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Designing Mobile Game Based Learning about Mah Meri People

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ABSTRACT

This study presents the design and development of a mobile game-based learning application aimed at enhancing cultural knowledge and appreciation of the Mah Meri community, an indigenous group in Malaysia. The project involved identifying user requirements, designing application features, and developing a functional prototype, which was subsequently evaluated with public users. Storyboards, flowcharts, and use case diagrams were employed to structure the application, ensuring an intuitive and engaging learning experience. The adapted Digital Educational Game Life Cycle (DEG) methodology guided the development process, encompassing design, game-based learning, and feedback, as well as implementation phases. The application integrates gamification features such as scoring, rewards, lifelines, and animations to foster user motivation, interactivity, and engagement. The evaluation with public users demonstrated that the application performed as intended. The findings demonstrate the potential of mobile game-based learning as an innovative medium for promoting cultural awareness and preserving indigenous heritage through interactive experiences. Future enhancements will focus on extending the platform to iOS, incorporating dual-language options, and enriching tutorials to provide more comprehensive cultural learning.

1. Introduction

Mobile game-based learning has been proven to be an effective educational tool [1-3]. It can motivate people to participate in studying while having fun [4-5]. There are various advantages of mobile game-based learning education. Student perceptions of immersion enhanced self-regulated learning [6]. Self-efficacy and self-regulation affected each other in mobile game-based learning [6].

Gamification is an important aspect in higher education [7] and primary and secondary schools [8]. Gamification in mobile learning involves integrating game-based elements into educational content on mobile platforms to enhance student engagement, motivation, and learning outcomes. This approach takes advantage of the ubiquitous nature of mobile devices to provide a flexible, accessible, and engaging learning experience. Mobile game-based learning has improved skills for students, such as critical thinking skills [9 -10] and creativity [11]. Individual traits may influence enjoyment in a mobile learning game [12].

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There are possibilities that game-making can be particularly useful when tailored to learners with profound and multiple learning disabilities [13]. Furthermore, mobile applications can be designed for cultural heritage reactivation purposes [14]. Culture learning exhibited a strong interaction with content design [15]. Students' perceptions of competence and enjoyment of a mobile game within the context of mobile game-based learning are important [16]. There is evidence that cognitive learning effects of using mobile learning games in comparison with the textbook learning process [17], improve academic performance [18] and critical thinking [19]. Design principles should be employed to facilitate the implementation of game-based learning [20].

2. Methodology

The methodology involved using the adapted Digital Educational Game Life Cycle (DEG) [21] to suit the objectives of this study. The following are the objectives of this study.

i. To identify the requirements needed for the "Mah Meri" mobile game-based learning application about the Mah Meri people.
ii. To design a "Mah Meri" mobile game-based learning application about the Mah Meri people.
iii. To develop a "Mah Meri" mobile game-based learning application about the Mah Meri people.
iv. To evaluate the "Mah Meri" mobile game-based learning application about the Mah Meri people.

This study adapted the methodology Digital Educational Game Life Cycle (DEG), which consists of the adapted three processes, which are (i) design, (ii) game-based learning and feedback, and (iii) game implementation phase.

3. Results

3.1 To identify the requirements needed for the "Mah Meri" mobile game-based learning application about the Mah Meri people.

The functional and non-functional requirements of the Mah Meri mobile application are shown in Table 1 and Table 2, respectively.

Table 1
Mah meri mobile application functional requirements

Functional Requirements	Description
Storytelling	Players can choose to learn categories that contain musical instruments, the Mah Meri's language, and handcrafted masks before playing the game.
Game Musical Instrument	The user needs to play in the musical instrument category of the game to acknowledge and learn about the musical instruments of the Mah Meri people. The Game contains the lifeline, score, and timer. Besides that, users need to complete the game to get a reward, score, and the highest score.
Game Mah Meri' language	Users continue playing the games with the Mah Meri's language category to acknowledge and learn about the language of the Mah Meri people. The Game contains the lifeline, score, and timer. Besides that, users need to complete the game to get a reward, score, and the highest score.

