

Development of E-Jisha Mobile Learning Application of Japanese Vocabulary For JLPT N5 Students: E-Jisho

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Abstract

Foreign languages have long been practiced in Malaysia as a third language. Learning a foreign language is necessarily beneficial as it can be used for many purposes. Among the popular foreign languages currently learned by the Malaysian community nowadays is Japanese, despite its reputation as a challenging language to master. However, the existing application to learn the Japanese language that has been studied is too generalized and lacks a strong focus on the beginner learner and is often not user-friendly for those at the introductory level. Therefore, this project aims to develop a mobile learning application called E-Jisho, which offers simple but detailed lessons and enjoyable activities that can help users improve their knowledge in Japanese vocabulary and reading skills by using Multimedia Mobile Content Development (MMCD) methodology. This project's target user is a JLPT N5 student who wants to take the examination, and people who are beginners in learning the Japanese Language. At the end of the testing phase, the result obtained based on the user acceptance test showed an average score of 56.33% which places the application in the Marginal usability category, indicating the application is competent for user acceptance. This indicates that the application may serve as a supporting tool for learning Japanese language. Within further enhancement based on the user feedback, the application can advance into a comprehensive learning platform in the future.

1. Introduction

Language is a basic communication tool that is constructed of sounds, words, and grammar used by people living in a particular country [1]. Language plays a crucial role for people to communicate with each other and understand each other by learning the languages of respective races without barriers. Learning foreign languages offers numerous benefits, including increasing career opportunities, enhancing your confidence level, and fostering critical and creative thinking in individuals. In Malaysia, one of the foreign languages learned by Malaysians as their third language is the Japanese language. The Japanese language has become the most popular foreign language among Malaysian learners due to supportive national policies, frequent interactions between both countries, and positive social perception [2]. Meanwhile, vocabulary is an essential part of learning any language. Vocabulary refers to a collection of words or words or phrases, typically arranged alphabetically with meanings and explanations provided [3] In brief, vocabulary is a collection of words known and used by a particular person to communicate in their daily life or written documents. Vocabulary is one of the essential

elements for learning a foreign language, as the meanings of new words are frequently highlighted, whether in books or classrooms. It is also central to language teaching and paramount to a language learner [4]. Other than that, vocabulary is key for a conversation to happen as it is the raw building block that is used to express people's thoughts, opinions, ideas, share information, and understand others and grow personal relationships [5].

Japanese language learners who learn the Japanese language as their second or third language need to enhance their vocabulary knowledge over time to achieve their goal of mastering the language. However, learning applications nowadays are often focused on learning and exercises to help language learners improve their language skills. However, the lack of multimedia elements in the applications will cause the user to lose interest in the application. The popular Japanese mobile-learning applications only accommodate enhancing reading, vocabulary, and writing ability, so user experience issues are still prevalent and may affect the learning outcome [6]. Most of the learning applications focus on common knowledge, which is not too specific in solving the lack of vocabulary issues. Too many words can cause users to feel exhausted, to using the applications which caused the applications is not efficient enough to help the target audience.

The first objective of this project is to design a Mobile Learning application of Japanese Vocabulary for JLPT N5 students based on the JLPT N5 syllabus. This objective, aiming to design a mobile application for those who are preparing for JLPT N5, involves identifying the required Japanese vocabulary as highlighted in the JLPT N5 syllabus and arranging it into a structured, learner-friendly content with clear navigation, visual aids, and categorized lessons to support beginners' understanding and memorization necessary for vocabulary learning. The proposed application also aims to develop an interactive E-Jisho that facilitates Japanese vocabulary learning through engaging activities on the Android platform. Within the second objective, the application proposed will incorporate interactive features such as interactive notes with listening practice and pronunciation learning, quizzes on the respective topic provided, and a simple hidden game object for the user to practice reading and learns new words. Finally, the proposed application also aims to evaluate the usability and user acceptance of the proposed application among the target users, which focuses on assessing how the proposed application meets the expectations and needs of its users. This goal will be conducted using the System Usability Scale (SUS) and gathering feedback through a questionnaire distributed to the target users.

Therefore, the E-Jisho application is designed to offer interesting and interactive learning ways for the user to learn Japanese vocabulary within the JLPT N5 syllabus, in hoping the application could assist as many people as possible who aim to broaden their vocabulary knowledge on Japanese language learning. Featuring relaxing and leisurely gameplay, users can benefit by calmly playing the games while learning new words for their vocabulary knowledge

2. Related Work

These sections discuss the background of the studies, the technology used, and the results of the comparative analysis.

2.1 Japanese Language Proficiency Test

The Japanese Language Proficiency Test, also known as JLPT, is a standardized test designed to measure and certify the Japanese language proficiency of those whose native language is not Japanese. JLPT is jointly organized by the Japan Foundation and Japan Educational Exchanges and Services, which were previously known as the Association of International Education, Japan, and were established in 1984 [7]. At the very beginning, the first test was held back in 1984 due to the growth of demand for standardized Japanese Language certification, and approximately 7000 people worldwide took the test. However, over time, the JLPT became the largest-scale Japanese language test in the world. The test will take place twice a year in East Asia and once a year in other regions [8] The test has been widely recognized internationally and used in academic measurement, professions, and other personal purposes such as language skills, university applications for admissions or scholarships, or job applications.

2.2 Game-Based learning

Game-based learning is defined to emphasize that it is a type of gameplay designed with specific learning outcomes in mind [9] It is also known as a method that combines learning and digital games into a new concept, which is known as game-based learning. Digital game-based learning has the potential to introduce new learning concepts that can enhance students' communication skills. Game-based Learning engages students by embedding educational content or learning theories into games. Its implementation is rooted in the principles of constructive learning [10].

2.3 Learning Approach

Visual learning is the ability to organize, structure, and give meaning to visible objects, and it is recognized as an educational approach where the concepts, ideas, data, and information are linked to images and visual methods [11]. These learning approaches are used to improve students' ability to memorize certain things through the visualization of pictures. This learning style is very beneficial for language learners, as certain objects have different names and meanings depending on the respective language they learn, especially in the vocabulary part. However, by using visual learning methods, users could learn way faster compared to verbal methods, especially vocabulary that is related to nouns.

2.4 Comparative Analysis

In this section, a comparison is made between 3 existing applications and the proposed application to distinguish the differences in the features of each of the apps. The three applications that are selected are Bunpo, Duolingo, and J-Crossword, as shown in Figures 1 (a), (b), and (c), respectively. Table (a) below shows the overall result of the comparative analysis.

