



GAME FOR EDUCATION

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Thitikan Wanthanakanul

**BACHELOR OF SCIENCE
IN
SOFTWARE ENGINEERING**

**SCHOOL OF INFORMATION TECHNOLOGY
MAE FAH LUANG UNIVERSITY**

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ABSTRACT

This study examines the usability criteria applicable to mobile educational games, with a specific emphasis on the English Vocabularies Game. This study draws upon the heuristics proposed by Nielsen and Molich as a source of inspiration. It aims to identify various issues and obstacles related to user experience and afterwards proposes ideas for improvement. The results of the study demonstrate the significance of integrating usability heuristics into the development of mobile games, since they add to user engagement and enhance learning effectiveness. Rating heuristic principles.

Keywords: Game design, Heuristic evaluation, English vocabulary

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CHAPTER 1

INTRODUCTION

1.1 Background and Problem Definition

The 2D game supports learning by providing an English vocabulary word-matching game that enhances vocabulary retention and practical usage in English language courses. The objective is to enable students to write English words and understand their meanings, facilitating real-life communication.

Currently, we have seen that most students do not score very well on exams.

We assume that most students have problems with their studying. We collect data about student problems. From the data, we found out First place has a problem about learning because they do not understand the content taught, the Second caused by the environment that affects learning, the third because of the duration of the study, etc. We found out most students place great emphasis on technology. Therefore, use technology media to create games to reduce problems and increase student learning efficiency.

1.2 Objectives

1. With the objective of enhancing enjoyment in the English vocabulary learning process.
2. To strengthen spelling skills.
3. To broaden knowledge and introduce new vocabulary.
4. To test the usability and functionality of this game.

1.3 Scope

This project is a game centered around spelling English vocabulary words in a 2D format. The game aims to test high school-level vocabulary proficiency by presenting questions related to the meaning of words.

- Single Player Game play: This game is designed for only one player.
- Levels: There are a total of 5 levels, each named after different countries and featuring vocabulary categories in English:
 1. Thailand: Classroom
 2. Japan: Occupations
 3. Korea: Places
 4. Island: Hospital
 5. Germany: Normal things
- Vocabulary: For this project, we have selected 25 high school-level words, referenced from the Public Education Office database.

1.4 Expected Result

The expected outcome of our final product is that players will find enjoyment while playing our game, even with the incorporation of learning elements. We hope that players will develop spelling skills along with an increased understanding of vocabulary. Additionally, our expectations encompass designing a game that is both engaging and user-friendly.

1.5 Project Plan

Planning	Responsible	Start	End	Days
Create a work plan and create a clear schedule.	Thisana, Kamonchanok, Thitikan	01/01/23	07/01/23	7
Research	Responsible	Start	End	Days
Get requirements about what students are interested in.	Thisana, Kamonchanok, Thitikan	22/01/23	22/01/23	1
Requirement and Analysis	Responsible	Start	End	Days
Analyze student needs from the report.	Thisana, Kamonchanok	23/01/23	30/01/23	8
Design	Responsible	Start	End	Days
English Model Design	Thisana, Kamonchanok	01/03/23	30/03/23	30
Gameplay Design	Thisana, Kamonchanok	01/04/23	30/04/23	30
Environment Design	Thisana, Kamonchanok	01/05/23	30/05/23	30
Level Design	Thisana, Kamonchanok	01/06/23	30/05/23	30
Development	Responsible	Start	End	Days
2D Object	Thisana, Kamonchanok	01/07/23	30/07/23	30
2D Environment	Thisana, Kamonchanok	01/08/23	30/08/23	30
Coding	Thisana, Kamonchanok	01/09/23	30/09/23	30
Testing	Responsible	Start	End	Days
Game Testing	Thisana, Kamonchanok, Thitikan	20/11/23	20/11/23	1
Delivery	Responsible	Start	End	Days
Deliver final product	Thisana, Kamonchanok Thitikan	24/11/23	12/12/23	18

Table 1 Project Plan

1.6 Equipment, Place and Budget

1.6.1 Hardware

Device name DESKTOP-07FMUJC Processor AMD Ryzen 5 3400G with Radeon Vega Graphics 3.70 GHz Installed RAM 16.0 GB (13.9 GB usable)

1.6.2 Software

- Unity
- Textmate.

1.6.3 Place

Mae Fah Luang University

1.6.4 Budget

About 1500 THB.

- 300 THB for Unity book.
- 1200 THB for Unity online course.

CHAPTER 2

LITERATURE REVIEW

This chapter is an introductory chapter on Theory, Foundations of Game-Based Learning, Narrative centered learning, and Related Work that tells you how the game will turn out. Developed using what tools? and game style.

2.1 Theory

In this section, we will present the theory of developing 2D games, covering three essential aspects: 2D games, Animation, and Gameplay. These components play a crucial role in the process of creating 2D games.

2.1.1 2D games

2D games are game formats that use two-dimensional graphics. Only the X and Y axes allow characters or scenes to move. You cannot alter the game's perspective. Usually, these are "flat" games in which you can move left and right, as well as up and down. Since it doesn't have a lot of opportunities, Educational games are games that use information to have fun while also learning. Because 2D games are often simpler than their 3D counterparts. But you also don't need to bother about the development of such a game, as well as feature updates.

2.1.2 Animation

Actions that cause things on the screen to move unexpected directions. It is known as animation, but 2D animation can be seen only on the X and Y axes, or as left and right movement. Or the top and bottom.

In game development, 2D graphics, animations, sprites design and character design are essential for the success of the game. These components could not be created without drawing skills, creativity and most importantly, understanding in animation. Many software such as 3D modeling software are also used to ensure accuracy in creating sprites for games and game engines.

2.1.3 Gameplay

3D games have a more pronounced and vivid interface that makes playing fun. Focusing on the appearance of the world around you are the most important part of a 3D game. Textures should be perfect, and colors should be saturated.

2D games focus on gameplay but don't focus on landscape and quality of saturation. But still able to use colorful themes. Such games tend to be relaxing and distract from the world without creating difficulties.

2.2 Technology and Tools

Game development is a formalized process that utilizes a diverse range of tools and technologies for game creation. We have officially chosen Unity as our primary technology and tool, and the development is carried out using the C# programming language.

2.2.1 Unity

Unity is a cross-platform game engine developed by Unity Technologies, first announced, and released in June 2005 at Apple Inc.'s Worldwide Developers Conference as a Mac OS X-exclusive game engine. The engine has since been gradually extended to support a variety of desktop, mobile, console and virtual reality platforms. It is particularly popular for iOS and Android mobile game development and used for games such as Pokémon Go, Monument Valley, Call of Duty: Mobile, Beat Saber and Cuphead. It is considered easy to use for beginner developers and is popular for indie game development.

The engine can be used to create three-dimensional (3D) and two-dimensional (2D) games, as well as interactive simulations and other experiences. The engine has been adopted by

industries outside video gaming, such as film, automotive, architecture, engineering, construction, and the United States Armed Forces.

2.2.2 C#

C# is probably one of the best programming languages for gaming. This language is heavily used to create fan-favorite games like Rim world on the Unity Game Engine.

C# offers many different advantages to both novice and seasoned programmers. For example: C# can save you time, there's a low learning curve, It's a scalable language that's easy to maintain, There's a large community—very large and C# is object-oriented.

2.3 Foundations of Game-Based Learning

Game-Based Learning (GBL) is an educational approach that uses games to enhance learning and instruction. It engages learners by providing challenges, rewards, and a sense of achievement. GBL promotes active participation, critical thinking, and decision-making. Games offer a simulated environment for experiential learning, allowing learners to explore and learn through trial and error. Immediate feedback in games helps learners assess their performance and adjust. GBL can be personalized to accommodate different learning styles and abilities. Collaboration and social interaction are encouraged through multiplayer features, fostering teamwork and interpersonal skills. Progress tracking and assessment in GBL provide valuable insights into learners' progress and help tailor instruction. By leveraging these foundations, educators can create immersive and interactive learning experiences that motivate learners and deepen their understanding.

2.4 Narrative centered learning

About telling stories and applying them to teaching contexts to motivate them to act as media in teaching and learning. and increase problem-solving skills in a lecture-based learning environment that combines “Story Context and Teaching Support Strategies to Deliver Effective and Engaging Educational Experiences” using narrative to teach is the ability to create context fun structure. The benefit of Narrative is that it saves money and can assess the ability of students to see how well they understand. It can also increase learning motivation for students and can also allow students to participate in storytelling as well.

Technology can be used to assist in organizing various learning activities for learners to be conducted efficiently and effectively, and a combination of online and offline learning can be applied under a format that results from the collaborative opinions of educators. During learning, educators should find activities that make learners feel engaged, increase their interest, and provide more opportunities for learners to ask questions.

This creates a more meaningful learning experience and inspires storytelling through visual media.

2.5 Heuristic evaluation

To assess the usability of a system, several studies have employed the heuristics evaluation method developed by Jakob Nielsen [1]. The evaluation of heuristics is a frequently employed approach for evaluating the usability of computer software systems. This approach frequently entails the participation of a limited number of experts who hold pertinent expertise within the respective domain. This technique effectively decreases the required time and cognitive resources, enabling assessors to ascertain the design of the system.

