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Suhartini, T.T. (2024). Problem-Based Learning with Gamification-based: Improving Critical Thinking Skills and Indonesian Learning Outcomes for Seventh Graders of SMPN 1 Jatiroto. *Journal of Applied Educational Study*, 1(1), 25-36.

Journal of Applied Educational Study

Problem-Based Learning with Gamification-based: Improving Critical Thinking Skills and Indonesian Learning Outcomes for Seventh Graders of SMPN 1 Jatiroto

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Abstract: Critical thinking skills are a foundational factor in student learning that can enhance academic achievement. However, the seventh-grade students at SMPN 1 Jatiroto exhibit low academic performance and underdeveloped critical thinking skills. Analysis shows that problem-based learning combined with gamification can improve both aspects. Therefore, this study aims to address the low academic performance and critical thinking skills of the seventh-grade students at SMPN 1 Jatiroto by implementing a problem-based learning and gamification strategy. This classroom action research involved 34 students from class 7B in the 2022/2023 academic year. Using a descriptive quantitative approach, the study was concluded after two cycles, as the success indicators had been met. The results indicate that the issues faced by the seventh-grade students at SMPN 1 Jatiroto can be resolved by employing a combination of these two strategies for optimal outcomes. Given that this study was not conducted in consecutive sessions, future research could address this gap by implementing the intervention over consecutive meetings with a wider variety of materials.

Keywords: Problem-based learning; gamification; critical thinking skills; Indonesian course learning outcomes; seventh graders

Received: 11-10-2024	Accepted: 23-10-2024	Published: 25-10-2024

Introduction

Critical thinking skills represent a pivotal foundation for student learning (Saputri et al., 2020; Wulandari et al., 2023). Furthermore, they are instrumental in cultivating students' ability to refine and elevate their critical faculties. Critical thinking transcends mere memorization of information; it entails the adept application of knowledge to creatively and insightfully resolve problems (Rahmaniah et al., 2023). Consequently, the development of critical thinking is an indispensable competency for all students. The "Merdeka Curriculum" further underscores this necessity by requiring students to engage in high-order thinking skills (HOTS), which are assessed through HOTS-based questions. As highlighted by Manurung et al. (2023), critical thinking is integral to HOTS, as it involves the capacity to analyze complex information, discern valid arguments, evaluate evidence, and make informed decisions based on sound reasoning.

The strong relationship between critical thinking skills and academic performance is well-established, as the ability to think critically equips students with the tools to engage deeply with academic content and apply it with precision and efficacy

(Triwulandari & Supardi, 2022). Through critical thinking, students are able to distill core issues, critically evaluate alternative solutions, and make well-reasoned decisions in the execution of academic tasks. This cognitive process fosters a more profound comprehension of subject matter, thereby enhancing academic achievement (Saputri et al., 2020).

However, preliminary research reveals a marked deficiency in student performance. Specifically, only 8 out of 34 seventh-grade students at SMPN 1 Jatiroto were able to meet the minimum competency standard (KKM) in the Indonesian language subject, particularly in the descriptive text unit. Moreover, when posed with high-order thinking questions, the vast majority of students struggled to respond accurately. This trend was observed across multiple subjects. Therefore, immediate intervention is imperative, as deficiencies in both critical thinking and academic performance exert a significant influence on students' overall educational outcomes within the classroom context (Wulandari et al., 2023).

Low academic achievement reflects a lack of comprehension of the subject matter, which can hinder students' progress at subsequent educational levels. If left unaddressed, this issue may lead to difficulties in mastering more complex topics, ultimately diminishing students' motivation to learn and their self-confidence (Cáceres et al., 2020; Sulitiyani, 2023). Moreover, creative thinking skills are crucial in the learning process, as they enable students to devise innovative solutions, think beyond conventional boundaries, and apply learned concepts to broader contexts. These skills also support problem-solving abilities, which are essential in project- or challenge-based curricula (Alsaleh, 2020).

Previous research has shown that improving students' critical thinking skills and academic performance can be achieved through problem-based learning. According to Robiyanto (2021), problem-based learning creates an environment conducive to developing critical thinking, analytical abilities, and the capacity to solve complex real-world problems, thereby fostering a culture of critical inquiry among students. Consequently, problem-based learning has been demonstrated to enhance both critical thinking skills (Cahyani et al., 2021) and academic performance (Rahmawati, 2023).

