

Development of an Educational Application Using Gamification Approach: *Peribahasa Pintar*

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Abstract: The educational system is constantly evolving, and with the rise of nowadays technology, the integration of gamification in education can become increasingly popular. Students have difficulty remembering and comprehending a proverb since it has various interpretations. However, the proposed educational application's gamified approach to learning can help students tackle this challenge by providing a fun and engaging way to learn proverbs and their meanings. The proposed educational application is designed to target children between the ages of 10-12 years old. Additionally, the application was developed using the Multimedia Mobile Content Development (MMCD) methodology, which ensured a comprehensive approach to creating engaging and interactive multimedia content. The app combines game elements and trivia to provide an immersive learning experience on Malay proverbs for children. With engaging features, kids effortlessly learn while having fun and participating actively. In Beta testing, the feedback showed 100% user acceptance, with users learning and remembering proverbs. Future work includes expanding content, adding awards, incentives, and social interaction.

Keywords: Gamification, Proverb, MMCD

1. Introduction

Peribahasa or Malay proverbs are a metaphorical and layered arrangement of words with an inferred meaning. Malay proverbs, which have been passed down through generations, serve as a metaphorical representation of humor and teachings. Malay proverbs are considered valuable because they embody noble qualities that contribute to the establishment of a harmonious community. As a result, proverbs are included in the curriculum of schools, specifically in the Bahasa Malaysia subjects. Proverbs encompass various forms, such as idioms, parables, sayings, epigrams, and words of wisdom. According to the Dokumen Standard Kurikulum Dan Pentaksiran (DSKP) [1], proverbs are recognized as an essential component of the language system used in Bahasa Malaysia subjects.

The use of a language system that includes grammar, spelling, pronunciation and intonation, vocabulary, and proverbs in Bahasa Malaysia teaching and learning enables students to use and practice

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the standard Malay language. This knowledge can assist kids in evaluating a situation and deciding on the best course of action for themselves and the surrounding community. Malay proverbs are also essential for these younger generations in forming a community's identity and experiencing fun socializing while talking or writing. Some children nowadays prefer to follow trending terms on social media that have no real meaning rather than learn about Malay proverbs that are full of pure value. Consequently, this project is suggested to encourage children to learn Malay proverbs while having fun with it through gamification. According to a study by Sailer [2], gamification can improve students' motivation and engagement in learning. This document presents the idea of an educational application that uses gamification as an approach to motivate and engage students.

The positive aspects of games, such as increased motivation, competitiveness, better team communication, and sharpened problem-solving and decision-making, provide a wider perspective on how a game can have a positive rather than a negative impact [3]. Furthermore, gamification has been applied in a variety of educational apps to engage children in gameplay while also improving their knowledge. However, there are some challenges in teaching children the meaning of each Malay proverb, and most of them believe that learning Malay proverbs is challenging because it requires them to remember the words and their meanings. Then, because children prefer to recall things based on what they see on the screen, this application was developed to have an engaging character, a compelling storyline, and an easy-to-use interface. Besides, these game components are used in this technique to increase user engagement, motivation, and attention span. In a non-game context, the gamification method will be implemented in this application to assist the learning process, as games are fun.

According to a survey [4], students in year six at Rantau Panjang National School are familiar with proverbs, but their mastery is not widespread. Children should learn more about Malay proverbs because it is a cultural heritage. The nation of Malaysia uses Malay proverbs to highlight wisdom and beauty in language. According to the results of the survey, 90% of the students are unable to understand Malay proverbs. This proves that children's Malay proverb understanding needs to be improved. However, based on the existing applications on the play store, there are fewer Android-based applications on Malay proverbs with gamification approaches. Most current applications are likely to be used as references, such as a digital dictionary where students can search for the words and their meanings. Besides, the application and utilization of Malay proverbs face challenges in contemporary society, as there is a declining interest and limited understanding of their value among the younger generation. This poses a threat to the preservation of cultural heritage and the development of a strong community identity. The lack of exposure to and appreciation for Malay proverbs has resulted in a preference for superficial and trendy language expressions found on social media platforms, which do not contribute to the cultivation of noble qualities and ethical decision-making. This issue calls for effective strategies and platforms to revive and promote the application of Malay proverbs, fostering a deeper understanding, engagement, and enjoyment among the younger generation while instilling cultural values and enriching their language skills.

The objectives of this application are to design a *Peribahasa Pintar* educational application using the Gamification approach, to develop an educational application for primary school students by implementing level and progression game mechanics from the first objective, and to perform functional testing and user acceptance test on the developed application to the target user. Most children nowadays understand how to use a phone to investigate things and learn. This application will assist students in learning and comprehending the *peribahasa* that they have already learned in school during classes. This application will be developed in Bahasa. The Subject Matter Expert (SME) involved in the information retrieval process in this project is Madam Suhaila Binti Mohd Said worked as a *Bahasa Melayu* teacher at Sekolah Kebangsaan Haji Abdullah Sadun. The application consists of three levels, each offering distinct backgrounds and a unique set of items to collect to unveil the Malay proverbs. Additionally, the second and third levels present bonus trivia questions for users to answer upon

completing the level. In the final level, users face the added challenge of completing the game within a specified time frame, adding a sense of urgency and excitement to the experience.

The application will incorporate a rich selection of Malay proverbs derived directly from the textbook, ensuring an authentic and educational experience. To create an immersive environment, the game will introduce diverse decorations representing a vibrant village and city setting, bringing the Malay proverb's context to life. These will encourage the exploration and application of Malay proverbs in a fun and interactive manner. By integrating the village and city concept of Malaysia into the application, players will not only develop a deeper understanding of Malay proverbs but also gain a sense of cultural identity and community connection. Furthermore, this project was developed using Multimedia Mobile Content Development.

The expected outcome of this application is a fully functional and user-friendly platform that allows users to explore Malay proverbs while enjoying an interactive gaming experience. The application specifically targets children in primary school, aiming to enhance their knowledge acquisition process. The user interface was designed intuitively, ensuring that all buttons and navigation elements are clear and easily accessible to guide users seamlessly through the app. The game section will provide a smooth and engaging experience, allowing users to play games without any technical glitches or interruptions. In the trivia section, users will be able to select their responses, and the application will provide immediate feedback, indicating whether the answer is correct or incorrect. The application will utilize multimedia elements, including appropriately placed text, images, animations, and background designs, to create an immersive and visually appealing learning environment. The interface design will prioritize user preferences, particularly those of children, ensuring that the application's icon and text effectively convey its features and facilitate easy navigation. By utilizing the *Peribahasa Pintar* application, users will have an enjoyable experience while expanding their understanding and knowledge of Malay proverbs in a fun and accessible manner.

