TRANSFORMING ENGLISH EDUCATION: A GAME-BASED APPROACH FOR ACTIVE LEARNING

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ABSTRACT

New ways to teach and learn this skill are necessary to meet the rising worldwide quest for English fluency. Traditional learning methods, however, do not interest students that much, and the memorization rates and practical use of vocabulary are also quite low. To solve these problems this project comes up with a game-based learning (GBL) approach to facilitate vocabulary learning. Current approaches to language learning suffer from passive and repetitive methods leading to decreased student engagement and retention, which is the real challenge. A user-friendly platform that encourages students to learn through word games and quizzes; a design that provokes students to extend their experience with vocabulary beyond the definitions and into practical application. The development strategy uses the incremental development model which allow the platform be incrementally developed and tested. Unity has been used for the interactive game mechanism design, while Firebase/MySQL has been used for real time Data synchronization. The final realization of this project is an interactive learning game, delivering a more engaging, user-centered and personalized learning experience, that will make the vocabulary memories of users more stable.

1.0 INTRODUCTION

In the current global landscape, English proficiency has become a crucial skill, required across various sectors such as international trade, technology, and cross-cultural communication. As global integration advances, the demand for fluent English speakers continues to rise,

particularly in education, professional settings, and day-to-day interactions. However, traditional methods of English teaching, which often focus on rote memorization of vocabulary and passive learning, have proven ineffective in maintaining student engagement and in facilitating long-term retention and practical use of the language (Kefalis et al., 2020).

To address these challenges, this project proposes the integration of Game-Based Learning (GBL) into English vocabulary instruction. GBL transforms the learning process into an engaging and interactive experience, aiming to enhance student motivation and improve the retention of new vocabulary. By incorporating fun, game-like elements such as quizzes and challenges, students are more likely to remain engaged, thus improving their learning outcomes. The core idea behind GBL is that students become more engaged and motivated when learning is enjoyable and rewarding. This method not only provides instant feedback but also fosters a more hands-on approach to learning, encouraging students to apply vocabulary in real-world contexts. With the rise of digital platforms, GBL has become even more powerful, allowing for personalized learning experiences that adapt to the learner's skill level, further enhancing the effectiveness of vocabulary learning.

This project aims to design an interactive, game-based learning system that makes learning English vocabulary a more immersive and personalized experience. The system will provide real-time feedback, allowing students to actively correct mistakes and deepen their understanding of vocabulary, ultimately promoting long-term retention and practical application.

This report explores the development of an interactive learning platform that incorporates GBL to improve English vocabulary acquisition. The system is designed to offer a user-friendly and engaging interface that motivates students to learn through various game-based activities such as word challenges, spelling tests, and vocabulary drills. The aim is to replace traditional, monotonous learning techniques with a dynamic and student-centered approach that maximizes both engagement and educational outcomes.

2.0 LITERATURE REVIEW

According to the 2023 English Proficiency Index (Clark, R. C. and R. E. Mayer 2023), many countries continue to face challenges in achieving high levels of English proficiency, creating a significant demand for effective English learning tools. As a result, there is growing interest in using English learning applications and game-based learning (GBL) platforms (Hu, G. and S. L. McKay 2012).

English learning software and applications have evolved from simple vocabulary generators into comprehensive learning platforms. These applications now integrate interactive games, quizzes, and conversation practice to engage learners more effectively. The shift from traditional methods to more engaging, technology-driven approaches reflects the changing preferences of global learners. Moreover, as digital tools become more accessible across various educational environments, the market for GBL continues to expand.

The primary users of English learning applications and games are typically young adults and students aged 18-35, constituting a large portion of the user base. Among them, professionals and university students form the largest group, often seeking to improve their language skills for career advancement or academic purposes. Non-native English speakers from regions such as Asia, Europe, and Latin America represent a diverse population eager to enhance their English proficiency.

The main motivations for using English learning applications and GBL platforms are to improve communication skills, vocabulary retention, and overall language proficiency. For both personal and professional reasons, users often turn to these tools to enhance their speaking and writing abilities. In particular, game elements such as role-playing and quizzes help maintain user engagement and reinforce learning through interactive methods (Clark R. C. 2014).

Therefore, the competitive focus in the English learning application market has shifted toward providing high-quality, user-centered experiences. This underscores the importance of enhancing user satisfaction by customizing features to meet the diverse needs and preferences of different learners.

3.0 METHODOLOGY

The development process model suggested for this project is Incremental Development Model. In this approach, the project is divided into smaller increments which are easier to manage. They are developed in a cycle of Planning, designing, implementing, testing and deploying each increment separately. End deliverable is based on multiple levels of delivery, with an increasing level of functionality in each phase thus being more agile to changes.

The following six points are explanations of this model:

Requirements: the project begins by gathering the minimum requirements for the first increment, a key feature needed to move the system to basic functionality. this targeted approach enables you to start development quickly if only the necessary conditions are met.

System Design: this is the initial stage of building the basic architecture and basic functionality of the system. for example, specify a general framework, database, interface, and basic functionality. it features a modular design that includes the option to increase future increments without affecting the core system.

Implementation: the initial increment includes the implementation of basic system functions, including user registration and authentication as well as simple gaming functions. it's about building a working product that can be tested and deployed to get initial feedback.

Testing:the first step is implementation, and then we test for bugs, performance issues, and usability issues. this stage covers the main features of the system to verify that the basic functionality is reliable.

Deployment :The first increment is then deployed into the real environment, but with limited capacity. here, stakeholders can experience the system working, but still in a fairly early version, and provide feedback. you deploy at an early stage and it allows you to detect major issues so that when scale arrives(Kumar 2023).

Maintenance:Following the release of the first increment, hardly any maintenance is needed for bug-fixing and performance testing during initial use(Roger & Bruce 2015).

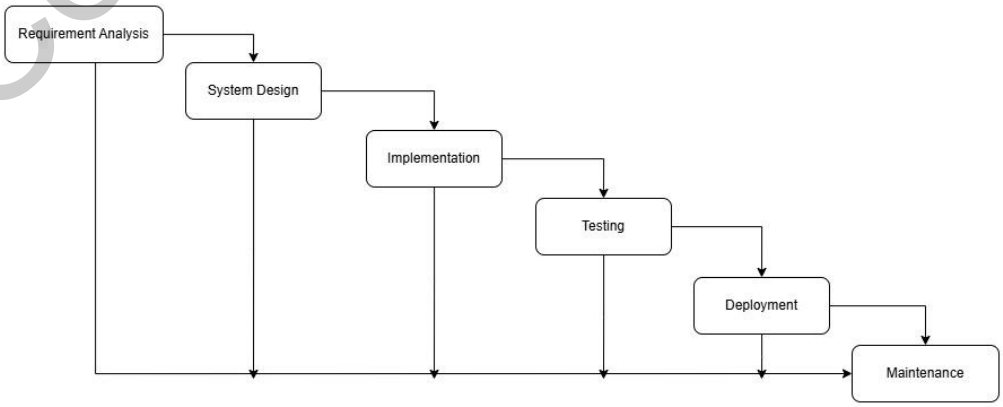

Figure 1 Incremental Development model

As shown in Figure 1, the Game-Based Learning Platform WBS working group. This method divides the project into six phases: Requirements, System Design, Implementation, Testing, Deployment and Maintenance — each of these phases is then further divided into its own set of tasks. This is to visualize the structure of the project, which helps us each task effectively.

