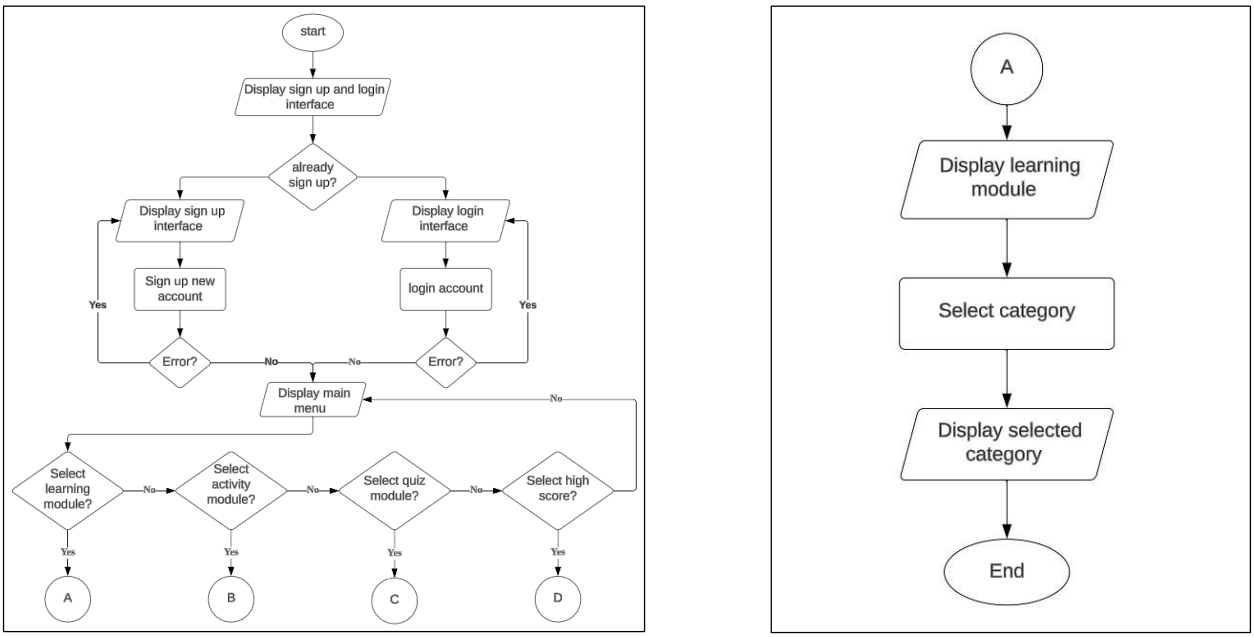
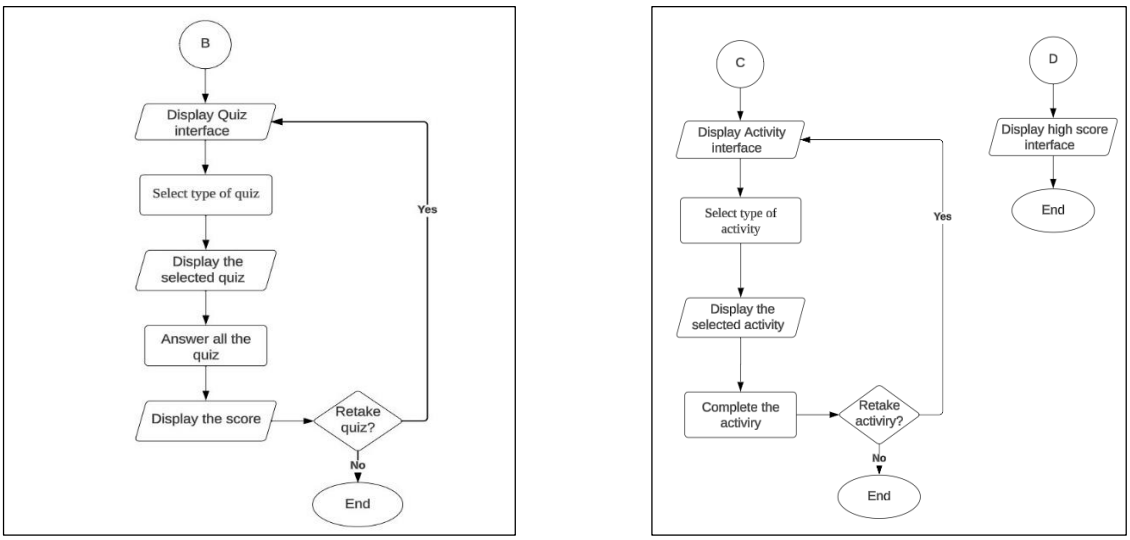


(a) (b)

Fig. 4 *System flowchart (a) Overall flowchart (b) Flowchart of the learning module*



(a) (b)

Fig. 5 *System flowchart (a) Flowchart of quiz module (b) Flowchart of activity module and high score*

3.3 Design the Process

This section discusses the design process which is the third phase of the MMCD approach. Object design is discussed in this stage which includes button design and interface design for the proposed application. The overall colours used for the Happy Español application are red and yellow, which represent Spain, and Spanish cultural elements are applied as metaphors for the application. the button design for the proposed application is shown in Table 6, while Table 7 shows the interface design.

