International Journal of Primary Education and Learning
Vol, 1 No 1 May 2025
ISSN: xxxx-xxxx (Electronic)
Open Access: https://auroracendekia.com/i-jpeel

THE EFFECT OF GAMIFICATION ON ALTERNATIVE ENERGY SOURCE MATERIALS ON STUDENTS' LEARNING MOTIVATION AND SELF-CONFIDENCE

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Article Info

Article history:
Received June 6, 2025
Revised June 7, 2025
Accepted June 9, 2025

Keyword:
Gamification; Learning Motivation; Confident Attitude

ABSTRACT

This study evaluated the effect of gamification on students' learning motivation and self-confidence. The underlying problem was low learning motivation due to monotonous conventional learning methods. Using a quantitative method, this study screened relevant literature and employed a quantitative approach with an experimental design. The research subjects were 60 grade 5 students, who were divided into an experimental group (using Kupin Edu) and a control group (using traditional methods). Data were collected through pretest and posttest questionnaires, analyzed by statistical tests. The results showed that the experimental group experienced significant improvements in learning motivation, from a score of 65.3 to 82.7, and self-confidence, from 58.7 to 75.3. In contrast, the control group showed minimal improvement. Competitive elements, such as leaderboards, and collaborative elements, such as daily challenges, were shown to significantly increase student engagement. This study concluded that gamification was an effective approach to increase students' learning motivation and confidence, particularly at the primary education level. The practical implication was that gamification could be integrated into the curriculum to create a more engaging and relevant learning environment. This research contributed to expanding the application of educational technology to improve the quality of student learning.

INTRODUCTION

In the digital era, challenges in education became increasingly complex. One of the main obstacles was the decline in student learning motivation, often caused by the monotony of conventional learning methods (Buckley & Doyle, 2016; Duggal et al., 2021; Fotaris et al., 2016). A recent UNESCO survey showed that more than 40% of students felt disengaged with traditional learning methods, especially in developing countries. The inability of traditional methods to adapt to changing times impacted students' confidence in facing academic tasks (Legaki et al., 2020; Subhash & Cudney, 2018). echnology offered opportunities to improve learning experiences, one of which was through the integration of gamification elements.

Gamification was introduced as a game-based learning approach designed to enhance students' learning motivation and confidence through interactive and enjoyable game mechanics (García-Iruela et al., 2020). By utilizing features such as leaderboards, daily challenges, and immediate feedback, gamification provided an adaptive learning experience tailored to students' abilities. Additionally, the application of gamification in education had gained significant attention globally. A World Economic Forum report noted that the use of gamification in education could increase learning motivation by up to

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60% compared to traditional methods (Acosta-Medina et al., 2021). Previous research indicated that digital-based games positively impacted students' learning motivation and performance. For instance, studies showed that collaborative and competitive game modes significantly increased students' motivation and self-efficacy compared to solo modes. These elements also enhanced student engagement, which was crucial for learning outcomes (Zou et al., 2021; Yu et al., 2020)

The use of educational games in learning had been shown to positively affect students' learning motivation and confidence. Previous studies demonstrated that digital-based games could improve students' motivation and academic performance. For example, research found that collaborative and competitive game modes in digital games could boost students' motivation and self-efficacy compared to individual modes (Zou et al., 2021) Moreover, educational games increased student engagement, which in turn raised motivation and learning satisfaction (Yu et al., 2020). In STEM education, game-based learning proved effective in improving student motivation and outcomes, particularly among elementary school students (Arztmann et al., 2022). Other research showed that digital-based games designed with competition and collaboration elements could enhance students' interest and goal orientation, which are important for learning motivation (Plass et al., 2013a). Additionally, educational games contributed to boosting students' confidence in learning, as evidenced in studies on game-based vocabulary learning that improved students' vocabulary achievement, motivation, and confidence.

The gamification concept aligned with modern educational theories. Gamification referred to the application of game elements in non-game contexts to increase motivation and engagement. In an educational context, gamification could be used to create more engaging learning experiences by incorporating elements such as challenges, rewards, and competition. The motivation theory underlying gamification was Maslow's Hierarchy of Needs, which emphasized the importance of a sense of achievement and reward in motivating individuals (Suwandani & Sunyono, 2024) In gamification, rewards such as points and badges were given to recognize students' success, directly affecting their intrinsic motivation. In addition to Maslow's theory, this research was supported by Bandura's self-efficacy theory, which explained that an individual's belief in their ability to succeed in a task played a crucial role in learning. Feedback elements in gamification, such as real-time notifications of student progress, provided success experiences that strengthened students' self-efficacy (Baah et al., 2023). Constructivism theory was also relevant to this study, as gamification encouraged students to actively construct their knowledge through interactive and meaningful learning experiences. Previous research, such as that conducted by Amalia et al. (2023), showed that gamification had great potential to increase student engagement. However, research examining the direct impact of gamification on students' learning motivation and confidence in the Indonesian educational context was still very limited (Amalia et al., 2023; Febriansah et al., 2024).