The evaluation of usability heuristics encompasses a set of 10 fundamental principles that serve as guidelines for the assessment and enhancement of user interfaces. A comprehensive assessment of usage behavior of 10 basic principles that serve as guidelines for Evaluating and improving these ten user interfaces The principles prioritize a design approach centered on User needs and preferences, They emphasize various Factors that lead to user-centered design such as:

- (1) ensuring that the system's status is clearly visible to the user
- (2) establishing a correspondence between the system and real-world concepts
- (3) granting users control and freedom in their interactions
- (4) maintaining consistency and adhering to established standards
- (5) implementing measures to prevent and recover from errors
- (6) emphasizing recognition rather than recall in user interactions
- (7) promoting flexibility and efficiency in system usage
- (8) incorporating aesthetic and minimalist design principles
- (9) assisting users in recognizing, diagnosing, and recovering from errors
- (10) providing help and documentation that is clear and concise.

By adhering to these principles, designers ensure that interfaces exhibit qualities of intuitiveness, efficiency, and alignment with users' cognitive models, thereby enhancing usability and user pleasure [2]. The approach can be customized to accommodate various assessment tasks within the framework of game-based learning. Furthermore, heuristic evaluation is particularly suitable for the preliminary phases of game development and prototyping. The insights and identified issues can subsequently serve as valuable guidance for the further improvement and development of games.

2.6 Related Work

In this section, there is a game related to our project, most of which will be English games or puzzle games on the market, such as The Candy Factory Game and ESCAPE Puzzles.

2.6.1 The Candy Factory Game: An Educational iPad Game for Middle School Algebra-Readiness

This proposal aims to investigate the engaging elements of video games in relation to pre-algebra topics for youth. According to Jones [3], graphics, music, visual effects, and interesting animations are key factors that attract youths' interest in video games. However, one of the most

engaging features is the presence of challenging problems to solve with appropriate support or scaffolding (Hoffman & Nadelson,) [4]. Video games that offer both challenge and guidance are considered highly engaging and effective as learning tools. The proposal outlines a mixed-method design for the development and testing of an educational game called the Candy Factory Game. Initial pilot results indicate that the video game prototype is engaging and that its core mechanics align with the predicted learning trajectory. However, these findings are based on a limited number of interventions with a specific sample. To further refine the game, the researchers plan to incorporate feedback from end-users, conduct additional pilot tests, and refine the measurement instruments and observation protocols [5].



Figure 1 This image is an example of gameplay and in-game UI from

“The Candy Factory Game”

2.6.2 ESCAPE Puzzles: Bringing Physics to Fruition Through Classroom Based Making

The study focuses on increasing student engagement and interest in physics learning by providing opportunities for personal decision-making. The use of Escape Room Puzzles in the classroom allows students to engage in meaningful and challenging tasks that are relevant to their interests. The findings suggest that students experience a sense of pride and ownership in their work, leading to increased interest and motivation. The use of hands-on, maker-based activities in physics education has been linked to improved engagement and learning outcomes. Furthermore, the Escape Room Puzzles offer a potential assessment method for evaluating student knowledge and application of physics concepts. By designing and building these puzzles, students demonstrate their mastery of the content, providing an authentic and engaging assessment approach.[6]

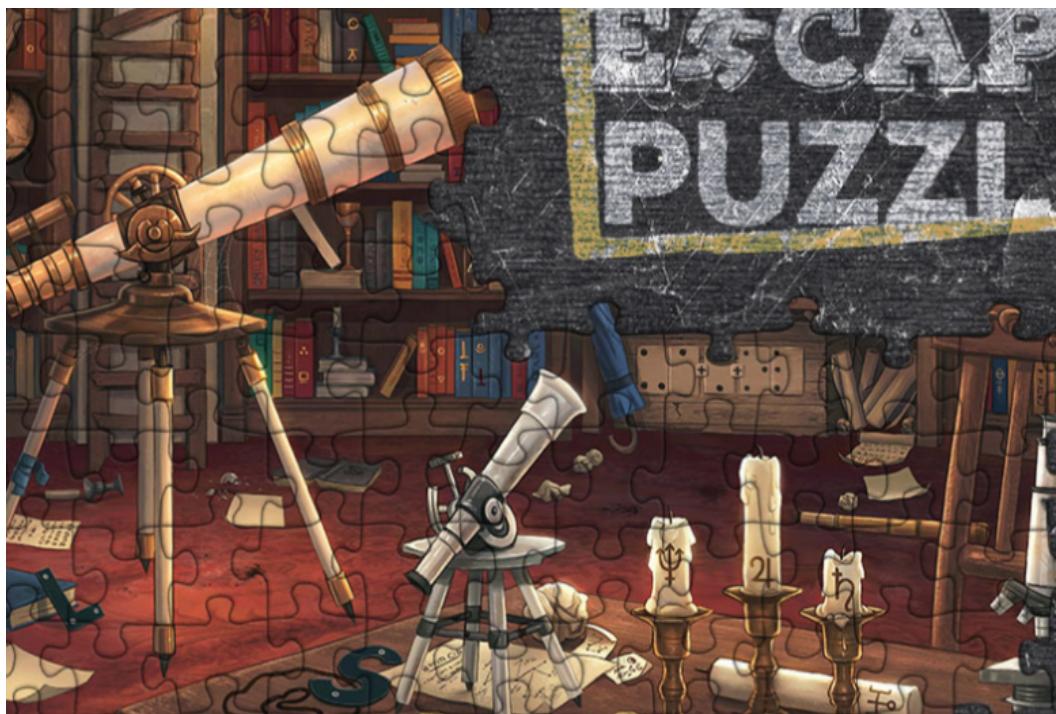


Figure 2 This image is an example of gameplay and in-game UI from “ESCAPE Puzzles.”

There are also other related works Because it have similar gameplay and game formats.

As shown in the example in Table 2.6.

Game	Story	Gameplay	Genre	Strength	Weakness
คำไทย ไดโนเสาร์ :ผิดหรือถูก 	The hunter hunts dinosaurs by writing the correct Thai language to inflict damage.	The hunter hunts dinosaurs by writing the correct Thai language to inflict damage by dragging letters to answer in words.	Puzzle	can learn by yourself language knowledge	When taking the quiz wrongly, no correct answer is given.
Spelling Quiz English words 	Guess the answer to that thing in English words.	Spell the English word from the picture to guess the word in the next picture.	Puzzle	Use common words easy to answer questions	It is a basic vocabulary used at the elementary level.
words capes 	Give the letters and form words.	Arrange letters to form words and generate Sudoku.	Puzzle	Challenging and able to learn new words Hints are provided when encountering difficult words.	Maybe the player answered correctly. But it's a random word. But don't know the real meaning of the words.

<p>Fun Animal Spelling- Game to learn</p> 	<p>Guess the word about the animal.</p>	<p>Drag the letters up to answer in the box. to sort into words</p>	<p>Puzzle</p>	<p>Cute pictures, suitable for children who are going to kindergarten. to practice skills simple English words</p>	<p>not suitable for adults because using easy vocabulary</p>
<p>Word connect- Letter spelling</p> 	<p>Word Connect is an exciting puzzle game for TRUE WORD geniuses. Find the hidden words in the mixed letters and combine them to form the correct word.</p>	<p>Guess the word from the letters provided by the game.</p>	<p>Puzzle</p>	<p>can collect points and compete with friends</p>	<p>It's a rather difficult word. and hints must use points to exchange</p>

Table 2 Features comparing tables of the project and the other related work.

CHAPTER 3

METHODOLOGY

The research development method used in the ADDIE model is a systematic approach to designing learning and development processes. It aims to save time and money by analyzing the problem and following five steps: analysis, design, development, implementation, and evaluation. The research begins with interviews and document analysis to understand student needs, learning styles, and problem areas. The content and questions are then tailored to create an engaging RPG-style game where players assume characters and make decisions based on set conditions.

3.1 Analysis and Requirement Gathering

To achieve the main objective, we have to identify the key elements of designing and developing game-based learning.

1. Identify the problems and source of the problems in traditional learning?
2. Identify the common characteristics of our target students.
3. Identify instructional goals? (curriculum, engagement, motivation, knowledge transfer, learning and game balancing, etc.)
4. Identify game-based learning experience preference (plot, character, setting, interface and control, gameplay, curriculum integration)
5. Identify sequence of instruction
6. Identify test items.

We have classified the objective analysis plan into six tables are Student Problem Analysis Plan(Table 3); General Target Data Analysis Plan(Table 4); Teaching Analysis Plan(Table 5); Analysis Plan for Target Experience(Table 6); Teaching Analysis Plan(Table 7); Target analysis plan(Table 8)

Identify the problems and source of the problems in traditional learning	
Questionnaire	Relevance
	1.Which subjects do you think you have problems learning?
	2.What learning unit or subject do you think you have problems with?
	3.Why does learning become less effective?

Table 3 Identify the problems and source of the problems in traditional learning

Effectively pinpointing the issues and their origins in traditional learning is a pivotal step towards crafting impactful solutions. In our case, we tackled the problem by delving into the analysis of the questionnaire retrieved from the student.

Identifies the common characteristics of our target students.	
Questionnaire	Relevance
	1. Age
	2. Grade
	3. GPAX
	4. Level of understanding of the subject.
	5. Which devices can you access?
	6. The ability to use the device.
	7. How much time do you spend on your phone a day?
	8. What operating system do you currently use?

Table 4 Identifies the common characteristics of our target students.

Analyzing the characteristics of your audience is crucial for tailoring educational experiences to their needs and preferences.

Identify instructional goals	
Questionnaire	Relevance
	1.Which kinds of games do you believe are appropriate for learning media?
	2.What kinds of graphic games would you think should be created?

Table 5 Identify instructional goals.

Pinpointing the specific goals and objectives you aim to achieve through game-based learning.