2. Related Work

When researching a topic, it is imperative to thoroughly examine related works to gain a comprehensive understanding. In this section, it will delve into two sub-sections that shed light on various examples directly relevant to the project. These sub-sections will explore the Gamification approach, which offers a compelling method to engage and motivate learners, and delve into the realm of Android Technology, which presents exciting possibilities for the application's development and accessibility. By exploring these specific areas, this project aims to provide concrete examples that showcase the potential impact and effectiveness of incorporating Gamification and Android Technology in the application.

2.1 Gamification

Gamification is the process of applying gaming methods and mechanics in a non-game context to engage and motivate individuals. Gamification involves incorporating game-like features such as rules, leaderboards, rewards structure, points, badges, challenges, and levels [5]. These features can be used for various activities to enhance user engagement, learning and behavior change. By leveraging the intrinsic human desire for competition, achievement, and social interaction, gamification aims to make it more enjoyable and compelling, ultimately leading to increased motivation and participation of the user when using the application. A study reported that the gamification principles created excitement, curiosity, and a sense of achievement when activities were completed, and feedback was received [6].

The concept of gamification has gained significant attention and popularity in various fields, including education, marketing, employee training, health and wellness, and customer engagement. By introducing game mechanics into the educational application can drive desired behaviors, boost productivity, encourage knowledge acquisition, and improve overall experiences. Numerous successful

examples of gamification can be found across different industries and platforms. For instance, Duolingo is a language-learning platform that integrates game-like features to engage users in learning language practice, offering points, level, and streaks as reward of consistency learn through the platform.

Gamification is a powerful strategy that leverages game design elements to engage and motivate individuals in various domains. By incorporating game-like features, organizations can enhance user experiences, drive desired behaviors, and achieve better outcomes. With its ability to tap into human motivation and engagement, gamification continues to be a valuable tool for improving engagement and participation in a wide range of contexts.

2.2 Android Technology

The term "Android" was originally intended to refer to a robot, but now it refers to Google's open-source mobile phone operating system. Android is a mobile operating system, middleware, user interface, and application software that are built on the Linux platform. It is regarded as the first genuinely open mobile software for mobile terminals. Developed by Google, Android powers a wide range of smartphones, tablets, smartwatches, and other devices. It provides a robust platform for developers to create and distribute applications, offering a rich set of features and capabilities. The key aspects of Android technology are its layered architecture, which includes components such as libraries written in C or C++ that offer a wide range of capabilities, including graphic rendering and more. Besides, Android provides the development tools that facilitate application creation and testing. An example of the primary tools is the Android SDK, which allows developers to create, test, and debug Android applications. Android Emulator is also a tool that allows developers to emulate different Android devices for testing purposes, and Gradle is the build system used in Android development to manage dependencies and build application packages. Android supports application development using Java, Kotlin, and C/C++. Developers can leverage the Android SDK and APIs to create applications with rich user interfaces and multimedia capabilities. Additionally, the application can be distributed through various channels or through the primary one, which is the Google Play Store, to reach a larger audience of Android device users. Alternative app stores and direct distribution methods are available for application deployment.

2.3 Existing Applications

The project will analyze three current similar applications that can be utilized to conduct a comparative study in this part. Table 1 below contains highlights from each application, as well as a short list feature that better matches the proposed application to three other applications. In this section, a comprehensive comparison has been conducted between several existing applications, namely Teka Peribahasa [7], e-BM [8], Peribahasa Sekolah Rendah [9], and the innovative proposed application, *Peribahasa Pintar*. Figure 1 of the existing application is attached in Appendix A.

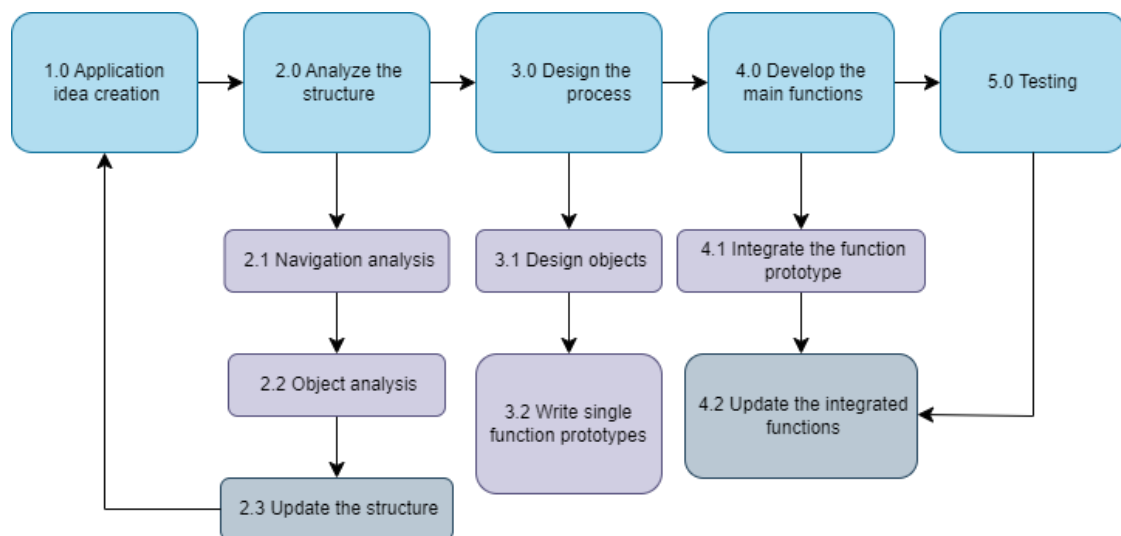
The *Peribahasa Pintar* application is specifically designed for the Android platform, utilizing a gamification approach to enhance user engagement. It is available as a free download, providing easy access to users. On the other hand, the Peribahasa Sekolah Rendah application requires a purchase before it can be utilized. All these four applications primarily concentrate on Malay proverbs; however, they adopt distinct styles of engagement, offering users diverse and unique experiences. The *Peribahasa Pintar* Application offers an engaging experience with its three progressive levels, where users must successfully navigate each level to unlock the next. Additionally, in the second and third levels, users are presented with exciting bonus trivia questions upon completing the respective levels.

Table 1: Similar existing application comparison

Application	Teka Peribahasa	e-BM	Peribahasa Sekolah Rendah	Peribahasa Pintar
Platform	Android	Android	iOS, iPadOS and macOS	Android
Language	Malay language	Malay, English and Tamil	Malay	Malay
Module	Quiz module	Learning by theme and exercise module	Game module	Game with trivia module
User interface	Consistent placement of button and icon. Side-bar menu	Colorful panel and icon. Bottom main navigation	Consistent style and design for button	Interactive interface with audio, text, and video.
Price	Free	Free	RM4.90	Free
In-app purchases	In-app purchasing	No in-app purchasing	No in-app purchasing	No in-app purchasing
Sound Effect	Available	Not available	Available	Available

3. Methodology

The Multimedia Mobile Content Development (MMCD) methodology was used to develop this project. The phases involved in the MMCD methodology are listed below in Figure 2.