In parallel, gamification further contributes to the improvement of critical thinking and academic outcomes. One of the primary objectives of gamification in education is to capture students' attention and motivate them to engage in learning activities (Miri & Macke, 2022). Additionally, gamification incorporates game mechanics and elements to create an engaging and motivating experience for users (Meilina, 2023). Therefore, the combination of these two strategies—problem-based learning and gamification—has the potential to enhance both critical thinking skills and academic performance. The identification of the problem and the proposed solutions are presented in Table 1.

Table 1. Formulation of Seventh Graders' Problems and Solutions

Problem	Urgency	Solution
The low critical thinking abilities of the seventh-grade students at SMPN 1 Jatiroto.	Critical thinking skills enhance students' capacity for reasoning and problem-solving.	The implementation of problem-based learning.
The low academic performance of seventh-grade students at SMPN 1 Jatiroto in Indonesian language studies.	Low academic achievement is attributed to a lack of student engagement during the learning process.	The application of gamification-based teaching strategy.

Previous studies have demonstrated that the combination of problem-based learning and gamification can enhance student learning outcomes. First, Rahmati

(2023) reported that problem-based learning and gamification improved academic performance among elementary school students. Similarly, research by Laeli (2022) showed significant improvement in the learning outcomes of high school students in physics when problem-based learning with gamification was employed. Fathoni (2023) also highlighted an increase in both motivation and academic achievement among sixth-grade elementary students using this combined approach. However, these studies primarily focused on improvements in learning outcomes without exploring whether this combination also enhances students' critical thinking skills. Therefore, this study aims to address the low academic performance and critical thinking skills of seventh-grade students at SMPN 1 Jatiroto by implementing a combination of problem-based learning and gamification strategies.

Method

Research Design and Procedure

This study is considered as Classroom Action Research (CAR) research. CAR is centered on the classroom context and provides researchers with the opportunity to systematically enhance logical thinking abilities in task execution, deepen their understanding of actions taken, and improve the overall effectiveness of teaching practices (Susilo et al., 2022) In practice, CAR can be utilized by teachers to reflect on the teaching methods they employ, enabling them to refine or enhance the learning process and improve student outcomes (Priyanti & Nurhayati, 2023).

The subjects of this study were 31 seventh-grade students (13 male and 18 female) from class 7B at SMPN 1 Jatiroto in the 2022/2023 academic year. The study involved the entire population using a total sampling technique. The research was conducted over four meetings per cycle during the year 2023.

According to the Kemmis and Taggart Model (2014), the procedures in CAR are organized into cycles, with each cycle comprising four stages: (1) Planning, (2) Implementation, (3) Observation, and (4) Reflection (Susilo et al., 2022). These procedures are illustrated more clearly in Figure 1. In this study, the cycle will be discontinued once students' test scores meet the predetermined success indicators.

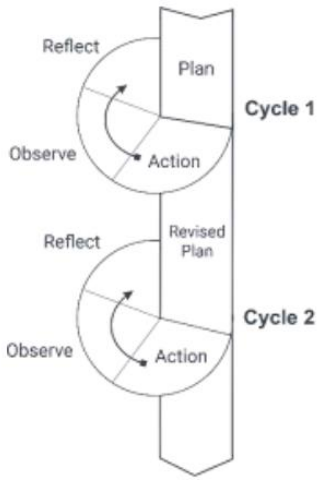

Figure 1. CAR Procedure

In this study, the Indonesian language material provided to the students focused on fantasy narrative texts. According to Hanafi & Hanafi (2019), fantasy texts are narratives that depict worlds or situations that are impossible in real life, often involving elements such as magic, mythical creatures, or extraordinary phenomena. The specific fantasy texts used in this research were (1) "Kekuatan Ekor Biru Nataga" by Ugi Agustono and (2) "Ini Bukan Ragaku" by Aji Tyas Hermawan.