Identify Game-Based Learning Experience Preferences	
Questionnaire	Relevance
	1.What kind of game are you playing?
	2.Sort the plot game you like most to the least.
	3.What kind of character are you interested in?
	4.When you play a game, what do you give the most importance to?

Table 6 Identify Game-Based Learning Experience Preferences.

Understanding the preferences of your target audience in terms of plot, characters, settings, interface, gameplay, and how to seamlessly integrate the curriculum.

Identify sequence of instruction	
Questionnaire	Relevance
	1.What kind of subject do you think are suitable for making games for education?
	2.What are the lessons or subjects that should be made into educational games?

Table 7 Identify sequence of instruction.

Planning the order and structure of the instructional content and activities to ensure a logical and effective learning progression.

Identify test items	
Questionnaire	Relevance
	1. If the game had the content of learning combined with the game, would you think you'd remember it?

Table 8 Identify test items.

Determining the types of assessments or evaluations that will be used to measure learning outcomes.

3.2 Design

To achieve perfection in design, three key processes are integrated: game objective, game elements, and game mechanics.

3.2.1 Game objective

“Word Venture” is an English vocabulary game designed for game-based learning. The main objective of our game is to enhance players’ vocabulary skills while providing an engaging and immersive experience. The game gives players an opportunity to improve their language skills at their own pace, making productive use of their leisure time for educational benefits. The game covers a wide range of vocabulary words that are targeted at the middle school level. These words are carefully selected to align with the guidelines set out by the National Institute of Educational Testing Service (NIETS), a Thai academic institution serving educational measurement and evaluation.

3.2.2 Game elements

“Word Venture” provides components or features integrated into a game’s design that contribute to the overall gameplay experience. These elements are the building blocks that shape how players interact with the game’s environment, mechanics, and objectives. A list of the game elements is as follows:

- Different maps of a different set of vocabulary words
- Timer that adds a time-based challenge
- Points earned by players for correct answers or achievement.
- Lives and opportunities that players have before the game ends are lost with incorrect answers.
- A visual representation of how far players have come in the maps.
- Sound Music
- Feedback, responses provided to players after they answer questions.
- Tutorials that help players understand how to play the game.



Figure 3 GUI Main page

When start game this page will show at first if want to play game can click START but don't want can click EXIT.



Figure 4 Level display page

Level display page when click start form main game display will be show level and able to select the level but level unlock when game complete from before level.



Figure 5 Game play

In this page show about envelopment of game and show element about game.



Figure 6 Enemy Character

In this figure is enemy in our game. Basically, our character moves in place. And when the player answers the question correctly, the character will move “Hurt”, but if the answer is wrong, the character will move “Hit”.



Figure 7 Player Character

In this figure is player in our game. Basically, our character moves in place. And when the player answers the question correctly, the character will move “Hit”, but if the answer is wrong, the character will move “hurt”.



Figure 8 Heart Player

In this figure is heart of player, when starting the game player will have a total of 3 hearts. The player must spell the vocabulary correctly. If the player spells a vocabulary incorrectly, 1 heart will be lost. The player has 3 chances to spell incorrectly per 1 vocabulary after the player spell vocabulary correct player will get heart regeneration.



Figure 9 Heart Enemy

In this figure is heart of player, when starting the game enemy will have a total of 5 hearts if player spell the vocabulary correctly 1 heart.

1. หนังสือเรียน

Figure 10 Meaning

In this figure is meaning, player must be spelling vocabulary follow these meaning.

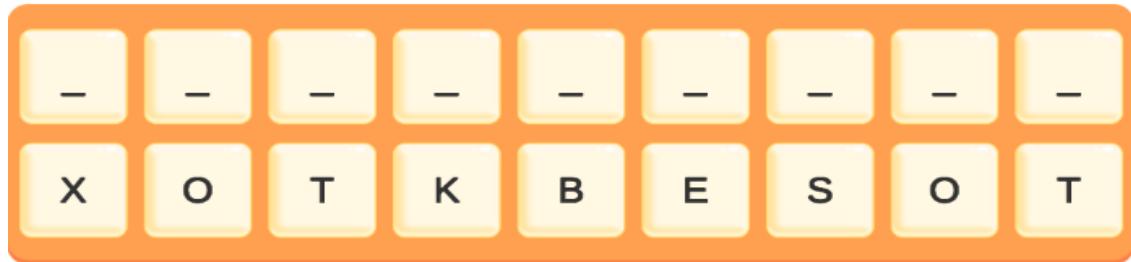


Figure 11 Characters

In this figure is Characters, at the start of the game The character is switched positions and the player must click on the character to spell the correct vocabulary.



Figure 12 Remove button

In this figure is Remove button, this button stays at the left side of character. When player want to remove character player can click there.



Figure 13 Check button

In this figure is check button, when player select all character must be click this button for check answer.

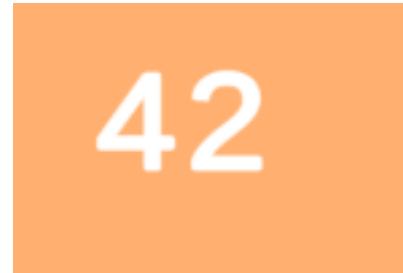


Figure 14 Time

In this figure is time, when game start time to start and time can stop when player click setting button and time to continue when setting page is close.

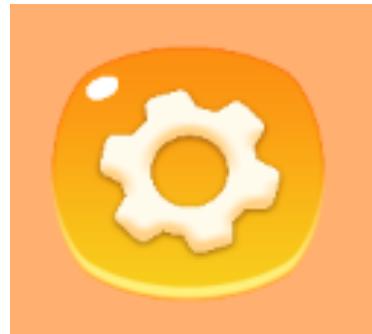


Figure 15 Setting button

In this figure is setting button, if player want to pause the game can click this button and after click this button setting page will show.

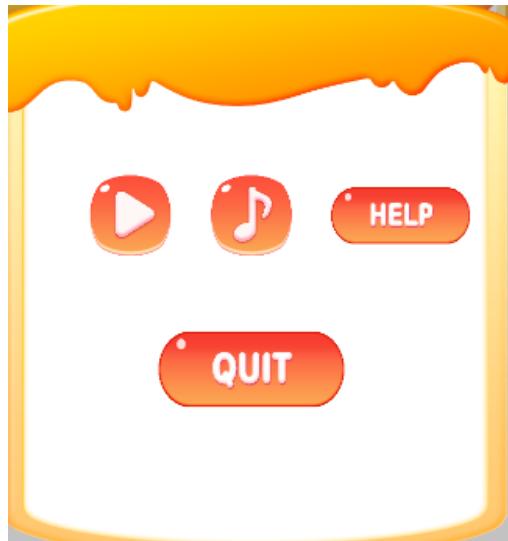


Figure 16 Setting page

In this figure is setting page, after click setting button this page will show and player can mute music, read how to play this game and can quit the game

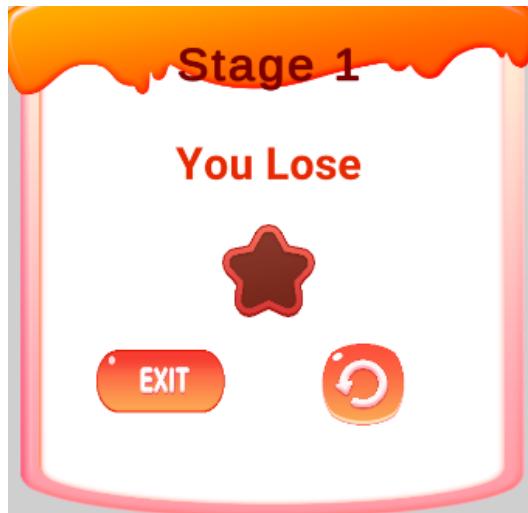


Figure 17 Lose

In this figure is lose, when player spell vocabulary 3 time incorrectly this page will show if player want to play again with click play again at right side.



Figure 18 Quiz page

When player spelling vocabulary complete this page will be show. Player must be do the quiz for unlock next level.

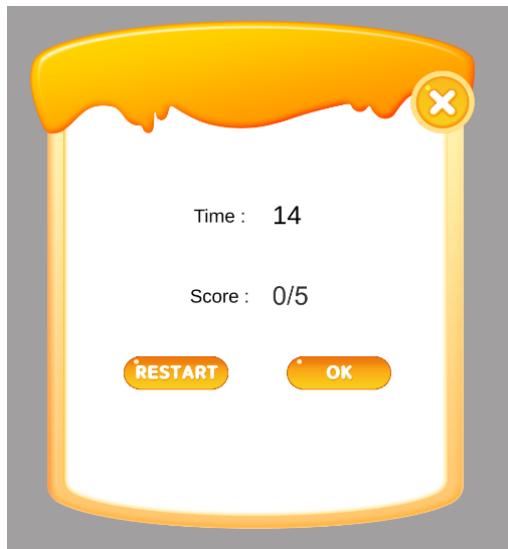


Figure 19 score and time page

When player complete the quiz this page will be show. If player want to play next level can click OK button at right side if want to play this level again can click RESTART button.

3.2.3 Game mechanism

In this game, different maps have been created based on word categories depicting the activity diagram of the game mechanism. By starting from the lobby page to start the game, players can select a map to play, and when they complete the map, there will be quizzes to evaluate their learning of vocabulary words. When a player enters a map, two characters become present: the player's avatar and the avatar representing the enemy. The map displays Thai words alongside a collection of English alphabets. The player must order the letters of the alphabet in an accurate sequence that matches the given Thai definition. The player's avatar has three icons of hearts, which.

3.2.3.1 Diagram

This section contains a description of how the game works using the Use Case Diagram and Activity diagram.