Table 6 *Application Idea Checklist*

Button	Description	Button	Description
	This is a sign-up button.		This is the previous button.
	This is a login button.		This is a learn button.
	This is a play button.		This is a learn button.
	This is a home button.		This is a quiz button.
	This is a setting button.		This is an activity button.
	This is a return button.		This is a score button.
	This is the next button.		This is an exit button.

Table 7 *Interface Design*

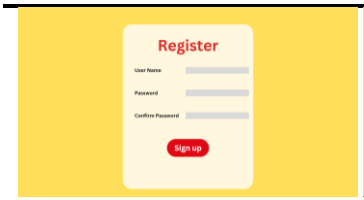
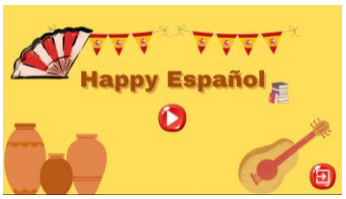
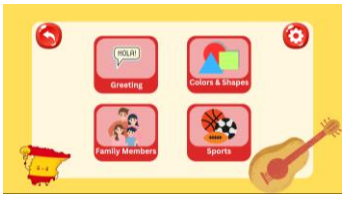
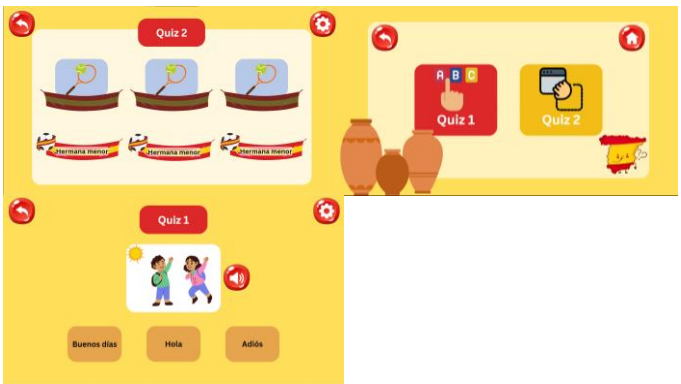
Interface	Description
	The interfaces of register and log in. Each time the user launches the application, these interfaces will come out.
	The interfaces of the first page and main menu. After logging in, it will show the first page, and when the user clicks the play button, it will show the main menu.
	The interfaces of the category module. The first interface allows the user to choose categories, the second interface allows the user to learn Spanish words and vocabulary, and the third interface allows the user to learn simple sentences in Spanish.
	The interfaces of the quiz module. The first interface allows the user to choose the type of quizzes. The second and third interfaces allow the user to answer the quiz.

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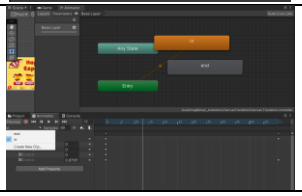
Table 7 *Interface Design (cont)*

Interface	Description
	The interface of the activity module. Allow the user to answer the activities.
	The interface of the score. Allow the user to look for their high score.
	The interface of setting. Allow the user to modify the volume of sound and music.

3.4 Develop Main Function

At this stage, the core functionality of Happy Español is being developed. This involves creating the assets for the application, including graphics, audio, and animations, and then integrating these assets into Unity, as detailed in Table 8.

Table 8 *Development of Assets*

Assets	Development	Description
Graphics		CanvaPro and Procreate are utilized to design the elements such as buttons and characters to import into Unity.
Audio		The sound group integrated across all scenes in the application. This sound group includes two categories: sound effects and background music.
2D Animations		The 2D animations are created inside Unity by simply adding an Animator component to the game object and inserting the keyframes into different properties.

3.5 Testing

This is the final phase of the MMCD methodology, where two types of testing will be conducted to ensure the developed application meets expectations and objectives. The first type is alpha testing, which involves functional testing throughout the development phase. The second type is user acceptance testing, which involves target users. If any bugs are found during this phase, the project will revert to the previous phase to modify and update the integrated functions to resolve them. The results of the functional testing are presented in Table 9 in Appendix C. For the user acceptance testing, which also serves as user acceptance testing, 20 respondents completed a questionnaire via Google Forms. The System Usability Scale (SUS) is used to evaluate the application's usability.

