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Development of gamification-based interactive multimedia application for object recognition in children

Taufiqurrochman[1]*, Lela Nurlaela[2], Tuhfatul Habibah Hasibuan[3], Hari Suryantoro[4], Ike Kurniati[5]

[1*]Prodi Sistem Informasi, Institut Teknologi dan Bisnis Swadharma, [2,3,4]Prodi Teknik Informatika, Institut Teknologi dan Bisnis Swadharma, [5]Prodi Sains Data, Institut Teknologi dan Bisnis Swadharma

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ABSTRACT

The ability to identify items in the environment is a crucial element of cognitive development and early education in children. Nevertheless, there are still constraints in the advancement of specialised applications for the identification of nearby items in youngsters using a gamification methodology. Furthermore, there remains a deficiency of programmes specifically tailored to children, lacking features such as user interfaces that are child-friendly and content that is age-appropriate. This study employs the Research and Development (R&D) methodology, encompas sing the phases of analysis, design, development, implementation, and testing. The findings demonstrated that incorporating gamification into interactive multimedia introductions to surrounding objects in children serves as an alternative educational medium that can assist teachers in the teaching and learning process. Specifically, it aids in explaining the identification and description of objects. By employing gamification through practice questions, it effectively stimulates children, enhancing their comprehension and proficiency in recognising surrounding objects. The comprehensive test findings indicate that this application has the potential to serve as an efficient and enjoyable alternative educational medium for children.

Corresponding Author:
Taufiqurrochman
Prodi Sistem Informasi, Institut Teknologi dan Bisnis Swadharma
taufiqurrohman@swadharma.ac.id

INTRODUCTION

In the current digital era, the use of technology in education is becoming increasingly relevant, especially in supporting children's learning processes. Recognizing objects around children is an important aspect in their cognitive development and early learning(Adnyana et al., 2019; Dharmalau & Nurlaela, 2021). Through this introduction, children learn to recognize, understand and interact with the environment around them. Gamification, which is the application of game elements in a non-game context, has been proven to be effective in increasing motivation and learning experiences. By integrating gamification-based interactive multimedia, the process of recognizing surrounding objects for children not only becomes more interesting, but also more effective and fun.(Çeltek, 2021; Kurniati et al., 2021).

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The use of gamification-based interactive learning media has become an interesting research topic in the world of education. This media can increase student involvement and motivation in learning, especially in the context of introducing children to objects around them(Aditama et al., 2023; Sudipa et al., 2022; Wiguna et al., 2023). Apart from that, the development of interactive multimedia applications has also been proven effective in improving student learning outcomes.

Despite its great potential, there are still limitations in developing applications specifically designed for recognizing surrounding objects in children using a gamification approach. Many existing applications focus more on academic learning than interaction with physical objects and the surrounding environment(Harianto et al., 2022; Suhanda & Kurniati, 2021). In addition, there is a lack of applications designed with a child-friendly approach, such as child-friendly interface design and age-appropriate content. There is still a need for the development of gamification-based interactive multimedia applications specifically aimed at recognizing surrounding objects in children. Apart from that, it is also necessary to carry out research regarding the feasibility, effectiveness and response of students to this learning media(Trilaksono et al., 2023).

The urgency of the research is considering the importance of recognizing surrounding objects in children's development and the great potential of gamification in education. The development of gamification-based interactive multimedia applications can provide innovative solutions to enrich children's learning processes in a more interactive and fun way. It is hoped that this research will fill existing gaps in the literature and practice(Arsana & Lestari, 2021; Lubis et al., 2022; Rohman & Subarkah, 2024; Saputra et al., 2024), as well as providing guidance for developers of educational apps for children. With the growth of technology and changes in student learning patterns, the development of gamification-based interactive multimedia applications has become very important. This is because this learning media is able to increase students' interest and motivation to learn(Rahman et al., 2023).

The main aim of this research is to develop an effective gamification-based interactive multimedia application for recognizing surrounding objects in children. So there are research implications, namely designing applications that integrate gamification principles with educational content about surrounding objects that are suitable for children.(Aparicio et al., 2021). Provide recommendations for further development in the field of gamification-based educational applications for children by applying Research and Development (R&D) methods so that the applications designed can be fun and interactive.

METHODS

The R&D (Research and Development) methodology is frequently employed when creating multimedia applications that interact with the user. A methodical sequence of procedures is utilised to design, develop, and assess interactive multimedia products using this approach. The R&D method typically comprises the following phases: analysis, design, development, implementation, and evaluation(Hasibuan et al., 2024; Ibrahim et al., 2023; Nurlaela et al., 2023).

