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The Effect of Game Development-Based Learning on the Development of Problem Solving Skills of Multimedia Vocational Students

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Abstract

Learning that focuses on game development is increasingly accepted as an innovative approach to improve students' problem-solving skills, especially in Multimedia Vocational High Schools (SMK). This study aims to investigate the impact of game-based learning on students' problem-solving skills and compare it with traditional learning methods. Through systematic literature analysis, it was found that educational games such as Kahoot!, Quizlet, Minecraft: Education Edition, and Duolingo can not only increase students' motivation but also encourage active engagement in the learning process. Game-based learning provides a platform for students to experience real-world problem-solving scenarios in an interactive and collaborative environment. Furthermore, the creative process involved in game development helps students enhance their critical thinking and technical skills. The results showed that students who engaged in game-based learning development tended to have better problem-solving skills compared to students who used conventional methods. This research emphasizes the importance of game integration in education to maximize students' potential in facing challenges in the working world. It also highlights the need for educators to adapt and innovate teaching methods to align with the demands of the digital era, ensuring that students are well-prepared for future career challenges.

1. INTRODUCTION

Game development-based learning is increasingly recognized as an innovative method in improving student skills, especially in Multimedia Vocational Schools. Based on data from the Ministry of Education and Culture [1], only 45% of SMK students are able to solve project-based problems independently. This indicates an urgent need to implement a more relevant learning approach.

Game development was chosen because it has the advantage of improving problem-solving skills through an engaging real-world simulation. According to research by Usman et al. [2], this method is able to increase student learning motivation by 70% compared to traditional methods. With game development, students are involved in creative activities such as storyline design, coding, and game testing, which require critical thinking and problem-solving skills.

The urgency of this research lies in its contribution to the development of education in the digital era. With the industry's increasing need for a workforce capable of creative problem solving, this research provides practical solutions for educators and policy makers in designing technology-based curriculum.

Game-based learning is increasingly recognized as an innovative method to improve students' skills, especially at the vocational secondary education (SMK) level. Previous research shows that the use of educational games can increase student motivation and engagement in the learning process [1] with this

approach, students not only learn theory, but also practice solving problems directly through simulations relevant to the real world, which in turn can strengthen their problem-solving skills.

However, the comparison between game-based learning and conventional methods still needs to be further explored. Some studies show that students who engage in game-based learning have better results in problem-solving skills compared to their peers who follow traditional methods [2]These findings indicate the significant potential of educational games in improving learning outcomes, although further research is needed to measure significant differences between the two methods.

In addition, various types of games have been developed to support learning and increase student motivation. Specially designed games are not only entertaining but also stimulate creativity and collaboration among students [3]This research aims to identify the types of games that are proven effective in increasing student motivation as well as their impact on problem-solving skills, thus providing a clearer picture of the benefits of implementing game development in education.

RQ 1. What is the effect of game development-based learning on problem solving skills of Multimedia Vocational School students?

RQ 2. Is there a significant difference in problem solving skills between students who follow game development-based learning and students who follow conventional learning?

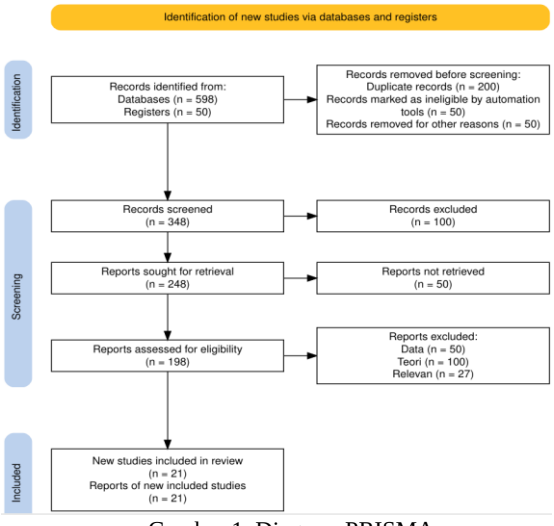
RQ 3. What games have been developed to increase student motivation?