4. Result and Discussion

For the result of functional testing, the results show that most buttons and systems are working as expected, with no corrective actions needed. However, there was an issue with the audio button which is the audio clips overlapped when clicked multiple times. To resolve this, corrective action was taken to ensure the audio clips played only once, even when clicked multiple times. The result of user acceptance testing is shown in Figures 6 and 7 and the outcomes are analysed.

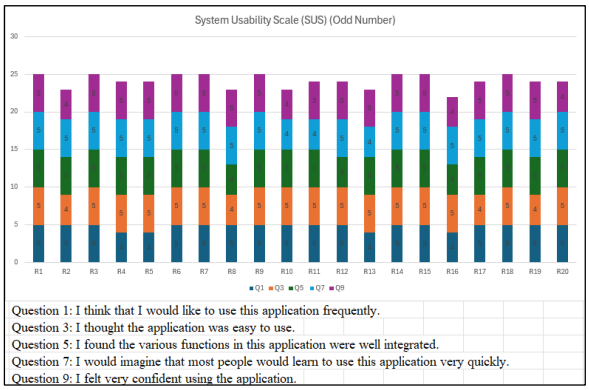


Fig. 6 *SUS Positive Question Result*

Based on Figure 6, all respondents gave 4 marks and above, which reflects a positive user experience, with respondents generally agreeing that they found the various functions were well integrated and would imagine that most people would learn to use this application very quickly. Overall, it shows a high level of satisfaction and confidence among the users about the developed application.

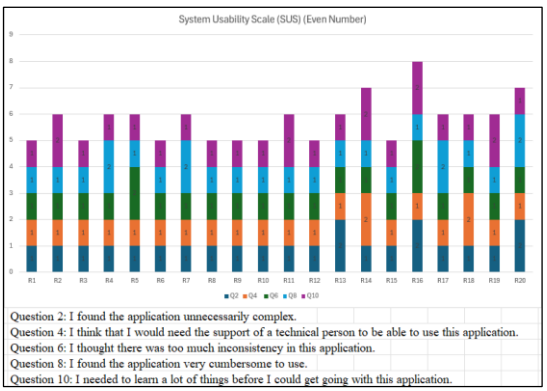


Fig. 7 *SUS Negative Question Result*

Based on Figure 7, all respondents gave 2 marks and below, which indicates most respondents did not find the system to be unnecessarily complex, inconsistent, cumbersome, or in need of technical support. Overall, the system seems to have minimal usability issues according to the even-numbered questions.

Respondent	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Total Score
R1	5	1	5	1	5	1	5	1	5	1	100
R2	5	1	4	1	5	1	5	1	4	2	92.5
R3	5	1	5	1	5	1	5	1	5	1	100
R4	4	1	5	1	5	1	5	2	5	1	95
R5	4	1	5	1	5	2	5	1	5	1	95
R6	5	1	5	1	5	1	5	1	5	1	100
R7	5	1	5	1	5	1	5	2	5	1	97.5
R8	5	1	4	1	4	1	5	1	5	1	95
R9	5	1	5	1	5	1	5	1	5	1	100
R10	5	1	5	1	5	1	4	1	4	1	95
R11	5	1	5	1	5	1	4	1	5	2	95
R12	5	1	5	1	4	1	5	1	5	1	97.5
R13	4	2	5	1	5	1	4	1	5	1	92.5
R14	5	1	5	2	5	1	5	1	5	2	95
R15	5	1	5	1	5	1	5	1	5	1	100
R16	4	2	5	1	4	2	5	1	4	2	85
R17	5	1	4	1	5	1	5	2	5	1	95
R18	5	1	5	2	5	1	5	1	5	1	97.5
R19	5	1	4	1	5	1	5	1	5	2	95
R20	5	2	5	1	5	1	5	2	4	1	92.5
											95.75

Fig. 8 *Respondent's Score*

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The formula used to obtain usability results based on the SUS is:

Total score = (odd items + even items) x 2.5

$$\text{Average score} = \frac{\text{Total score}}{\text{Total respondents}}$$

Where:

Odd items (Q1, Q3, Q5, Q7, Q9) = contribution – 1
Even items (Q2, Q4, Q6, Q8, Q10) = 5 – contribution

Fig. 9 *Formula to calculate the SUS score*

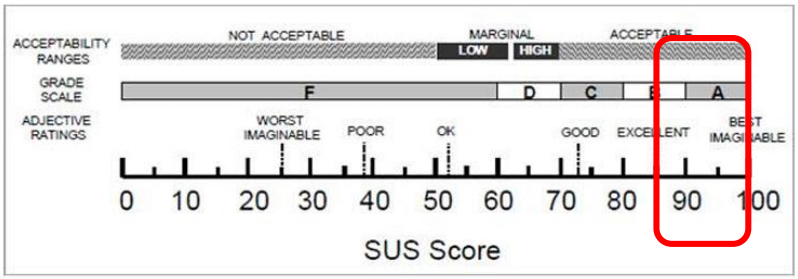

Fig. 10 Grade rankings of SUS scores

Figure 8 shows the total scores for each question from the questionnaire were determined by calculating the average score using the formula. The resulting average score is 95.75, which falls within the "Acceptable" range on the Acceptability Ranges score scale. This score corresponds to a Grade Scale of "A" and an Adjective Rating of "Excellent." In conclusion, the developed application has successfully met the needs of the target users.