**Figure 2: Phases in MMCD method**

MMCD refers to the process of creating interactive and engaging content for mobile devices that incorporates various forms of media such as text, images, audio, videos, and animations. It involves designing and producing content that leverages the capabilities and features of mobile to deliver a rich and immersive user experience. The method consists of five main phases which are application idea creation, analyze the structure, design the process, develop main functions and testing. There are other sub phases under the second to fourth phase. This framework design helps the developer to speed up the development activities and to ensure that the application developed will perform as planned [10].

3.1 Application Idea Creation Stage

The initial phase entails conducting thorough data gathering for the proposed application. This process involves the collection of pertinent information to identify the specific user requirements. To gather relevant insights, an online interview session with a Subject Matter Expert (SME) is conducted, enabling valuable input and expertise to be incorporated into the project. Table 2 below presents the process of idea creation undertaken prior to commencing the design and development phases of the application, ensuring a well-planned foundation for the project.

Table 2: Application idea creation checklist

Item	Note
Type of application	Mobile Educational Application
Target device	Android
Target users	Primary school student (Year 4-6)
Unity	<ul style="list-style-type: none"> ▪ Version 2021.3.24f1 ▪ Assets ▪ Develop the animation and the game panel
Canva	Design assets or decoration
Adobe Illustrator	Design character, background, panel, checkpoints, and pop-up message
Procreate	Draw images of item that relate to Malay proverbs
GUI	Background for main menu, each level, and trivia
Images	Images for decoration and items (draw)
Video	Tutorial for movement
Audio	Background music, movement, and sound effects
Application Synopsis	<p><i>Peribahasa Pintar</i> is an innovative mobile educational application that offers users an engaging gameplay experience centered around collecting items related to Malay proverbs. This interactive application presents users with Malay proverbs and their corresponding meanings, along with the specific type of proverb, as they progress by collecting the required items. It should be noted that this version of the application focuses exclusively on Malay proverbs included in the textbooks for students in year 4 to year 6, ensuring a targeted and curriculum-aligned learning experience.</p>

3.2 Analyze the Structure Stage

In this phase, navigation and objects used in the application are analyzed. Figure 3 below shows the navigational structure of the application.

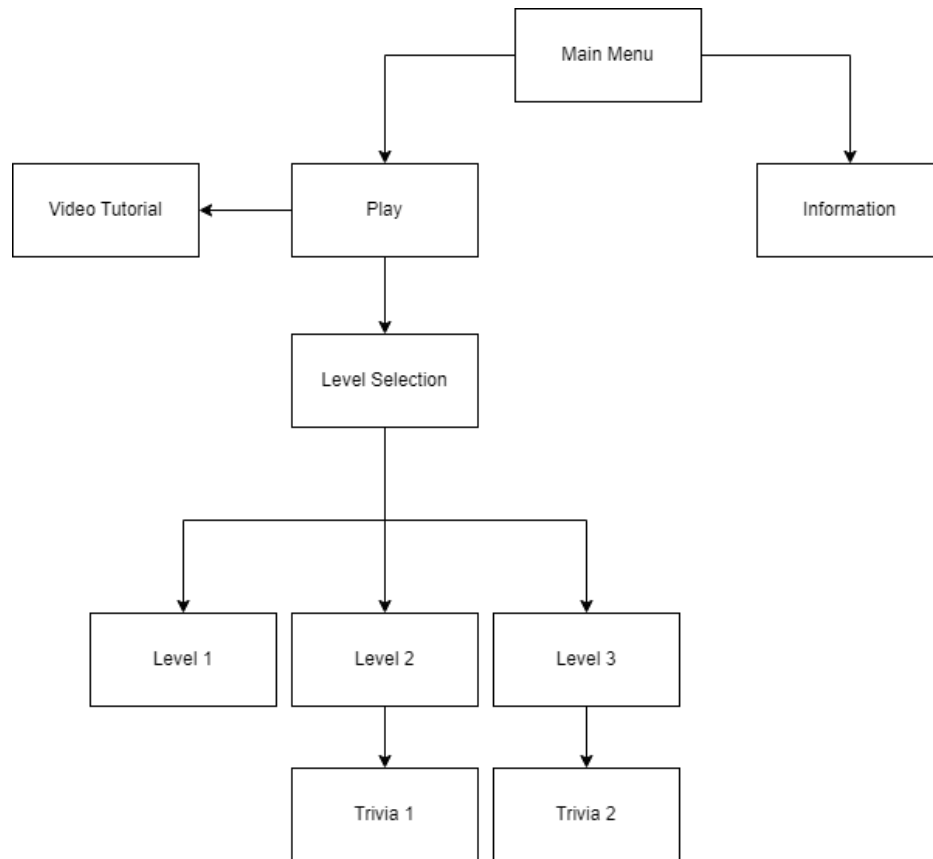


Figure 3: Navigational Structure

Furthermore, this section delves into an in-depth discussion on both the functional and non-functional requirements of the application. Table 3 and Table 4 provided below outline the specific criteria for each category, offering a comprehensive overview of the necessary considerations.

Table 3: Functional requirements

Functional Requirements	Description
User interaction	<ul style="list-style-type: none"> ▪ The application should allow the user to select play or information by clicking on the button. The application should allow users to navigate through the application by clicking on the specific icon. ▪ The application should allow the user to move the character when clicking on the movement button. ▪ The application should allow the user to close the display of Malay proverbs after the user reads it. ▪ The application should allow the user to navigate to trivia questions after finishing the second and third level.

Table 3: (cont)

Functional Requirements	Description
User interaction	<ul style="list-style-type: none"> ▪ The application should allow the user to open an inventory when the user clicks on the inventory button. The user can see the items that need to be collected.
Application behavior	<ul style="list-style-type: none"> ▪ After launching the application, the application will display the main menu interface. ▪ The user can access the level selection page or information of the application. ▪ In the level selection page, only level 1 can be chosen for the first time. Users need to finish the first level to unlock the next level.
Learning content	<ul style="list-style-type: none"> ▪ The application should allow users to learn about Malay proverbs. ▪ The application should allow users to gain knowledge of proverbs with the related item. ▪ The application should allow the users to know the meaning and type of the proverbs. ▪ The application should enable users to gain better understanding about Malay proverbs. ▪ The application should enable the user to gain more knowledge about Malay proverbs when the user plays the game.

Table 4: Non-functional requirements







Non-Functional Requirements	Description
Usability	<ul style="list-style-type: none"> ▪ The flow of the application has been meticulously designed to ensure ease of understanding, particularly for children. ▪ The application aims to deliver a delightful and thrilling experience while enhancing the user's knowledge. ▪ The application provides the flexibility for users to download and utilize it at their convenience, anytime and anywhere, allowing for seamless accessibility and engagement.
Implementation	<ul style="list-style-type: none"> ▪ The application shall be able to run using Android devices starting from Android 5.0.