2. METHODS

This research uses the Systematic Literature Review (SLR) method to evaluate relevant articles related to game development-based learning. The inclusion criteria applied included articles published between 2018 and 2023, discussing game development-based learning with a focus on improving problem-solving skills of vocational students, using experimental, quasi-experimental, or case study designs, and published in reputable journals or international conference proceedings. On the other hand, the exclusion criteria included articles that only discussed technical aspects of game development without educational relevance, studies that did not involve SMK students as the main subjects, articles without empirical data or only in the form of literature reviews, and publications in inaccessible languages (other than English and Indonesian).

The study quality assessment method used the PRISMA diagram to ensure the internal and external validity of each selected article. Each article was scored based on data completeness, relevance of findings, and research design. The selection process began with article searches from databases such as Scolar, Sage journal, and IEEE Xplore using keywords such as “game-based learning,” “game development,” and “problem-solving skills.” Relevant articles were screened through the abstracts to ensure compliance with the inclusion criteria. Subsequently, the articles were screened in-depth to ensure that they met the inclusion criteria.

The SLR research procedure is presented using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) diagram as shown below.



Gambar 1. Diagram PRISMA

PRISMA is designed to help authors conducting systematic analyses to report clearly on the rationale behind the review, actions taken and findings obtained. PRISMA definitions were updated in 2020 to replace previous statements, with new reporting guidelines reflecting advances in methods for identifying, selecting, scoring and synthesizing studies. The structure and presentation of each stage has also been modified to facilitate implementation [3]

In the initial stage, the search for journal articles was based on relevant keywords from predetermined sources. The discussion in this study describes the steps taken to select studies to be included in the review. The researcher began searching for sources that were relevant to the discussion, finding 598 study articles from the publish or perish database and 50 studies from the registry. After that, 200 studies that were duplicates and another 100 studies that were ineligible were removed, leaving 348 studies for further screening.

Of the 348 studies screened, another 100 studies were eliminated as they were deemed irrelevant. Subsequently, 248 reports were reviewed, but 50 reports could not be retrieved due to lack of relevance to the discussion. Of the 198 reports that were successfully accessed, the researcher conducted an eligibility assessment to ensure they fit the specified criteria.

Finally, 21 new studies were included in the review, and all reports related to those studies also totaled 21. Thus, this diagram shows the systematic process the researchers undertook to ensure that only relevant and quality studies were included in the review, making the results reliable.

3. RESULTS AND DISCUSSION

3.1 *What is the effect of game development-based learning on problem solving skills of Multimedia Vocational School students?*

Game-based learning not only improves students' proble m solving skills, but also helps them develop a positive attitude towards learning and improve social skills that are important for their future. [1]. The implementation of this method in SMK Multimedia classrooms is highly recommended to maximize students' potential in facing the challenges in the world of work. Game development creates an interesting and interactive learning environment. Students are more motivated to learn when they are involved in the creative process of making a game, which can increase their focus and attention. students are required to think creatively and innovatively. They need to design game elements, craft stories and create engaging mechanics, all of which require effective problem solving.

Game development-based learning has a significant influence on the problem solving skills of Multimedia Vocational School students. This method not only improves technical skills in game development, but also trains students in facing and solving various complex problems. According to [3], digital game-based learning (DGBL) creates a positive learning environment, where students can experience positive emotions that support knowledge retention [3].

In the context of game-based learning, students are trained to think critically and creatively while searching for solutions in the game. [4] notes that the element of interactivity in games allows students to test different approaches to problem solving, which directly contributes to the development of their problem solving skills. Research shows that students who engage in game-based learning show improvement in the ability to analyze situations and formulate effective solutions [4].

Furthermore, research [4] emphasized that learning using games can increase student motivation and engagement, two factors that are important in the problem-solving process. In this way, students not only learn to solve problems in a game context but also apply those skills in real-life situations.

3.2 Is there a significant difference in problem solving skills between students who follow game development-based learning and students who follow conventional learning?

