Development of Game-Based Learning Applications to Increase Students' Learning Motivation

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ABSTRACT

In the continuously evolving digital era, education faces new challenges in maintaining students' interest and learning motivation. One approach that has been introduced to address this challenge is the use of technology in learning, specifically through game-based learning applications. The aim of this study is to develop an effective game-based learning application that enhances students' learning motivation. The research method employed is the Research & Development (R&D) method. The development stages include needs analysis, application design, implementation, evaluation, and revision. The application was developed with consideration to attractive game design principles that motivate and take into account curriculum needs. The research findings indicate that the development of the game-based learning application successfully increased students' learning motivation. Assessments of the application showed positive responses from students to the learning experience provided. Additionally, there was a significant increase in the level of student participation and engagement in the learning process. The conclusion of this study is that the development of game-based learning applications is an effective approach to enhancing students' learning motivation. This application transforms the learning experience into something more engaging and challenging for students, thereby increasing their interest and activity in the learning process. The implication of this study is that the integration of technology in learning can be an effective strategy to motivate students and enhance the overall quality of education.

Keywords: *Learning Apps, Games, Motivation, Student Learning*.

INTRODUCTION

In the constantly changing world of education, the challenge to maintain students' interest and motivation to learn is becoming increasingly pressing (Mosalanejad & Mansouri, 2023). The conventionality of teacher-centered learning approaches often fails to capture students' interest, resulting in boredom and a lack of engagement in the learning process (Al-Said et al., 2023). This phenomenon is exacerbated by technological advances that change how students interact with information and learn (Guerra-López & El Dallal, 2021). Therefore, in order to face this challenge, the development of game-based learning applications has become a primary focus in efforts to enhance students' learning motivation (Dandi Damara et al., 2023). The development of game-based learning applications offers an innovative and engaging learning approach that utilizes game elements to create an interactive and enjoyable learning experience (Antón-Rodríguez et al., 2020). By using challenges, achievements, and reward systems similar to games, game-based learning applications design a learning environment that motivates students to actively participate in their learning processs (Chen et al., 2018). However, despite the great potential of game-based learning applications to increase learning motivation, there are still many questions and challenges that need to be answered and addressed to optimize their effectiveness.

The game-based learning approach has become a spotlight in the education world as an attractive and effective method to enhance student engagement, motivation, and learning outcomes (Alzubi, 2023). In today's digital era, where technology increasingly permeates daily life, the educational paradigm is also changing (Suyanta et al., 2022). Children and teenagers grow up in an environment flooded with video games, smartphone apps, and other interactive media (Yadav & Oyelere, 2021). In this context, educators and educational researchers are beginning to recognize the great potential in leveraging this trend to create more engaging and relevant learning experiences for students (García-Ceberino et al., 2023). This is the emergence of the game-based learning concept (Jarrah et al., 2022a). Game-based learning carries the idea that learning does not have to be a boring or rigid task (Al-Emran et al., 2021). Instead, this approach integrates game elements into the learning process to enhance student engagement and motivation (Perutka & Vymazal, 2021). By offering a more interactive, enjoyable, and challenging learning experience, game-based learning aims to motivate students to learn more effectively and efficiently.

One of the fundamental principles of game-based learning is the presence of clear learning objectives (the Accounting Department, State Polytechnic of Malang, Malang, East Java, Indonesia et al., 2023). In every game, players are given a goal to achieve, whether it is reaching a certain level, solving puzzles, or defeating opponents. Similarly, in game-based learning, students are given specific learning goals that they

must achieve through interaction with learning content. Game-based learning also emphasizes the importance of instant feedback. In games, players often receive immediate feedback on their actions, whether in the form of points, levels, or entertaining animations (N. Kim, 2023). The same applies in game-based learning, where students receive immediate feedback on their progress in understanding lesson material, answering questions, or completing specific tasks. Furthermore, game-based learning also emphasizes the need for customized challenges. In every game, the difficulty level is adjusted to the player's ability to ensure that they remain engaged and challenged (Garadat, 2023). Similarly, in game-based learning, the difficulty level and complexity of learning tasks are adjusted to students' understanding and capabilities to ensure that they remain engaged and motivated.

The benefits of the game-based learning approach are diverse. First and foremost, this method has proven effective in increasing student engagement (X. Wang et al., 2021). By presenting lesson material in the form of engaging games, students are more motivated to learn and participate in the learning process. They learn not just because they have to, but because they want to achieve the goals set within the game context. Additionally, game-based learning can enhance information retention (Ahlers et al., 2022). Through structured repetition and challenges tailored to students' understanding, games can help reinforce the knowledge and skills taught. Difficult or abstract concepts can be presented in a format that is easier to understand and remember through direct interaction in the game. Furthermore, game-based learning encourages the development of critical skills such as problem-solving, critical thinking, and teamwork. In many games, players face situations that require creative and strategic thinking to achieve their goals. They often also need to collaborate with their peers to complete specific tasks, promoting effective collaboration and communication.