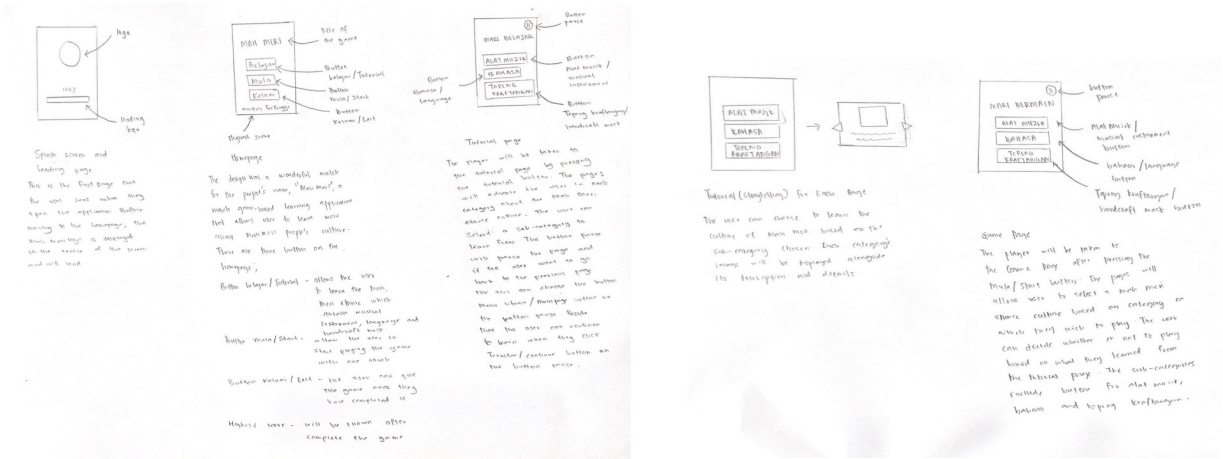
Game Handcraft Mask	Users proceed to playing the games with the Handcraft Mask category to acknowledge and learn about the handcraft mask of the Mah Meri people. The Game contains the lifeline, score, and timer. Besides that, users need to complete the game to get a reward, score, and the highest score.

Table 2
Mah meri mobile application non-functional requirements

Non-Functional Requirements	Description
Platform compatibility	The Mah Meri mobile application must be able to run on an Android-based mobile device.
Performance and responsiveness	The mobile game-based application response time correlates with the user's input behaviour to produce the appropriate output.
Usability	The user can effortlessly interact with the buttons by clicking on them.
Consistency	The design on the user interface must be consistent for each page. The interface for this application should be user-friendly, easy to understand, and simple to use.
Reliability	This application can run anytime and anyplace.

3.2 To design a "Mah Meri" mobile game-based learning application about the Mah Meri people

Storyboard provides a better visual overview, which is important when developing a game with many phases or concentrating on a particular visual presentation. The visual shown in Figure 1 is a sample of the "Mah Meri" mobile game-based application storyboard.



