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Design and Development of an Android-Based Educational Puzzle Game of Indonesian Heroes

Misdiyanto[1]*, **Uma Belly Yuri Evan**[1,]

[1] Faculty of Engineering and Informatic, Panca Marga University, 67216, **Indonesia**

*misdie@upm.ac.id

Abstract

Getting to know the heroes including remembering their services is very important as a form of respect and in order to foster a sense of nationalism, a sense of nationhood and patriotism. therefore, more appropriate and interesting media are needed that can be used by the generation in this millennial era to get to know and remember the heroism of the independence fighters, especially the national heroes. This study uses the Luther-Sutopo Multimedia Development Life Cycle (MDLC) method which has six stages, namely from the concept design stage, collecting materials for the manufacturing process, testing applications, to distributing applications. For testing the application using the SUS method. The Finite State Machine (FSM) method in this game application is applied in compiling puzzles, there are scores and times when the user succeeds in placing each puzzle piece according to its actual position, then the score will increase. The purpose of this study is to design and build an educational game to get to know Indonesian national heroes based on Android for elementary school students in grade 3. The results of the study obtained an average score of 68%. These results can be categorized as good, acceptable with an OK predicate on usability.

Keywords: Engine Construct, Education, Games, HTML5, MDLC

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1. Introduction

Games are inherently a form of entertainment; however, their application as educational tools is both appropriate and effective [1]. From a psychological perspective, play is considered more engaging and enjoyable than conventional learning methods, making it a powerful medium for education. Games foster learning through hands-on experience or learning by doing, where players are actively involved in tasks that simulate real-world scenarios [2]. This experiential engagement enables learners to acquire knowledge and develop skills indirectly,

while also shaping their thought patterns and behaviors [3]. As such, games serve not only as entertainment but also as dynamic platforms for meaningful learning.

In the context of modern education, interactive multimedia tools such as educational games are increasingly essential [4]. These tools integrate visual, auditory, and kinesthetic elements, offering an immersive learning experience that enhances conceptual understanding, motivation, and collaboration among learners [5]. Educational games extend beyond cognitive instruction to include affective and psychomotor development. Their entertaining and competitive nature encourages repeated engagement and learning through trial and error, providing a learner-centered approach that supports sustained educational outcomes [6].

Moreover, educational games can serve as strategic tools for promoting values such as patriotism and national identity [7]. Knowledge of a nation's history, including the lives and contributions of national heroes, plays a crucial role in shaping civic awareness and nationalism among younger generations [8]. For digital-native learners, particularly millennials, game-based media can be an effective means of introducing historical narratives and heroic figures in a compelling and relatable format [9]. Through educational games themed around national struggle and heroism, students not only gain historical knowledge but also internalize values of courage, sacrifice, and love for the homeland [10]. Therefore, the integration of character education and digital media through game-based learning offers a promising pathway for nurturing intelligent and patriotic future generations [11].

2. Methods

2.1 Methodology

This study employs the Luther-Sutopo Multimedia Development Life Cycle (MDLC) method, which consists of six sequential stages: concept development, design, material (asset) collection, assembly (production), testing, and distribution. These stages guide the systematic development of multimedia applications, particularly educational games [12]. The detailed process of each stage involved in the game's development is illustrated in **Figure 1** :