4.0 RESULTS

4.1 Application Development

This system is developed using the Unity engine, which is a widely used platform for interactive game development and follows the MVC architecture to ensure clean code structure and maintainability. Firebase and MySQL Database are used to store relational data and synchronize data in real-time, thereby creating the functionalities of learning words and word challenges. Widely usable by students from different age groups.

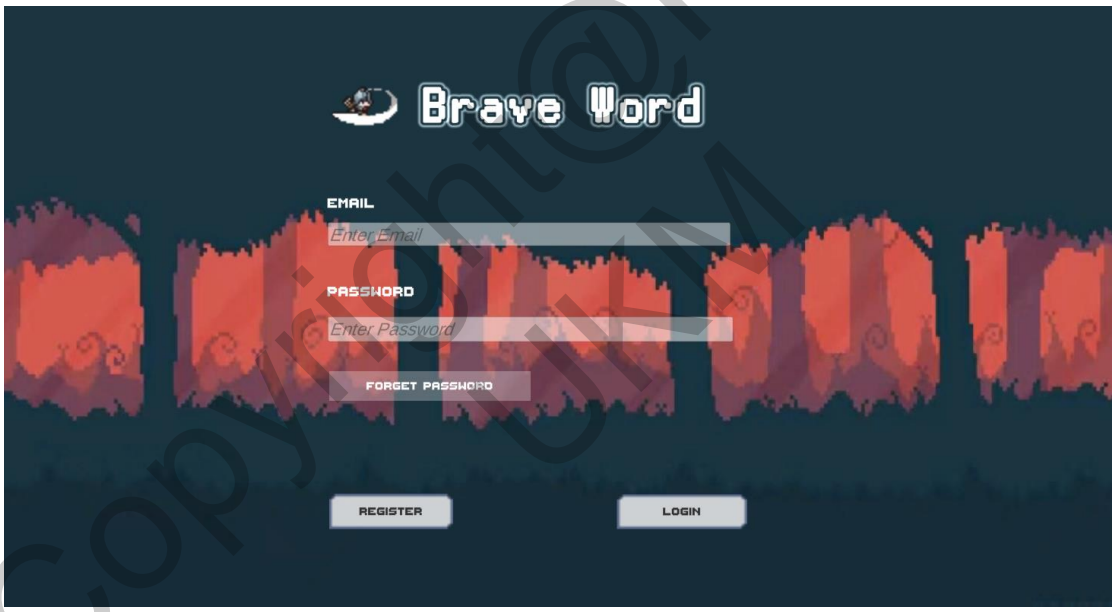

Figure 2 Log page and Signup page

This interface is the login page for the English vocabulary learning game. Users can log in by entering their email address and password, provided they are registered. If the user is not registered, they need to go to the registration page, where they must fill in their username, email, and password. If the user forgets their password but their account has been registered, they can click the "Forgot Password" button. The system will guide the user to the password reset page to assist with resetting their password.

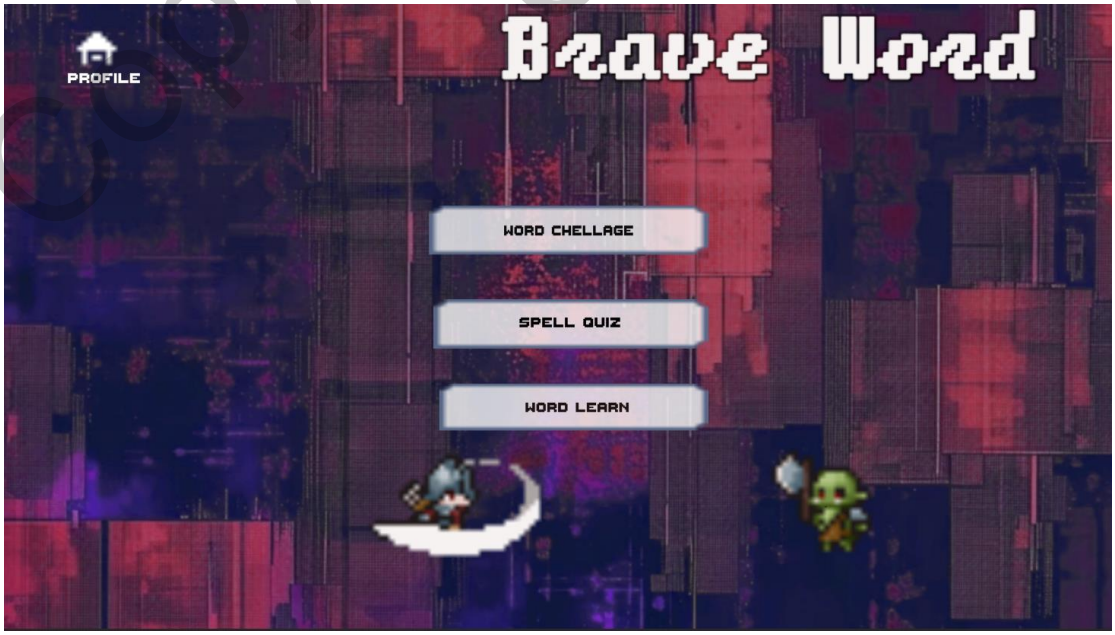

Figure 3 Game main page

Then we enter the main page of the game. On this page, there are four main functions. In the upper left corner is the user interface, where users can click to enter their own information page. In the middle of the interface are the important modules of the game, namely the Word Challenge, Word Learning and Spell Quiz modules.