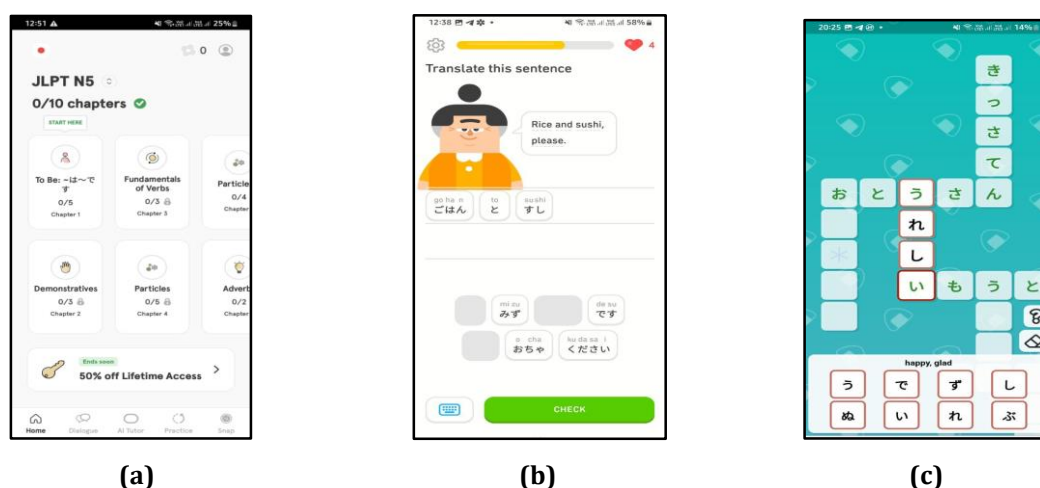


Fig. 1 (a) Bunpo [13]; (b) Duolingo [14]; (c) J-Crossword [15]

Table 1 Application Comparison

Application	Bunpo [13]	Duolingo [14]	J-crosswords [15]	E-Jisho
Technology	Mobile App	Mobile App	Mobile App	Mobile App
Application contents	Japanese Grammar	General Language Learning	Japanese Vocabulary	Japanese Vocabulary
Activities Module	Interactive quizzes, practice exercises	Multiple-choice, translation, speaking, listening	Drag-and-drop crossword puzzles	Simple notes with audio pronunciation, multiple choice quizzes, and a hidden object game.
Multimedia Elements	Audio recordings, example sentences.	Audio recordings, images, and animations	Hand-drawn scenes, puzzle interface	Images, animations, audio, and interactive elements.

Table 1: Application Comparison (cont.)

Advantages	Tailored for JLPT, offline mode, detailed explanations	Wide range of languages, gamified, and community support	The engaging way to learn vocabulary, ad-free	Designed to be friendly for beginners with engaging, simple puzzle games and to provide short but detailed lessons.
Limitations	Not all lessons are free. Need to subscribe to take advanced lessons	Most of the vocabulary is introduced in Romaji and simple hiragana or katakana.	Does not provide proper instructions. Use of complex vocabulary at the beginning of the game. Not a beginner family.	Only limits to beginner lessons and N5 students.

Based on Table 1 shown above, all 4 applications stated are focused on Japanese language learning content. However, compared to the three existing applications, E-Jisho offers a balanced mix of educational value and entertainment, making the application more ideal for JLPT N5 learners. The features, such as a friendly interface, multimedia support, and creative learning activities like hidden object games and quizzes, cater specifically to beginners. While currently focused on the N5 level, its structure provides a strong foundation for future expansion, aiming to become a comprehensive and enjoyable mobile learning tool for mastering Japanese vocabulary to improve the user experience.

3. Methodology

Multimedia Mobile Content Development (MMCD) is the methodological approach that is used to develop mobile learning applications. As technologies advance through time, it is stated that the development of mobile learning applications has the potential to dominate distance education. Therefore, MMCD methodology is selected to guide this proposed project to develop a game-based learning application. The MMCD consists of 5 stages, which start with the application idea creation stage, the analysis of the structure stage, the design process stage, the development of the main functions stage, and the testing stage. Figure 2 below shows the MMCD methodology and its stages.

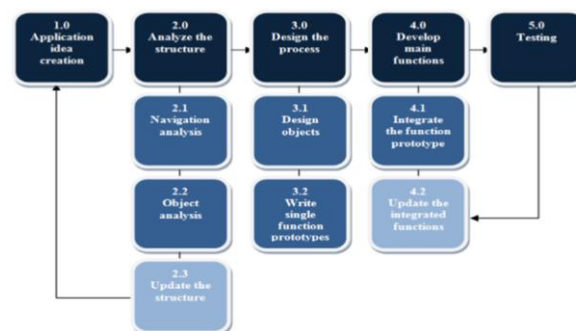


Fig. 2 MMCD methodology [12]

3.1 Application Idea Creation

The stage begins with the first phase of the MMCD methodology, which is application idea creation. During this phase, all the necessary information is gathered before beginning the design and development process. The user requirements are identified through one information-gathering method. The method used for information-gathering is through interviews with the Subject Matter Expert, Madam Junko Hiyama, who is a lecturer of Japanese Language at University Tun Hussein Onn Malaysia. The interviews transcribed are attached to Appendix B. The results of the initial requirement checklist are tabulated in Table (b). Table (c) shows the user analysis checklist.

Table 2 *Application Idea Creation Check List*

Item	Description
Type of application	Mobile learning application
Objectives	Learning Application - To design a Mobile Game-based learning application of Japanese Vocabulary for JLPT N5 students based on the JLPT N5 syllabus. - To develop an interactive Mobile learning application of Japanese vocabulary for JLPT N5 students that facilitates Japanese vocabulary through engaging activities on the Android platform, and - To evaluate the usability and user acceptance tests on the Mobile Game-based learning application of Japanese Vocabulary for JLPT N5 students for the target user
Target platform	Android-based device
Target user	JLPT N5 students and Japanese Language beginner learners.
Content	The Japanese language focuses on vocabulary
Graphical user interfaces (GUI)	Homepage interfaces, Main menu interface, Lesson module, Quiz module, Play game module
Text	Description of the lesson module, use for quiz questions and answers for the quiz module, guides, and hints for the game module.
Images	Background interface, images in the lesson module, and icon button.
Audio	A lesson on pronunciation sounds for Hiragana, Katakana, and Kanji.