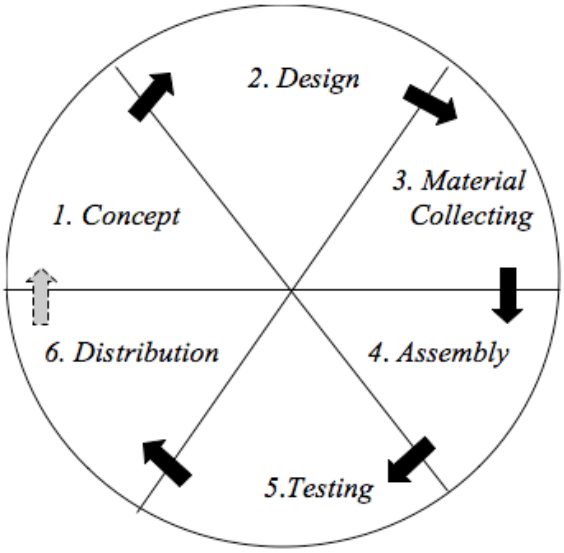

Figure 1. Research Methods Diagram

The initial stage in multimedia application development is the conceptualization phase, which involves defining the objectives, target users, and overall purpose of the application—whether it is intended for information dissemination, education, or entertainment [13]. In this context, the application is specifically designed for third-grade elementary school students with the aim of enhancing their knowledge, supporting motor skill development through interactive gameplay, and serving as an engaging educational entertainment medium. Following this, the design phase focuses on constructing detailed specifications including application architecture, game mechanics, and user interface layout. The design provides a structural blueprint for subsequent development stages [14-15]. In the material collecting stage, all necessary multimedia assets such as clip art, images, animations, and audio files are gathered to be integrated into the application during the development process.

The assembly phase involves the actual development and programming of the application based on the approved design and collected materials. During this phase, all multimedia components are integrated into a functional product. Once the application has been built, it enters the testing phase, which aims to identify and correct any functional or usability issues [16]. This testing consists of two stages: alpha testing, conducted by media and content experts, and beta testing, carried out by the actual users [17]. Feedback from these stages determines whether revisions are required to meet the quality standards. The final stage is distribution, where the application is deployed to end users and evaluated in a real environment. This includes identifying the required hardware and software specifications, outlining implementation methods, presenting final visual outputs, and conducting a thorough evaluation of the application's effectiveness as an educational multimedia tool [18].

3.Results and Discussion

The resulting game application serves multiple purposes. It functions not only as a source of entertainment but also as a medium to convey real-life stories, reduce stress, and provide educational value—both for early childhood learners and secondary school students. In game-based learning environments, there is typically a clear goal to achieve, aligned with the learning objectives embedded within the gameplay [19]. Educational games with narrative elements often have a defined ending, where the learning experience is concluded through story resolution. The development of this Android-based educational puzzle game, which introduces Indonesian national heroes, was carried out using the Construct 3 game engine and implemented through the Multimedia Development Life Cycle (MDLC) methodology . The game is specifically designed for third-grade elementary school students as a fun and engaging learning tool, while also serving as a reinforcement for history lessons related to national heroes that are taught in schools.

The application interface is composed of multiple distinct pages, each serving a specific function in the gameplay experience. These pages were designed based on a thorough system requirements analysis, which allowed for the implementation of additional features as needed [20]. The user interface of the educational puzzle game offers intuitive navigation and an age-appropriate design, facilitating ease of use for young learners. The structured interface supports a seamless flow from the main menu to the puzzle activity, promoting both cognitive engagement and historical awareness among the target users.:

3.1 Implementation of Menu Page in Game

The main menu page displays all available game options when the application is launched, as shown in **Figure 1.**

Figure 1. Main Menu Display

The gameplay page serves as the selection interface for national heroes, where users can view the names and photos of each figure. These hero portraits will later be used as puzzle pieces in the main game. This page is illustrated in **Figure 2.**

Figure 2. Gameplay Interface

The puzzle page is where the core interaction occurs, allowing users to assemble the image of a selected national hero. The layout and functionality of this puzzle interface are depicted in **Figure 3**.