3.2.3.1 Use Case diagram

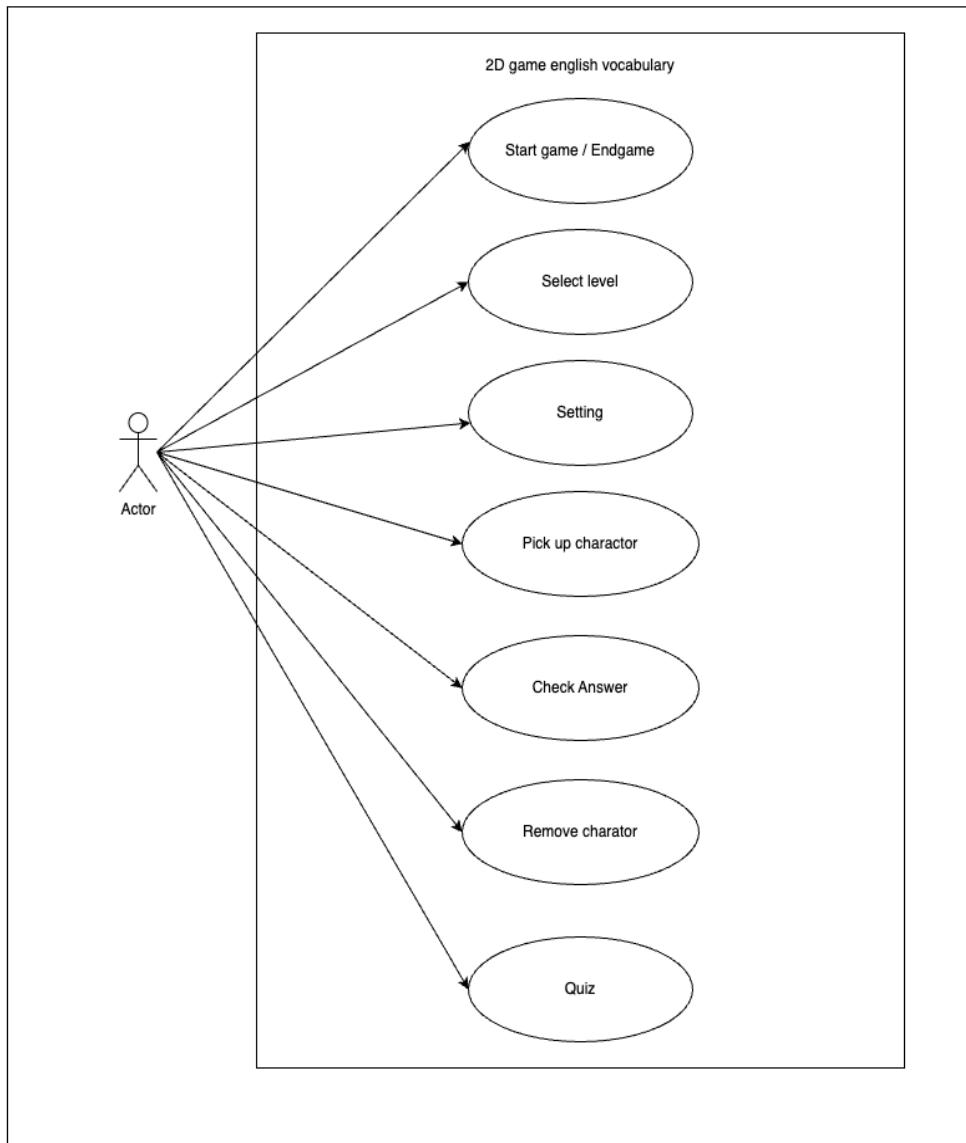


Figure 20 Use case diagram

Use case name	Start and exit the game
Description	Press the button and start the game or press the button and select Exit to Exit the game
Actor	User
Flow of event	1.Click the button 2.select and press Start or Exit 3.Run the game or close the program
Alternative flow	-
Precondition	Must have the program on your computer
Postcondition	Authorization to open program by user
Special requirement	-

Table 9 Start and Exit the game

Use case name	Select Level
Description	Can choose the level of difficulty to play
Actor	User
Flow of event	1.Select the stage
Alternative flow	OK and Back 1.if press Back will return page select stage
Precondition	After press button start
Postcondition	-
Special requirement	must have previously passed that particular level before.

Table 10 Select Level

Use case name	Setting game
Description	Modify some data in game by user need to change
Actor	User
Flow of event	1.press select setting button
Alternative flow	If user not to need change the data that will be return the data by authorization to basic game setting
Precondition	After select setting button
Postcondition	Game pause and show setting top-up
Special requirement	-

Table 11 Setting Game

Use case name	Select character
Description	Select the letter that corresponds to the meaning
Actor	User
Flow of event	1.Click the letter
Alternative flow	-
Precondition	Choose the character
Postcondition	Character top-up to blank space.
Special requirement	-

Table 12 Select character.

Use case name	Check Answer
Description	Check the answer
Actor	User
Flow of event	1.Select character 2.Press check button
Alternative flow	-
Precondition	Must be select character before press check button
Postcondition	If answer is correct you damage to enemy and can do next vocabulary else enemy damage to player and character back to being
Special requirement	-

Table 13 Check answer

Use case name	Remove character
Description	Remove character
Actor	User
Flow of event	Press remove button
Alternative flow	-
Precondition	If select the character wrong
Postcondition	Character back to being
Special requirement	-

Table 14 Remove character

Use case name	Quiz
Description	Evaluate the results from the previous gameplay
Actor	User
Flow of event	1. You must answer all 5 questions. 2. Click the correct answer
Alternative flow	You can redo it
Precondition	Select the answer
Postcondition	Know the score
Special requirement	Have to play through and complete all 5 vocabulary words