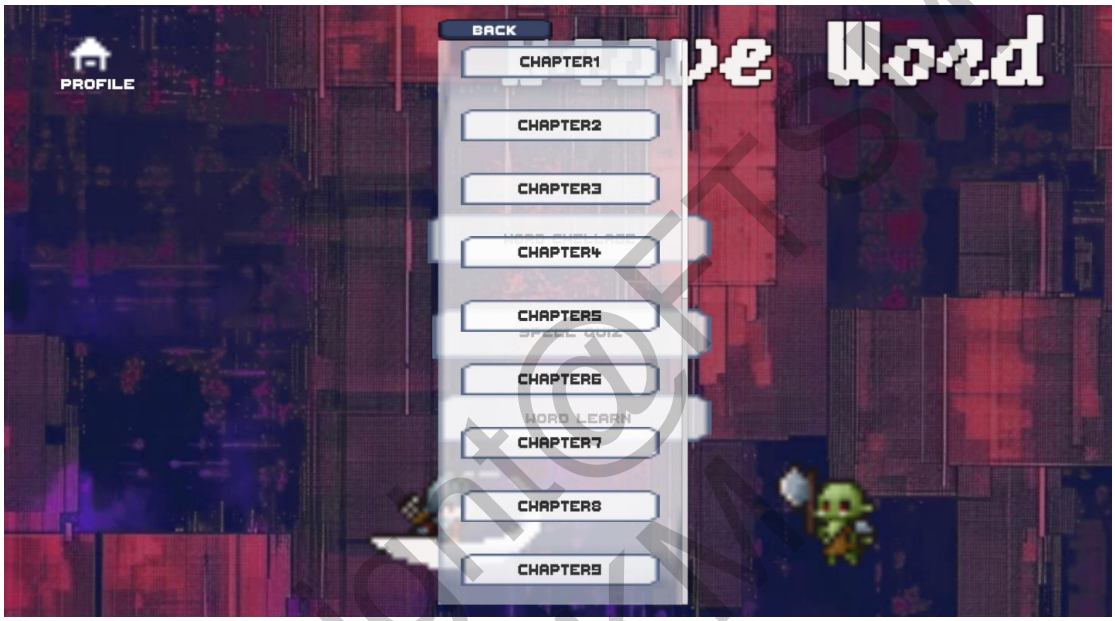

Figure 4 Word learning level page and Word challenge level page

When clicking on the Word Challenge and Word Learning modules on the homepage, the first thing that comes up is the level page. Both of these modules divide words by chapters. Word learning is carried out by entering different chapters. What needs to be noted more is that Each chapter of Word Challenge and Word Learning corresponds to the same words. Users can first enter the Word Learning page for the initial learning of words, and then return to the main page to enter the same chapter of Word Challenge to reinforce the memory of the words they have just learned.

Figure 5 Word Learning page

Select a chapter from the Word learning level page. What is presented are the words of this chapter, their parts of speech, meanings, and related example sentences. Users can click "next" to move to the next word, or click "back" to the previous word. In this way, users can navigate between words. Until you have learned the words of this chapter, click "Finish" and return to the homepage.