The implementation of the first cycle centered on the use of problem-based learning to determine whether there was an improvement in the learning outcomes and critical thinking skills of the seventh-grade students at SMPN 1 Jatiroto. In the second cycle, gamification was incorporated into the teaching of fantasy texts to enhance the problem-based learning approach. After completing two cycles, the success indicators of the study were met, and thus, the research concluded after the second cycle. The core teaching approach was based on the steps of problem-based learning, which included: (1) Elementary Clarification, (2) Basis for Decisions, (3) Inference, (4) Advanced Clarification, and (5) Supposition and Integration (Seibert, 2021).

Research Data Collection Techniques

Data were collected throughout the implementation of both Cycle I and Cycle II based on pre-test and post-test scores, along with observations, to assess improvements in students' learning outcomes and critical thinking abilities. The data were gathered and processed directly by the researcher, who also served as the Indonesian language instructor for the seventh grade at SMPN 1 Jatiroto. The pre-test was administered prior to Cycle I, while post-tests were conducted at the end of each cycle.

Test Components

The tests in this study encompassed two key aspects: assessing critical thinking skills and measuring academic performance. In practice, 14 questions were included to evaluate learning outcomes, aligned with indicators from the Merdeka Curriculum (Table 2). These questions were structured as closed-ended multiple-choice items with four options (a, b, c, and d). To measure critical thinking skills, the test included six questions, each representing one of six indicators (Table 2) that reflected students' critical thinking capacities. The assessment was consolidated into a single test document, organized into two distinct sections. Thus, each test administered at a single time contained these two sections.

Observation Analysis

In addition, observations were conducted to monitor students' academic integrity throughout the intervention, based on predetermined indicators (Table 2). These observations were also conducted by the researcher as the classroom instructor. Observation aimed to capture students' engagement and behavior during learning activities, particularly when engaged in tasks designed to foster critical thinking skills. The specific indicators and applications of each test and observation measure are detailed further in Table 2.

Table 2. Research Instrument

Instrument	Indicators	Use	Source
Learning Outcome Test (closed-ended questions)	1. Identifying the appropriate theme of a fantasy text 2. Identifying the characters within the fantasy text accurately 3. Identifying characterization within the fantasy text accurately 4. Identifying the plot structure of the fantasy text accurately 5. Identifying the setting within the fantasy text accurately 6. Identifying the narrative perspective of the fantasy text accurately 7. Identifying the moral or message within the fantasy text accurately	Pre and after action	(Kementerian Pendidikan Kebudayaan Riset dan Teknologi, 2022)
Critical Thinking Test (open-ended questions)	1. Formulating a problem 2. Providing an argument 3. Conducting induction 4. Conducting deduction 5. Performing evaluation 6. Drawing conclusions and taking action	Pre and after action	(Adhitya et al., 2022)
Observation		During action	

Indicators of Success

A cycle is deemed successful if it meets the established success criteria (Susilo et al., 2022). This success criterion represents the minimum threshold students must achieve following the learning activities. The success indicator in this study is met when 75% of the students reach the minimum passing grade (KKM) of 75 for the Indonesian language subject at SMPN 1 Jatiroto.

Data Analysis Techniques

This study employs both descriptive quantitative and qualitative analysis based on the collected data. Qualitative data were obtained through observations conducted during the learning sessions, while quantitative data were derived from test score analyses to assess students' academic performance and critical thinking skills. Student learning outcomes were calculated using the following formula:

$$\text{Academic Performance Score} = \frac{Number\ of\ correct\ answer}{14} x100$$

In contrast, students' critical thinking scores were assessed using a scoring rubric detailed in Table 3. The critical thinking score was calculated with the formula:

$$\text{Critical Thinking Skill Score} = \frac{Sum\ of\ ratings\ across\ each\ indicator}{24} x100$$