Table 15 Quiz

3.2.3.2 Activity diagram

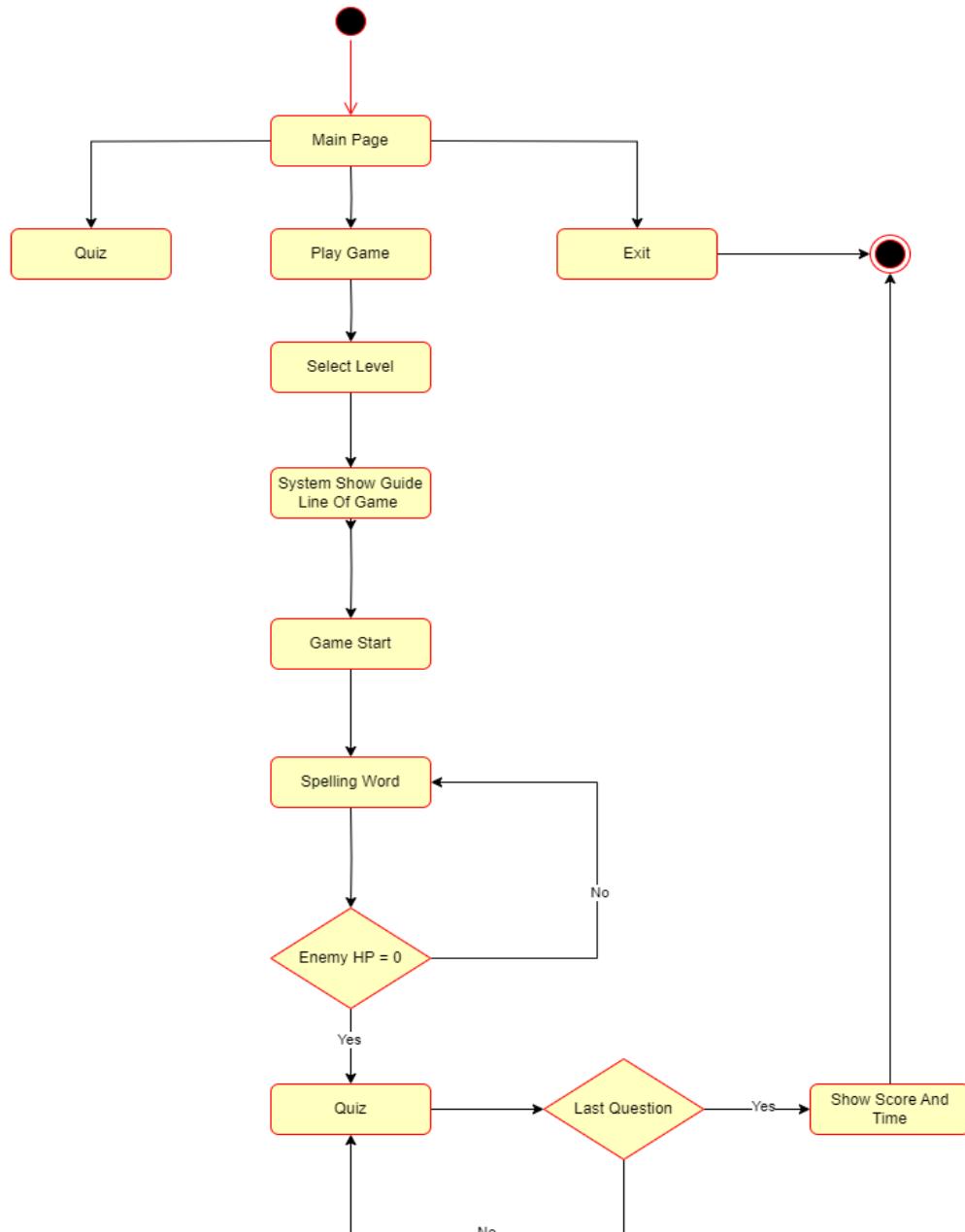


Figure 21 Activity diagram

3.2.3.3 Spelling Activity Diagram

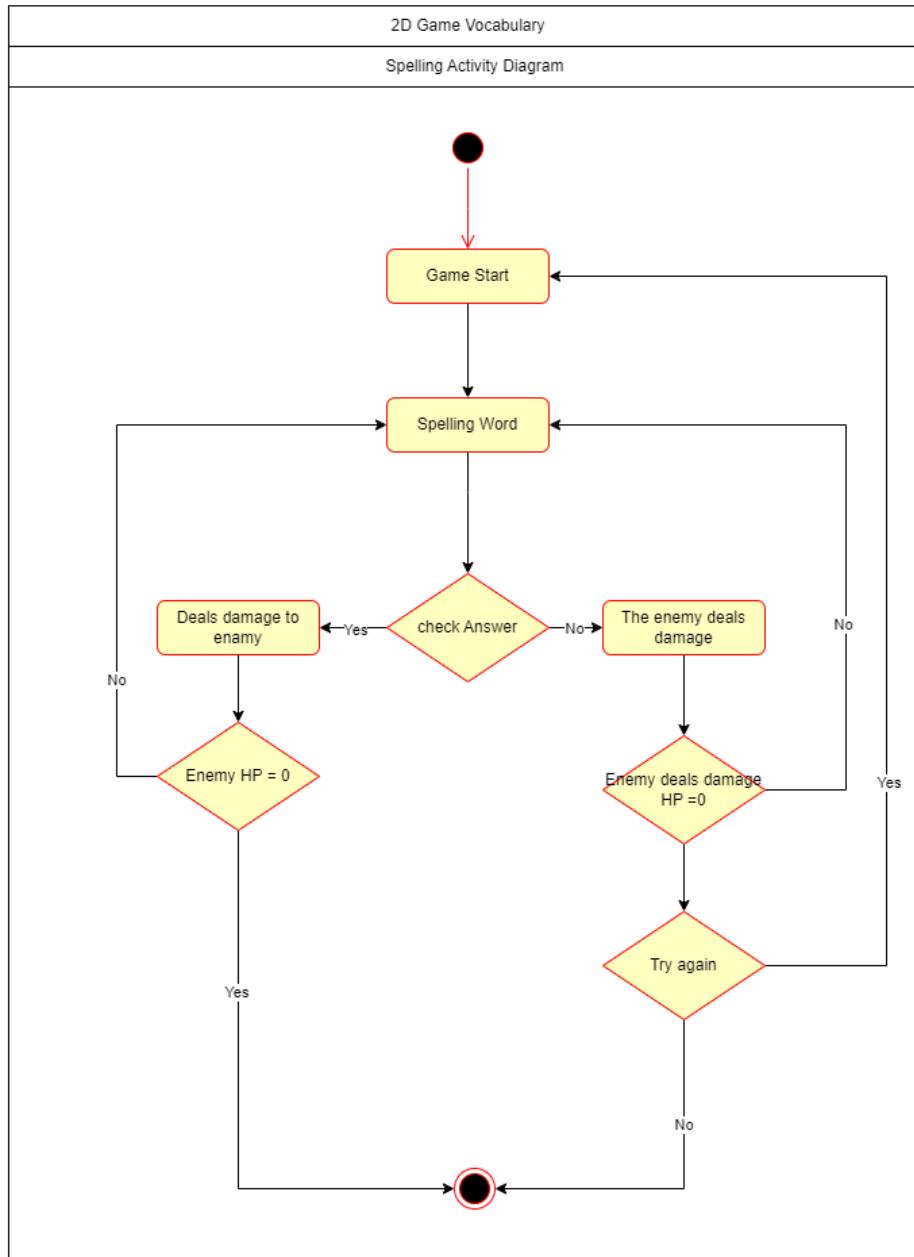


Figure 22 Spelling Activity Diagram

3.3.3.4 Quiz Activity Diagram

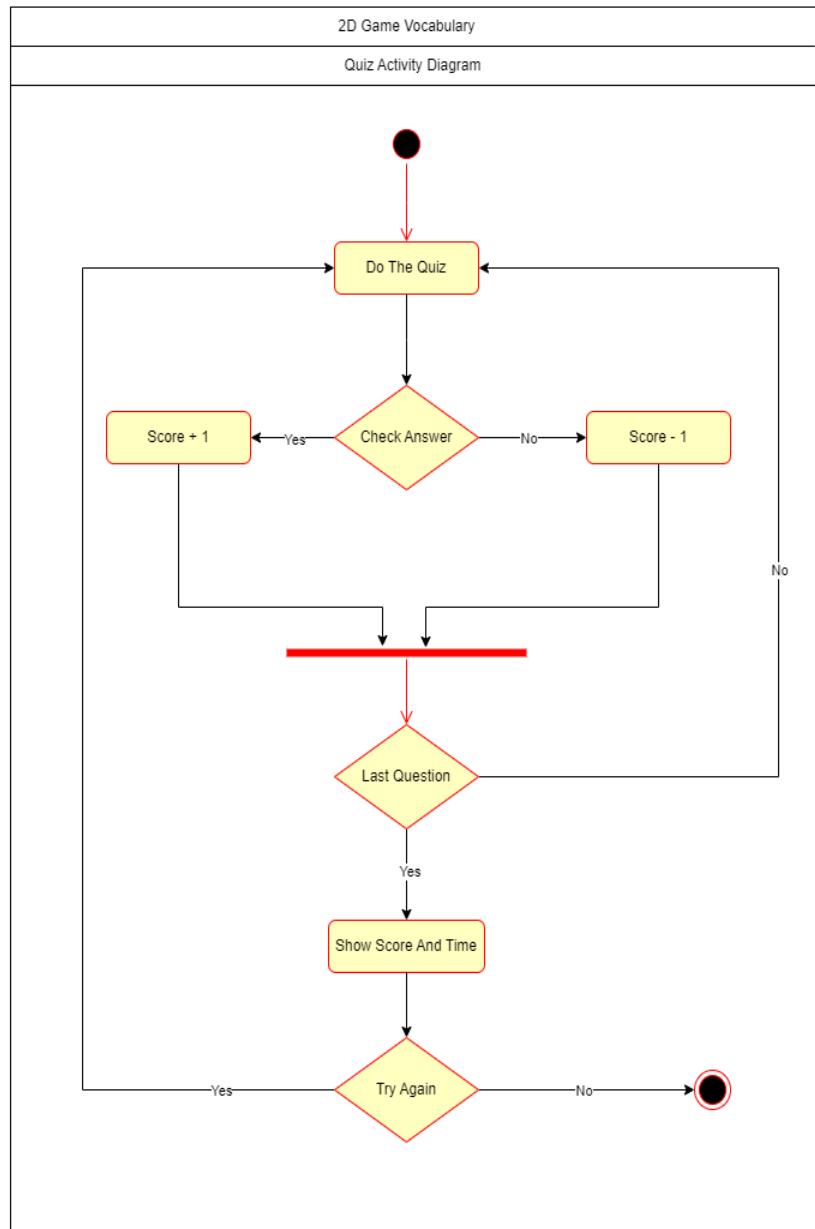


Figure 23 Quiz Activity Diagram

3.3 Development

In this section, there will be an explanation of the game development process using a Class Diagram to describe the utilization of classes within the system.