Table 3 *User Analysis*

Stakeholder Category	Role in Product	Design implications	Actions needed
Subject Matter Expert (Japanese Lecturer of UTHM)	Content consultant expert in the related field	Simple user interface design	Use both text buttons instead of icon buttons only. Use a clear and suitable font for the text. Ensure the sizes and shapes of the buttons are consistent.
		Easy to navigate, beginner-friendly	Provide a simple and not too complex navigation structure. Consists of each module, sub-topic, back, next, retry, home, and exit buttons.
		Reliable content	Use the appropriate materials based on the JLPT N5 syllabus and Japanese Communication 1.
		Multimedia elements	Use interesting graphics, animations, and audio to attract user interest.

3.2 Structure Analysis stage

Proceed to the second stage of MMCD, which is the structure analysis phase. It is essential to understand the requirements necessary to develop application projects effectively. The application's structure is evaluated during

this phase. The functional and non-functional requirements are detailed in Tables 4 and 5, respectively. The system flowchart, navigation structure, and content structure are shown in Appendices C, D, and E.

Table 4 *Functional Requirements*

Functional Requirements	Module/Scene	Descriptions
Autonomous system activity	Learning Module	Automatically delivers educational material, advancing through lessons based on user interactions.
	Quiz Module	Monitors user performance and scores, facilitating smooth transitions between questions.
	Game Module	Manages gameplay features like level progression, scoring, and offering hints for missed tasks.
User interactions	Main Menu	Users navigate the application using buttons such as Start, Modules, Settings, and Exit, ensuring seamless access to all functionalities.
	Learning Module	Users interact by tapping and swiping to explore educational content, images, audio, and animations.
	Quiz Module	They answer questions using tap gestures and receive instant feedback on their responses.
	Game Module	The game module enables users to play variations of puzzle gameplay.

Table 5 *Non-functional Requirements*

Functional Requirements	Descriptions
Performance	Ensure the gameplay is smooth and responsive without errors.
Implementations	Developed using 2D technologies and applied MMCD methodology to ensure interactive updates and efficiency.
Usability	It provides a friendly interface to use
Cultural	The language used for this application is English
Graphical user	Features a Japanese theme interface with a good combination of colors to make it friendlier.

3.3 Design the process

The third stage of the MMCD approach is to design the process. This stage outlines designing components and scripting a single-function prototype. The prototype of the hiragana, katakana, kanji, and quiz module

Table 6 *Button Design*

Button	Description	Button	Description
	This lesson button is for the lesson module.		This is the back button in the Notes interface.

Table 6: Button Design (Cont.)

	This Quiz button is for the lesson module.		This is the next button in the Notes interface.
	This Play Game button is for the lesson module.		This is the home button.
	This is a categorizing button for the lesson Topic.		This is the Retry button.
	This is categorizing button menu for Quiz Topic.		This is the back button.
	This is a sub-menu button.		This is the exit button.

3.4 Develop Main Functions

In this stage, the implementation of application development is discussed. There are two major parts: the first part is asset development, and the second part is integrating the developed assets to implement the main functions in Unity using C# scripts. The designed buttons and interface are crafted using the free resource website Canva and self-made illustrations using the ibisPaint Application, ensuring originality and high-quality elements customized for user interactions. Table 7 below shows the process of making the assets for the developed applications.

Table 7 Application Assets Development

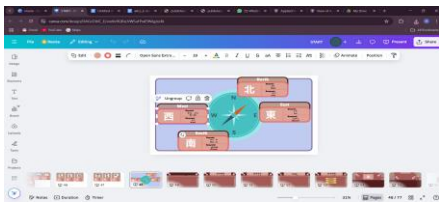
Materials	Development	Description
Graphics illustration	 	The components for buttons and background interfaces are designed using Canva, with a simple shape, combined shapes, and some illustrations to make the interface more appealing and clearer. A mascot is drawn using the iPaint app. And then transferred into the Canva website as an element of the main background.

Table 7: Application Assets Development (continued)

Interfaces		The developed assets are transferred into Unity to create the UI for the applications.
Audio		The audio for pronunciation is recorded using a mobile phone, then transferred into Unity as an Audio component.

Next, the second part is integrating the developed assets into the main functions, using C# scripts. The essential parts of the integrating script to the component, which are the quiz function and the hidden game object functions, are shown in Table 8.

Table 8 Integration in Unity with Scripting

Materials	Development	Description
Quiz Manager	<pre> void SetQuestion(int questionIndex) { questionText.text = shuffledQuestions[questionIndex].questio nText; foreach (Button r in replyButtons) { r.onClick.RemoveAllListeners(); } for (int i = 0; i < replyButtons.Length; i++) { replyButtons[i].GetComponentInChildren<T ext>().text = shuffledQuestions[questionIndex].replies [i]; int replyIndex = i; replyButtons[i].onClick.AddListener(() => CheckReply(replyIndex)); } } </pre>	The SetQuestion(int questionIndex) is used in Unity to set the question text, clear previous listeners, and set answer choices without setting up a new scene for on question interface.

Table 8 : Integration in Unity with Scripting (cont.)

Hidden Game Object	<pre> public class ClickControl: MonoBehaviour { public static string obj_name; public GameObject obj_txt; //Start is called before the first time frame update private void Start() { } //Update is called once per time private void Update() { } //Catch the mouse down event and do some stuff private void OnMouseDown() { //Link the object and the text obj_name = gameObject.name; //Debug.Log (obj_name); //Destroy the object and the text Destroy(gameObject); Destroy(obj_txt); } } </pre>	The clickControl class controls the behavior of the objects when clicked. Which is responsible for making the objects disappear when the user clicks. It also records the object's name before deletion.
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3.5 Testing

The final stage of the MMCD approach is testing, which involves functional testing, user acceptance testing, performance testing, and bug fixing. This stage is very crucial, as it determines the functionality of the applications for the user's acceptance. This stage also involves alpha and beta testing to ensure the applications meet their requirements and intended objectives and function effectively. The alpha testing will be conducted in a controlled environment to determine any critical problems in the initial stages of the development process.

3.5.1 Alpha Testing

The alpha testing is conducted before the real products are fully developed. The testing purpose is to ensure all functional features of the application are functioning well before the official version is released to external users. The testing covers all the functionalities of all multimedia elements that were used to develop the application, such as buttons, audio, and navigation. Table 9 shows the results of the functionality of the E-Jisho application.