5. Conclusion

In conclusion, the Happy Español 2D mobile learning application is suitable for children aged 7 to 12 to learn Spanish. Developed by the Multimedia Mobile Content Development (MMCD) methodology, the application was completed within the expected timeline and functions seamlessly on Android devices. Through the user acceptance test, the Happy Español 2D mobile learning application revealed a high level of satisfaction among users. The three objectives of this project have been achieved. Finally, future improvements to the application were recommended to make Happy Español 2D mobile learning application able to be more efficient and interactive when users use this application.

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Conflict of Interest

Authors declare that there is no conflict of interest regarding the publication of the paper.

Author Contribution

This journal requires that all authors take public responsibility for the content of the work submitted for review. The contributions of all authors must be described in the following manner:

The authors confirm contribution to the paper as follows: **study conception and design**: Shee Chen Yu, Dr. Ezak Fadzrin Bin Ahmad Shaubari; **data collection**: Shee Chen Yu, Dr. Ezak Fadzrin Bin Ahmad Shaubari; **analysis and interpretation of results**: Shee Chen Yu, Dr. Ezak Fadzrin Bin Ahmad Shaubari; **draft manuscript preparation**: Shee Chen Yu, Dr. Ezak Fadzrin Bin Ahmad Shaubari. All authors reviewed the results and approved the final version of the manuscript.

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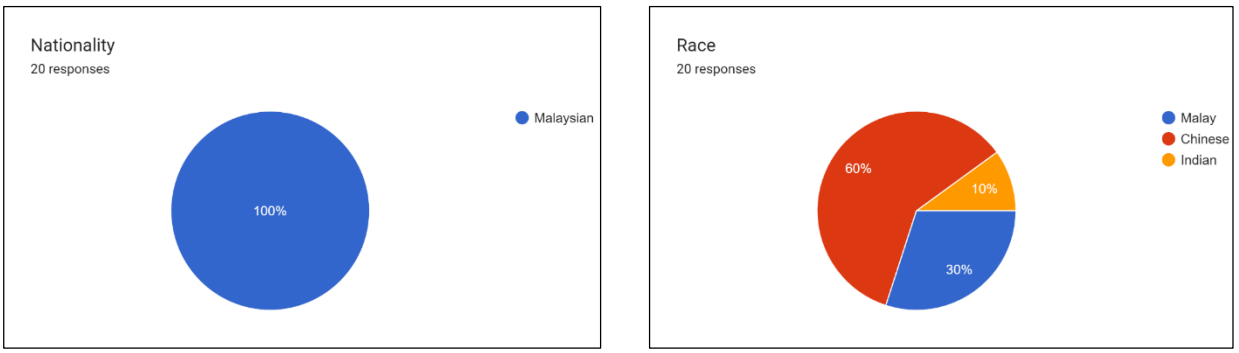
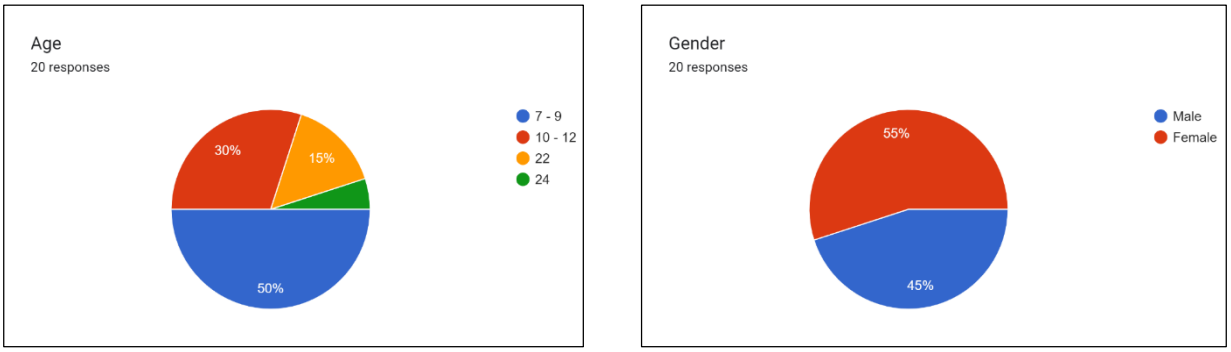
Appendix A

This section shows the results of the questionnaires for user analysis.