3.3.1 Class Diagram

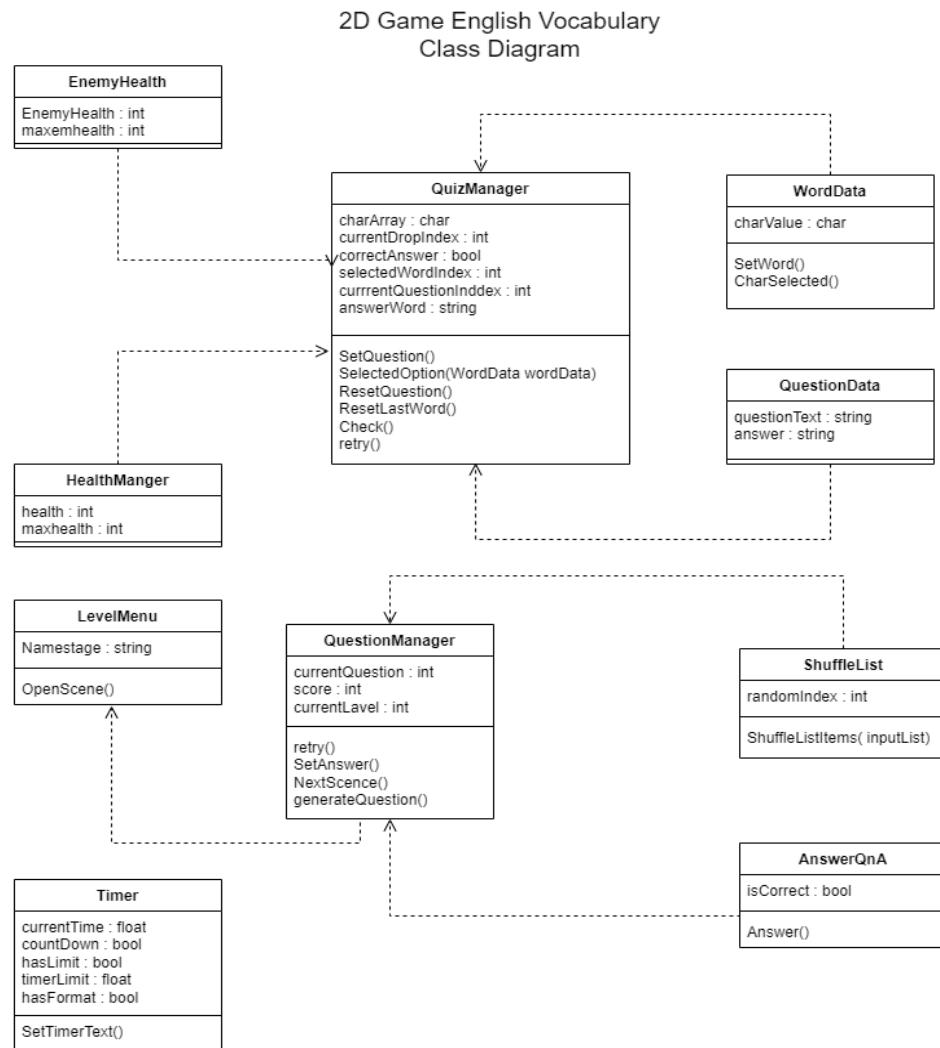


Figure 24 Class Diagram

3.4 Implementation

In this section, we elucidate the methodology employed for testing our game with users. We have implemented a categorization approach, dividing users into two distinct groups, each comprising five individuals. Group 1 is designated as the cohort exposed to learning through interactive gameplay within our application, while Group 2 represents the cohort engaged in traditional learning methodologies. The primary metric for evaluation centers on the administration of a post-learning assessment. Upon the completion of the learning phase by users in both groups, a comprehensive vocabulary test is administered, subsequently followed by a detailed knowledge assessment.

In addition, the implementation of the game conforms to Heuristic evaluation to ensure a user-friendly, engaging, and effective gaming experience. The game's user interface and interactions are implemented aligning with these principles as described in Table 16.

THE 10 USABILITY HEURISTICS OF JAKOB NIELSEN FOR THE ENGLISH VOCABULARIES GAME		
Heuristic	Description	Image
1. Visibility of system status	The heart level serves as an indicator of the character's current statistical status.	
2. Match between system and the real world	Use symbols that are widely recognized, such as a gear icon in place of the word "Settings".	
3. User control and freedom	Users can stop playing a game by hitting the "Quit" button.	
4. Consistency and standards	The size, color, and font of the text are consistent and appropriate.	
5. Error prevention	Use input fields for giving and human-readable, and the player must only type in the given letters.	
6. Recognition rather than recall	The game uses buttons and symbols that are precise and familiar to users to recognize.	
7. Flexibility and efficiency of use	The 'Quiz' can be skipped by the user if they no longer want to spell the word.	
8. Aesthetic and minimalist design	The game is designed in a beautiful way. The color scheme complements the setting. The screen displays the most important details.	
9. Help users with the error	In the Quiz, if a player provides an incorrect response to a question, the game will inform and provide the information of the correct answer. The question may be repeated at any point.	
10. Help and documentation	At the question mark icon, players can access the instructions on how to play the game.	

Table 16 10 USABILITY HEURISTICS

3.5 Evaluation.

This step aims to assess the functionality of our games and heuristic evaluate their effectiveness in facilitating English vocabulary learning. By providing students with an opportunity to evaluate the games after playing, we will gain insights into how game contribute to vocabulary acquisition.

The questionnaires consist of four sections: one for collecting post-learning knowledge; two for collecting demographic and background information; three for evaluating the usability of the game; and a final section for collecting the learning process and game performance.

3.5.1 Task Design for Heuristic Evaluation

During this phase, participants were given explicit instructions to engage in planned actions. The assigned tasks have been developed with the objective of evaluating the usability of the game in alignment with Nielsen's usability criteria. Players are presented with the following tasks to perform:

1. Enter the game.
2. Read game instructions.
3. Select level.
4. Start the game.
5. Press words by means by clicking a letter.
6. Press the Settings button.
7. Press mute/unmute music.
8. Press on until the last word is found.
9. Do Quiz.

3.5.2 Task Design for Post-learning knowledge evaluation

During this phase, participants were given explicit instructions to engage in planned actions. The assigned tasks have been developed with the objective of post-learning knowledge evaluation. Players are presented with the following tasks to perform:

Group 1

1. Enter the game.
2. Select Level
3. Press that word.
4. Do a quiz and play up to 5 level.

Group 2

Learn a general vocabulary by getting 25 English words.

3.5.3 Questionnaire post-learning knowledge

The process of collecting knowledge after learning is a process that involves gathering information about the knowledge that learners have acquired after experiencing a learning or experimental process. This process focuses on understanding what knowledge learners have gained and how it has evolved after the learning experience.

3.5.4 Questionnaire background

The primary objective of this initial questionnaire is to gather demographic data and background information relevant to the study participants. The data indicated above has the potential to be useful in the task of segmenting and evaluating responses, with the objective of identifying patterns and trends within different user cohorts. Furthermore, the survey includes inquiries that pertain to the gaming habits and interests of the participants.

3.5.5 Questionnaire heuristic

After players complete the assigned tasks, they will assess the game's usability by doing a questionnaire. The questionnaire has been structured in accordance with Nielsen's established procedures. A series of questions is presented, enabling participants to express their viewpoints regarding the usability of the game. The players are required to choose the given choices for each question. The scores obtained through the evaluation process provide significant data for assessing the game's design.

3.5.6 Questionnaire Summative

The Summative Questionnaire is a set of questions used in the evaluation process after learners have completed any learning or experiential activities. Its objective is to summarize outcomes and assess the effectiveness of the learning process or past activities.

3.5.7 Test case

ในขั้นตอนนี้คือการทดสอบฟังชั่นของเกม โดยจะทดสอบทั้งหมด 8 อายุ่ก็อป select level function,

3.5.7.1 Test result of select level function.

Test case NO.	GUTC_SelectLevel_001
Test Case Name	Select level function.
Test Step Description	Test level unlock
Pre-Requisites	<ul style="list-style-type: none"> 1. Level 1 unlock 2. Next level will be unlock when complete about quiz form before level

Table 17 Test result of select level function.

3.5.7.1.1 Test case of select level function.

Test case ID	Action	Expected output	Actual output	Pass/Fail
TC_01	Before level complete	Next level unlock	Next level unlock	Pass
TC_02	Before level don't complete	Next level lock	Next level lock	Pass

Table 18 Test case of select level function.

3.5.7.2 Test result of check answer function

Test case NO.	GUTC_CheckAnswer_002
Test Case Name	Check Answer function.
Test Step Description	Test check answer
Pre-Requisites	<ul style="list-style-type: none"> 1. Select character 2. Click check

Table 19 Test result of check answer function

3.5.7.2.1 Test case check answer

Test case ID	Action	Expected output	Actual output	Pass/Fail
TC_01	Correct answer	1. Heart of enemy -1 2. Player deal damage to enemy 3. Show next vocabulary	1. Heart of enemy -1 2. Player deal damage to enemy 3. Show next vocabulary	Pass
TC_02	Don't correct answer	1. Heart of player -1 2. Enemy deal damage player 3. Character return start	1. Heart of player -1 2. Enemy deal damage player 3. Character return start	Pass
TC_03	Don't select character but click check button	1. Heart of player -1 2. Enemy deal damage player	1. Heart of enemy -1 2. Player deal damage to enemy 3. Show next vocabulary	Fail
TC_04	Select character but don't complete	1. Heart of player -1 2. Enemy deal damage player 3. Character return start	1. Heart of player -1 2. Enemy deal damage player 3. Character return start	Pass

Table 20 Test case check answer

3.5.7.3 Test result of remove character

Test case NO.	GUTC_RemoveCharacter_003
Test Case Name	Remove Character function.
Test Step Description	Test remove character
Pre-Requisites	<ol style="list-style-type: none"> 1. Select character 2. Click remove button

Table 21 Test result of Remove Character

3.5.7.3.1 Test case remove character

Test case ID	Action	Expected output	Actual output	Pass/Fail
TC_01	Don't select character	Display don't show every thing	Display don't show every thing	Pass
TC_02	Select character	Character return to start	Character return to start	Pass

Table 22 Test case remove character

3.5.7.4 Test result of setting button

Test case NO.	GUTC_Setting_004
Test Case Name	Setting button
Test Step Description	Test show display setting and time stop
Pre-Requisites	<ol style="list-style-type: none"> 1. Click setting

Table 23 Test result of setting button

3.5.7.4.1 Test case setting button

Test case ID	Action	Expected output	Actual output	Pass/Fail
TC_01	Click setting button	1. Time stop 2. Game show setting display	3. Time stop 1. Game show setting display	Pass
TC_02	Click exit button	1. Setting display close 2. Time continue	1. Setting display close 2. Time continue	Pass

Table 24 Test case setting button

3.5.7.5. Test result of resume button

Test case NO.	GUTC_ Resume _005
Test Case Name	Resume button
Test Step Description	Test continue of game
Pre-Requisites	1. Click setting 2. Click resume or exit button

Table 25 Test result of resume button

3.5.7.5.1 Test case resume button

Test case ID	Action	Expected output	Actual output	Pass/Fail
TC_01	Don't select character	Display don't show every thing	Display don't show every thing	Pass

Table 26 Test case resume button

3.5.7.6 Test result of music button

Test case NO.	GUTC_Music_006
Test Case Name	Music button
Test Step Description	Test music play and stop
Pre-Requisites	<ol style="list-style-type: none"> 1. Click setting 2. Click music

Table 27 Test result of music button

3.5.7.6.1 Test case music button

Test case ID	Action	Expected output	Actual output	Pass/Fail
TC_01	Click stop music	Music stop	Music stop	Pass
TC_02	Click play music	Music playing	Music stop	Pass