Table 3. Rubric for Assessing Students' Critical Thinking Skills

No	Indicator	Rating			
		Does not meet the standard (1)	**Meets the minimum standard (2)**	**Meets the standard (3)**	**Exceeds the standard (4)**
1	Formulating a problem	Unable to formulate a problem	Minimal ability to formulate a problem	Able to formulate a problem	Able to formulate a problem with precision
2	Providing an argument	Unable to provide accurate arguments	Minimal ability to provide accurate arguments	Able to provide arguments	Able to provide accurate and credible arguments
3	Conducting induction	Unable to conduct induction	Limited ability to conduct induction	Able to conduct induction	Able to conduct induction flawlessly
4	Conducting deduction	Unable to conduct deduction	Limited ability to conduct deduction	Able to conduct deduction	Able to conduct deduction flawlessly
5	Performing evaluation	Unable to perform evaluation	Limited ability to perform evaluation	Able to perform evaluation	Able to perform evaluation flawlessly
6	Drawing conclusions and taking action	Unable to draw conclusions and take action	Limited ability to draw conclusions and take action	Able to draw conclusions and take action	Able to draw conclusions and take action flawlessly

Source: (Ardiansyah, 2022)

Results

Pre-Cycle Analysis Results

The pre-cycle analysis was conducted during the initial meeting prior to implementing CAR in the second semester of the 2022/2023 academic year. This analysis aimed to assess students' overall performance, encompassing both their academic outcomes and critical thinking skills. The results of the pre-test analysis from the pre-cycle stage are presented in Figures 2 and 3.

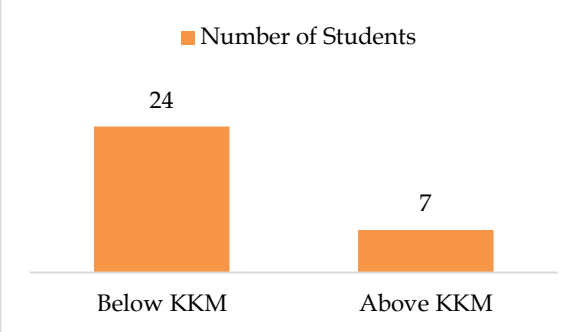

Figure 2. Pre-cycle Results on Students' Indonesian Language Learning Outcomes

The results displayed in Figure 2 illustrate the academic performance of seventh-grade students in Indonesian language at SMPN 1 Jatiroto. The analysis shows that 24 students scored below the minimum competency standard (KKM), while only 7 students scored above it. The average score calculated was 65.68, indicating that only 21% of students achieved scores above the KKM. Thus, student learning outcomes remain notably low.

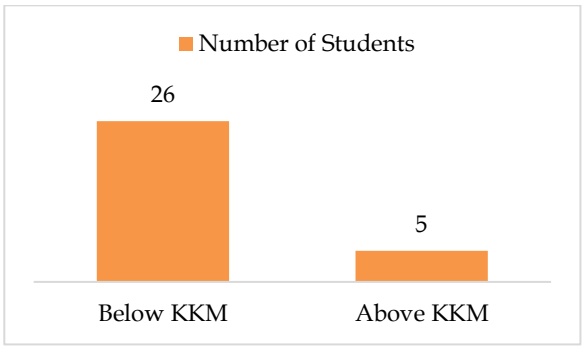

Figure 3. Pre-cycle Results on Students' Critical Thinking Skills

Furthermore, Figure 3 presents the scores for students' critical thinking abilities. Here, 26 students scored below the KKM, while only 5 scored above it. Additionally, the average pre-test score for critical thinking skills was 65, signifying that only 15% of students met or exceeded the KKM threshold. This outcome indicates that students' critical thinking skills are markedly underdeveloped. Therefore, an instructional method tailored to meet these specific student needs is essential.

Implementation of Problem-Based Learning Strategy

Based on various analyses of previous research, problem-based learning has been identified as an effective approach for addressing the issues of low academic achievement and underdeveloped critical thinking skills among seventh-grade students at SMPN 1 Jatiroto. In the implementation of Cycle I, problem-based learning was introduced through an activity called "Ayo Selesaikan Masalah".

This method began with an introduction to the fantasy story "Kekuatan Ekor Biru Nataga." Students were then presented with a problem related to the fantasy narrative, such as a story conflict that required a creative resolution. Students were encouraged to analyze this problem by envisioning themselves as characters in the story and considering how they would resolve the conflict. They were then grouped and prompted to discuss possible solutions, leveraging story elements like character powers, imaginative settings, and plot progression. This group discussion process fostered critical and collaborative thinking as students explored creative solutions. Following this, students were tasked with developing an alternative storyline as a solution to the problem, using their imagination to integrate various fantasy elements. They also presented their group discussions to the class, with each student given the opportunity to explain their ideas. In the final stage, students reflected on the learning outcomes by writing their own fantasy stories based on the solutions they developed, deepening their understanding of fantasy text structure.

