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Implementation of Problem-Based Learning with Gamification Approach in Improving 21st Century Skills

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Abstract

The 21st century learning presents significant challenges in the learning process. In this context, critical thinking, creativity, collaboration and communication skills are important skills that students must master. This study aims to explore the implementation of Problem-Based Learning (PBL) integrated with a gamification approach as a solution to improve 21st century skills in students. This research uses the systematic literature review (SLR) method with the inclusion criteria of review articles published within the last 5 years and covers the research area of gamification in Problem-Based Learning (PBL) to improve 21st century skills. Problem-Based Learning (PBL) provides meaningful learning experiences through learning activities that are relevant to the real world and can encourage students to actively participate in the learning process. However, there are challenges in maintaining the consistency of students' motivation and active involvement in learning. The implementation of PBL with a gamification approach is proven to show a significant increase in students' critical, creative and collaborative skills. However, in this context, educators' skills in designing learning by incorporating gamification elements are important factors in determining the success of gamification. The results of this study are expected to contribute positively to the development of effective and joyful learning models. It is also expected that the results of the research can provide recommendations for the creation of an interactive learning environment and support the achievement of mastery of 21st century skills in students.

Keywords: Gamification; Problem-Based Learning; 21st century skills

INTRODUCTION

The 21st century learning is characterized by significant changes in the learning process. Under these conditions, the learning process should ideally be able to accommodate students' needs, especially in the development of skills that are relevant to the challenges of the times. Technological developments have significantly changed the educational paradigm, globalization and massive digital developments demand innovative learning approaches in order to prepare students to face the challenges in the 21st century. The 21st century skills are present as the key to surviving and competing in the professional fields and everyday life. There are several skills that must be mastered in the 21st century, including critical thinking, creativity, collaboration, and communication skills (Yokhebed, 2019). Along with the complexity of educational challenges, a relevant approach needed in developing 21st century skills through applicable and contextual learning strategies. In the implementation of 21st century learning, there are several characteristics that educators must master as facilitators, motivators, and inspirers. This is in line with Syahputra's research (2024) that an educator must have a high reading interest and the ability to write scientific papers, another substantial thing is the ability of educators to be creative and innovative in implementing learning models. In this context, educators must be able to combine learning models with technology that supports the learning process. In supporting 21st century learning, educators must undergo a cultural transformation in the view of learning in the form of changing teacher centered learning to student centered learning. This transformation in the field of education goes hand in hand with the characteristics of students who should have several abilities, including the ability to think critically, have the ability and willingness to solve problems and communicate, be creative, collaborative and also innovative. There are supporting characteristics that students should ideally have, namely the willingness and ability of digital literacy, initiative, flexibility and adaptiveness to changes in the world of education.

In learning there are various strategies that can be applied, one approach that is considered effective in developing 21st century skills is Problem-Based Learning (PBL). It is an approach that places learning in meaningful assignments such as case-based instruction and project-based learning. The implementation of PBL can stimulate students' critical thinking skills through the development of interaction and communication patterns that emphasize the process of knowledge formation in a meaningful way (Junaidi, 2020). PBL can help students become active learners by positioning learning on real- world problems that make students fully responsible for their learning. In addition, PBL provides opportunities for students to develop critical skills, problem solving, and collaboration which are important skills to master in the 21st century. The PBL approach provides opportunities for students to work together in groups, through brainstorming students can contribute to each other and discuss factual information and formulate hypotheses on the problems discussed (Laili, 2019). In this context, students do not just memorize the information they get, but there is also student involvement in the process of implementing the knowledge they learn in a real context relevant to their daily lives.

The implementation of PBL brings many benefits, but there are also challenges that must be faced, namely maintaining how to keep students' engagement and motivation consistent throughout the learning process. In complex learning contexts, it is common to find students who lose interest and energy in the learning process. To increase students' motivation and engagement in learning, the educators can integrate gamification approaches in the learning process. The integration of gamification in the form of applying game elements in the form of points, levels and challenges can create interesting and dynamic learning. The use of game elements in this non-game context increases motivation in an activity (Marisa et al., 2020). The integration of PBL and gamification has great potential in enhancing 21st century

skills which is a solution to the challenge of creating a meaningful, immersive and joyful learning environment. Gamification in learning not only serves to attract students' interest, but has the function of encouraging students to achieve learning goals through fun and motivating activities. Vitianingsih (2022) in her research said that gamification can support collaborative learning that can increase student interest. In addition to collaboration, there are critical and creative thinking skills that are no less important to master in the 21st century. In PBL learning, students are encouraged to have assumptions and find innovative solutions to the problems they face. This condition can also be supported by the integration of gamification elements that provide a supportive atmosphere to make students become challenged by the problems presented (Mayanti & Putra, 2023).