(a) (b)

Fig. 6 *User demographic for (a) Nationality; (b) Race*



(a) (b)

Fig. 7 *User demographic for (a) Age; (b) Gender*

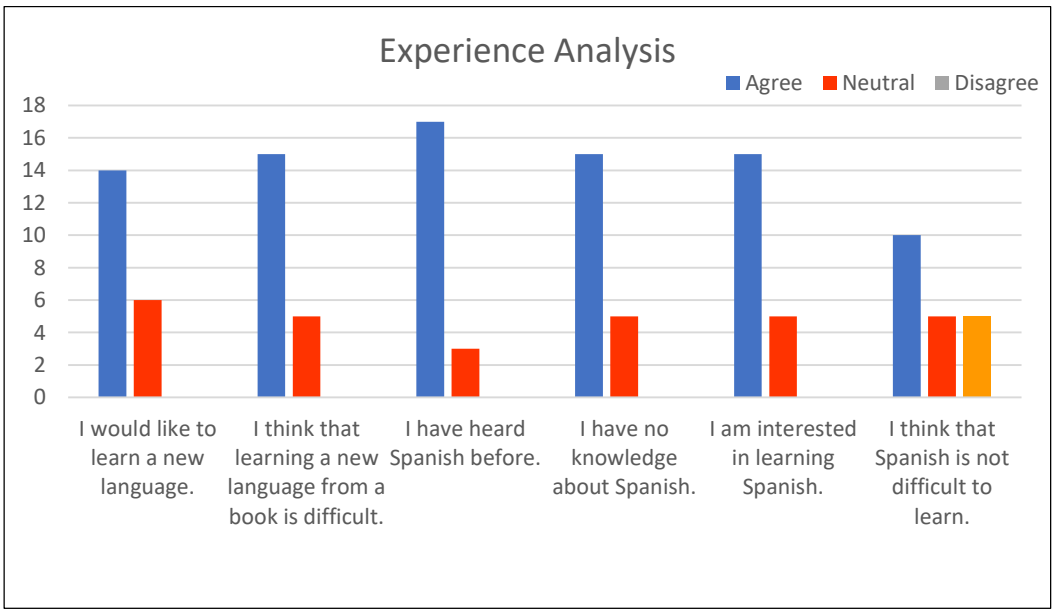
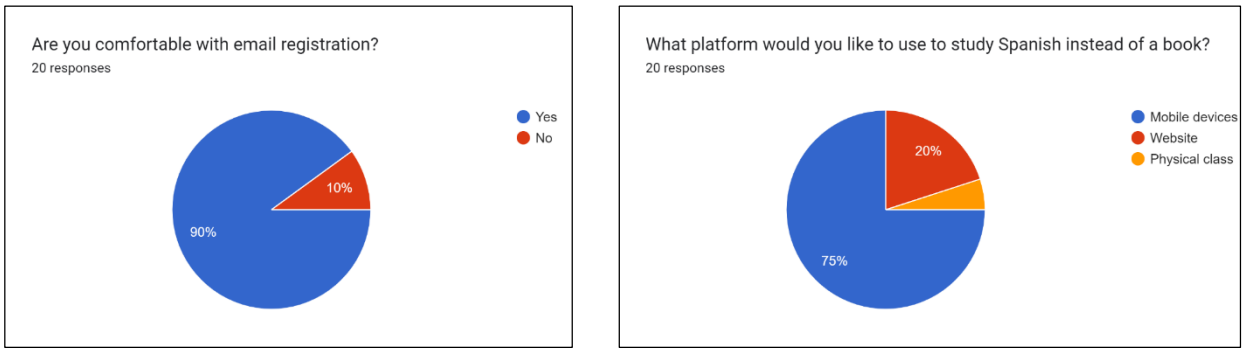
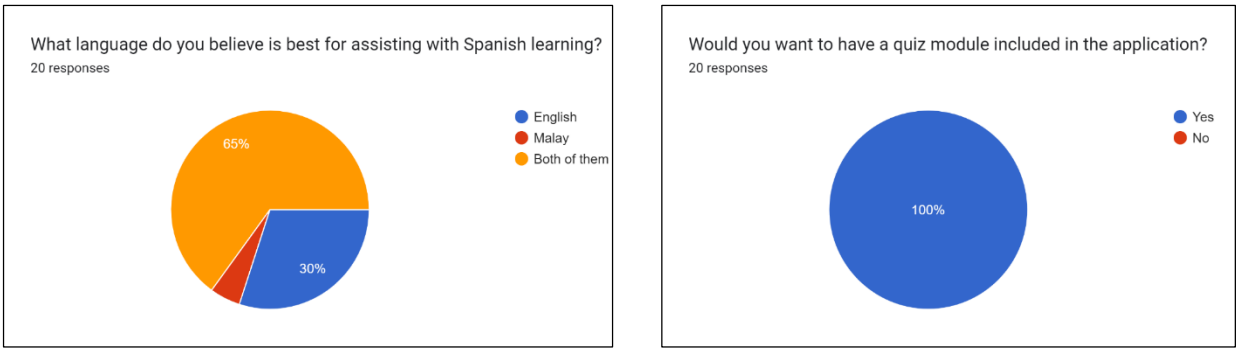