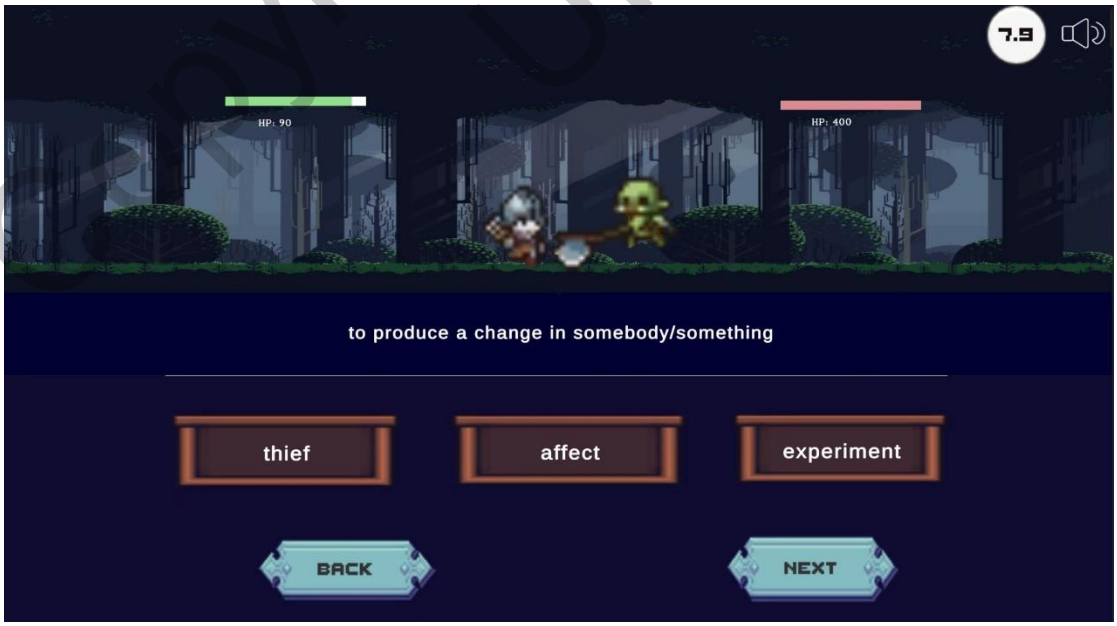

Figure 6 Word Challenge page

Figure 7 Word Challenge win page

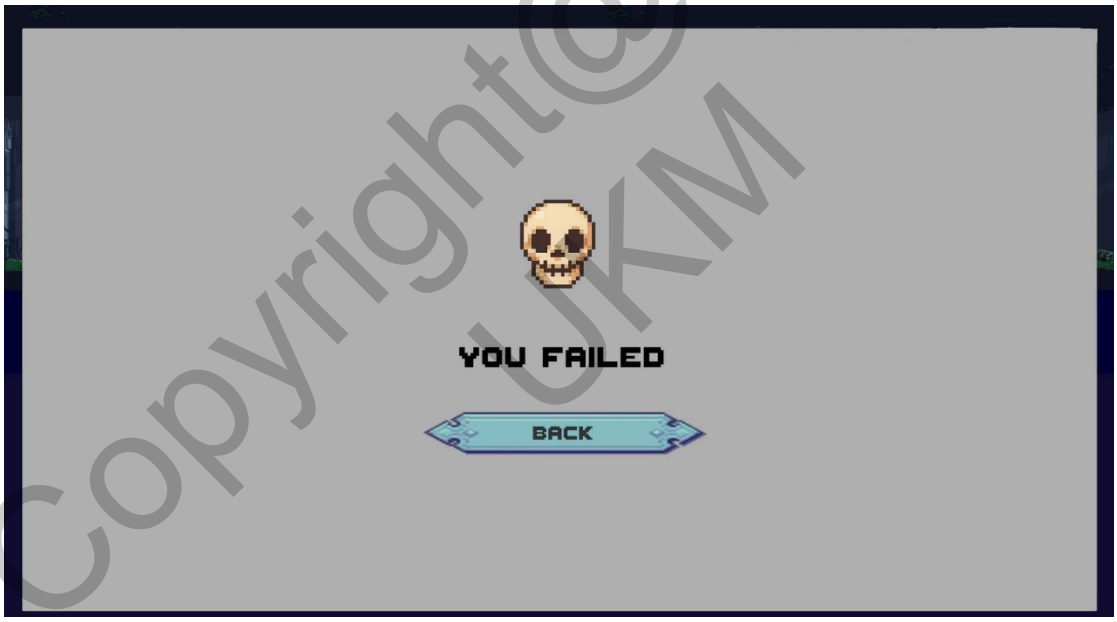

Figure 8 Word Challenge Failure page

Select a chapter from the Word challenge level page and enter the Word Challenge page. This is a game where you can win by attacking the opponent. If the health bar above the opponent's monster reaches zero, the game is won. However, when the protagonist's health bar reduces to zero, the challenge is regarded as failed. The user needs to see the word meaning above and quickly react by selecting the corresponding word below. Each question is limited to ten seconds. If the user cannot answer it, they can click the "next" button. In this way, the system

will automatically determine that the question is answered incorrectly, and they will be attacked by the monster on the opposite side. When the challenge is successful, the system will display a success page. If the challenge fails and the protagonist dies, the system will also display a failure page. The sound switch in the upper right corner can control the sound on the challenge page.