One fundamental issue of concern is the lack of interest and motivation for learning among students. This phenomenon is not only common but also a major obstacle in achieving optimal learning outcomes (Chirikov et al., 2020). Through conventional learning approaches, students often lose interest in the taught material, which in turn can hinder their academic achievements. Therefore, it is important to explore innovative and effective solutions to enhance students' interest and learning motivation. Students with high intrinsic motivation tend to be more enthusiastic and dedicated to learning, which ultimately can improve their academic achievements. However, attracting and maintaining students' learning motivation is not an easy task, especially in an era where digital distractions are rampant. Therefore, an innovative and engaging learning approach is necessary to create a learning environment that sparks students' interest and motivation (El Kouzi & McArthur, 2021). The problem to be solved is how to address the lack of interest and motivation for learning among students through the development of effective game-based learning applications. In this study, we will identify strategies and techniques that can be used in the development of game-based learning applications to significantly enhance students'

learning motivation. We will also evaluate the effectiveness of game-based learning applications in increasing students' interest and engagement in the learning process.

This study is conducted due to the awareness of the importance of enhancing students' learning motivation as an initial step in achieving better learning outcomes. Through the development of game-based learning applications, we hope to improve students' interest and engagement in the learning process. This study also aims to fill the knowledge gap regarding the effectiveness of using technology to enhance students' learning motivation (Lam et al., 2023). The researcher will use a holistic and structured approach to address this gap by involving various research methods and data analysis. The contribution of this study lies in its ability to provide innovative solutions in the form of game-based learning applications specifically designed to enhance students' learning motivation. We will use an iterative prototype-based software development approach to develop the application. By applying attractive game design and appropriate learning content, we hope to create an application that is effective in enhancing students' learning motivation.

The current state of the art indicates that the use of technology in learning has become a growing trend, but there is still room for further innovation. The innovation proposed in this study is the development of customized game-based learning applications to enhance students' learning motivation (Griggs et al., 2019). The novelty of this article lies in a comprehensive approach in integrating game elements with relevant learning materials. Furthermore, this study will involve a thorough evaluation of the effectiveness of the developed application in enhancing students' learning motivation. We also hope this study can inspire further researchers to explore more about the use of technology in learning and refine the solutions we offer. Thus, we hope to make a meaningful contribution to efforts to improve the quality of education through the integration of technology in the learning process.

There is several relevant research related to the use of games in learning. The first research according to (Akour et al., 2020), with the research title Game-based learning approach to improve self-learning motivated students. The results of his research stated that our developed application provides students with a friendly educational mobile application, provide an entertainment educational environment, provide rich database that contain diverse courses questions and answers and enhance students learning skills. The second research according to (Hartt et al., 2020), with the research title Game On: Exploring the Effectiveness of Game-based Learning. The results of his research stated that students favored and were more engaged in the game-based lecture. Finally, we contend that gamification is particularly well suited for planning education. The third research according to (Chang & Yeh, 2021), with the research title A blended design of game-based learning for motivation, knowledge sharing and critical thinking enhancement. The results of his research stated that while the bingo games may carry more effects on enhancing learning motivation, Socrative may lead to more knowledge sharing and critical thinking. In addition, both instructional methods had positive influences on learning outcomes through different

mechanisms and shared mechanisms. The shared mechanisms included focused attention, brainstorming, active participation, interaction and logical thinking.

RESEARCH METHODOLOGY

The research method used is the research development (R&D) method (Hartt et al., 2020). The R&D (Research and Development) research method is a systematic approach used to develop new products or technology. In the context of developing game-based learning applications to increase student learning motivation, an R&D approach can be used to ensure that the application developed is effective, meets educational needs, and is able to increase student learning motivation in a significant way (Mavromihales et al., 2019). The following is an explanation of how R&D research methods can be applied in the application development process. The first step in the R&D research method is the planning stage. At this stage, researchers will conduct a needs analysis and formulate clear objectives for application development. In the context of this research, needs analysis will involve a literature study on learning motivation theories, effective game-based learning methods, and challenges in current education that may influence student learning motivation. In addition, researchers also need to identify success criteria that will be used to evaluate the application being developed, for example an increase in the level of student engagement or an increase in learning outcomes.