This study aims to explore the implementation of PBL with gamification approach in the context of improving 21st century skills in students, identify challenges faced by educators in the integration of gamification with PBL, and explore the extent to which the implementation of PBL with gamification can contribute to the improvement of students' critical, creative, and collaborative thinking skills in learning. The implementation of PBL and gamification is expected to contribute positively to the development of an effective and joyful learning model for students. This research examines several aspects related to the implementation of PBL and gamification in the educational context and provides recommendations for educators and curriculum developers in constructing interactive skill-based learning with a focus on improving 21st century skills.

RESEARCH METHODS

This research uses the systematic literature review (SLR) method introduced by Kitchenham (2010). This method has 5 stages that must be carried out according to the following figure 1.

***Fig 1**. Literature review process*

The research questions used in this study are (1) "How can the implementation of problem-based Learning with a gamification approach improve 21st century skills in students?", (2) "What are the challenges faced by educators in integrating gamification in problem-based learning models?", and (3) "To what extent does the implementation of PBL with gamification contribute to improving students' critical, creative, and collaborative skills in learning?". Based on the research questions that have been made, the literature search process is used to obtain relevant sources to answer the problem formulation. The literature search process was conducted by entering the keywords problem-based learning, gamification, and 21st century skills into an online article database search engine as primary and secondary data. Furthermore, the literature was filtered with the help of the automatic filter "year" within the last 5 years.

The next stage is study selection. This stage is carried out to decide whether the literature encountered is suitable for use in research or not based on inclusion and exclusion criteria. Literature in the inclusion criteria means that the literature is included in the category of articles that are suitable for use in conducting reviews and will be used as primary data. The inclusion criteria used were (1) using the literature review research method, (2) articles published within the last 5 years, and (3) discussing problem-based learning (PBL) integrated

with gamification and containing at least one of the 21st century skills. Then, an assessment of the quality of studies that were truly relevant to answering the research questions was carried out by reading the abstract, introduction, and results in the article. Data findings were analyzed qualitatively descriptively with reference to the research objectives. This section reviews the results and analyzes the findings.

RESULT AND DISCUSSION

Results

Based on the results of literature selection, finally obtained as many as 5 suitable articles with predetermined inclusion criteria. All articles showed that the implementation of problem-based learning with a gamification approach can improve 21st century skills. The results of the comprehensive analysis of the five articles are described in table 1 below.

Table 1. Results of article analysis

Author	Title	Results
Laksana, S. D., Saputro, A. D., Hidayah, K., & Wafa, S. S. (2024).	A Review of The Literature: The Usage of Digital Gamification in Education to Improve Mathematical Problem-Solving Skills and Mental Health.	1. Gamification can improve problem-solving skills. 2. Gamification encourages creative learning.
Situmorang, R. P., Suwono, H., Munzil, Susanto, H., Chang, C. Y., & Liu, S. Y. (2024).	Learn Biology Using Digital Game-Based Learning: A Systematic Literature Review.	1. Based learning digital games improve achievement, motivation, problem-solving skills, and critical thinking. 2. Support collaboration interdisciplinary to DGBL implementation that is effective. 3. Provide experience, interesting learning and interactive for students.
Júnior, E. S., Reis, A. C. B., Mariano, A. M., Barros, L. B., De Almeida Moysés, D., & Da Silva, C. M. A. (2019).	Systematic Literature Review of Gamification and Game-Based Learning in The Context of Problem and Project Based Learning Approaches.	1. Gamification improves engagement and students' motivation. 2. Learning Based Games Improve perception and learning performances. 3. Students develop problem skills and create decisions.
Poonsawad, A., Srisomphan, J., & Sanrach, C. (2022).	Synthesis of Problem-Based Interactive Digital Storytelling Learning Model Under Gamification Environment Promotes Students' Problem-Solving Skills.	1. This learning model significantly improved problem-solving skills. 2. Gamification improves motivation and learning outcomes. 3. Group discussion increases effective learning models.

Romano Daba, J. B., Rosmansyah, Y., & Dabarsyah, B. (2019).	Problem Based Learning Using Gamification: A Systematic Literature Review	1. PBL using gamification to improve students' performance 2. Engagement affects user participation in the learning process. 3. Increased learning motivation through fun gamifies experiences. 4. Performance includes academic performance, speed, points, and badges. 5. Achievement progress is essential to motivate users.

Discussion

The application of Problem-based Learning model with gamification approach is popularly used to develop 21st century skills (Hudha et al., 2023). PBL emphasizes learning on real problems that exist around students (Kladchuen & Srisomphan, 2021). PBL requires students to be able to gain knowledge by solving problems through investigation, research and collaboration (Boom- Cárcamo, 2024). One of the benefits of PBL is that students are invited to work together in solving a problem, this can improve students' communication and collaboration skills. Research shows that PBL can improve critical thinking and problem solving skills, which are very important to face real- world challenges (Laksana et al., 2024).