After completing the learning process through problem-based learning, a post-test was administered. The results of this post-test in Cycle I are presented in Figure 4 for academic performance and Figure 5 for students' critical thinking skills.

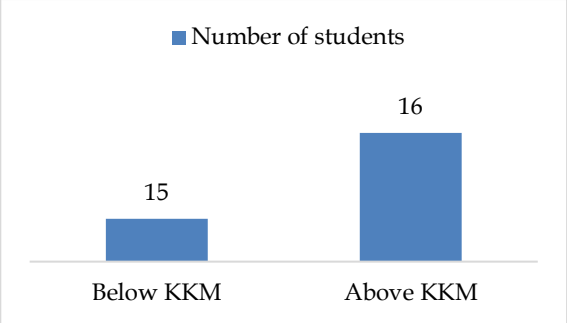

Figure 4. Results of Students' Indonesian Learning Performance in Cycle I

Figure 4 demonstrates that, following the implementation of problem-based learning, 16 students achieved scores above the minimum competency standard (KKM). This reflects an increase of 11 students scoring above the KKM. The average score rose to 71.9. However, despite this improvement, only 47% of students achieved scores above the KKM, indicating the need for a second cycle.

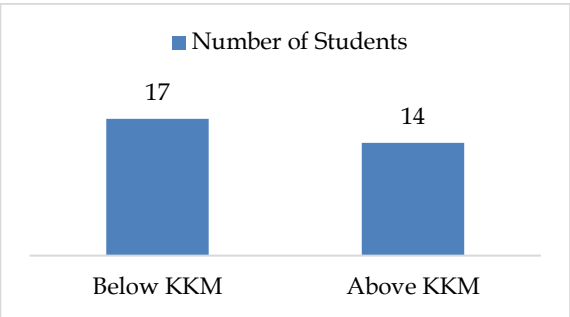

Figure 5. Results of Students' Critical Thinking Skills in Cycle I

Similarly, there was a notable increase in students' critical thinking abilities, with 14 students now reaching scores above the KKM. The average critical thinking score rose to 72. Nonetheless, only 41% of students scored above the KKM in this area, further necessitating the implementation of Cycle II.

Implementation of Gamification-Based Problem-Based Learning Strategy

Since Cycle I, which utilized problem-based learning alone, did not meet the minimum achievement indicators, Cycle II was conducted. In this second cycle, gamification was integrated to enhance the problem-based learning approach. Gamification, with its elements such as awards, challenges, and feedback, is known to effectively increase student engagement (Rosyidah et al., 2023).

The Cycle II strategy began by introducing the fantasy text "Ini Bukan Ragaku." The teacher then provided a problem scenario through gamification elements, presenting a "rescue mission" involving the protagonist "I" from the story. Students were divided into groups, each representing a "hero team" tasked with resolving the character "I's" body-switching conflict. To solve the mystery of how "I" switched bodies and to rescue the character through creative solutions, each group was awarded badges for progress milestones. Students collaborated to devise a problem-solving plan for the character within the fantasy narrative, leveraging story elements such as character powers, imaginative settings, and plot development. The problem-solving discussions were highly interactive, with the teacher acting as the "game master" to facilitate learning and provide timely feedback. Students could earn additional "rewards," such as extra points, for each creative idea or effective solution proposed. In the final stage, each group presented the fantasy storyline they developed, evaluated based on creativity and the appropriateness of their solution within the story framework.

After completing the entire gamification-based problem-based learning process, a post-test was conducted. The results of the post-test in Cycle II are presented in Figure 6 for academic performance and Figure 7 for students' critical thinking skills.