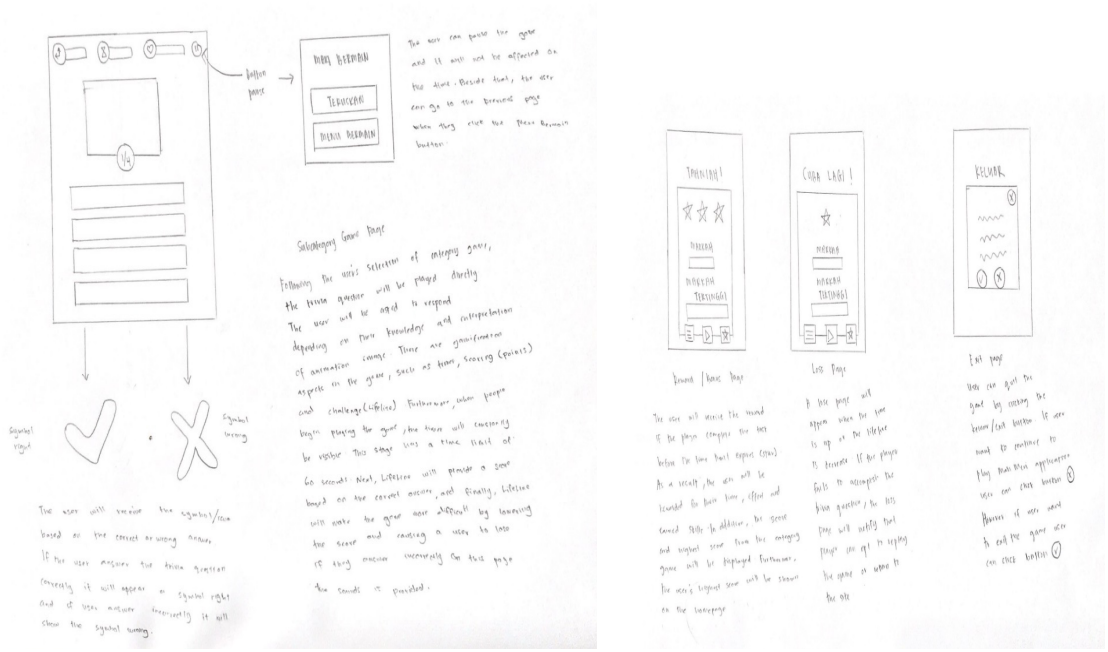


Fig. 1. Storyboard of the mah meri mobile application

The flowchart acts as a guide to a system or program's process flow. It provides users with a clear understanding of how to properly use the system. In this case, a flowchart has been shown for this Mah Meri mobile application framework using an online software, Draw.io, which can be seen in Figure 2.

First, once the user launches the application, the main page will display that they are required to learn and choose the category of tutorial which has a musical instrument, Mah Meri's language, and a handcrafted mask. Once the user finishes learning the tutorial, they can play the game in the category they choose. The game provides gamification elements such as a timer, scoring (points), and challenges (lifeline). After completing the game, the user will get a score and the highest score. The data of the highest score will appear on the main page. Besides that, if the user answers all the questions correctly, they will receive a bonus or reward as a gift for their effort. Finally, the user can exit the game on the exit button.

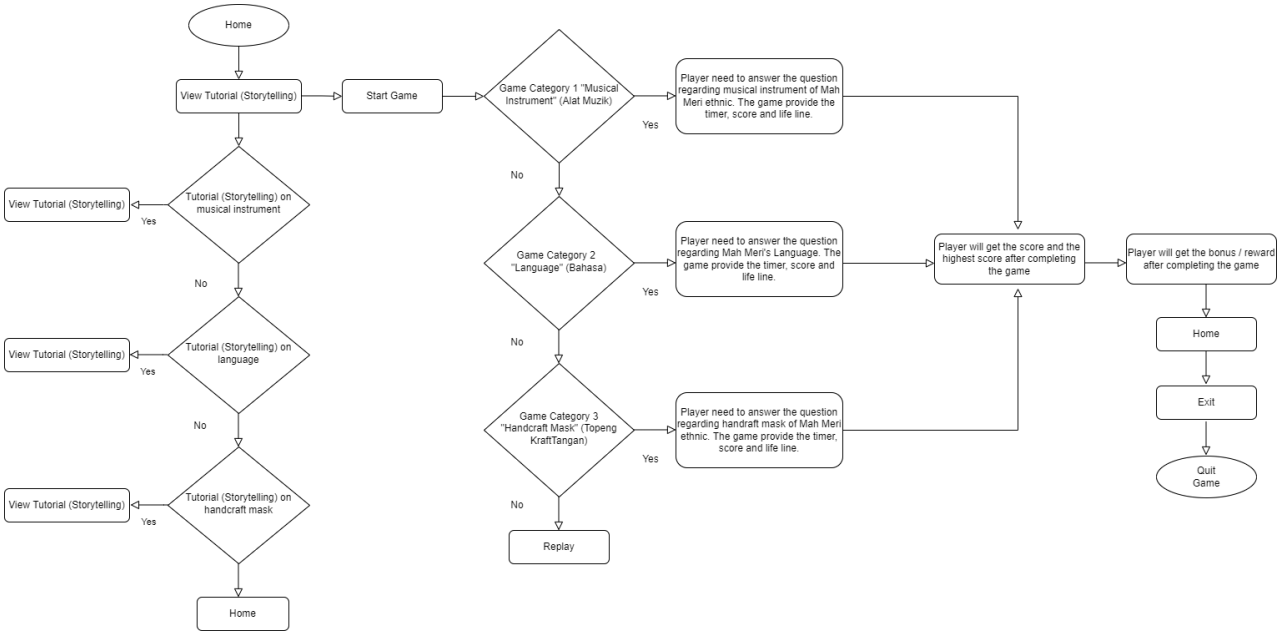


Fig. 2. Flowchart of the mah meri mobile application.

In this project, use case diagrams are used in the software design phase. The use case diagram is a diagram showing the relationships in a system between the components. It is used to represent the coveted elements and the usefulness of the mobile learning game for Mah Meri knowledge. A case diagram for a Mah Meri mobile application is used for modelling the Unified Modelling Language (UML). The activity between the user and the process is presented in Figure 3 using the case diagram.