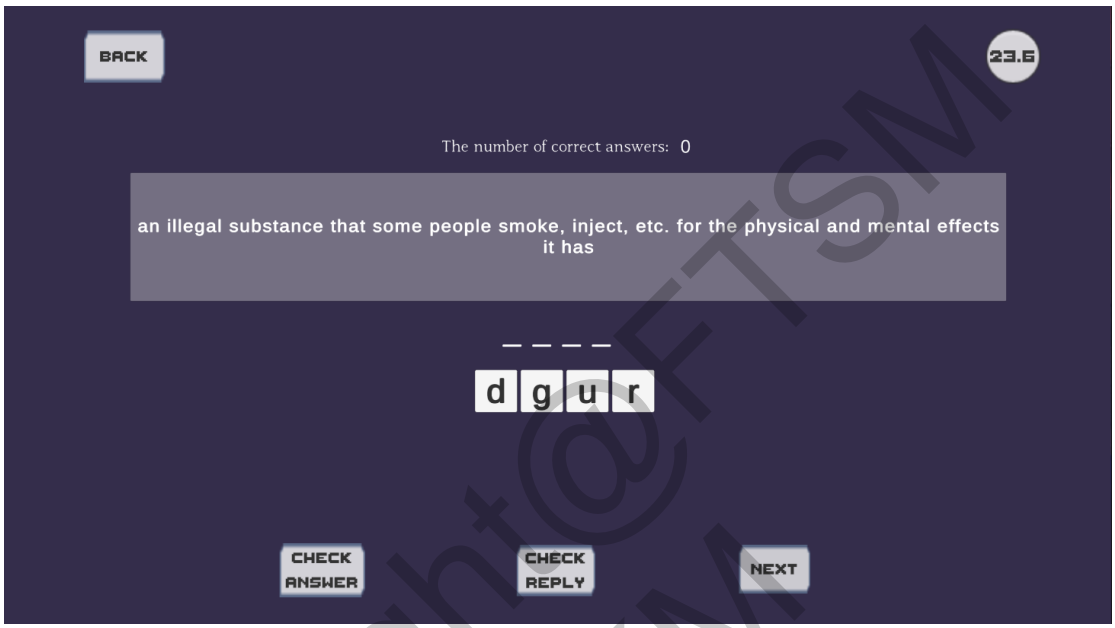

Figure 9 Spell Quiz page

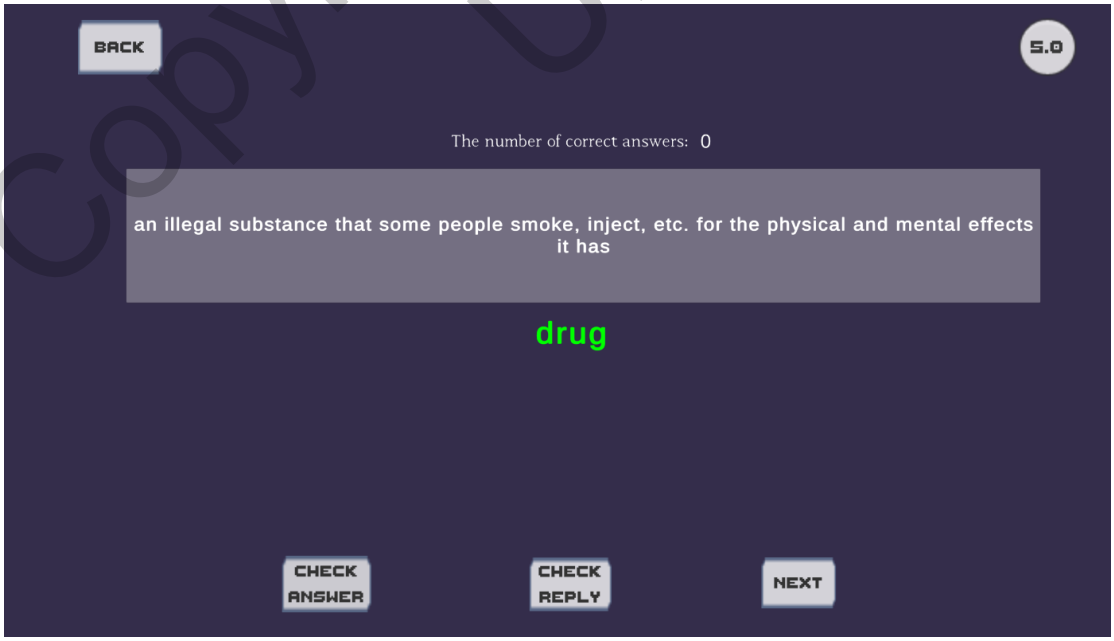

Figure 10 Spell Quiz Correct page

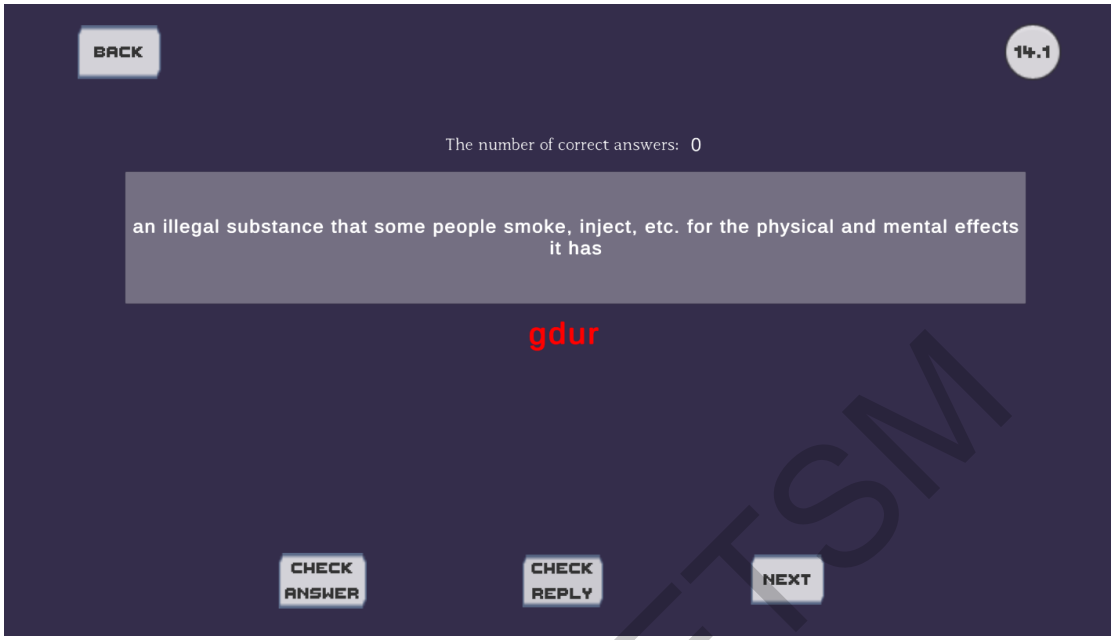

Figure 11 Spell Quiz Error page

The last major module of the homepage is Spell Quiz, which is specially designed for vocabulary learning exercises focusing on word spelling. It provides an interesting and interactive way to learn new words. At the top, there is a definition of a word. Below the definition, users will see a group of out-of-order letters. The number of dashes above indicates how many letters a word has, guiding users to understand the length of the word they need to form. These are hints for the words that users need to spell. Users can rearrange the letters to try to form the correct words. These letters are displayed in blocks and users can interact with them to arrange them in the correct order. The user needs to complete the answer within the time in the timer. Click to check the answer and judge whether it is correct or not based on the color displayed by the words. As shown in the figure, red is the wrong answer and green is the correct one. If the user forgets how to spell the words, they can select the check answer button. In this way, the system will automatically sort the correct answers. Click the "next" button to check the spelling of the next word. The number of words answered correctly can be counted above.

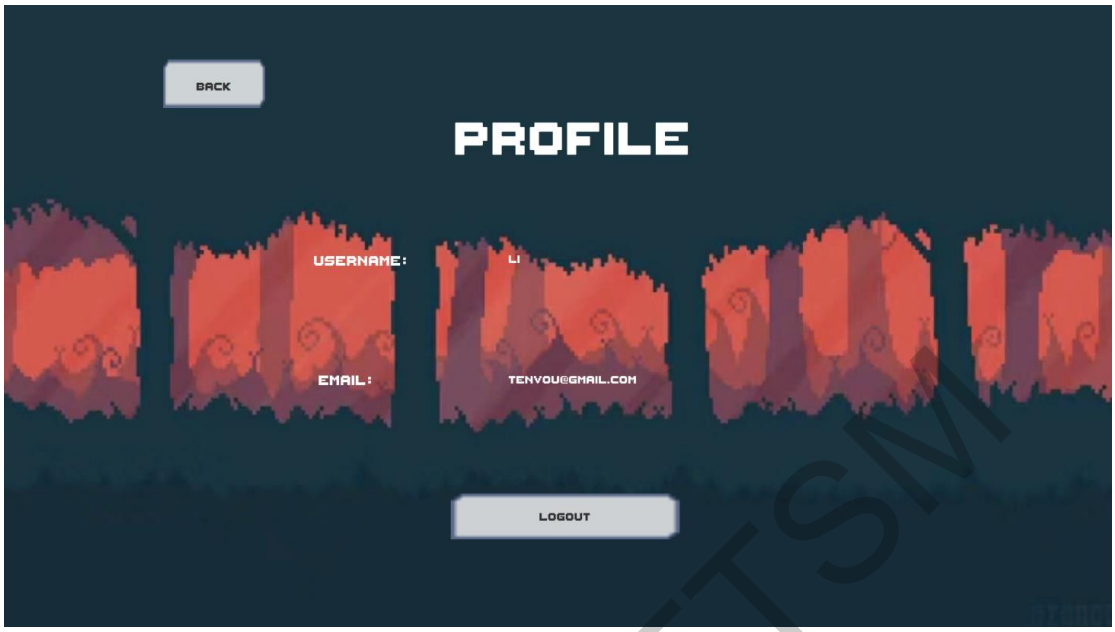

Figure 12 Profile page

Return to the home page and click the profile button in the upper right corner. It will jump to the Profile page, where the user's name and ID can be seen. Click the log out button to go back to the login page.

4.2 Application Evaluation

4.2.1 Software Functionality Test Results

Functional tests use case testing techniques. Through the system test, the application is fully functional to comprehensively verify the module. The function test aims to verify whether each functional module of the platform works as expected, and ensure that the system can meet user needs ad business goals. Testing focuses on the accuracy of the input and output of the system and does not require knowledge of the internal implementation details of the application.

Table 1 Software Functionality Test Results

Test ID	Description	Steps	Expected Result	Status
UAT-01	Test if the user can successfully log in.	1.Open the login page. 2.Enter a valid email address.	The user can log in successfully and enter the	Pass