After planning is done, the next step is the design stage. At this stage, researchers will design a game-based application concept based on the needs analysis that has been carried out previously. Application design must take into account factors such as the type of game to be used, user interface interactions, and the integration of learning content into the game (Ćosović & Brkić, 2019). Researchers also need to consider technical aspects such as the platform to be used, infrastructure requirements, and resource availability. After the application design is complete, the next step is the development stage. At this stage, the development team will start implementing the application design into a real product. The development process involves creating program code, graphic design, functional testing, and repeated iterations to refine and perfect the application. It is important for the development team to collaborate with education and psychology experts to ensure that the app meets relevant and effective learning standards.

After the application has been developed, the next stage is the evaluation stage. At this stage, the application will be tested using experimental methods or case studies to evaluate its impact on student learning motivation. Quantitative research methods such as surveys or pre-and-post tests can be used to measure changes in students' learning motivation after using the app. Additionally, direct observations and interviews with students and teachers can also be conducted to gain a deeper understanding of user experiences with the application. After the evaluation is complete, the final stage is the dissemination stage. At this stage, the research results and applications developed will be disseminated to stakeholders, such as teachers,

school administrators and other educational researchers. Dissemination can be done through the publication of scientific articles, conference presentations, or training and workshops for educational practitioners. The aim of this stage is to ensure that the research results can be widely used in educational practice to increase student learning motivation. In the entire process of developing game-based learning applications to increase student learning motivation, it is important to pay attention to systematic and user-oriented R&D principles. With this approach, it is hoped that the application developed can make a significant contribution to improving the quality of education and student learning motivation.

RESULT AND DISCUSSION

Game-based learning applications are software designed for educational purposes where game principles are used to enrich the learning experience (Jarrah et al., 2022b). This concept is rooted in gamification, which is the application of game mechanisms in non-game contexts to enhance participation and motivation. In an educational context, this means integrating challenges, points, levels, and reward systems into lesson materials to make the learning process more engaging and interactive. Game-based learning applications have also become one of the innovative solutions in the education world to enhance students' learning motivation. The development of game-based learning applications presents an enjoyable and engaging approach for students by utilizing game elements in a learning context. In a constantly changing and evolving educational context, the development of game-based learning applications has shown great potential in creating a more engaging and dynamic learning environment. One of the main advantages of game-based learning applications is their ability to increase students' interest and motivation to learn. By presenting lesson materials in the form of engaging games, game-based learning applications can create an enjoyable learning experience for students. This helps to change students' perception of learning from something boring to something fun and interesting. As a result, students are more motivated to engage in the learning process and are more enthusiastic about learning (Department of Computing, Faculty of Art, Computing and Creative Industry, Universiti Pendidikan Sultan Idris, 35900 Tg. Malim Perak, Malaysia et al., 2019).

Furthermore, the development of game-based learning applications can also help increase student engagement in the learning process (Y. Wang & Liu, 2020). By presenting lesson materials in the form of interactive games, the development of game-based learning applications can create a more engaging and exciting learning experience for students. This makes students more actively involved in the learning process as they feel more involved and challenged by the games presented. As a result, student engagement in learning increases, which in turn can contribute to improving their academic achievements. In addition, the development of game-based learning applications can also help increase students' intrinsic motivation (Y. J. Kim et al., 2023). By presenting lesson materials in the form of engaging and challenging games, the development of game-based learning applications can help naturally arouse students' interest and motivation to learn. When students feel interested and motivated by the games presented, they are more motivated to

learn and achieve better results in their learning. This can help increase students' intrinsic motivation, which is a key factor in achieving long-term academic success. Additionally, the development of game-based learning applications can also help create a more inclusive and supportive learning environment. By presenting lesson materials in the form of engaging and exciting games, the development of game-based learning applications can help create a more enjoyable and attractive learning environment for students from various backgrounds and ability levels. This can help increase student participation and engagement in the learning process and help create a more inclusive and supportive learning environment for all students.

Table: Challenges in developing game-based learning applications.

NO	Challenges in Developing Game-Based Learning Applications
1	Integrate learning content into the game well
2	Create conformity between game content and curriculum
3	Maintain a balance between the excitement of the game and learning objectives
4	Ensure the availability of adequate technical infrastructure
5	Facing budget limitations for application development
6	Design a user interface that is intuitive and easy to understand
7	Adjust the difficulty level of the game to the students' abilities
8	Implement effective feedback to guide learning
9	Overcoming technical challenges in coding and integration
10	Take into account differences in student preferences and learning styles
11	Provide support and training for teachers in using the application
12	.Facing the challenges of user data privacy and security
13	Deal with limited human resources and technical expertise
14	Ensure application accessibility for students with special needs
15	Measure and evaluate application impact effectively

The process of developing game-based learning applications for students is a series of steps designed systematically and oriented towards educational goals. These steps allow developers to design, test, and improve applications with students' needs and learning goals in mind. Following are several steps that can be followed in the game-based learning application development process:

1.Identify Needs and Goals

The first step in developing a game-based learning application is to identify specific educational needs and formulate clear goals. This process involves an in-depth analysis of the applicable curriculum, student needs, and educational challenges faced. The goals set must be specific, measurable, achievable, relevant, and have a clear time limit (SMART). For example, goals may focus on increasing student motivation to learn in specific material or increasing understanding of critical concepts.