Table 28 Test case music button

3.5.7.7 Test result of help button

Test case NO.	GUTC_Help_003
Test Case Name	Help button
Test Step Description	Test display hoe to play dis game
Pre-Requisites	<ol style="list-style-type: none"> 1. Click setting button 2. Click help button

Table 29 Test result of help button

3.5.7.7.1 Test case help button

Test case ID	Action	Expected output	Actual output	Pass/Fail
TC_01	Click help button	Display show how to play this game	Display show how to play this game	Pass
TC_02	Click exit button	Display how to play this game close and back to setting display	Display how to play this game close and back to setting display	Pass

Table 30 Test case help button

3.5.7.8 Test result of quit button

Test case NO.	GUTC_QuitGame_003
Test Case Name	Quit button
Test Step Description	Test display confirm to quit game
Pre-Requisites	<ol style="list-style-type: none"> 1. Click setting button 2. Click quit button

Table 31 Test result of quit button

3.5.7.8.1 Test case quit button

Test case ID	Action	Expected output	Actual output	Pass/Fail
TC_01	Click quit button	Display show confirm to quit game	Display show confirm to quit game	Pass

Table 32 Test case quit button

CHAPTER 4

RESULT

4.1 Results of the post-learning knowledge Questionnaire

Data were collected from the evaluation of 10 people, tested with evaluators aged 13-18 years and over, divided into 2 groups: a group that learned vocabulary through games. and groups that learn vocabulary through memorization or regular teaching. The following results will include three males (30%) and seven females (70%). Group learning from the game. Before playing the language, level is excellent (40%), average (20%) and fair (40%) after playing the game. It was found that the percentage of memorization or answers that could be written down was higher than memorization or normal teaching, only 17.6 %, because some members of the memorization or normal teaching groups still answered the questions correctly. Before starting the assessment, the normal language level of the memorization or regular teaching group is 100% at the fair language level. As shown in Table 24

	Group 1 (Learn from game)					Group 2 (Learn from memorization or regular teaching)				
Age	18 up	18 up	13-15	16-18	16-18	13-15	13-15	16-18	13-15	16-18
Gender	Male	Female	Female	Male	Female	Female	Male	Female	Female	Female
Percent correct	88%	84%	92%	88%	92%	72%	76%	76%	64%	68%

Table 33 Results of the post-learning knowledge Questionnaire

4.2 Demographics and Background Questionnaire Result

Table 4.2 demonstrates the results of participant characteristics. The survey was conducted with a sample size of 15 participants, consisting of most females (80%) and males (20%).

Demographics and Background Result			
Category	Subcategory	Count	Percent
Total participants	-	15	100 %
Gender	Male	3	80%
	Female	12	20%
Age	13-15	6	40%
	16-18	7	46.7%
	18 up	2	13.3%
Device	Computer/Laptop	12	85.7%
	Phone	14	100%
	iPad/Tablet	11	78.6%
	Not all	0	0
Playing Games	Yes	14	93.3%
	No	1	6.7%
Daily Playtime	1-3 Hours	1	6.7%
	4-6 Hours	8	53.3%
	7-9 Hours	1	6.7%
	More than 10 Hours	5	33.3%

Table 34 Demographics and Background Questionnaire Result

Most participants fell within the age range of 13 to 18 over, and the primary gaming devices utilized by these individuals were computers or laptops, accounting for 85.7% of the sample. Most of the participants (90%) engage in gaming as part of their daily routine. The duration of daily playtime exhibited diversity, as indicated by the distribution of participants: 6.7% engaged in less than 1-3 hours of play, 53.3% allocated 4-6 hours, 6.7% dedicated 7-9 hours, 33.3% invested 10 hours up, and 3.3% devoted more than 10 hours to gameplay. The data presented offers valuable insights regarding the distribution of participants' gender, age ranges, device preferences, gaming habits. These findings collectively provide a comprehensive understanding of the survey's results.

4.3 Heuristic Evaluation Result

After participants have completed the assigned tasks. Participants will be able to start the Heuristic evaluation questionnaire and results as shown in table 19.

Heuristic Question		Count	Percent
		15	100%
1.Do you think that the game's playing status is told within the game?	Have	12	80%
	Don't have	2	13.3%
	Unsure	1	6.7%
2.Are the symbols used in the game similar to symbols in the real world?	Yes	12	80%
	No	2	13.3%
	Unsure	1	6.7%
3.Can players customize personal options, such as sound or notification settings?	Yes	14	93.3%
	No	1	6.7%
	Unsure	0	0%
4.Is the layout of information and elements in the game up to standard?	Yes	11	73.3%
	No	1	6.7%
	Unsure	3	20%

5. When you perform important actions during the game Is confirmation required from players before taking important actions?	Have Don't have Unsure	12 3 0	80% 20% 0%
6. Are symbols and icons used within the game that are immediately recognizable and understandable?	Yes No Unsure	14 0 1	93.3% 0% 6.7%
7. When finished playing the spelling game, You wanted to skip the quiz game, but You didn't want to go back to spelling words again. Within the game there is an option to skip to the game quiz or not.	Have Don't have Unsure	13 0 2	86.7% 0% 13.3%
8. Is the gaming experience beautiful and memorable?	Yes No Unsure	11 3 1	73.3% 20% 6.7%
9. When a player makes an error within the game, is there any help or recommended steps to help resolve the error?	Have Don't have Unsure	13 0 2	86.7% 0% 13.3%
10. Is there a game manual within the game?	Have Don't have Unsure	12 1 2	80% 6.7% 13.3%

Table 35 Heuristic Evaluation Result

Table 19 provides significant insights relating to user experience and design within the assessed game. The findings indicate that a significant proportion of participants, specifically 86.7%, demonstrated awareness of the option to terminate the game. However, a small percentage of participants expressed uncertainty regarding this feature. The study found that most participants (80%) perceived the game's fonts and button layouts to be consistent, indicating a satisfactory level of consistency in design. Nevertheless, 6.7% of participants it is worth noting that a notable proportion of participants (6.7%) exhibited a degree of uncertainty regarding this aspect. This finding underscores the significance of upholding design consistency to augment user engagement. A total of 13.3% of participants reported encountering problems, suggesting potential avenues for

enhancing overall satisfaction with gameplay and the user experience. The functionality of buttons was demonstrated by 93.3% of participants, with most participants exhibiting a strong understanding of the functions of the buttons. The game's design incorporates a user-centric approach, accommodating a wide range of player preferences. A consensus was reached among 73.3% of participants regarding the design elements, which included color schemes and fonts. 86.7% of participants reported receiving error notifications, which suggests that developers have implemented a proactive strategy to promptly inform users about any issues they may encounter. A significant majority of participants (80%) reported the existence of an in-game manual, which played a vital role in augmenting the overall user experience. In general, the findings emphasize favorable elements and potential areas for improvement regarding the game's design and usability. This enables developers to prioritize enhancements that are in line with user preferences and expectations.

4.4 Summative Result

After the learner has completed any learning activity or experience, an evaluation is performed to summarize the outcomes and assess the success of the preceding learning process. The outcomes were as follows: 53.3% had high vocabulary recall and could apply it in real-life circumstances. Only 6.7% were unable to recall any of the vocabulary. 46.7% can utilize vocabulary to produce phrases or stories in everyday life, 33.3% can learn at a good or exceptional level from the game, and another 53.3% are interested in learning more. 33.3% were extremely satisfied, while 60% were moderately satisfied. As shown in Table 20

Summative Questionnaire		Count	Percent
		15	100%
1. Indicates the level of memory of the words learned from the game.	Can remember well and use it in Real situation. Can be memorized but not sure how to use it. Remembers few vocabularies and rarely uses them. Can't remember any vocabulary.	8 5 1 1	53.3% 33.3% 6.7% 6.7%
2. Do you can use the vocabulary you have learned to create sentences or stories?	Can use vocabulary to create sentences or stories well. Can use vocabulary to create sentences or stories. It is difficult to use vocabulary to create sentences or stories. Can't use vocabulary to create sentences or stories.	4 7 1 3	26.7% 46.6% 6.7% 20%
3. To what extent do you know and understand the vocabulary you learned from the game?	Excellent good sufficient little	3 5 5 2	20% 33.4% 33.3% 13.3%
4. How well do you think games help in learning vocabulary?	Games help a lot in learning vocabulary. Games help in learning vocabulary. Games help in learning a few vocabularies. Games do not help in learning vocabulary at all.	5 7 2 1	33.3% 46.7% 13.3% 6.7%

5.Can you use the vocabulary you have learned in different contexts?	Able to use vocabulary in appropriate contexts.	3	20%
	Can use vocabulary in some contexts.	8	53.3%
	Difficult to put vocabulary into context.	3	20%
	The vocabulary cannot be used in context at all.	1	6.7%
6.Are you interested in learning more about vocabulary?	Interested	8	53.3%
	Little interest	1	6.7%
	Not interested	1	6.7%
	Have learned enough	5	33.3%
7.Are you satisfied with the process of learning vocabulary through games?	Very satisfied	5	33.3%
	Moderately satisfied	9	60%
	very dissatisfied	1	6.7%
	Not satisfied at all	0	0%

Table 36 Summative Result

CHAPTER 5

CONCLUSION AND DISCUSSION

5.1 Conclusion

Game development is well underway and focuses on logic, mechanics, and gameplay design, respectively. Usability behavior analysis plays an important role in designing and evaluating educational games.