Non-Functional Requirements	Description
Efficiency	<ul style="list-style-type: none"> The application shall exhibit swift responsiveness when users interact with the buttons, ensuring a seamless and efficient user experience.
	<ul style="list-style-type: none"> The application shall possess full offline functionality, allowing users to access and utilize its features without requiring an internet connection.

3.3 Design the Process Stage

The third phase of the MMCD methodology involves the meticulous design of the process. Within this phase, two sub-phases are undertaken, namely object design and the creation of a prototype's single function. These sub-phases ensure a systematic and focused approach to designing an efficient and effective solution. During this phase, the character design is crafted using Adobe Illustrator. With the versatile capabilities of Adobe Illustrator, various elements such as the background, buttons, characters, pop-up messages, and checkpoints are created. Additionally, Procreate, a powerful drawing tool, is employed to draw over 20 unique items that serve as missions for users to collect, providing a captivating way to reveal the proverbs. Moreover, Canva is utilized to craft exquisite decorations that complement the background and surroundings, adding an extra touch of visual appeal. The animation in the application is created using animator in Unity. Table 5 below shows the button design used for the development of the application and Table 6 shows the interfaces design of the application.

Table 5: Button design

Button	Description
	The play button to start the game.
	The information button to display the information of the application.
	The level selection button. There are three level
	The play button to start answering trivia question
	Pause button to stop the game
	Inventory button to display the instruction and the items to be collect in that level







Button	Description
	This is button allow user to watch a video tutorial on how to control the character in the game.
	Movement buttons to move the character to the left and right.
	Jump button.
	Closed button.
	Resume button
	Home button

Table 6: Interface design


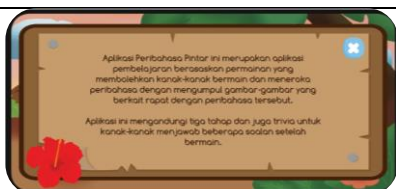



Interface	Description
	This is the main interface of the application where user can choose to play or to read the information.
	This is the information interface. User can click the closed button and the application will go back to the main interface.
	This is the level selection interface where user can click on the tutorial button to watch the video before starting the level 1.
	This is the tutorial video.

Table 6: (cont)

Interface	Description
	The is the first level, with the view and surroundings of Malacca city.
	This is the second level with the view and surroundings of Kuala Lumpur city. The second levels have few obstacles such as nail.
	This is the third level with the view and surroundings of Kedah. The third level have timer and user need to accomplish the mission within the time frame.
	This is the interface of the instruction when user click the inventory button.
	This is the interface where the application displays the Malay proverbs
	This is the interface when user click the pause button. User can choose to resume the game or go to the main menu.
	This is the starting of trivia questions interface after the user finish level two or level three.
	This is the trivia question interface with the score.

Interface	Description
	The is the final interface when the user answers all the questions. Upon clicking the closed button. The application will navigate the user to the level selection page.

3.4 Develop Main Functions

In the development of this application, the primary focus lies in creating a seamless user experience by providing key functionalities. These include smooth navigation across all scenes within the application, enabling users to control the character's movement to collect items, and offering the ability to preview and explore a wide range of Malay proverbs through the level. Furthermore, scripting is essential not only for enabling seamless character movement and interaction with various items, but also for ensuring that the camera adeptly tracks the character's every motion. When the user passes through an item and collides with a wooden checkpoint, the checkpoint performs a check to determine if the player has collected enough items to verify a preview of Malay proverbs. If the player does not have enough items, a message will appear, instructing the user to backtrack and locate the remaining items.

```

PlayerMovement.cs
C:\Users\user\Desktop>Create with Code>TESTING 2021>Assets>Scripts>Player>PlayerMovement.cs
21 public Rigidbody2D playerRB;
22 public Animator animator;
23
24 private void Awake()
25 {
26     controls = new PlayerControls();
27     controls.Enable();
28
29     // when run is performed - it called in the curly
30     controls.land.run.performed += ctx =>
31     {
32         direction = ctx.ReadValue<float>();
33     };
34
35     controls.land.jump.performed += ctx => Jump();
36
37 }
38
39 void FixedUpdate()
40 {
41     isGrounded = Physics2D.OverlapCircle(groundCheck.position, 0.1f, groundLayer);
42     animator.SetBool("isGrounded", isGrounded);
43
44     playerRB.velocity = new Vector2(direction * speed * Time.fixedDeltaTime, playerRB.velocity.y);
45     animator.SetFloat("speed", Mathf.Abs(direction));
46     // for movement to left right
47
48     //to check where character facing
49     if(isFacingRight && direction < 0 || !isFacingRight && direction > 0)
50     {
51         Flip();
52     }
53
54 void Flip()

```

Figure 4: Code of Player Movement

Figure 4 provides an illustrative depiction of the code responsible for managing player movement. By examining the code, the player possesses the ability to navigate both to the right and left while situated on the ground. To determine whether the player is on the ground or not, the code includes a check based on the "ground" tag assigned to the platform. Additionally, the code ensures that the player's direction aligns with their intended movement. This means that when moving to the right, the character is oriented towards the right, and similarly, when moving to the left, the character is facing in the leftward direction. Figure 5 below illustrates the code for the player manager, which efficiently

handles the navigation of buttons upon user interaction. When the user clicks on the button, this code activates the corresponding screen, ensuring a seamless transition.

```

150     }
151
152 }
153
154 //after game over , button replay
155 public void ReplayLevel()
156 {
157     SceneManager.LoadScene(SceneManager.GetActiveScene().buildIndex);
158     // SceneManager.LoadScene(sceneBuildIndex: 1);
159     ResetScore();
160 }
161 //pause button
162 public void PauseGame()
163 {
164     Time.timeScale = 0;
165     pauseMenuScreen.SetActive(true);
166 }
167
168 //inventory / book button
169 public void QuestHint()
170 {
171     Time.timeScale = 0;
172     QuestHintScreen.SetActive(true);
173 }
174 // closed book button
175 public void ClosedHint()
176 {
177     Time.timeScale = 1;
178     QuestHintScreen.SetActive(false);
179 }
180 //resume game @ pause button
181 public void ResumeGame()
182 {
183     Time.timeScale = 1;