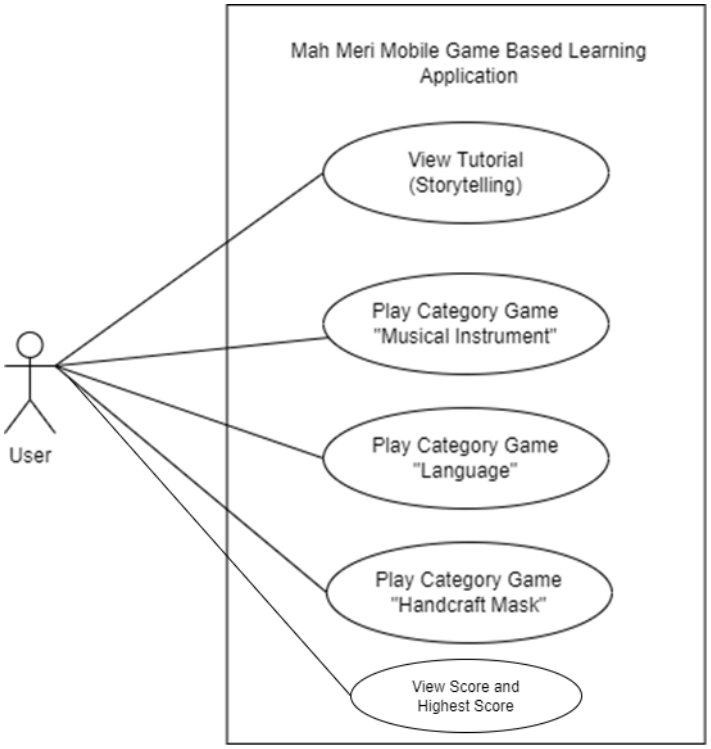


Fig. 3. Use case diagram of the Mah Meri mobile application.

3.3 To develop a "Mah Meri" mobile game-based learning application about the Mah Meri people.

Construct 2 and Android Studio were used to develop the "Mah Meri" mobile game-based learning application about the Mah Meri people. Figure 4 shows the mobile game-based learning application about the Mah Meri people.