This English word game case study highlights the importance of following these behaviors to ensure an engaging and effective user experience. Implementing the recommendations outlined in this report To improve and develop And although there are some minor flaws But it's not a problem when playing as it should.

Game environments and model designs use 2D models to develop and improve because they are beautiful and simple. Make the game look colorful, easy to understand and fun to play. And development using Unity also has free downloadable models for both programs and programming languages like C# that are easy to use and quick to learn.

5.2 Discussion

The study observed that after engaging in vocabulary games, there was a noticeable improvement in the ability to memorize and provide written answers. The game-based group demonstrated a higher percentage (82.4%) compared to the memorization/regular teaching group (17.6%). This suggests that interactive and gamified learning approaches may contribute positively to knowledge retention.

The heuristic evaluation revealed that a significant majority (86.7%) of participants were aware of the option to terminate the game. However, a small percentage expressed uncertainty, emphasizing the importance of clarity in user interfaces. Consistency in design elements, such as

fonts and button layouts, received positive feedback from 80% of participants, underscoring the role of design coherence in user satisfaction.

Participants generally demonstrated a strong understanding of button functionality (93.3%), highlighting the effectiveness of the user-centric approach in accommodating diverse preferences. While a majority (73.3%) reached a consensus on design elements, a notable proportion (6.7%) exhibited uncertainty, signaling areas for potential improvement.

The high frequency of error notifications (86.7%) suggests a proactive approach by developers in addressing issues promptly. The presence of an in-game manual was reported by 80% of participants, indicating its positive impact on enhancing the overall user experience.

The summative results indicate that a substantial portion (53.3%) achieved high vocabulary recall and could apply it in real-life situations. Only a small fraction (6.7%) struggled with vocabulary recall. Additionally, 46.7% could utilize vocabulary in generating phrases or stories, and a significant majority (53.3%) expressed interest in further learning.

In terms of satisfaction, 33.3% were extremely satisfied, while 60% reported moderate satisfaction. These findings suggest a generally positive response to the learning methods employed.

In conclusion, the results provide valuable insights into the effectiveness of game-based learning compared to traditional methods. The study highlights strengths in vocabulary retention and user engagement, as well as areas for improvement in design clarity and consistency. These findings serve as a foundation for refining educational approaches and game design to better cater to the diverse needs of learners.

APPENDIX

APPENDIX A

Questionnaire

This section will show all the appendices and information sources.

6.1 Demographics and Background Questionnaire

To demonstrate the results of participant characteristics.

1.School

.....

2.Gender

- Male
- Female
- Not specified

3.Grade level

- Elementary school
- Upper elementary school
- Middle school
- High school
- Bachelor's degree or higher

4.Age range

- under 10 years
- 10 -12 years
- 13-15 years
- 16 - 18 ½
- 18 years and older

5.Cumulative GPAX

.....

6.What devices do you have access to? (You can choose more than one answer.)

- Computer/Laptop
- Mobile phone
- IPad/Tablet
- Not all used

7. Ability to use devices (maximum 5)

5	4	3	2	1
---	---	---	---	---

Computer/Laptop	<input type="checkbox"/>				
Mobile phone	<input type="checkbox"/>				
iPad/tablet	<input type="checkbox"/>				

8. How much time per day do you spend on your phone or computer?

- Less than 1 hr.
- 1 hr. - 3 hrs.
- 4 hrs. - 6 hrs.
- 7 hrs - 9 hrs.
- More than 10 hrs

9. How often do you play games?

- Play every day
- Play 3-5 days/week
- Play 1-2 days/week
- Play once in a while
- Don't play at all.

10. How much time do you spend playing games per day?

- Don't play at all.
- Less than 1 hour
- 1 hr. - 3 hrs.
- 4 hrs. - 6 hrs.
- 7 hrs - 9 hrs.
- More than 10 hrs

6.2 Questionnaire heuristic

For a complete assessment Ask users to play games and evaluate in the following order
 Enter game 2. Read the game instructions 3. Choose a level 4. Start the game. 5. Press the word by clicking on the letter. 6. Press the setting button. 7. Press mute/turn on the music. 8. Press until you find the last word. 9. Take the quiz. 10. End the game.

1.Do you think that the game's playing status is told within the game?

- Have
- Don't have
- Unsure

2.Are the symbols used in the game similar to symbols in the real world?

- Yes
- No
- Unsure

3.Can players customize personal options, such as sound or notification settings?

- Yes
- No
- Unsure

4.Is the layout of information and elements in the game up to standard?

- Yes
- No
- Unsure

5.When you perform important actions during the game Is confirmation required from players before taking important actions?

- Have
- Don't have
- Unsure

6.Are symbols and icons used within the game that are immediately recognizable and understandable?

- Yes
- No
- Unsure

7. When finished playing the spelling game, You wanted to skip the quiz game, but You didn't want to go back to spelling words again. Within the game there is an option to skip to the game quiz or not.

- Have
- Don't have
- Unsure

8. Is the gaming experience beautiful and memorable?

- Yes
- No
- Unsure

9. When a player makes an error within the game, is there any help or recommended steps to help resolve the error?

- Have
- Don't have
- Unsure

10. Is there a game manual within the game?

- Have
- Don't have
- Unsure

6.3 post-learning knowledge Questionnaire

Data were collected from the evaluation of 10 people, tested with evaluators aged 13-18 years and over, divided into 2 groups: a group that learned vocabulary through games. and groups that learn vocabulary through memorization or regular teaching.

1.School

.....

2.Gender

- Male
- Female
- Not specified

3.Age

- under 10 years
- 10 -12 years
- 13-15 years
- 16 - 18 years
- 18 years and older

4.Cumulative GPAX

.....

5.English level

- Excellent
- Moderate
- Fair
- Should improve

6.Which group are you in?

- 1 (Learn by playing games)
- 2 (learn by normal teaching methods)

Answer 25 questions

1. สถาปนิก

2. แพทย์

3. นักฟิสิกส์

4. นักชีววิทยา

5. ศาสตราจารย์

6. .registered nurse

7. ผู้ช่วย

8. ยา

9. การรักษา

10. การวินิจฉัย

11. ตะเกียง

12. ไมโครเวฟ

13. อ่างล้างหน้า

14. แม่น้ำพิมพ์

15. โทรศัพท์

16. หนังสือเรียน

17. สมุด

18. เครื่องฉายโปรเจกเตอร์

19. ทิศทาง, การควบคุมหรือการจัดการ

20. ปากกาลูกปืน

.....
21. ร้านหนังสือ

.....
22. ห้องเรียน

.....
23. ร้านขายยา

.....
24. ภูเขา

.....
25. น้ำตก

6.4 Questionnaire Summative

After the learner has completed any learning activity or experience, an evaluation is performed to summarize the outcomes and assess the success of the preceding learning process.

1. Indicates the level of memory of the words learned from the game.

- Can remember well and use it in Real situation
- Can be memorized but not sure how to use it.
- Remembers few vocabulary and rarely uses them
- Can't remember any vocabulary.

2. Do you have the ability to use the vocabulary you have learned to create sentences or stories?

- Can use vocabulary to create sentences or stories well.
- Can use vocabulary to create sentences or stories.
- It is difficult to use vocabulary to create sentences or stories.
- Can't use vocabulary to create sentences or stories.

3. To what extent do you know and understand the vocabulary you learned from the game?

- Excellent
- Good
- Sufficient
- Little

4. How well do you think games help in learning vocabulary?

- Games help a lot in learning vocabulary.
- Games help in learning vocabulary.
- Games help in learning a few vocabulary.
- Games do not help in learning vocabulary at all.

5. Can you use the vocabulary you have learned in different contexts?

- Able to use vocabulary in appropriate contexts.
- Can use vocabulary in some contexts.
- Difficult to put vocabulary into context.
- The vocabulary cannot be used in context at all.

6. Are you interested in learning more about vocabulary?

- Interested
- Little interest
- Not interested
- Have learned enough

7. Are you satisfied with the process of learning vocabulary through games?

- Very satisfied
- Moderately satisfied
- Very dissatisfied
- Not satisfied at all

8. Have any suggestions? Would you like to suggest something to further improve the game or the learning process?

.....

9. Do you have any suggestions? For improvements to the game that you would like to suggest?

.....

APPENDIX B

Picture of actual data collection



Figure 25 Evaluation



Figure 26 Evaluation



Figure 27 Evaluation



Figure 28 Evaluation



Figure 29 Evaluation



Figure 30 Evaluation

REFERENCES

- [1] J. Nielsen(1993), Usability engineering. Academic Press, Retrieved from <http://surl.li/nkghk>
- [2] Nielsen, J. (10). Usability heuristics for user interface design. Retrieved from <http://surl.li/nkgrt>
- [3] Jones, M. G. (1998, February). Creating electronic learning environments: Games, flow and the user interface. Proceedings of selected research and development presentations at the national convention of the association for educational communications and technology (AECT), St. Louis, MO. Retrieved from <http://surl.li/nkhct>
- [4] Hoffman, B. & Nadelson, L. (2010). Motivational engagement and video gaming: a mixed methods study. Educational Technology Research and Development, 58, 245-270. Retrieved from <http://surl.li/nkhdb>
- [5] Evans, M., Norton, A., Deater-Deckard, K., & Chang, M. (2012). The Candy Factory Game: An Educational iPad Game for Middle School Algebra-Readiness. Retrieved from <http://surl.li/nkhdb>
- [6] Ball, D., Tofel-Grehl, C., & Searle, K. (2020). ESCAPE Puzzles: Bringing Physics to Fruition Through Classroom-Based Making. Retrieved from <http://surl.li/nkhje>