```

Figure 5: Code of Player Manager

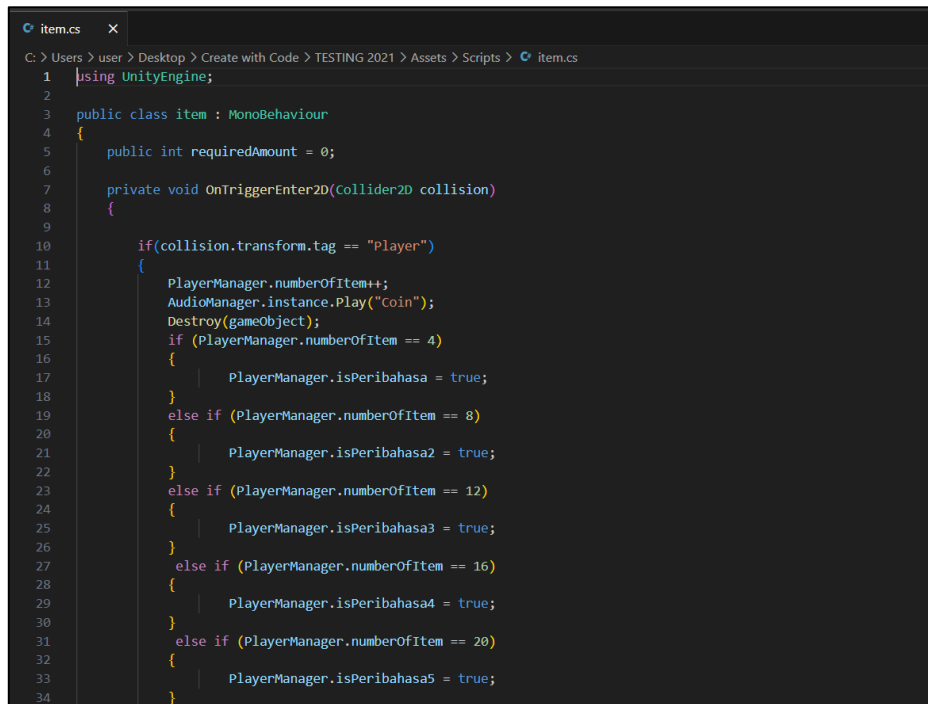
```

1 using UnityEngine;
2 using System.Collections;
3 public class PlayerCollision : MonoBehaviour
4 {
5
6     private void OnCollisionEnter2D(Collision2D collision)
7     {
8         if(collision.transform.tag == "Obstacle")
9         {
10             Debug.Log("Game Over");
11             PlayerManager.isGameOver = true;
12             AudioManager.instance.Play("GameOver");
13             gameObject.SetActive(false);
14         }
15         if(collision.transform.tag == "Obstacle1")
16         {
17             Debug.Log("Game Over");
18             PlayerManager.isGameOver1 = true;
19             AudioManager.instance.Play("GameOver");
20             gameObject.SetActive(false);
21         }
22     }
23 }
24
25

```

Figure 6: Code of Player Collision

Figure 6 illustrates the code execution when the game character collides with an obstacle, resulting in a game over condition. Additionally, a specific line of code triggers a corresponding sound effect upon collision. This application incorporates two types of obstacles: water and nails. Touching either of these obstacles leads to the termination of the game; however, users have the option to replay the game. Upon replay, the game resets to its initial starting point, emphasizing the importance of caution and precision in achieving the mission. Next, Figure 7 below demonstrates that when players collide with the item, the item will be tallied and presented as "*Kutipan*.". Moreover, upon collecting the first four items, the window showcasing Malay proverbs will be prominently exhibited.



```

1  using UnityEngine;
2
3  public class Item : MonoBehaviour
4  {
5      public int requiredAmount = 0;
6
7      private void OnTriggerEnter2D(Collider2D collision)
8      {
9
10         if(collision.transform.tag == "Player")
11         {
12             PlayerManager.numberOfItem++;
13             AudioManager.instance.Play("Coin");
14             Destroy(gameObject);
15             if (PlayerManager.numberOfItem == 4)
16             {
17                 PlayerManager.isPeribahasa = true;
18             }
19             else if (PlayerManager.numberOfItem == 8)
20             {
21                 PlayerManager.isPeribahasa2 = true;
22             }
23             else if (PlayerManager.numberOfItem == 12)
24             {
25                 PlayerManager.isPeribahasa3 = true;
26             }
27             else if (PlayerManager.numberOfItem == 16)
28             {
29                 PlayerManager.isPeribahasa4 = true;
30             }
31             else if (PlayerManager.numberOfItem == 20)
32             {
33                 PlayerManager.isPeribahasa5 = true;
34             }
35         }
36     }
37 }

```

Figure 7: Code of Item

3.5 Testing

In the development of this application, the final phase is testing, which plays a crucial role in ensuring its quality and functionality. Two essential types of testing are conducted during this stage: functional testing and user acceptance testing. Functional testing involves assessing the application's individual components and features to ensure they perform as intended. By subjecting the application to various test scenarios, potential errors or bugs can be identified, allowing for necessary improvements. Simultaneously, user acceptance testing or beta testing is performed to gauge how well the application meets the needs and expectations of its intended users. This testing phase involves real users interacting with the application, providing valuable feedback that helps refine its usability and overall user experience. If errors or bugs are detected during this testing phase, the project undergoes a feedback loop, necessitating a return to the previous step to update and integrate functions. This iterative process ensures that any identified issues are promptly addressed and resolved, leading to a more robust and reliable application.

4. Results and Discussion

This section provides a comprehensive overview of the user results and testing outcomes obtained during the evaluation of the *Peribahasa Pintar* application.

4.1 Testing

This section will delve deeper into the results obtained during the testing phase. During this phase, both alpha and beta testing were conducted to ensure the fulfillment of objectives and meet the requirements of the target users. The developer performed alpha testing to meticulously identify and rectify any potential bugs or errors. On the other hand, beta testing involved the distribution of an .apk file along with a Google Form questionnaire, and the findings from the questionnaire are presented in Table 7 in Appendix A.

4.1 Functional Testing

Table 8 presents the comprehensive testing categories conducted on the application, providing a detailed overview of the evaluation process.

Table 8: Functional Testing Result

Category	Description	Expected Result	Actual Result
Main Menu	▪ <i>Main</i> Button	▪ Navigate to the level selection page. ▪ Navigate to information page.	Pass
	▪ <i>Info</i> Button		Pass
Level Selection	▪ Tutorial button	▪ Display video tutorial.	Pass
	▪ Pause button	▪ Display resume or main menu options.	Pass
		▪ Navigate to level 1 game.	
	▪ <i>Tahap 1</i> button	▪ Navigate to level 2 game.	Pass
	▪ <i>Tahap 2</i> button	▪ Navigate to level 3 game.	Pass
	▪ <i>Tahap 3</i> button		Pass
Video Tutorial	▪ Closed button	▪ Back to the level selection page.	Pass
	▪ Tutorial	▪ Automatic play the video.	Pass
Pause Window	▪ Resume button	▪ Back to previous page.	Pass
	▪ Main menu button	▪ Navigate to the main menu page.	Pass
Level	▪ Movement button	▪ Move the player to right, left and jump.	Pass
	▪ Pause Button	▪ Display pauses window	Pass
	▪ Pop-up message	▪ Display message	Pass
	▪ Sound effects	▪ Play sound effect upon interaction.	Pass
	▪ Scoring system	▪ Display numbers of collected items.	Pass
	▪ Inventory button	▪ Display inventory window	Pass
	▪ Proverbs	▪ Display proverbs after collect the item	Pass
	▪ Game over	▪ Display game over when collide with obstacle.	Pass
	▪ Timer	▪ Display timer on level 3	Pass
Trivia	▪ <i>Mula</i> button	▪ Start the trivia.	Pass
	▪ Question	▪ Display the question on the top.	Pass
	▪ Answers option	▪ Display list of answers that the user can choose.	Pass
	▪ Feed back		Pass