Table 9 Functionality testing results

Test	Expected result	Actual Result	Corrective Action
Lesson button	Navigates to the Lesson sub-menu interface.	Works well as planned	Not Required
Quiz button	Navigates to the Quiz sub-menu interface.	Works well as planned	Not Required

Table 9: *Functionality testing results (cont.)*

Hiragana Lesson Button	Navigates the user to the Hiragana interactive notes interface.	Works well as planned	Not Required
Katakana Lesson button	Navigates the user to the Katakana interactive notes interface.	Works well as planned	Not Required
Kanji lesson button	Navigates the user to the Kanji interactive notes interface.	Works well as planned	Not Required
Greetings lesson button	Navigates the user to the Greetings interactive notes interface.	Works well as planned	Not Required
Hiragana Quiz button	Navigates the user to the Hiragana quiz question interface.	Works well as planned	Not Required
Katakana Quiz button	Navigates the user to the Katakana quiz question interface.	Works well as planned	Not Required
Kanji Quiz button	Navigates the user to the Kanji quiz question interface.	Works well as planned	Not Required
Greetings Quiz button	Navigates the user to the Greetings quiz question interface.	The navigation is misplaced in the Greeting lesson scene.	Ensure the Scene order written in the scripts is correct.
Home button	Navigates the user to the main menu interface	Works well as planned	Not Required
Answer button	Invoke a function in scripts to increase the score if correct and null the score if false.	Works well as planned	Not Required
Audio button	Playing a sound when clicked.	Some of the buttons do not play with the correct sounds of pronunciation.	Rechecked the audio attachment in the Inspector section of Unity.
Quit Game button	Navigates the user to the main menu after finishing the gameplay	The button does not react when clicked.	Fix the Button component OnClick () consists of the Scene Button Script function.
Retry button	Restart the quiz question when clicked	Works well as planned	Not Required

3.5.2 Beta Testing

The beta testing is conducted after the functionality test is done. The beta testing is carried out by involving target users, who are JLPT N5 students and people who do not have any basic in the Japanese language but plan to or want to learn Japanese. This testing is to gain feedback and opinions on the proposed application. The data obtained will be recorded and evaluated for the user acceptance test. Due to difficulties of time and place of the target user, a questionnaire was constructed in Google Forms and distributed through social media platforms. The applications are also formed in apk.file and shared through the Google Drive platform, for the target user to download the application on their own devices. At the end of the beta testing, a total of 30 responses were recorded. The Google Form was constructed with 10 questions on the Likert scale of 1 to 5, where 1 is Strongly Disagree and 5 is Strongly Agree.

Meanwhile, beta testing is performed involving JLPT N5 students and some beginner learners. The student's interaction with the application is a crucial part of evaluating the usability and effectiveness of the application to target users. After finishing the application testing, the user testing System Usability Scale (SUS) is distributed to collect feedback on their experience and satisfaction. Through the scoring evaluation, collected. E-Jishou scoring SUS as 56.33%, which indicates this application is acceptable but has room for improvement.

4. Results and Discussion

This section provides the data and analysis of user acceptance testing results collected by using the System Usability Scale (SUS) that is carried out through distributing the questionnaire to social media platforms, as most of the target users are outside the University area. Based on the industry standard, the average score to get a grade is 80.3 or above, for an average score is 68 for Grade C, and a score below 51 below which is Grade F, indicates poor usability.

Figures 4 (a) and 4 (b) show the results of the System Usability Score. In Figure 4(a), the first question is "I think that I would like to use this system frequently." Most respondents gave a positive response—13 agreed, 9 were neutral, and the rest disagreed. This suggests that users find the E-Jishou interface user-friendly and easy to understand. For the second question, "I found the system unnecessarily complex," responses were mixed. 11 respondents disagreed, 10 were neutral, and the rest found it complex. This is expected, as the gameplay module is difficult for some users, especially those who cannot read Hiragana, Katakana, or Kanji, and because instructions in this module are minimal. The third question, "I thought the system was easy to use," had mostly positive responses, with only 4 respondents disagreeing. This shows that the system is generally seen as easy to use. For the fourth question, "I think that I would need the support of a technical person to be able to use this system," most respondents said they didn't need help, though a small number felt they did. The fifth question, "I found the various functions in this system were well integrated," had strong agreement (14 respondents), with 13 neutral and only 3 disagreeing.

In the sixth question, about system inconsistency, most respondents disagreed, though 14 were neutral. This may be due to missed issues during alpha testing, like buttons that didn't work properly. For the seventh question, "I would imagine that most people would learn to use this system very quickly," responses were mostly neutral. 11 agreed, while 5 disagreed. The high number of neutral answers might suggest that first-time users found it confusing due to limited instructions. The eighth question, "I found the system very cumbersome to use," received mixed feedback. 11 disagreed, 10 were neutral, and 9 agreed. This shows that while some features work well, others—like the quiz module with time limits—may be frustrating. The near-equal responses suggest that while some users find it difficult, others do not, and the system is generally adaptable. For the ninth question, "I felt very confident using the system," 14 agreed, 13 were neutral, and only 2 disagreed. Overall, feedback is positive, but the high neutrality indicates users understand the system but are not completely confident with all features. Some content may feel overwhelming, but still learnable. The final question, "I need to learn a lot of things before I can get going with this system," had more negative responses. Many users felt they needed to learn a lot before using the app, while fewer disagreed or were neutral. This may be because some users were unsure if the question referred to the system itself or the Japanese content, especially since not all respondents are actively learning Japanese. This suggests that adding a help button or guidance feature could help users understand the system better.

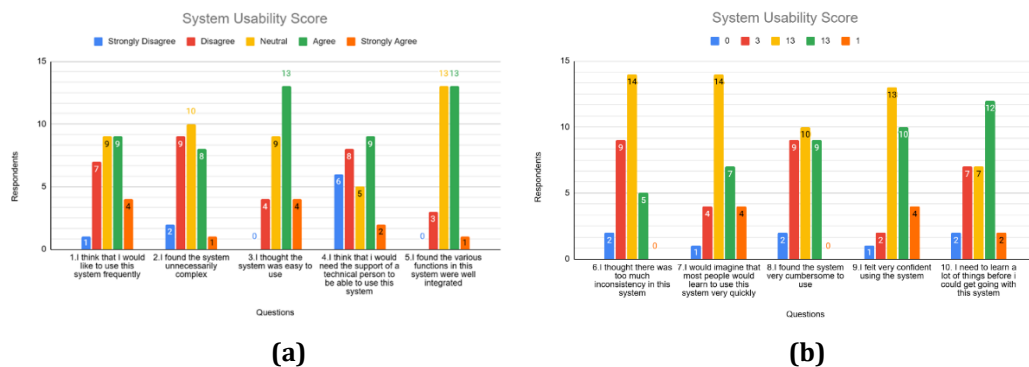


Fig.4 (a) Analysis of System Usability Scale from Question 1 to Question 5 (b) Analysis of System Usability Scale from Question 6 to Question 10