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Research and Development (R&D) is a comprehensive methodology frequently applied to the creation and enhancement of processes or products, particularly in the field of educational technology (e.g., the development of interactive multimedia applications based on gamification). The procedure commences with an initial phase of information collection, during which the researcher ascertains the precise requirements and challenges encountered by consumers (Hasibuan et al., 2024; Nurlaela & Syadida, 2023; Rony et al., 2023). By conducting surveys, interviews, and literature evaluations, scholars acquire an in-depth comprehension of the ways in which technology can facilitate learning (Apriyansyah et al., 2024; Rony, 2017, 2019; Rony et al., 2019).

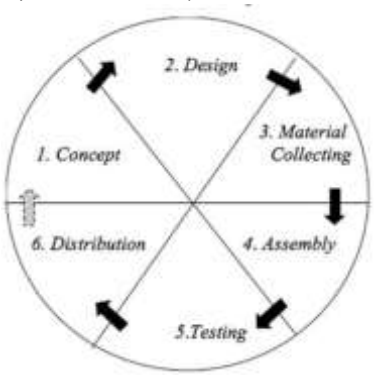

Figure 1. R&D Method

Based on Figure 1, the steps for developing gamification-based interactive multimedia applications using the R n D method include (Rachmad et al., 2023; Sudipa et al., 2023).

a) Analysis
   This stage involves identifying needs, user characteristics, and learning materials that will be delivered through the application(Nursumaryanti et al., 2023). Apart from that, the analysis also includes determining the gamification concept that will be applied.
b) Design
   At this stage, detailed design is carried out regarding the appearance, features and functionality of the interactive multimedia application. This includes planning the use of gamification elements to increase user engagement.
c) Development
   The development stage involves implementing the design into a real product. The developers will create multimedia content, integrate gamification elements, and test the overall functionality of the application.
d) Implementation
   Once development is complete, the application will be implemented in a real learning environment(Hasibuan, 2023). This may involve limited testing with a limited number of users.
e) Evaluation
   The final stage is a thorough evaluation of the application. Evaluation is carried out to ensure that the application has met learning objectives and is effective in increasing user engagement and understanding(Suryantoro et al., 2022).

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RESULTS AND DISCUSSION

Interactive Multimedia Gamification Analysis and Design Stage

At the analysis stage there is an information needs analysis approach that explainsexplain or describe the analysis related to making the interactive animation that will be built. Information needs analysis is divided into:functional and non-functional requirements applied in this research.

Non-functional requirements emphasize the operational quality and performance of the application, including usability which ensures the application is easy to understand and operate by children with a friendly and attractive interface, application performance which must be responsive with minimal loading times to keep children engaged, reliability which reduces bugs or errors for a smoother user experience.

Functional requirements are a type of requirement that contains what processes are carried out by the system, where there is a functional requirements analysis, namely the system used must be compatible, both in terms of software and hardware to make it easier for users to use the application. The system created must be understood by the user. A user-friendly system for display and easy presentation of learning material around objects.

By paying attention to these two aspects of need, development teams can create applications that are not only educational and engaging, but also high quality and reliable, ensuring an effective and enjoyable learning experience for children.

Use Case Diagrams

Use case diagrams are used to identify and document interactions between users (actors) and systems (gamification applications). This helps determine the main functions that the system must provide as well as the user's expectations of the system. In the system there are administrator actors and application users.

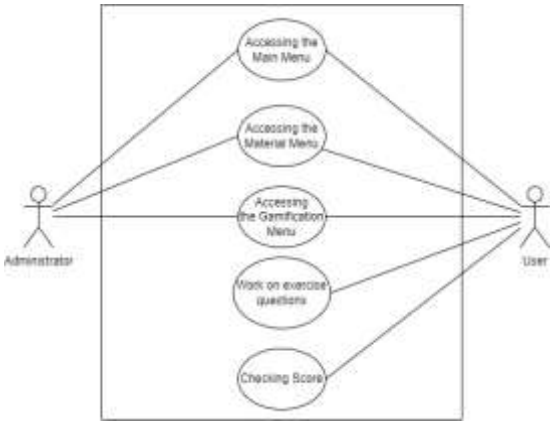

Figure 2. Use case diagram

Based on Figure 2, the processes that can be carried out by actors in the system can be explained is accessing the main menu so that actors can see the main menu which consists of menu material and menu gamification. After that, the actor can access the gamification menu for each object and can work on practice questions and check the score for each exercise carried out.

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Activity Diagrams

Activity diagrams are used to model workflows or business processes in a system. It describes the steps or activities involved in carrying out one or more system functions. In this interactive multimedia gamification application there are activity diagrams for accessing menu materials and accessing gamification menus.