Fig. 8 *User experience analysis*



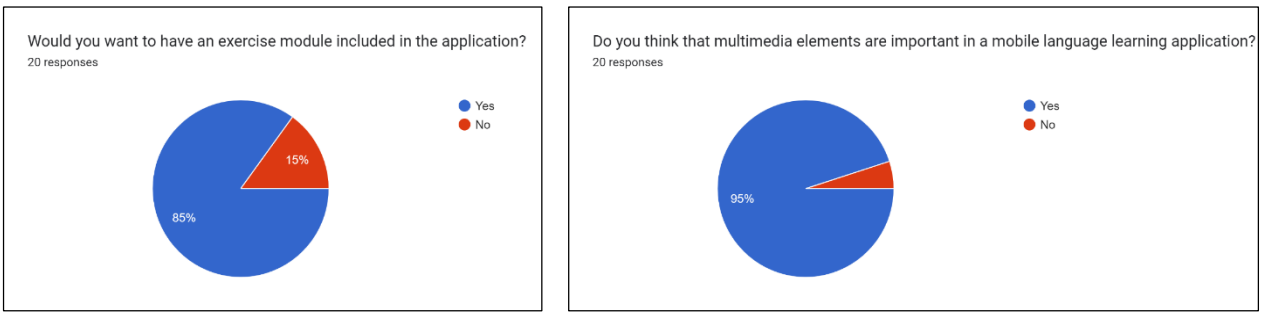
(a) (b)

Fig. 9 *Preferable elements for (a) email; (b) platform*



(a) (b)

Fig. 10 *Preferable elements for (a) Assisting languages; (b) quiz module*



(a) (b)