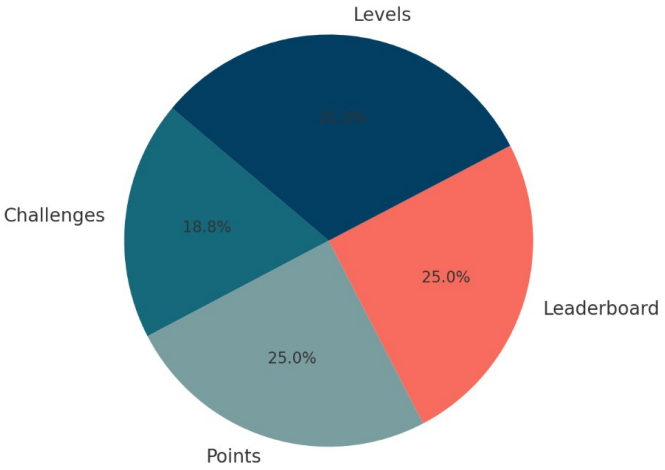

***Fig 2**. Frequently used gamification elements*

PBL with a gamification approach using game elements such as points, challenges and leaderboards in the learning process can increase student motivation and engagement (Papadakis et al., 2022; Poonsawad et al., 2022). Integrating gamification into the PBL model can create more interactive and fun learning (Abdulghani et al., 2022). This can increase student motivation and engagement in the learning process and have an impact on increasing student learning outcomes (Taesotikul et al., 2021). Gamification can trigger student engagement by adding elements such as points, challenges and leaderboards (Su et al., 2015). Research shows that students who engage in learning using gamification in PBL models tend to be more effective in collaborating to solve a problem (Laksana et al., 2024).

Gamification with challenge elements can encourage students to think creatively in solving a problem (Boom-Cárcamo, 2024). Students are required to think in different ways

than usual to find ways or solutions in facing the challenge of solving a problem (Suhartini, 2024). Integrating gamification PBL can encourage students to improve their ability to find creative solutions, which is one of the important skills in the 21st century (Yeo et al., 2022). In addition, gamification in PBL can also help students develop critical thinking skills, students must be able to think critically and make decisions by analyzing strategies and consequences in solving problems (Sahito & Sahito, 2024; Poonsawad et al., 2022). This skill is very relevant in everyday life where decisions must be made with careful and precise consideration.

Problem-Based Learning (PBL) with a gamification approach has a lot of potential to improve the skills needed by students in the 21st century, but there are some challenges in combining the two effectively (Laksana, 2024). Educators' skills in designing learning by incorporating gamification elements are important factors in determining the success of gamification (Nurhikmah et al., 2023). Gamification does not only include elements such as points, challenges, leaderboards, but requires clear design and instructions in order to support the learning process and achieve the desired goals (Bennani et al., 2022).

On the other hand, some students may be less interested or find it difficult to adapt to the application of gamification in the learning process (Laksana, 2024). Therefore, educators need to ensure that the use of gamification elements must be appropriate to the needs and truly support the learning process. The assessment system of PBL with a gamification approach should be measured objectively that covers all aspects of learning (Alshammari, 2019). Educators must determine the right way or assessment system to be able to assess students' skills and abilities in the problem- based learning model (Seibert, 2021). Educators need to pay attention to these challenges in order to effectively implement gamification in problem-based learning and support students to develop 21st century skills.

The implementation of PBL with a gamification approach is proven to show a significant increase in students' critical, creative, and collaborative skills. PBL requires students to think critically in analyzing problems and can provide effective solutions. The application of gamification in PBL by including challenge elements can motivate students to think more deeply and quickly in solving problems encountered (Junior et al, 2019). Laksana (2024) explained that gamification can increase student engagement to think critically, this happens because the encouragement or motivation of students increases with the point system and the level of the learning process.

Gamification also plays a role in increasing student creativity to be able to find solutions to problems encountered. Students are required to think creatively in finding a solution to overcome the problems encountered (Laksana, 2024). Gamification elements such as challenges and levels require students to think creatively and innovatively in facing the challenges given. On the other hand, collaborative skills can also be improved by using one of the gamification elements such as rewards (Poonsawad et al., 2022). Gamification with reward elements can create interaction dynamics in PBL. For example, reward elements such as best team can be given by creating competition between groups (Daba et al., 2019). With the reward element, students will be motivated to improve teamwork effectively. Teamwork not only includes task sharing, but can also improve students' skills in discussing, sharing ideas, and finding solutions together to solve the challenges faced.

CONCLUSIONS

The implementation of Problem-Based Learning (PBL) model with gamification approach shows significant potential in learning that emphasizes the development of 21st century skills. PBL implementation focuses on solving real problems that encourage students

to be actively involved in the learning process through investigation, research, and collaboration that can improve critical thinking and problem solving skills. The integration of gamification elements can provide an interactive and fun learning experience that contributes to improving student learning outcomes more effectively. The implementation of PBL with gamification approach is proven to show significant improvement on critical skills, creative, and collaborative. However, in its implementation, educators' skills in designing learning by incorporating gamification elements are an important factor in determining the success of gamification in the learning process.

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