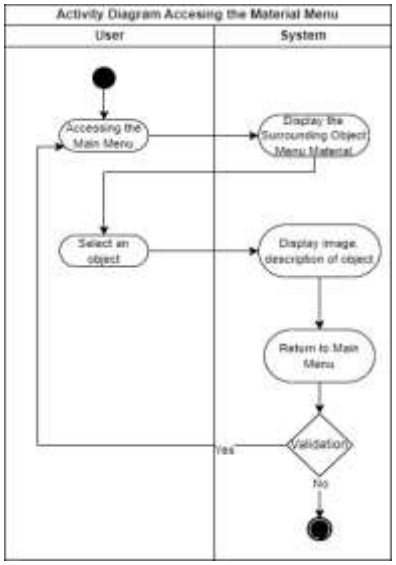

Figure 3. Activity Diagram Accessing the Material Menu

Based on Figure 3, it can be explained that the user first accesses the main menu, after that the system will display the menu material. The next step, the user can select an object that can display images and descriptions of the object and is equipped with sound to clarify the object. Next, the user can return to the main menu or exit the application.

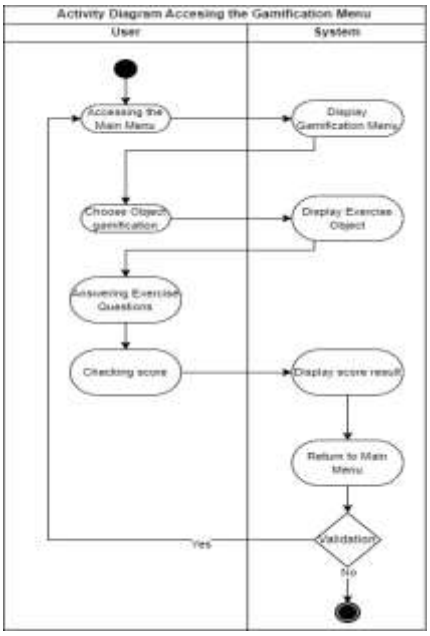

Figure 4. Activity Diagram Accessing the Gamification menu

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Based on Figure 4, it can be explained that the user first accesses the main menu, after that the system will display a gamification menu. The next step, the user can select an object which can display practice questions for each object, the user can answer each question and can check the final score. Next, the user can return to the main menu or exit the application.

Interactive Multimedia Development and Implementation Stage

During the development phase of interactive multimedia, specifically in the design of the display and the animation and scripting process in Adobe Flash. The implementation stage commences by scrutinizing software requirements for facilitating the development of interactive multimedia utilizing Adobe Animate, Adobe Illustrator, and Adobe Premier tools. Design is created with the intention of offering an aesthetically pleasing and user-friendly visual presentation. The purpose of implementation is to create a menu consisting of content and practice questions, which aims to facilitate the identification of items in the surrounding environment for users. The visual representation of the application may be observed in Figure 5 below.

Figure 5. Material Display and Gamification Menu

Based on Figure 5, it can be explained that there are pictures and descriptions of surrounding objects, then there are options for practice questions and processing time. There are 20 random exercises that can be accessed by users to learn about surrounding objects through interesting digital-based learning media.

Interactive Multimedia Application Testing Phase

The selection of respondents must represent the age group and school level relevant to the application's objectives, to ensure effective and relevant feedback on the usability and educational effectiveness of the application. The research respondents were aimed at children aged 3-5 years accompanied by their parents. At this stage, the focus was on recognizing simple and basic surrounding objects. Kids learn through highly interactive games and gamification with engaging visuals and fun audio. Children at this level focus more on learning through play. Application testing should ensure that interactions and gamification are designed to develop gross and fine motor coordination, as well as early

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recognition of shapes, colors and simple objects.Based on the results of testing in a questionnaire with 15 children, it can be explained that 84% of children agreed that this interactive multimedia was relatively easy to use in understanding the navigation flow and the clarity of each functional menu in the interactive multimedia application. Assessments related to gamification show that 87% of children agree that this application can provide training in recognizing objects through an attractive display and can provide simple introductions to surrounding objects.

The overall test results show that interactive multimedia gamification for introducing objects around children is an alternative learning media that can help teachers in the teaching and learning process, especially in explanations related to names and descriptions of objects, as well as through gamification in the form of practice questions, can stimulate children to improve their understanding and understanding. ability to recognize surrounding objects.

CONCLUSION

The research findings show the development of interactive multimedia applications utilising gamification to teach children to recognise objects in their surroundings represents a significant advancement in the field of education. This application can facilitate children's learning, particularly by providing descriptions and names of objects. By incorporating gamification elements in the form of practice questions, it can encourage children to increase their comprehension and recognition of objects in their surroundings. Research and Development (R&D), a comprehensive approach frequently used in the creation and improvement of products or processes, is the research method employed. This is particularly true in the field of educational technology, where interactive multimedia applications based on gamification are developed. This application was developed through the phases of analysis, design, development, implementation, and testing. The test results indicate that this application has the potential to serve as an effective and enjoyable alternative learning medium for children. Therefore, the creation of this application possesses significant potential to enhance student motivation and engagement in the learning process, particularly with regard to children's ability to identify objects in their surroundings.

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