2. Application Concept Design

Once the needs and objectives have been identified, the next step is to design a

game-based application concept. This design process involves selecting the type of game that suits the learning goals and student preferences, creating an intuitive user interface, and organizing the learning content in a format appropriate to the game context. This design should consider alignment with the curriculum, ease of use, and visual appeal to ensure the effectiveness of the application.

3.Prototype Development

Once the application concept is established, the next step is to develop an initial prototype of the application. This development process involves creating program code, graphic design, and integrating learning content into the game. This prototype does not have to be perfect, but it should include the main features and basic functions of the application. This prototype will be used to test the concept and get feedback from stakeholders, such as teachers and students.

4. Trial and Evaluation:

ter the application prototype is developed, the next step is to test the application using relevant evaluation methods. This testing process may involve a beta trial with a group of students or a small case study in a real learning environment. During the pilot, it is important to collect data on user responses and experiences, as well as their impact on student motivation and learning outcomes. This evaluation will provide valuable insights to improve and enhance the application.

5. Refining and Improvement

Based on the evaluation results, the next step is to make improvements and improvements to the application. This process involves optimizing application features, bug fixes, and adjustments based on feedback received from users. It is important to remain open to change and adapt to user needs throughout the development process.

6.Implementation and Launch

Once the application has been tested and refined, the next step is to implement it in the learning environment. This process involves training teachers and students on how to use the application, as well as integrating the application into the existing curriculum and learning processes. It is important to provide adequate technical and pedagogical support to ensure a successful rollout.

7.Monitoring and Updates

Once the app is launched, the development process is not finished. The next step is to monitor application usage, collect feedback, and conduct regular evaluations of its effectiveness. Based on the data and feedback received, the application can be updated and refined regularly to ensure it remains relevant to needs and developments in education.

8.Long-Term Evaluation

Long-term evaluation is carried out to measure the impact of the application on

learning motivation and overall student learning outcomes. This evaluation process involves analyzing long-term data about student achievement improvements, engagement levels, and changes in learning behavior. This evaluation will help determine the success of the application in achieving the educational goals that have been set. By following these steps, the development of game-based learning applications for students can be carried out systematically and effectively, with the aim of increasing student motivation and learning outcomes in the context of modern education.

Successful examples of applications used in online learning include, first, Duolingo. Duolingo is a language learning platform that uses game principles to teach new languages (Zaibon & Yunus, 2022). Users start at the beginner level and progress through various lessons designed as "game levels." Each lesson includes a variety of interactive tasks designed to aid learning of vocabulary, grammar, and conversation. Duolingo also integrates a reward system such as experience points and "lingots" (in-app currency) that can be used to purchase additional features or improve lessons. Second, Kahoot. Kahoot is a game-based learning tool that allows educators to create quizzes that can be used as classroom activities (Cadet, 2023). With Kahoot, teachers can prepare multiple-choice questions that students answer in real-time using their devices. This not only makes the class more interactive and fun but also provides teachers with immediate feedback on students' understanding of the taught material. Third, DragonBox. DragonBox is a series of apps designed to teach mathematics and algebra to children in a highly intuitive and engaging way. Through well-designed games, DragonBox hides the complexity of mathematics behind game mechanics that are easy to understand. Children learn concepts such as variables and equations without feeling like they are learning traditional mathematics, which is often considered difficult and boring.

CONCLUSION

The conclusion of this study is that game-based learning applications have great potential for transforming education, providing a more dynamic and responsive method for teaching and learning. With the integration of advanced technologies such as artificial intelligence and virtual reality, the potential for these applications is even broader, offering a more personal and in-depth experience. By merging engaging game elements with well-defined learning goals, such applications have the capability to create a more dynamic, engaging, and challenging learning experience. With a focus on enhancing student engagement, optimizing feedback, and presenting learning materials that adapt to students' preferences and learning patterns, these applications can serve as effective tools in enhancing their enthusiasm for learning. Challenges such as integrating learning content, adapting to the curriculum, and technical support for users still require attention in the development process. Nonetheless, through the careful application of methods and a commitment to ongoing refinement of the application, the development of game-based learning applications has substantial potential to shape a more dynamic and empowering learning environment for students while also driving more optimal learning outcomes.

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