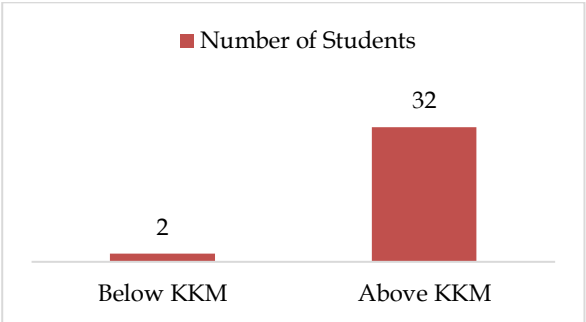

Figure 6. Results of Students' Indonesian Learning Outcomes in Cycle II

Figure 6 shows that after implementing gamification-based problem-based learning, 32 students scored above the minimum competency standard. This represents an increase of 16 students compared to the previous cycle who achieved scores above the KKM. The average score rose to 85, indicating that 94% of students surpassed the KKM, thereby meeting the success criteria for Cycle II. As a result, further intervention is deemed unnecessary.

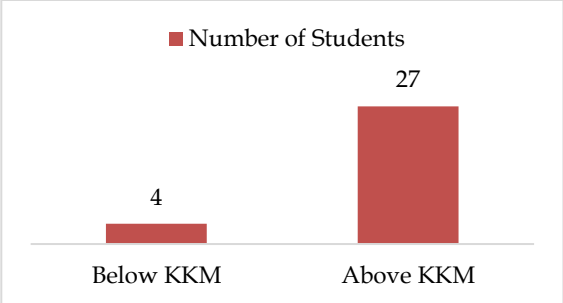

Figure 7. Results of Students' Critical Thinking Skills in Cycle II

Furthermore, the results of students' critical thinking abilities showed a significant improvement, with the number of students achieving scores above the KKM increasing from 14 to 27. The average critical thinking score reached 79. Based on these results, 79% of students have now scored above the KKM, indicating that Cycle II has successfully met the success criteria. Therefore, no further action is required.

Discussion

The discussion section should analyze the significance of the work's results rather than repeating them. Combining the results and discussion sections is often appropriate. Avoid extensive citations and detailed discussions of published literature. The discussion is the most crucial part of your article, as it allows you to effectively present your data. Align the discussion with the results without reiterating them. Typically, begin with a brief summary of the main scientific findings, excluding experimental details.

The findings of this study indicate that enhancing students' academic performance and critical thinking skills can be maximized through the implementation of gamification-based problem-based learning. According to Yuliati et al. (2018), critical thinking encompasses the ability to apply, analyze, synthesize, evaluate information, and generalize results derived from observation, experience, reflection, reasoning, or communication. Critical thinking is not an innate ability but rather a skill that can be cultivated through direct experiences where students confront real-world problems. Thus, when students regularly engage in such practices, their critical thinking skills can be developed (Maryam et al., 2020).

On the other hand, the problem-based learning strategy is a teaching method that creates a learning environment conducive to fostering critical thinking (Amin et al., 2020). Problem-based learning is centered on problematic and puzzling situations, which arouse students' curiosity and motivate them to investigate the issues (Hussin et al., 2018). As students engage in inquiry during the learning process, they apply critical thinking steps to investigate problems, analyze evidence, and make decisions based on their findings (Fadilla et al., 2021). Furthermore, as noted by Maryam et al. (2020), problem-based learning places students at the center of the learning process, where they actively participate and become deeply involved in problem-solving and exploring subject matter.

In addition to improving critical thinking skills, problem-based learning also enhances students' academic performance. This aligns with research by Nihayah (2022), which found that problem-based learning contributes to improved student achievement. These findings are consistent with previous research demonstrating that problem-based learning effectively enhances conceptual understanding and students' ability to apply knowledge. In Indonesian language classes using problem-based learning, students do not simply memorize theories or concepts; instead, they apply their

knowledge to solve problems presented through stories, text analysis, or story development. Observations revealed that students gained a deeper understanding of the material because they were actively engaged in the learning process, rather than merely being passive recipients of information.