Table 6 Respondent's SUS score

Respondents	Questions										Score
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	
R01	5	1	4	1	3	2	5	2	4	2	82.5
R02	4	2	4	1	4	3	3	2	4	4	67.5
R03	2	2	4	4	3	3	4	4	3	4	47.5
R04	4	2	2	4	2	4	4	3	3	4	45
R05	5	1	4	4	4	2	5	1	5	2	82.5
R06	4	3	4	1	4	3	4	2	4	2	72.5
R07	3	2	5	3	4	1	3	2	5	3	72.5
R08	2	2	4	5	3	2	3	4	3	4	45
R09	2	4	2	3	3	3	3	3	3	3	42.5
R10	4	3	4	2	4	3	2	4	3	1	60
R11	2	5	2	5	3	4	1	3	1	4	17.5
R12	4	2	5	1	5	1	4	2	4	1	87.5
R13	3	4	3	4	3	3	2	4	3	4	37.5
R14	3	2	3	4	2	4	2	3	4	4	42.5
R15	4	3	4	1	3	2	4	3	5	5	65
R16	2	2	4	2	3	2	4	3	4	2	65
R17	3	4	4	2	4	3	3	3	4	3	57.5
R18	4	4	5	3	4	2	5	1	5	4	72.5
R19	3	4	3	4	3	3	3	4	3	4	40
R20	3	3	3	3	3	3	3	3	3	3	50
R21	5	3	3	2	4	2	3	4	4	2	65
R22	3	4	3	4	3	4	3	4	3	4	37.5
R23	3	3	3	4	4	3	5	3	3	3	55
R24	5	3	4	2	4	3	2	4	3	2	60
R25	2	4	4	2	3	4	3	2	3	3	50
R26	1	3	3	4	4	3	3	4	2	3	40
R27	2	4	2	3	3	3	3	2	4	2	50
R28	3	3	4	2	4	3	3	2	4	4	60
R29	4	3	3	2	2	2	3	3	3	5	50
R30	4	2	5	1	4	2	4	2	2	4	70
Average											56.3

The formula was applied to get usability results based on the SUS, as follows:

$$\text{Total Score} = (\text{odd items} + \text{even items}) \times 2.5$$

$$x = \text{Odd items (Q1, Q3, Q5, Q7, Q9)} = \text{sum} - 1$$

$$y = \text{Even items (Q2, Q4, Q6, Q8, Q10)} = 5$$

$$\frac{82.5+67.5+47.5+45+82.5+72.5+72.5+45+42.5+60+17.5+87.5+37.5+42.5+65+65+57.5+72.5+40+50+65+37.5+55+60+50+40+50+60+50+70}{30} = 56.33$$

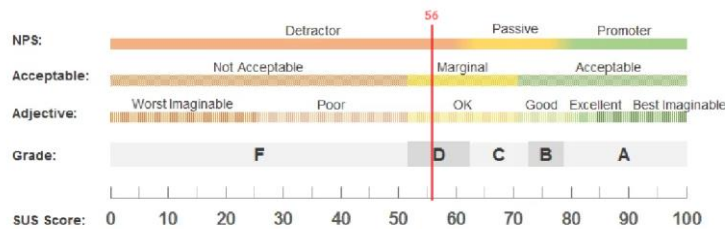


Fig.5 The scale of SUS Score [16]

Based on the Table 6 and using the formula, the average usability score is 56.33. According to Figure 5 this score falls within the “Marginal” range, meaning the system is just usable but still needs improvement. For the adjective rating, a score of 56 is in the “OK” zone, which reflects an average experience—neither very good nor very bad, and not particularly frustrating or satisfying. However, in terms of the Net Promoter Score (NPS), a score of 56 is in the “Detractor” range. This indicates user dissatisfaction, suggesting that most users are not likely to recommend the system to others. This result shows that the system needs clearer and more detailed guidelines to help users understand how to use it properly.

One reason for the low score may be the lack of clear instructions in the system. Another possible factor is that some users had no prior knowledge of the Japanese language but still wanted to use the app. As a result, they may have found the content difficult to understand, especially since understanding the Japanese writing system is important for using the app effectively. The results suggest that the application is usable, but several areas need improvement. Some users found the app somewhat easy to use and felt fairly confident, but also reported issues such as complexity, the need for technical support, and the need for learning resources to help them use the system better.

5. Conclusion

The development of E-Jisho applications comes to an end as soon as the testing phase is finished. Based on the results of the user acceptance test, the proposed application is able to score 56.33, which is placed in the Marginal scale, indicating the application is neither bad nor good but acceptable. In conclusion, the development of the E-Jisho successfully met all the objectives of the project. The testing conducted on the target user found that, by using this application, users can apprehend the vocabulary that is often use in the JLPT N5 syllabus and deepen their understanding of the Japanese writing system. The application is designed to align with the JLPT N5 syllabus, which focuses on Japanese vocabulary. By using the Multimedia Mobile Content Development (MMCD) model, the application was developed as an interactive and accessible tool for Android users. It supports beginner learners through lessons, quizzes, and games.

This application also serves as a helpful medium for practicing and memorizing hiragana, katakana, and beginner-level kanji. The advantages and limitations of the application are identified based on the feedback gathered from the target users during the testing phase and can be referred to in Table 7. Finally, some enhancements to improve the application are suggested in the future work section of the E-Jisho application, in the hope that the application will be useful and better in the future.

Table 7 *Advantages and Limitations of E-Jisho*

Advantages	Limitations
- Alignment with JLPT N5 syllabus.	- Limited user guidance.
- Interactive Learning Features	- lack of English support or pronunciation aids
- Audio pronunciation support	- Lacks self-progress tracking or personalization
- Beginner-Friendly Interface	

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Conflict of Interest

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

Author Contribution

*The authors confirm their contribution to the paper as follows: **study conception and design:** Hasnifa Syarmilla Omar, Noraziahtuhidayu Kamarudin; **data collection:** Hasnifa Syarmilla Omar, Noraziahtuhidayu Kamarudin; **analysis and interpretation of results:** Hasnifa Syarmilla Omar, Noraziahtuhidayu Kamarudin; **draft manuscript preparation:** Hasnifa Syarmilla Omar, Noraziahtuhidayu Kamarudin. All authors reviewed the results and approved the final version of the manuscript.*

An author's name can appear multiple times, and each author's name must appear at least once. For single authors, use the following wording:

The author confirms sole responsibility for the following: study conception and design, data collection, analysis and interpretation of results, and manuscript preparation.