		3.Enter the correct password. 4.Click the "Login" button. 5.Verify if the user successfully logs in and is redirected to the main page.	main page.	
UAT-02	Test if the user can successfully register.	1.Open the registration page. 2. Enter a valid username. 3. Enter a valid email address. 4. Enter a valid password and confirm it. 5. Click the "Register" button. 6.Check if the system successfully shows a "Registration Successful" message and redirects to the login page.	The user registers successfully, the system shows a "Registration Successful" message, and the user can log in.	Pass
UAT-03	Test if the forgot password function works as expected.	1.Click the "Forgot Password" link on the login page. 2.nter the email address used during registration. 3.Click the "Submit" button. 4.Check if the system sends a password reset link to the email. 5.Use the link in the email to successfully reset the password.	The system successfully sends a password reset link, and the user can reset the password and log in successfully.	Pass
UAT-04	Verify whether the jump functions of each functional module and navigation button on the homepage are normal.	1. Click the "Profile" button in the upper left corner. 2. Click the Word Challenge button in the middle 3. Click the Spell Quiz button in the middle 4. Click the Word Learning button in the middle	The system redirects to the personal page and displays detailed information. The system jumps to the chapter page of the word challenge and displays all the chapters	Pass
UAT-05	Test if the user can successfully open and navigate to the	1.lect a learning chapter within the vocabulary learning module. Verify if the system successfully loads the chapter's words, parts of	The vocabulary of each chapter is displayed correctly and the data is not confused	Pass

	vocabulary learning chapter page.	speech, and example sentences.		
UAT-06	Test if the user can browse and learn vocabulary smoothly.	1. Enter the word chapter page 2. Select a chapter. 3. Ensure the page correctly loads the words, parts of speech, Word meaning and example sentences for the chapter. 4. Click the "Next" button to check if the next word is loaded smoothly. 5. Click the "Back" button to see if you can switch to the previous word smoothly Click the "Done" button to return to the homepage.	The page should load each word and related information, and the user can smoothly browse and learn the vocabulary.	Pass
UAT-07	Test if the spelling quiz works as expected.	1. Enter the spelling quiz page. 2. The system displays a scrambled word. 3. The user tries to arrange the letters and spell the correct word. 4. Click the "Check Reply" button to verify if the spelling is correct. 5. Click the "Check answer" button to check if the system gives the correct answer. 6. Based on the spelling result, the system should provide feedback on whether the spelling is correct or incorrect. 7. Click the "Next" button to check if the next word is loaded smoothly. 8. Click the "Back" button to see if you can smoothly return to the home page. Check that the countdown in the top right corner is accurate	The system should provide immediate feedback on whether the spelling is correct or incorrect, showing green for correct and red for incorrect. And all the keys, countdown can interact correctly.	Pass
UAT-08	Test whether the user can successfully open and navigate to the	1. Select a challenge chapter in the Vocabulary challenge module. Verify that the system has successfully loaded the game scene, animations, words, and	The vocabulary of each chapter is displayed correctly and the data is not confused. can see the same words you	Pass

	word challenge chapter page.	buttons that require interaction. 2. Select the same chapter in the chapter where you just studied the word, and see if each chapter you studied corresponds to the challenge chapter, and the words in the challenge chapter are the same as the words in the study chapter	just learned in the same chapter of the challenge.	
UAT-09	Test if the user can successfully participate in the game challenge and interact correctly during the challenge.	1. In the "Game Challenge" page, select a challenge chapter. 2. The system loads and displays the challenge game interface, including opponent information, a timer, and multiple-choice questions. 3. Based on the system's prompts, select the correct word or answer. Each question has a 10-second time limit. 4. The system provides real-time feedback based on the user's answer, e.g., reducing the opponent's health if correct, or reducing the user's health if incorrect. 5. Depending on whether the answer is correct or not, the system can display the attack and death actions of the opposite and the player 6. When the user's health reaches zero, the challenge ends, and a failure page is displayed. 7. When the opponent's health reaches zero, the challenge ends, and a victory page is displayed The user can click the "Return to Homepage" button to go back to the main page.	1. The user successfully selects the challenge and enters the game interface. 2. The user can select the correct answer according to the prompt, and the system feedback is correct or wrong in real time. 3. The game can be played according to the health of both sides, until one side's health drops to zero. 4. After the challenge, the system correctly displays the win or defeat page and allows the user to return to the home page. The system should be able to correctly handle answer times as low as 0 seconds or close to timeout.	Pass
UAT-10	Test if the system can correctly	When one party's health reaches zero, the system will display the user's and the other	After the game challenge, the system can automatically	Pass

	submit the results and display the victory or failure status after completing the game challenge.	party's health, determining the outcome of the game. The system automatically submits the challenge result, showing the relevant page (Win Page or Failure Page). When the health reaches zero, the opponent and the user will display a death animation The user can click the "Return to Homepage" button to go back to the main page and check their results and challenge history.	display the victory or defeat page to accurately reflect the challenge result. The user can return to the main page of the platform and continue with other operations.	
UAT-11	Test if the user can successfully log out and exit the system, ensuring all related functionalities work as expected.	Log in to the system and ensure the user is on the profile page. Locate the "Logout" button on the profile page. Click the "Logout" button. Verify if the system logs the user out successfully and redirects to the login page. Check if the login page is displayed, prompting the user to enter the username and password again.	The user successfully logs out, and the system redirects to the login page. The user cannot access the main page or any protected features. And the login page is displayed correctly, prompting the user to enter the username and password again.	Pass

4.2.2 Usability Testing

Non-functional testing uses usability testing methods. Their feedback and suggestions for the game were collected by distributing questionnaires (via Google forms). The goal of this usability testing was to observe the users as they interact with the system and to find any possible pain points in using the system. The tasks were performed by real users — students and teachers, who did such tasks as registering, passing vocabulary quizzes, and moving through levels in the game. All of this was carefully watched for problems, especially relating to navigation and understanding the game flow. They looked at how clear instructions were, how easy it was to recognize key features, and how seamlessly the game flowed between tasks. On completion of the tasks, users were asked to provide feedback via surveys or through interviews, which was crucial to assess their level of satisfaction identify the need for improvement, and assess how fun and facilitating the game was. These insights were used in tandem with the data collected on the platform to iteratively adjust the design to improve

usability and user experience. The game can then be improved by eliminating pain points so that it can be more natural and flow seamlessly, enhancing user engagement and resulting in better learning.