<ul style="list-style-type: none"> ▪ Score ▪ Closed button 	<ul style="list-style-type: none"> ▪ Display animation feedback on true or false after the user clicks the answer. 	Pass
	<ul style="list-style-type: none"> ▪ Display score (5 marks per question). ▪ Navigate to the level selection page 	Pass

Table 8 shows a comprehensive overview of the functional testing results, indicating that all buttons and interactions within the application are functioning well. The primary goal of this functional testing is to ensure that the application functions correctly and meets the intended functional requirements. Furthermore, this test also serves the purpose of ensuring that all interfaces are displayed correctly in response to the user's interactions with buttons, collectible items, checkpoints, and trivia questions.

4.2 User Acceptance Test

The user acceptance test was conducted specifically on the primary school student target audience, primarily focusing on students in years 4-6. This selection was based on the application's utilization of proverbs from the Malay Language textbook for these grade levels. To ensure comprehensive testing, the developers organized testing sessions at the SME's school and extended the testing to other target audiences through online platform and face to face session. To gather feedback, a set of questions was created using Google Forms, which allowed testers to provide insights after completing the application testing. In total, the testing process involved 25 respondents, providing valuable input for further improvements. The questionnaire consists of a linear scale question range from 1 to 5, encompassing a spectrum of responses from 1 - "*Sangat Lemah*" (Very Weak) to 5 - "*Terbaik*" (Excellent). Figure 8 visually demonstrates unanimous agreement among all the testers regarding the application's efficacy in aiding them with learning and remembering Malay proverbs.

Based on the results from Table 7 in Appendix A, it can be observed that 76% of the testers rated their satisfaction with the application as a 5, indicating a positive response from the users. Furthermore, 80% of the testers gave a rating of 5 for their enjoyment while using the application, suggesting a high level of user engagement. These findings demonstrate the application's potential to successfully attract and engage the target users. It is worth noting that all respondents (100%) agreed that the application was helpful in learning and remembering Malay proverbs, emphasizing its educational value. However, there were a few lower ratings, such as 20% giving a rating of 3 - "*Biasa*" for button functionality. This could be attributed to some buttons requiring users to touch them for a few seconds or to target at specific area, which might have caused usability issues. Nonetheless, it is important to highlight that despite these concerns, all buttons were found to be functioning well and as expected.

Regarding the User Interface design, most respondents (84%) gave a rating of 5 for the attractiveness of the interface display. The findings also revealed that the text, score, and overall interface were well-displayed and interesting, as agreed upon by the respondents. These positive ratings indicate that the developers successfully designed the characters and interface based on user preferences.

In summary, the data from Table 7 indicates a generally positive response from the testers. The high satisfaction and enjoyment ratings, coupled with the agreement on the application's educational value, highlight its potential to engage and attract the target users. Although there were some concerns about button functionality, overall, the User Interface design received positive feedback, suggesting a well-designed and visually appealing application. Figure 9 in Appendix A visually presents a collection of insightful pictures captured during the user acceptance testing phase, providing a visual representation of the test process and user interactions.



Figure 8: Users Feedback

5. Conclusion

In conclusion, the *Peribahasa Pintar* application has been successfully developed for the Android platform, aligning with its proposed objectives. The feedback received from the testers indicates a high score and positive evaluations from most users. Moreover, several suggestions for improvement have been put forward, including the addition of new characters for users to choose from, the introduction of more levels and challenges, and the expansion of the trivia question database with additional questions.

The users have expressed their enjoyment and excitement while using the application, highlighting its engaging nature. This educational tool serves as an aid in learning the Malay Language subjects, leveraging the familiarity of current technology, as even children nowadays are adept at using smartphones. By incorporating these advancements, the application can facilitate the wider dissemination and understanding of Malay proverbs among the younger generation, ensuring their preservation and cultural significance are not forgotten.

The users can embark on an enriching and immersive learning journey while engaging in gameplay and trivia challenges. The game revolves around presenting images that depict Malay proverbs, as children tend to grasp information more effectively through visual cues rather than textual content. However, to enhance the overall experience, certain aspects can be improved in the future, including the seamless movement of characters and animations. Furthermore, future recommendations entail incorporating additional levels and challenges, providing a visual representation of collectible item progress, and introducing new characters to diversify the gameplay.