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Appendix A: Summary of The Output of The Five Phases of the MMCD Methodology

Phase	Activities	Outcomes
Application Idea Creation Stage	Identify issues, objectives, and the scope of the project Identify the initial requirements from the SME Carry out the user analysis Set the project timeline	Project title, background, problem statement, objectives, and project scope. Storyboard User Requirements Hardware and Software Requirements User analysis results Gantt Chart for PSM 1 and PSM 2
Structure Analysis Stage	Analyze the navigation of the application. Analyze the components of the application. Identify	Content Structure Checklist. Object analysis checklist. Content structure, navigation structure, and flowcharts Functional and non-functional requirements.
Process Design Stage	Design the main interfaces Design the buttons Design the character Design the components for lesson modules Write a single function prototype	User interfaces Button and character
Main Functions Development	Chose development tools Integrate prototypes and develop key functions	Integrate assets into Unity
Testing Stage	Conduct usability testing Collect feedback and refine the application	User feedback and testing reports Bug fixes and final adjustments.

Appendix B: SME Interview Transcript

Hasnifa: Good afternoon, Madam Junko Hiyama. I am Hasnifa Syarmilla from the Faculty of Computer Science and Information Technology (FSKTM). I am a degree student at UTHM and currently conducting my final year project, which is to develop a mobile learning application for the Japanese language that focuses on Japanese Vocabulary. I am here today to conduct an interview session with you to help finish this project. Junko Hiyama: Hello, Konnichiwa, you can call me Sensei. I am from Japan and am currently teaching UHB10802 Japanese Communication 1 at UTHM. Hasnifa: Yes, Sensei. The first question for our interview is, what are the best elements that need to be implemented in Japanese language apps? Junko Hiyama: The best element that needs to be considered is language knowledge, which includes vocabulary, grammar, writing, and reading. As you know, in JLPT examinations, the first part is character. Do you know what kind of character is in the Japanese language? Hasnifa: Yes, sensei. It is Hiragana, Katakana, and Kanji. Junko Hiyama: Yes, exactly, and vocabulary. Another one of language knowledge is grammar. So, we need to implement character, vocabulary, and grammar in Japanese language applications. Hasnifa: Alright, so for the next questions, what is the best topic to introduce first for beginners?	Junko Hiyama: Some of you might learn just for the hobby, but for beginners who want to learn Japanese, it's great to focus on reading and writing first. For beginner's learner who wants to take JLPT examinations, they need to have enough vocabulary and grammar knowledge. Hasnifa: Is there any method to memorize the Japanese alphabet? Junko Hiyama: For memorizing the Japanese alphabet, it is good to do some writing and use graphical methods. Usually, I must recommend that my students memorize the character through applications called memory hints. Hasnifa: What is the best way to memorize the alphabet? Junko Hiyama: There are two ways of memorizing the character. The first one is writing, writing many times. Then another one is using images. Hasnifa: Sensei, what is your opinion about using a visual learning style implemented in game-based learning for learning vocabulary? Junko Hiyama: In my opinion, it is a very good idea to implement visual learning to learn vocabulary. For your information, the Japanese are considered visual learners as the characters are depicted in images to help students memorize the characters quickly. So, implementing the same idea for the vocabulary part is a great idea. Hasnifa: I see, so that is the last question for our interview. Thank you for your time, Sensei.
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Appendix C: Storyboard

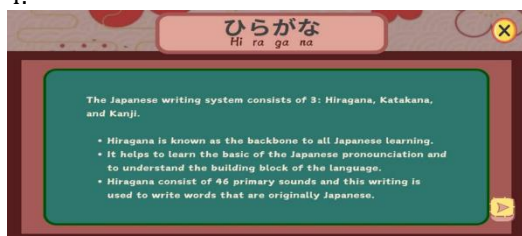
Storyboard	Description
1. 	This is the main menu interface. The main menu interface is constructed with four buttons in total, which are the lesson button, quiz button, and game button. All three buttons are placed in the middle of the interface. The fourth button is the exit button that is placed at the top right corner of the interface.
2. 	This is the topic menu interface for the lesson modules. There are five buttons included in the interface, which are the Hiragana lesson button, Katakana lesson button, Kanji lesson button, and Greetings lesson button. The back button is also provided at the top left corner for the user to quit the interface and back to the main menu interface.

3.



This is the subtopic menu interface for the Hiragana lesson button. Each subtopic menu has a different number of buttons to navigate the user to the respective lesson.

4.



This is the note interface for the Hiragana writing system lesson. The notes interface will give a brief explanation of the lesson topic that the user will learn. Next, a button is provided for the user to change the lesson interface; meanwhile, the cross button at the top right corner for the user to quit the lesson section.

5.



This is the audio interface for the Hiragana lesson. The interface consists of the 46 writing characters with sound attached for pronunciation guidance. It is the last interface for the lesson module. The user can click the button to hear the sounds.

6.



This is the Kanji lesson modules interface, where users can slide to learn each kanji appearance, how to read the kanji, and the meaning of the word.

7.



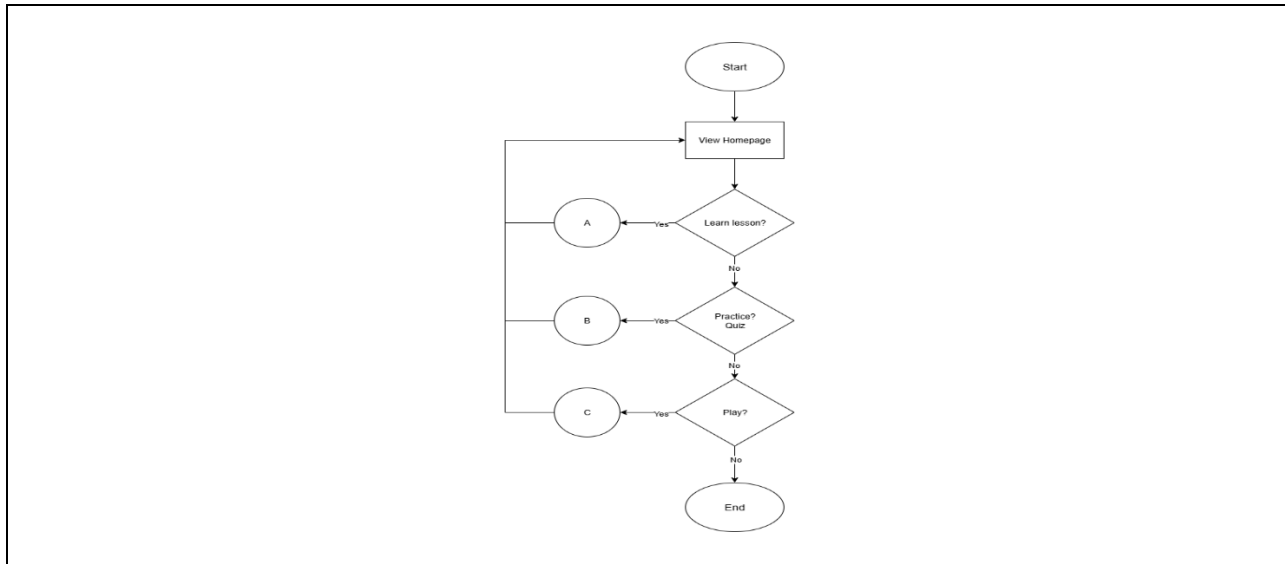
This is the quiz interface for the quiz modules. The quiz interface is designed with four answer buttons, with limited time displayed at the top, and score view at the right corner.