Fig. 11 *Preferable elements for (a) Acitvity module; (b) Multimedia elements*

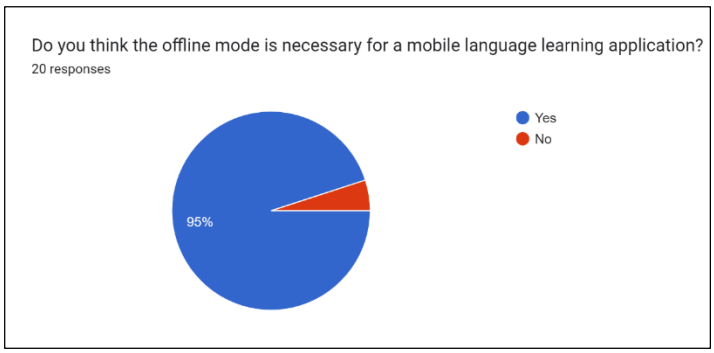


Fig. 12 *Preferable element for offline mode*

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Appendix B

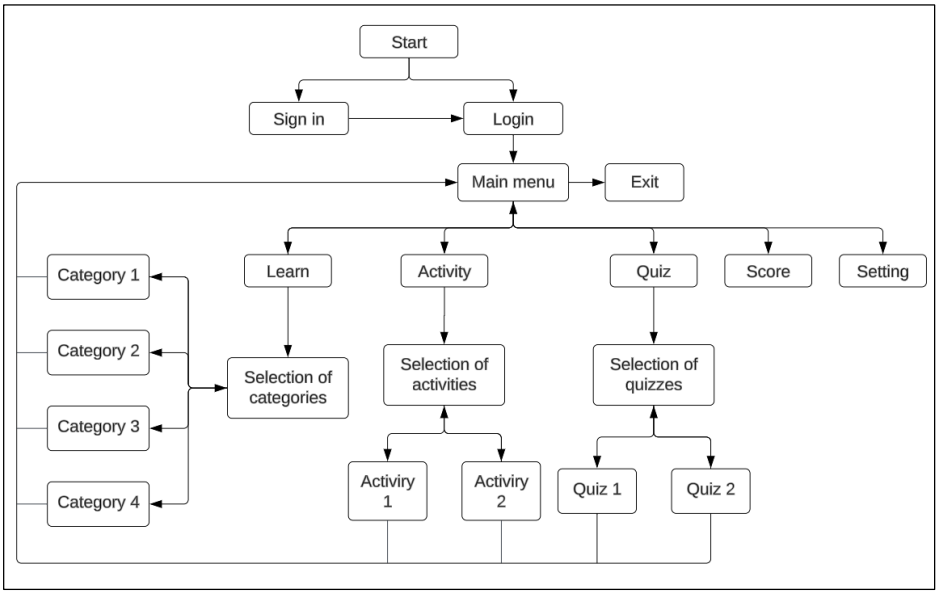

Fig. 13 *Navigation Structure*

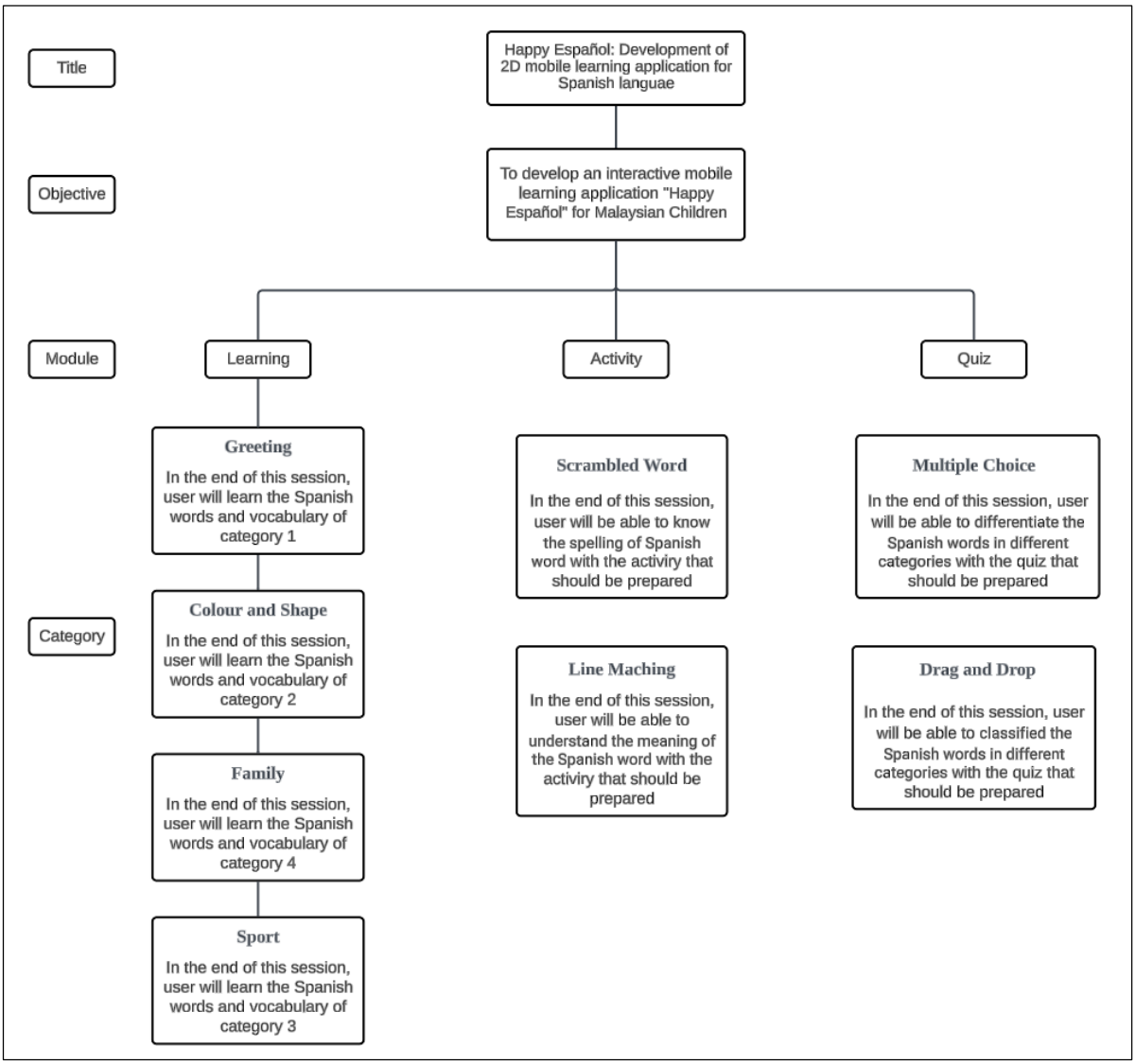

Fig. 14 *Content Structure*

Appendix C

Table 4 *Functional requirements*

Functional requirements	Description
Autonomous System Activities	• The application should play the background music when users launch the application.
	• The application should verify the users' login information when they sign in and load the users' profiles from the Playfab SDK.
	• The application should disconnect from the Playfab SDK when the user logs out of the application.
	• The application should mention the correct answer when the users select the wrong answer in the quiz module.
	• The application should display the user's score after they complete the quiz module.
	• The application should be able to let the user to retry after completing the activity module
User Interaction Support	• The application should enable users to provide input by touching the screens of their mobile devices.
	• The application should enable users to navigate each content using the provided navigation buttons freely.
	• The application should enable users to modify the music and sound settings.
Provide Learning Content	• The application should allow users to recognise Spanish words and vocabulary with English and Malay serving as supporting languages.
	• The application should allow users to recognise the pronunciation of the Spanish words and vocabulary.
	• The application should allow users to memorize Spanish words and vocabulary across various categories through quiz and activity modules.
	• The application should display the score and store the high score in Unity using the built-in PlayerPrefs.

Table 5 *Functional requirements*

Non-Functional requirements	Description
Performance	• The application should be capable of loading all modules without requiring an internet connection.
	• The interface and button responses of the application should be fast, taking no longer than 2 seconds.
Implementation	• The application should be able to operate with Android mobile devices running on Android version 4.4 and above.
Usability	• Users should be able to access the application anywhere and anytime through their mobile devices.
	• Users should be able to use this application easily, which employs simple words and vocabulary to deliver the learning content.
Legal	• The application should permit users to view the information but restrict them from making any modifications.

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Table 5 *(cont)*

Non-Functional requirements	Description
Cultural	• The application should be created in three languages: Spanish, English, and Malay, so that users may readily comprehend the meaning of Spanish words and vocabulary in English and Malay.
	• The application should provide content that is suitable for children aged 7 to 12.