The findings of this study indicate that the academic performance and critical thinking skills of seventh-grade students at SMPN 1 Jatiroto in their Indonesian language class can be enhanced through the use of gamification. These results are consistent with previous research, which has shown that gamification improves critical thinking skills (Angelelli et al., 2023) and student learning outcomes (Sailer & Homner, 2020). According to Pratama et al. (2021), gamification enhances learning outcomes and critical thinking skills by incorporating additional motivational elements that make the learning process more engaging and interactive. By utilizing game mechanics such as points, badges, challenges, and leveling systems, students are encouraged to actively participate and complete tasks (Rosyidah et al., 2023). In a gamified learning environment, students are deeply involved in the learning process through challenges that require independent or collaborative problem-solving, thereby fostering critical thinking (Adornes & Muniz, 2019). For instance, students must analyze situations, make strategic decisions, and evaluate the outcomes of their actions, all of which are essential components of critical thinking.

These findings align with research by Khaleel et al. (2020), which demonstrated that gamification promotes student engagement and enhances intrinsic motivation, ultimately leading to improved conceptual understanding and higher-order thinking skills. Another study by Bouchrika et al. (2021) found that the use of gamification in education improves students' concentration and increases the appeal of learning, making it easier for students to focus on learning objectives and achieve better academic results. Overall, gamification creates a fun and challenging learning environment that stimulates the development of critical thinking skills and fosters higher academic achievement.

Through this combination, students are able to maximize the enhancement of their critical thinking skills. The integration of both strategies creates an interactive, challenging, and motivating learning environment. This was evident from the observational results, which showed that students were more engaged with the problems presented, further incentivized by "awards" in the form of points. These points encouraged students to perform optimally in order to accumulate as many points as possible. Additionally, based on observations, the combination of strategies allowed students to collaborate, evaluate alternative solutions, and correct their mistakes, indirectly deepening their understanding and improving learning outcomes. Thus, gamification-based problem-based learning not only facilitates problem-solving but also ensures that students remain motivated and focused on achieving optimal learning objectives.

However, this study was conducted on non-consecutive weeks due to certain curricular demands requiring students to master a range of materials over the course of a semester, as outlined in the curriculum and Learning Objectives Flow (ATP) established at the start of the semester. As a result, the research meetings focusing on fantasy narrative texts followed this predetermined plan. It is possible that the non-consecutive implementation of the research influenced the outcomes, potentially making them either higher or lower than reported. Therefore, future studies could address this gap by conducting research over consecutive meetings with a wider variety of materials (rather than being limited to one or two types of content). This would make the research more comprehensive, with a broader data set to better assess the alignment between classroom challenges and the teaching methods employed.

Conclusions

The issue faced by the 7B students at SMPN 1 Jatiroto was their low critical thinking skills and academic performance. The findings of this study indicate that improving students' academic performance and critical thinking skills can be maximized through the implementation of gamification-based problem-based learning. However, a limitation of this research lies in its non-consecutive implementation across sessions. As a result, the discontinuous nature of the research sessions may have influenced the outcomes, potentially making them higher or lower than reported. Therefore, future research should address this gap by conducting studies over consecutive sessions with a wider range of subject matter.

Suggestion and Recommendation

Based on the findings of this study, several suggestions and recommendations can be drawn. Educators seeking to enhance students' learning outcomes and critical thinking skills can achieve this through a combination of gamification-based problem-based learning. In implementing this approach, it is essential for teachers to design complex yet relevant problems that align with the lesson material. These problems should encourage students to engage in critical thinking by analyzing situations and exploring solutions. By presenting real-world issues or challenging fictional scenarios, teachers can ensure that critical thinking develops naturally throughout the learning process.

Furthermore, teachers can assign points for each step in problem-solving or for every creative idea proposed by students, thereby motivating them to actively participate in the learning process. Healthy competition through leaderboards or inter-group challenges can also be introduced, though it is important to maintain the primary focus on learning, rather than competition alone. In addition, teachers should foster collaboration among students by assigning challenging group tasks, where each member contributes to solving the problem. This enables students to learn teamwork, share ideas, and enrich their thinking through discussion.

Regular, targeted, and constructive feedback should be provided to help students refine their strategies and enhance their critical thinking skills. Teachers should also create opportunities for reflection, allowing students to evaluate their learning process and how they tackled challenges. By incorporating gamification elements, students will feel more motivated and emotionally engaged, ultimately leading to significantly improved learning outcomes. The implementation of gamification-based PBL not only strengthens conceptual understanding but also deepens the development of students' critical thinking skills.

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