8.

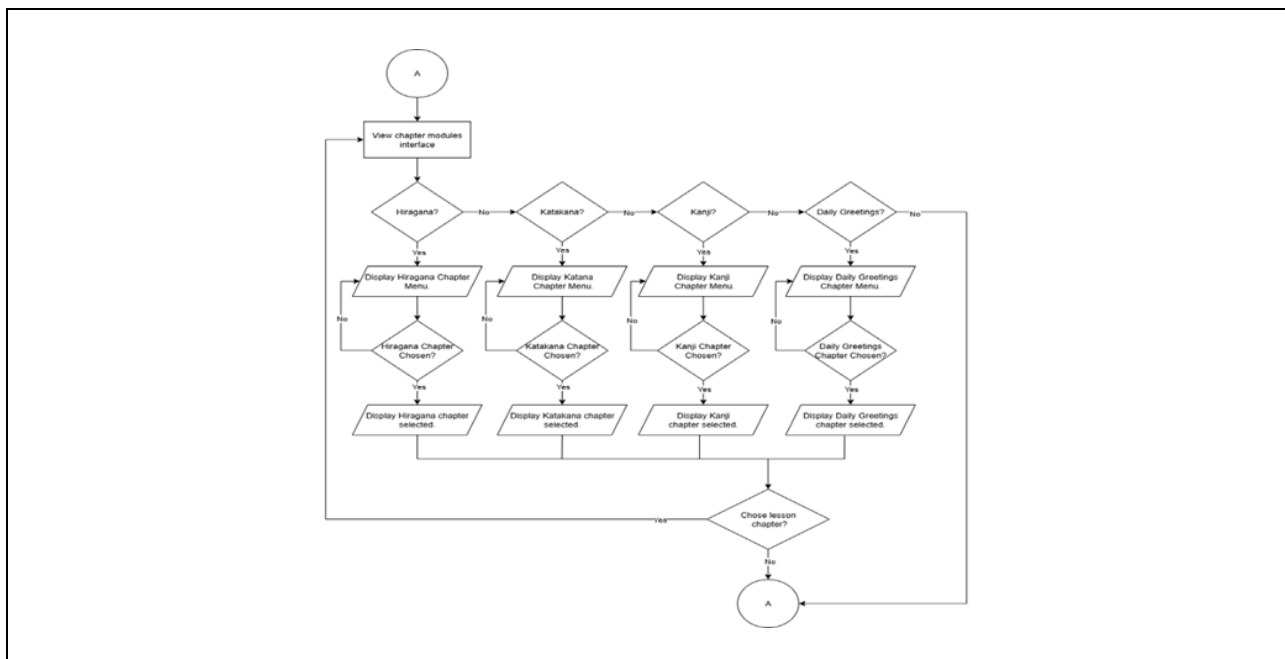


This is the game interface for hidden game object, with the limited time displayed at the middle top, score at the left top corner, and quit button at the right top corner. The list text for the object that need to be clicked is provided at the right side of the interface.