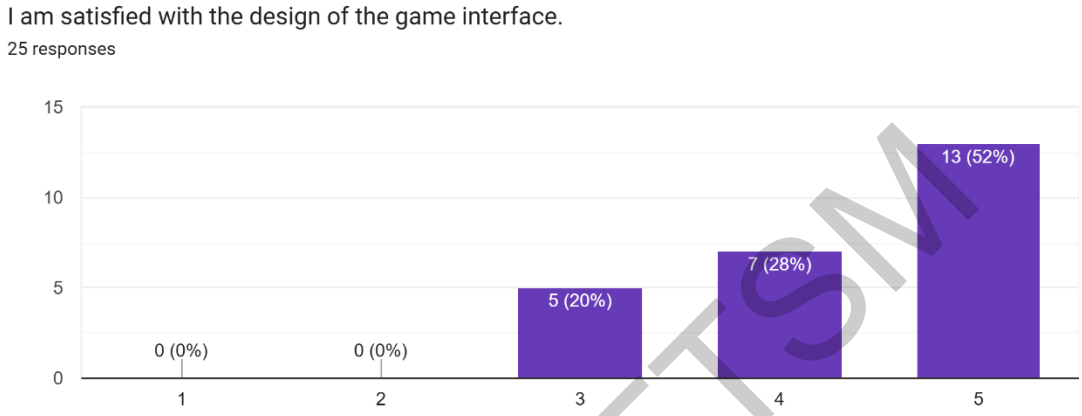

Figure 13 Users feedback

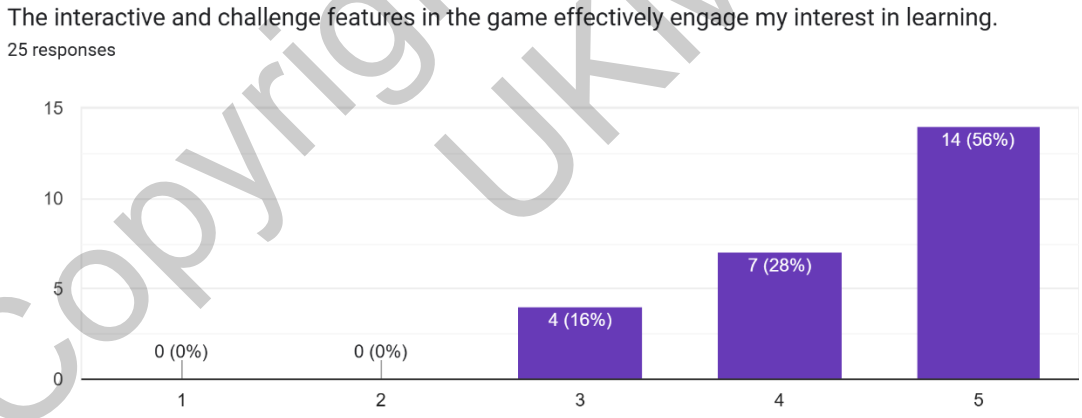

Figure 14 Users feedback

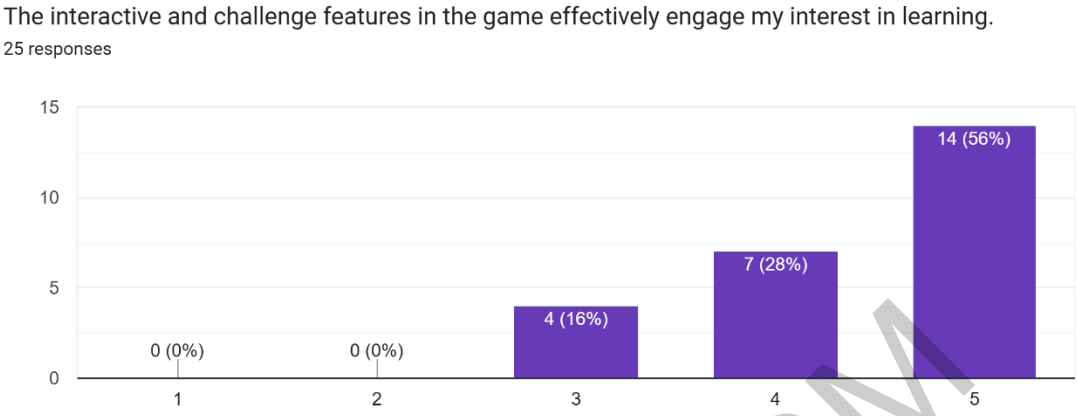

Figure 15 Users feedback

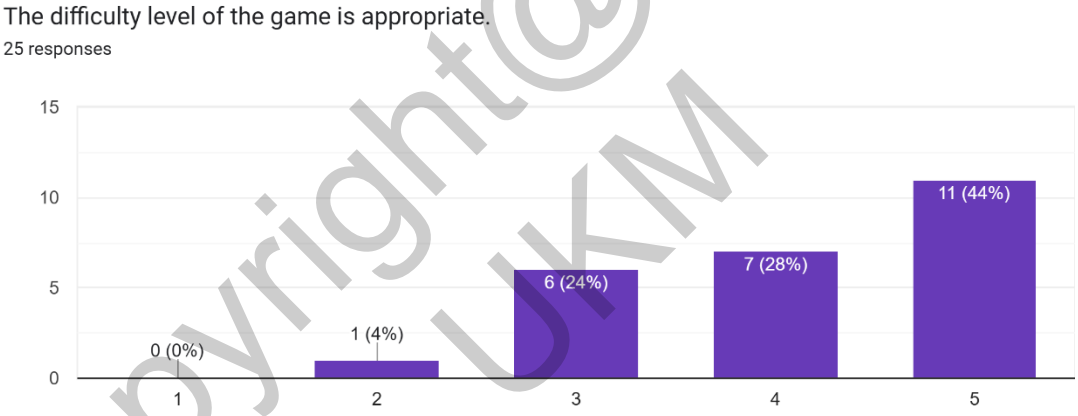

Figure 16 Users feedback

The feedback mechanism in the game (e.g., feedback after correct/incorrect answers) is timely and helpful.

25 responses

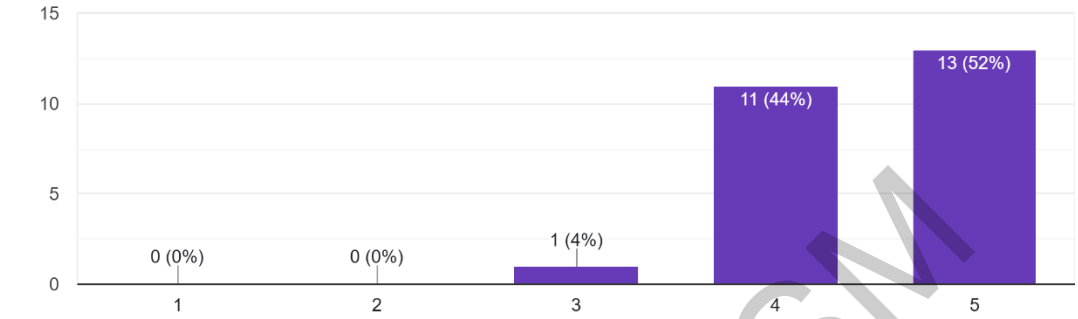

Figure 17 Users feedback

The sound effects and animations in the game help me stay focused and enjoy the learning process.