Acknowledgment

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Appendix A

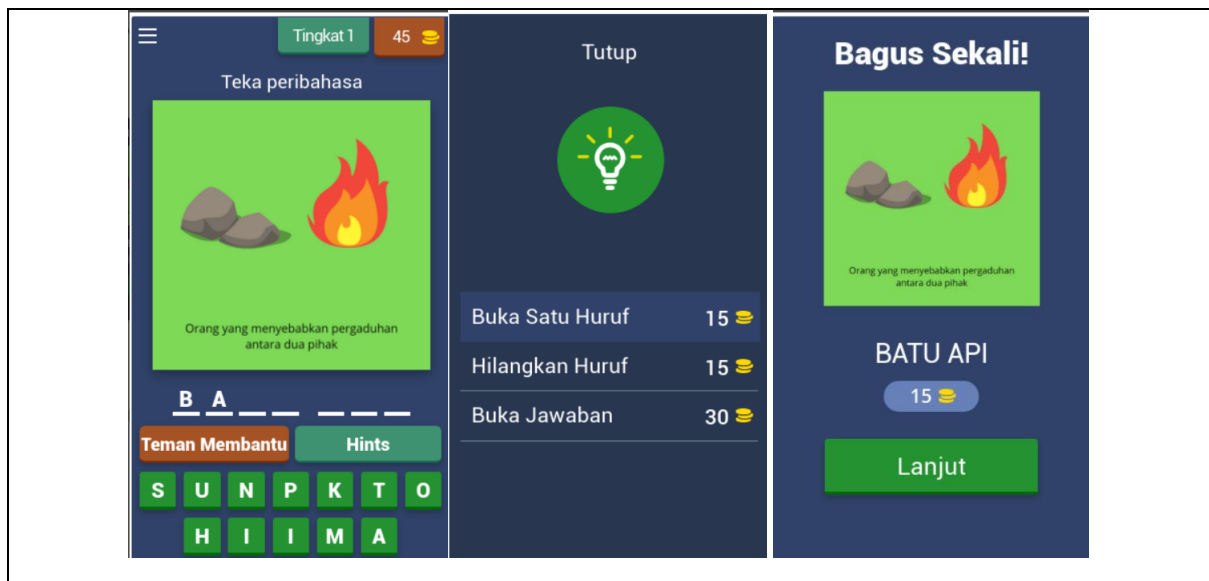


Figure 1(a): Teka Peribahasa

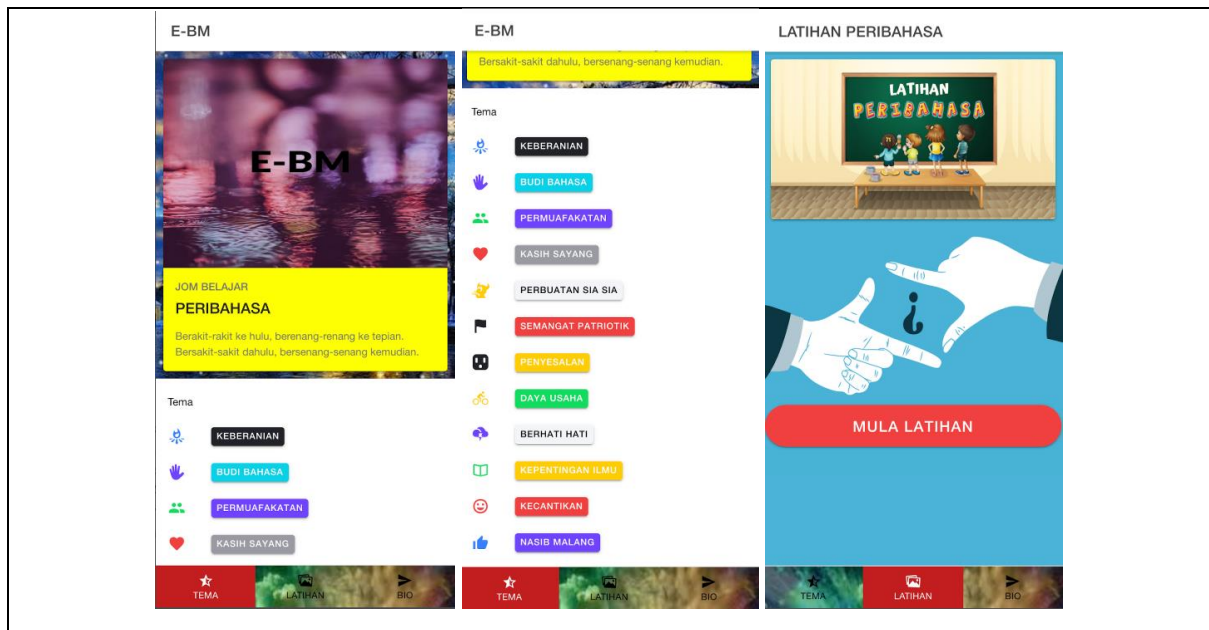


Figure 1(b): e-BM

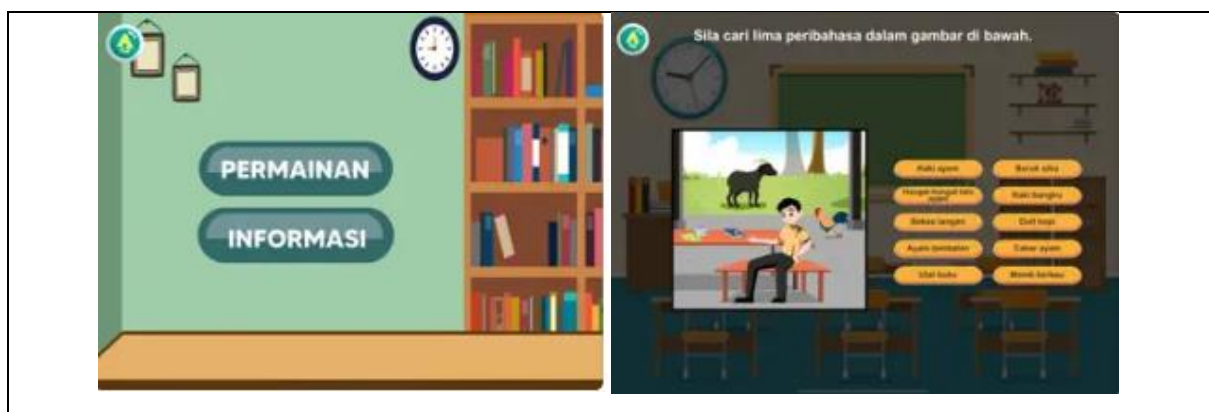


Figure 1(c): Peribahasa Sekolah Rendah



Figure 9(a): Testing at school with SME

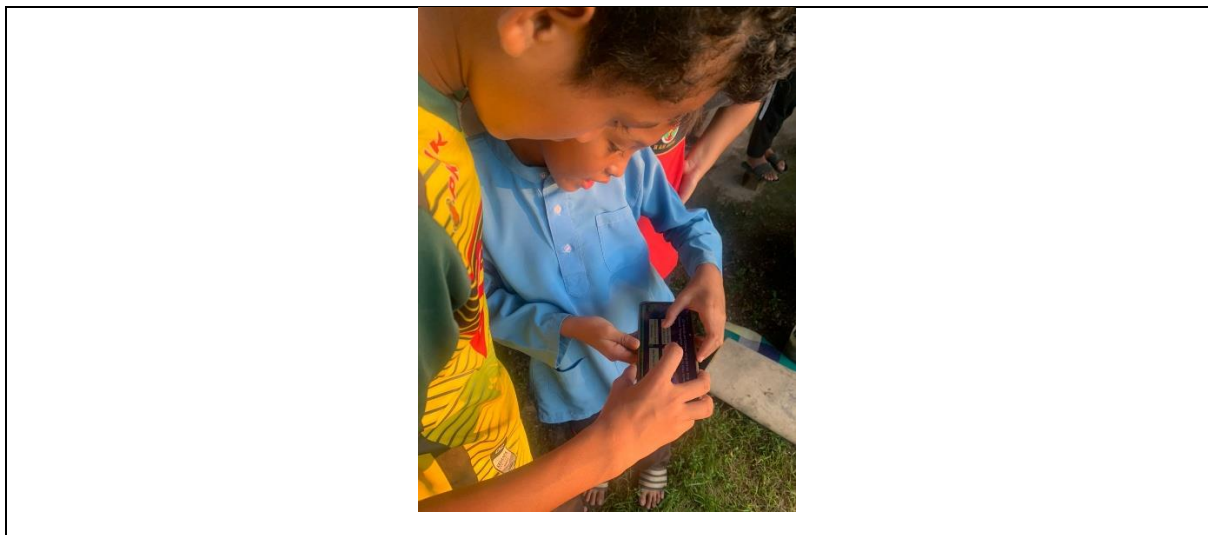


Figure 9(b): Testing

Table 7: Questionnaire User Acceptance

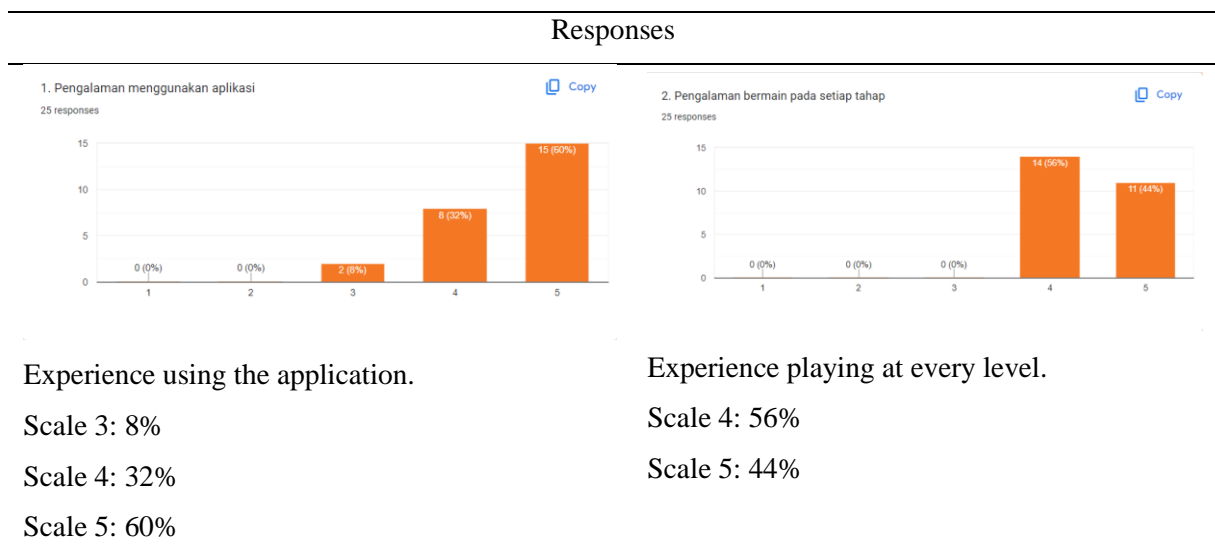


Table 7: (cont)

Responses

3. Pengalaman menjawab soal bonus

25 responses

1

0 (0%)

2

0 (0%)

3

1 (4%)

4

9 (36%)

5

15 (60%)

Experience answering bonus questions.

Scale 3: 4%

Scale 4: 36%

Scale 5: 60%

4. Kefungsian tombol / ikon

25 responses

1

0 (0%)

2

0 (0%)

3

5 (20%)

4

9 (36%)

5

11 (44%)

Button functionality

Scale 3: 20%

Scale 4: 36%

Scale 5: 44%

5. Adakah soal bonus / trivia berfungsi dengan baik?

25 responses

1

0 (0%)

2

0 (0%)

3

1 (4%)

4

6 (24%)

5

18 (72%)

Do the bonus / trivia questions work well?

Scale 3: 4%

Scale 4: 24%

Scale 5: 72%

6. Adakah skor trivia dipaparkan?

25 responses

1

0 (0%)

2

0 (0%)

3

0 (0%)

4

4 (16%)

5

21 (84%)

Are trivia scores displayed?

Scale 4: 16%

Scale 5: 84%

7. Adakah skor kutipan dipaparkan dengan baik ?

25 responses

1

0 (0%)

2

0 (0%)

3

0 (0%)

4

5 (20%)

5

20 (80%)

Is the collection score displayed well?