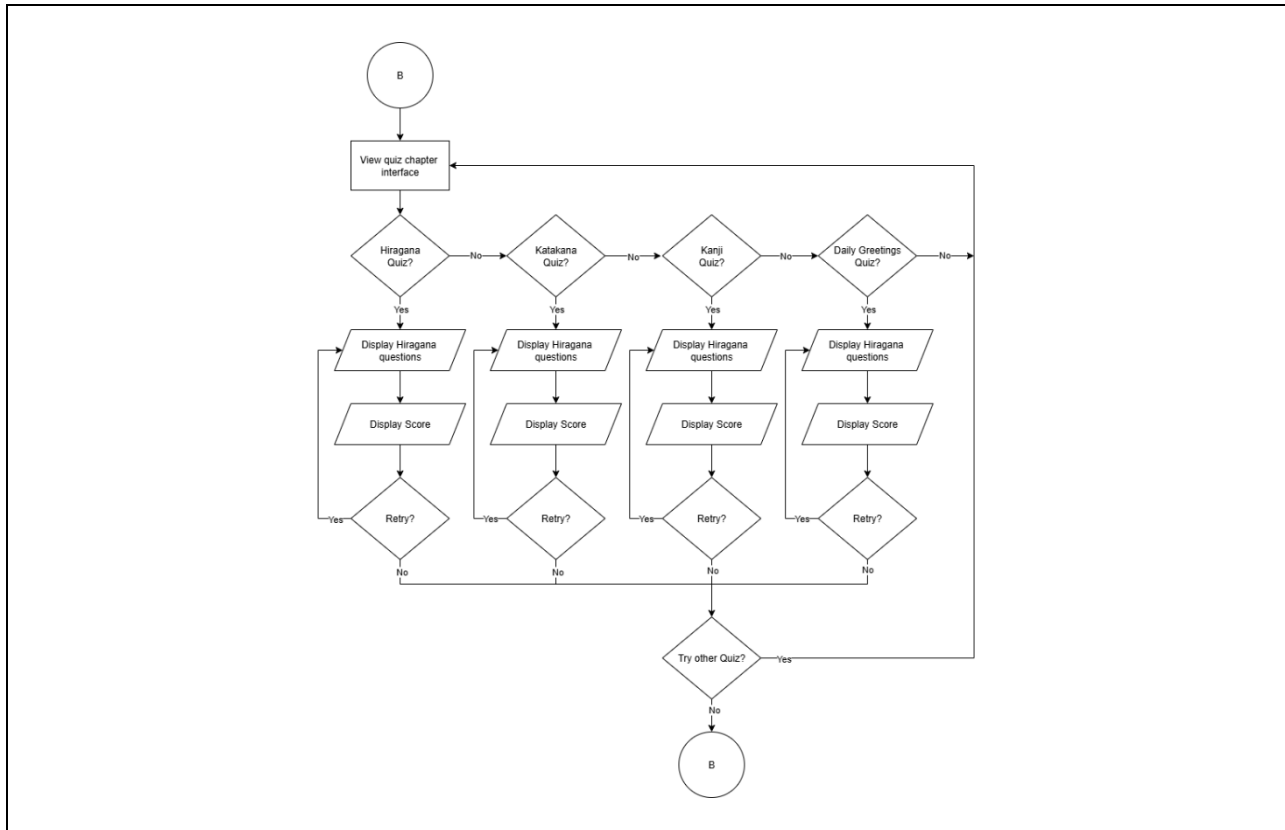
Appendix D: System flowchart



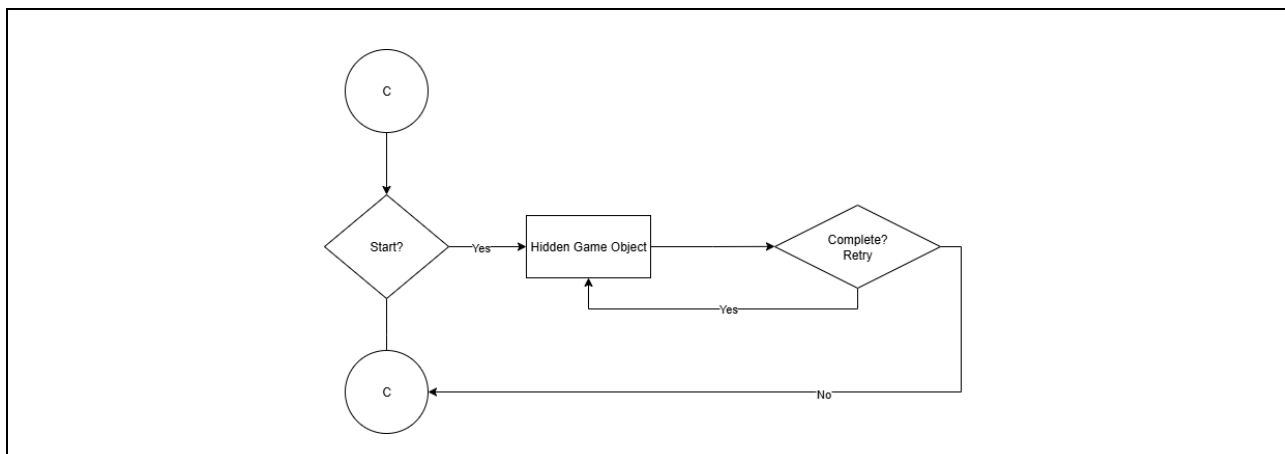
Appendix E: System flowchart of Lesson module



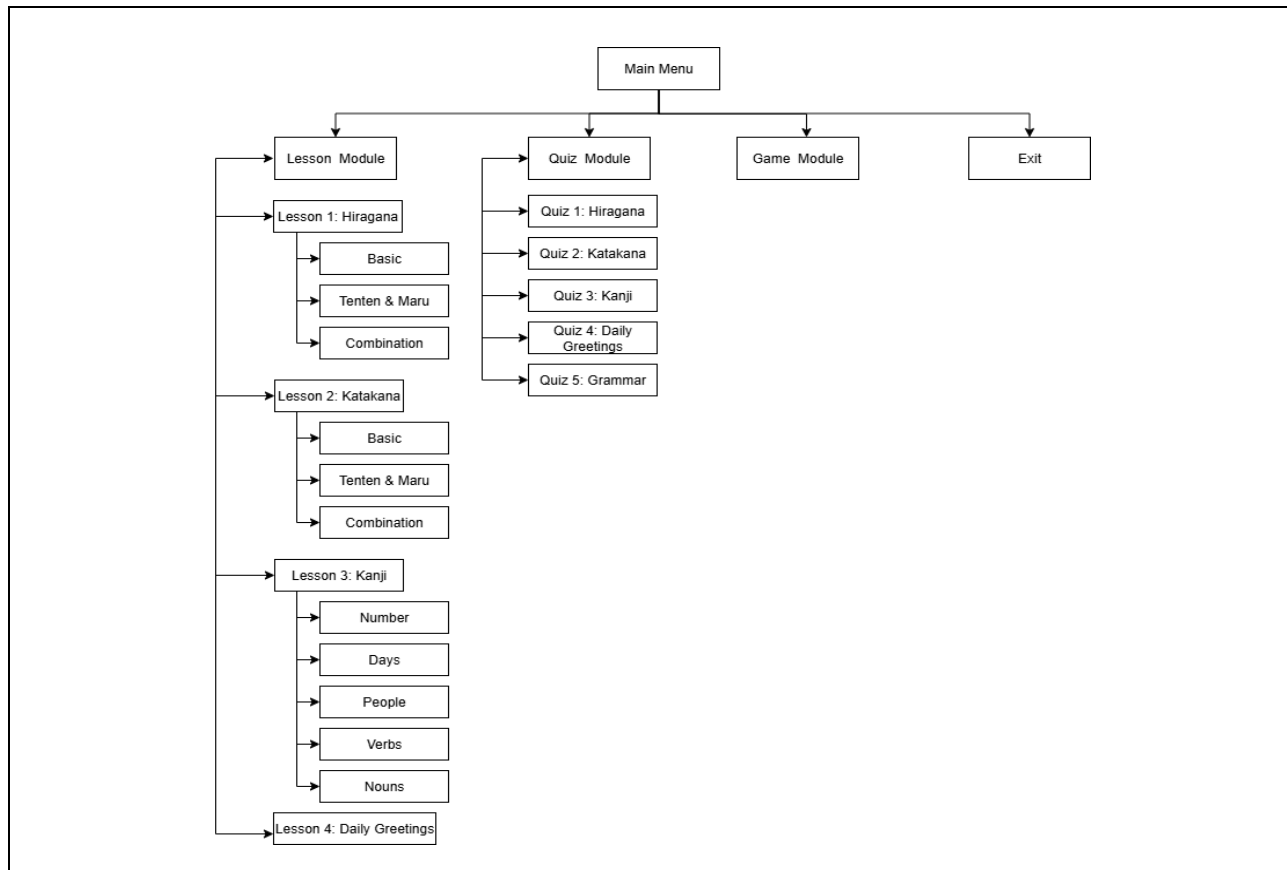
Appendix F: System flowchart of Quiz module



Appendix G: System flowchart of Game module



Appendix H: Navigational Structure



Appendix I: Content Structure