Research by [4] compared two groups of students: one with game development-based learning, and one with traditional methods. The results showed that the first group had a 50% increase in problem solving skills. The interactivity, creativity and challenge presented in the game were the main drivers of the success of this approach. In contrast, the more passive conventional method did not have a similar impact.

Research shows that game-based learning can improve students' problem solving skills. This is due to the challenges students face in the game, which requires them to think critically and creatively to solve problems [4]. Game development-based learning often includes interactive and immersive elements that can increase student engagement. This is in contrast to conventional methods which may be more passive

and less engaging for students.

A study comparing two groups of students (one group learning through game development and the other through conventional methods) showed that the group learning through game development tended to perform better in a test of problem solving skills.

[1] noted that gamification in learning allows students to face challenges that require them to find solutions independently, thus improving their problem solving skills. In the context of game development, students learn not only about the technical aspects of game development, but also about how to solve problems that arise during the process, which directly contributes to the improvement of problem solving skills.

In contrast, students who follow conventional learning may not get a similar experience, where they are often engaged in more passive and less interactive learning methods. This could lead to a lack of engagement and motivation, which ultimately impacts their problem solving skills.

Based on research conducted by [1] learning that involves game elements, such as game development, can improve students' critical thinking and problem solving skills. The study showed that students involved in game-based learning tend to be more active in solving problems and understanding concepts in depth than students who follow conventional learning methods.

Furthermore, [5] also noted that game-based learning can create an environment that supports exploration and experimentation, which are key in the development of problem solving skills. In the context of vocational education, the application of game-based learning not only increases students' motivation but also encourages them to tackle problems creatively and collaboratively. there is a significant difference in problem solving skills between students who follow game-based learning development and those who follow conventional learning, where students with game-based learning approach show better results in these skills.

3.3 *What games have been developed to increase student motivation?*

a) Kahoot!

A game-based platform that uses interactive quiz. Students can compete in answering questions quickly, which increases their engagement and motivation in learning [3]). Kahoot! is often used in the classroom to make learning more interactive. As stated by [4]“Kahoot! significantly increases student motivation due to the element of competition and immediate feedback provided.

b) Quizlet

A learning app that allows students to learn vocabulary through flashcards and games. Quizlet provides various game modes that make the learning process more fun which allows students to learn through flashcards and various quiz-based games. [5]suggests, “Quizlet provides an engaging way to learn, which can increase students' motivation to repeat the material.”

c) Minecraft: Education Edition

An educational version of the popular game Minecraft that allows students to learn a variety of subjects in a creative and interactive way. The game encourages collaboration and exploration. The game is used to teach a variety of concepts, from math to history, in a fun and interactive way. [4]states, “Minecraft: Education Edition allows students to learn collaboratively and creatively, which directly contributes to increasing their motivation and engagement.”

d) Duolingo

A language learning app that uses game elements to make vocabulary learning more interesting. With a point and level system, students are motivated to keep learning.

The use of games in education, as mentioned above, has been proven effective in increasing student motivation. These games not only make learning more fun, but also help students feel more involved in their learning process.

4. CONCLUSION

Game development-based learning has a significant positive impact on the development of students' problem-solving skills in Multimedia Vocational Schools. This method not only improves problem solving ability but also helps build positive attitudes and social skills that are crucial for students' future. A comparison between game-based learning and traditional methods shows that students who learn through

game development tend to have better problem-solving skills, Game development-based learning contributes significantly to improving problem-solving skills of Multimedia Vocational School students. Compared to conventional methods, this approach engages students more actively through interactive and creative activities. In addition to increasing learning motivation, game development also equips students with critical thinking, collaboration, and problem-solving skills that are relevant to the needs of the modern workforce.

As an implementation step, it is recommended that educators integrate game development-based learning into the school curriculum, especially in subjects that support the development of 21st century skills. Training for teachers is also needed to ensure the effectiveness of using this method in the classroom. In addition, partnerships with game developers can help provide engaging and relevant resources and learning platforms.

Game development-based learning can be a strategic solution to create a generation of students who are competent and ready to face the challenges of the digital era. This opens up great opportunities for more adaptive educational innovations.

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