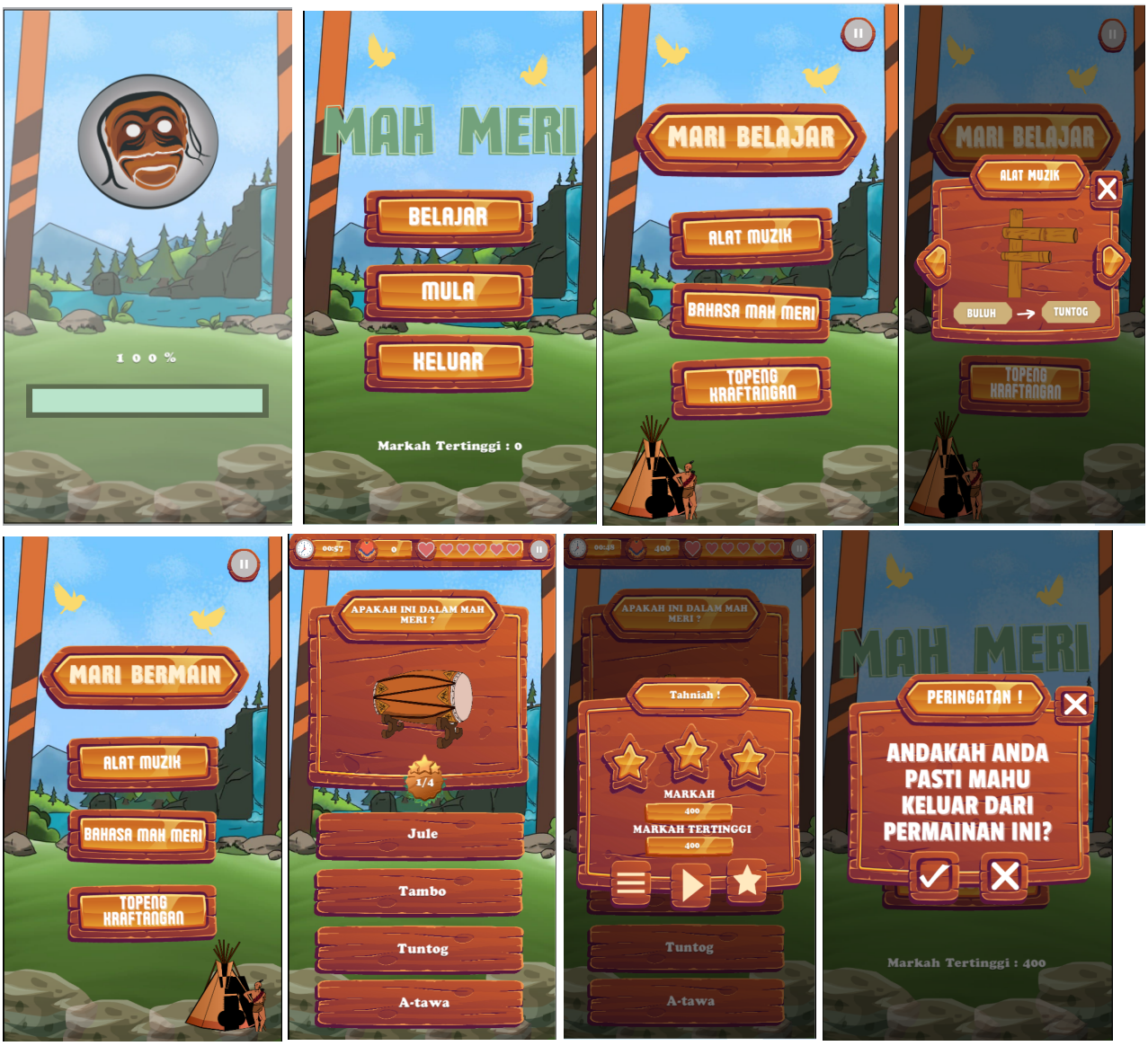


Fig. 4. Mobile game-based learning application about the Mah Meri people.

3.4 To evaluate the "Mah Meri" mobile game-based learning application about the Mah Meri people

The Mah Meri mobile application was evaluated with ten users for game-based learning and feedback. Table 3 shows the task activity for the testing procedure on the Mah Meri mobile application.

Table 3
User testing for mah meri mobile application

Activity/Name	Question	Function (Yes (Y) / No (N))									
		User 1	User 2	User 3	User 4	User 5	User 6	User 7	User 8	User 9	User 10
View and Learn Tutorial	Are you able to complete this task successfully?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Are you able to view the learn category?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Are you able to hear any sounds and view the animation for each of the categories?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Play The Trivia Questions	Are you able to complete this task successfully?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Are you able to see the animation image?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Are you able to distinguish between the sound of receiving the correct answer and the sound of getting the incorrect answer?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Are you able to watch the timer moving while answering the game of trivia questions?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Are you able to see your score when answering the game of trivia questions?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Are you able to see your lifeline (the heart symbol) decrease if you are answering the incorrect answer from game of trivia question?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Are you able to receive the bonus/reward (star) when you have completed the game of trivia questions?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Are you able to hear any sounds from the bonus/reward after completing the game of trivia questions?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Are you able to see the animation from the bonus/reward after completing the game?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Your Score and Highest Score	Are you able to complete the task successfully?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Are you able to view your score and the highest score?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Log out	Are you able to complete the task successfully?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Are you able to see the animation from the exit?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

According to the findings of user testing, all the Mah Meri mobile application's capabilities perform as intended. All the testers can complete the task successfully.

4. Conclusions

This study has successfully identified user requirements, designed, and developed the Mah Meri mobile game-based learning application, followed by testing of the application. With storyboards, flowcharts, and use case diagrams, the application was structured to provide engaging learning experiences focused on the Mah Meri community's musical instruments, language, and handcrafted masks. The development process, guided by the adapted Digital Educational Game Life Cycle (DEG), ensured that the application incorporated gamification features such as scoring, rewards, and animations to enhance motivation, interactivity, and user engagement. The evaluation with public users demonstrated that the application performed as intended. These findings highlight the potential of mobile game-based learning as an effective medium for fostering cultural awareness and preserving indigenous knowledge through interactive and enjoyable learning experiences. Future improvements could include extending compatibility to the iOS platform, integrating dual-language features, and enriching tutorials to provide more comprehensive cultural learning. With these enhancements, the Mah Meri application has the potential to serve as a valuable tool for digital heritage preservation while promoting wider appreciation of Malaysia's indigenous communities.

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