Scale 4: 20%

Scale 5: 80%

8. Adakah aplikasi ini membantu dan mudah difahami

25 responses

1

0 (0%)

2

0 (0%)

3

0 (0%)

4

7 (28%)

5

18 (72%)

Is the app helpful and easy to understand?

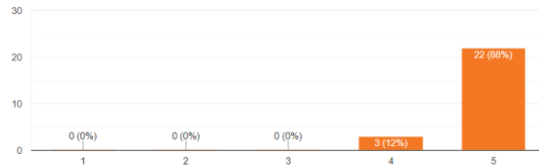
Scale 4: 28%

Scale 5: 72%

Table 7: (cont)**Responses**

9. Adakah tulisan dan warna jelas

25 responses



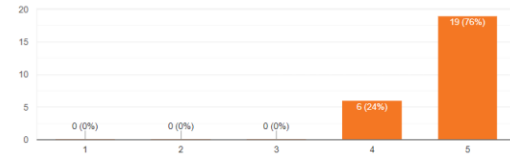
Is the writing and the color clear?

Scale 4: 12%

Scale 5: 88%

10. Adakah aplikasi ini sesuai dikalangan murid-murid sekolah rendah

25 responses



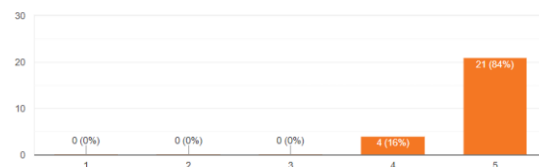
Is the application suitable for primary school students?

Scale 4: 24%

Scale 5: 76%

11. Adakah antaramuka / paparan pada aplikasi ini menarik ?

25 responses



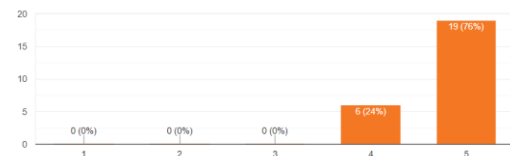
Is the interface / display on this application attractive?

Scale 4: 16%

Scale 5: 84%

12. Adakah aplikasi ini menarik minat anda

25 responses



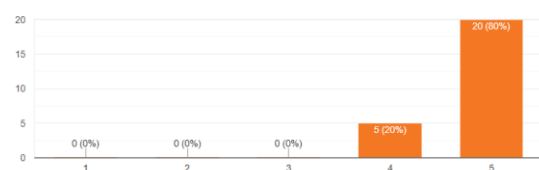
Does this app interest you?

Scale 4: 24%

Scale 5: 76%

13. Adakah anda seronok menggunakan aplikasi ini ?

25 responses



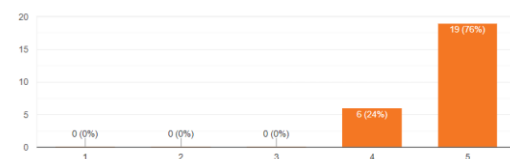
Do you enjoy using this application?

Score 4: 20%

Score 5: 80%

14. Adakah anda puas hati menggunakan aplikasi ini

25 responses



Are you satisfied using this application?

Score 4: 24%

Score 5: 76%

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