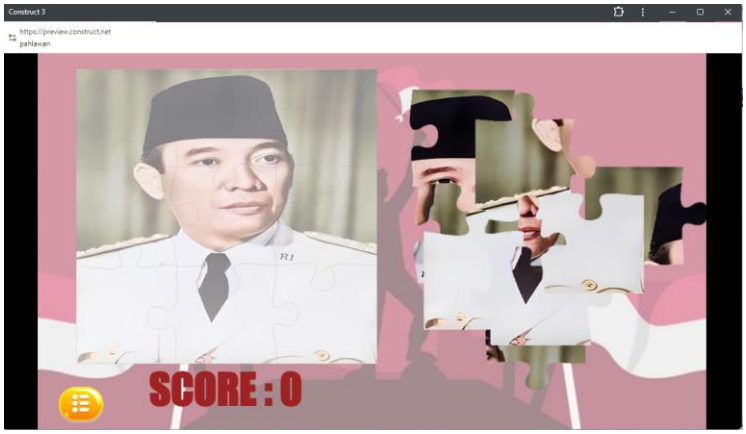

Figure 3. Puzzle Gameplay Display

The application testing was conducted based on user experience, where respondents interacted directly with the developed game. Subsequently, a set of questionnaire items related to the Android-based educational game, which focuses on introducing Indonesian national heroes and is specifically designed for third-grade elementary school students, was completed by the users. To facilitate the data collection process, a Likert-scale scoring system was employed as follows: (a) a score of 1 was assigned for "Strongly Disagree," (b) a score of 2 for "Disagree," (c) a score of 3 for "Neutral," (d) a score of 4 for "Agree," and (e) a score of 5 for "Strongly Agree." The System Usability Scale (SUS) questionnaire was utilized to evaluate the

user experience in engaging with the educational game. The average scores for each item were calculated to reflect the overall usability and acceptance of the application.

Table 1. System Usability Scale (SUS) Questionnaire

Respondence	Question No.										Amount	Value
R	1	2	3	4	5	6	7	8	9	10		
R1	5	5	2	2	4	2	5	1	3	2	27	67,5
R2	4	5	2	2	4	2	5	2	4	3	25	62,5
R3	4	5	2	2	4	2	5	2	4	2	26	65
R4	4	5	2	2	4	2	5	2	5	2	27	67,5
R5	4	5	2	3	4	2	5	1	3	1	26	65
R6	5	5	1	1	5	1	5	1	5	1	32	80
R7	4	5	2	2	4	2	5	2	4	2	26	65
R8	4	5	2	2	4	2	5	2	4	2	26	65
R9	5	5	3	3	4	2	5	2	5	1	28	70
R10	5	5	2	2	4	2	5	1	4	1	29	72,5
						SUM						68

The overall usability evaluation, based on responses from ten participants, yielded an average System Usability Scale (SUS) score of 68. According to established SUS benchmarks, this score falls within the category of "acceptable usability", with a qualitative rating considered good. This indicates that the application is generally functional and well-received by users in terms of ease of use, learnability, and interface navigation. Nevertheless, the result also highlights that there is room for improvement, particularly in enhancing user interaction, interface clarity, or efficiency, to push the usability score above the average benchmark.

To further optimize user experience, future iterations of the application should focus on refining visual elements, reducing cognitive load, and ensuring consistency in interaction design. Moreover, incorporating user feedback gathered during beta testing can help address specific usability issues and support the development of a more intuitive and engaging educational tool. Improving these aspects not only has the potential to raise the SUS score but also to increase user satisfaction, engagement, and learning outcomes—particularly important when the target users are young students in elementary school.

4. Conclusion

In conclusion, based on the processes of analysis, design, development, and testing, the Android-based Educational Puzzle Game Featuring Indonesian National Heroes has been successfully implemented and evaluated. The usability testing

involving ten respondents yielded an average System Usability Scale (SUS) score of 68, which is categorized as acceptable and falls within the "Good" usability rating. This indicates that the application is functional, accessible, and well-received by users. Designed specifically for third-grade elementary school students, the application introduces historical content through an engaging puzzle-based format, allowing students to become familiar with national heroes in an interactive and age-appropriate way. The game incorporates essential educational features, including intuitive navigation, character-based learning content, and drag-and-drop puzzle mechanics that enhance fine motor skills and cognitive engagement. The user interface is simple yet effective, enabling ease of use without overwhelming the learner. Furthermore, the game supports patriotic values and character education by integrating history learning with digital technology. Overall, the results demonstrate that the application not only fulfills its technical and educational objectives but also has potential to be expanded further for broader educational purposes, including integration into formal classroom settings or extracurricular digital learning initiatives.

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