25 responses

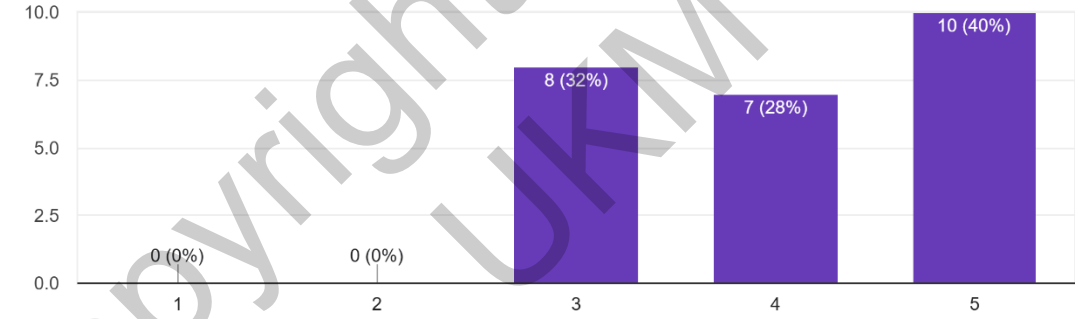

Figure 18 Users feedback

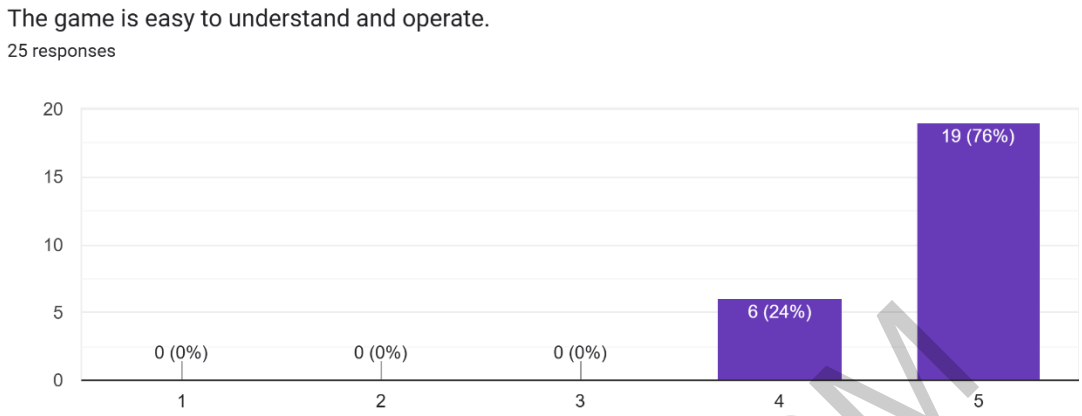

Figure 19 Users feedback

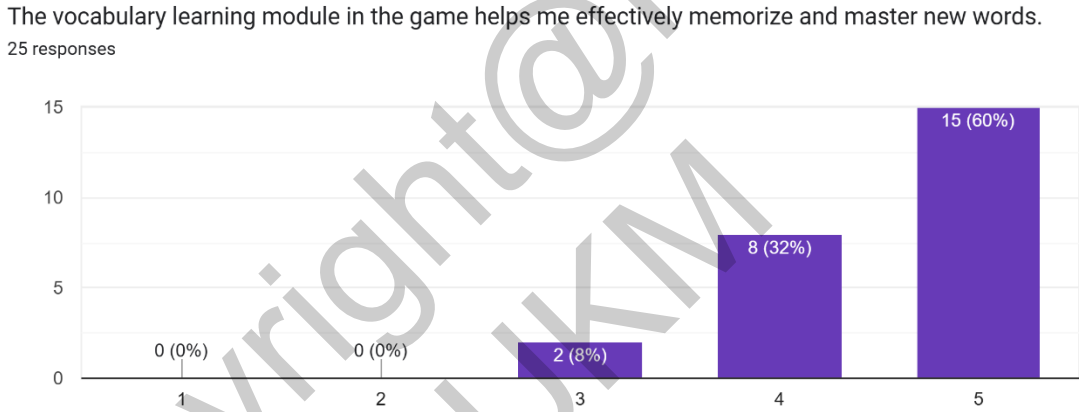

Figure 20 Users feedback

5.0 CONCLUSIONS

In conclusion, this project achieved its primary objective. By combining education with entertainment through the use of Game-Based Learning (GBL), the system provides learners with an interactive, enjoyable, and more personalized language learning experience. The integration of gamification elements—such as point scoring, instant feedback, and adaptive difficulty—effectively enhances student engagement and motivation, which are often lacking in conventional vocabulary learning approaches.

The use of Unity as the game development engine allowed for the creation of a visually appealing and interactive user interface, while Firebase and MySQL were employed to manage

and synchronize user data in real time. This technical architecture ensures that students' learning progress is constantly updated and stored efficiently, allowing for seamless gameplay and data access across different sessions or devices. The system's ability to provide immediate feedback helps students recognize and correct mistakes on the spot, reinforcing memory retention and promoting a more active learning process.

Throughout the project development, several advantages have become evident. The system not only encourages consistent participation from users but also supports a modular learning structure, offering flexibility for students with different learning speeds and goals. Moreover, the use of real-time databases enables dynamic content delivery and supports future scalability. However, the development process also encountered challenges. Limited development time constrained the inclusion of more advanced features, and the complexity of integrating multiple platforms sometimes led to technical issues. In particular, as the number of users increases, potential performance problems may arise, including slow database responses, prolonged loading times, and occasional system lag, especially during data-heavy operations.

Despite these limitations, the project demonstrates significant promise. Future development directions have been clearly identified and include enhancing the platform's social and interactive features, such as implementing leaderboards and achievement systems to encourage peer-to-peer interaction and competition. Additionally, expanding the content to support various levels of word difficulty and incorporating multimedia resources like images or audio can make learning more comprehensive and appealing. Balancing game difficulty is also essential to ensure that learners remain challenged without feeling overwhelmed. Furthermore, the system could benefit from improved analytics capabilities, such as learning progress tracking and personalized feedback based on user data, which would help learners identify their strengths and weaknesses more effectively.

Ultimately, this project has shown the potential of using GBL to transform the way vocabulary is learned, making it more dynamic, efficient, and learner-centered. It provides a practical reference for future educational technology development, especially in language learning, and offers valuable tools for both students and educators. With further enhancement, this platform could be expanded to support a broader range of educational content and serve as a powerful learning aid in academic and self-learning contexts.

6.0 ACKNOWLEDGEMENT

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7.0 REFERENCES

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BORANG PENYERAHAN LAPORAN ILMIAH

SEM 2 **SESI** 2024 / 2025

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Tandatangan (*Signature*): LI XIANGCHE Tarikh (*Date*) : 2025/7/31

Bahagian B: Perakuan Penyelia
Part B: Supervisor's Approval

Saya peraku laporan ini telah disemak dan dibaiki, dan **menyokong / tidak menyokong*** penyerahan laporan ilmiah ini.
*I certify that this report has been reviewed and amended, and **approved / rejected*** the report submission.*

Tandatangan (*Signature*): Tarikh (*Date*) : 05-Aug-2025

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