Graphical User Interface Support	• The application should support multimedia elements such as text, images, and audio that are fixed to different types of mobile devices.

Table 10 *Functional Testing*

Test	Expected Result	Actual Result	Corrective Action
Sign up button	Navigate to sign in.	Works well as expected.	Not needed.
Sign in button	Navigate to the first page.	Works well as expected.	Not needed.
Recovery button	Navigate to sign in.	Works well as expected.	Not needed.
Play button	Navigate to the main menu.	Works well as expected.	Not needed.
Credit button	Navigate to credit.	Works well as expected.	Not needed.
Learning button	Navigate to the learning module.	Works well as expected.	Not needed.
Activity button	Navigate to the activity module.	Works well as expected.	Not needed.
Quiz button	Navigate to the quiz module.	Works well as expected.	Not needed.
Score button	Navigate to the high score.	Works well as expected.	Not needed.
Setting button	Navigate to the settings panel.	Works well as expected.	Not needed.
Done button	Close the setting panel.	Works well as expected.	Not needed.
Exit button	Exit the application.	Works well as expected.	Not needed.
Back button	Navigate to the previous page.	Works well as expected.	Not needed.
Learning categories button	Navigate to the learning categories.	Works well as expected.	Not needed.
Previous button	Navigate to the previous page.	Works well as expected.	Not needed.
Next button	Navigate to the next page.	Works well as expected.	Not needed.
Audio button	Play the associated audio clip.	Audio clips overlapped when clicked multiple times.	Ensure the audio only plays once when multiple-clicked.
Activity type button	Navigate to different types of activity.	Works well as expected.	Not needed.
Activity categories button	Navigate to different categories of activity.	Works well as expected.	Not needed.
Retry button	Replay the quiz.	Works well as expected.	Not needed.
Menu button	Navigate to the activity/quiz types of selection.	Works well as expected.	Not needed.
Home button	Navigate to the main menu.	Works well as expected.	Not needed.
Hint button	Show the hint for Spanish words.	Works well as expected.	Not needed.
Title button	Change the title between English and Malay.	Works well as expected.	Not needed.
Quiz type button	Navigate to different types of quizzes.	Works well as expected.	Not needed.
Start button	Start the quiz.	Works well as expected.	Not needed.
Pause button	Pause the time for the quiz.	Works well as expected.	Not needed.

Table 10 *(cont)*

Test	Expected Result	Actual Result	Corrective Action
Resume button	Back to the quiz.	Works well as expected.	Not needed.
Answer button	Choose the answer for the quiz.	Works well as expected.	Not needed.
Drag object	Drag the object to the corresponding place.	Works well as expected.	Not needed.
Animation	Animation for change scene.	Works well as expected.	Not needed.
Log in system	Allow users to create a new account.	Works well as expected.	Not needed.
High score system	Record the highest score for the quizzes.	Works well as expected.	Not needed.
Audio setting system	Allow to adjust the volume for SFX and BGM.	Works well as expected.	Not needed.