Gamification offered various features specifically designed to enhance the learning experience. Features such as leaderboards, points, personalized challenges, and rewards provided an adaptive and personalized learning experience. Moreover, gamification provided real-time feedback that allowed students to evaluate their progress directly. These features offered positive reinforcement that not only increased learning motivation but also built students' confidence. By utilizing modern technology, gamification aimed to bridge the gap between traditional learning methods and the needs of today's students.

In the context of technology-based learning, the competition and collaboration elements in gamification had proven to have significant effects on student learning outcomes. Research showed that these elements could increase student engagement in ways that traditional learning methods could not achieve. For example, a study conducted on math learning in lower grades showed that gamified activities incorporating competition, narrative, and adaptivity significantly improved student performance (Jagušt et al., 2018). Additionally, a meta-analysis indicated that combining competition with collaboration in gamification effectively improved behavioral and motivational learning outcomes (Sailer & Homner, 2019). Furthermore, collaborative learning in a gamified environment also improved students' academic performance and intrinsic motivation. A study involving university students showed that the group engaged in gamified collaborative learning outperformed the control group academically (Zheng & Wang, 2023). Additionally, gamification elements such as leaderboards and challenges in collaborative learning could enhance student motivation and engagement.

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Cognitive theory developed by Sweller emphasized the importance of reducing cognitive load through the presentation of engaging information, as done in gamification. Studies showed that gamification elements such as collaboration and competition could increase students' intrinsic motivation, which in turn could improve learning effectiveness (Luarn et al., 2023). Gamification also improved group cohesion and team performance in collaborative learning environments.

Overall, the competition and collaboration elements in gamification not only increased student engagement and motivation but also contributed to improved academic learning outcomes. The implementation of gamification in learning proved to be an effective pedagogical strategy to improve student engagement and learning outcomes.

RESEARCH METHODS

This study used a quantitative approach with an experimental design to evaluate the effect of using Gamification games on students' learning motivation and self-confidence. The focus of the study was on 5th grade students in one of the elementary schools. The study involved 60 students who were divided into two groups: the experimental group, which used Gamification as a learning medium for 4 weeks in December 2024, and the control group, which used conventional learning methods during the same period.

The students were assigned to the experimental and control groups using a randomized assignment procedure, which ensured that the groups were comparable at the start of the study. This method eliminated any selection bias and ensured that each group had an equal chance of being assigned to either condition. The validity and reliability of the instruments used in this study were assessed prior to data collection. The Likert scale questionnaire used to measure students' learning motivation and self-confidence was validated through expert reviews and pretesting with a small sample of students. The reliability of the instruments was confirmed using Cronbach's alpha, with values exceeding the threshold of 0.7, indicating good internal consistency.

Gamification games were designed with features such as point awarding, daily challenges, and leaderboards to create an engaging and competitive learning experience. A Likert scale questionnaire was used to measure students' learning motivation and self-confidence, which were measured through a pretest before the intervention and a posttest after the intervention. This study was conducted in a classroom environment with adequate computer devices and internet connection to support game usage activities.

Data were collected through questionnaires completed by students, direct observation of student engagement during the study, as well as supporting interviews to obtain additional information. Data analysis was conducted using statistical tests, specifically the t-test, to compare pretest and posttest scores between the experimental and control groups. The results of this analysis aimed to identify the significant effect of Gamification on students' learning motivation and self-confidence. Additional information from observations and interviews was used to strengthen the quantitative findings in this study.

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RESULTS AND DISCUSSION

Results

The results of this study showed significant differences between the experimental and control groups. In learning motivation, the average pretest score of the experimental group was 65.3, which increased to 82.7 in the posttest. In contrast, the control group only increased from 64.8 in the pretest to 70.5 in the posttest. On self-confidence, the experimental group increased from 58.7 in the pretest to 75.3 in the posttest, while the control group increased from 57.5 to 63.2. The table below shows these descriptive result:

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Table 1. Descriptive Statistics of Learning Motivation and Confident Attitude

Group	Pretest Learning Motivation	Posttest Learning Motivation	Self-confidence Pretest	Posttest Self-confidence Attitude
Experiment Group	65.3	82.7	58.7	75.3
Control Group	64.8	70.5	57.5	63.2

Table 1 shows the descriptive statistics for students' learning motivation and self-confidence before and after the intervention in both groups. The experimental group showed a much more significant improvement than the control group in both aspects of learning motivation and self-confidence. This provides an early indication that the use of Gamification games has a positive influence on both variables measured. This significant difference is reinforced by the t-test results with a p-value <0.05 for both variables. These results ensure that the changes that occur are not coincidental.

Table 2. T-test Results

Variables	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Learning Motivation	7.854	58	0.000	12.2	1.553
Confident Attitude	6.732	58	0.000	12.1	1.797

Furthermore, Table 2 reinforces the findings from Table 1 with the t-test results showing statistically significant differences between the experimental and control groups on the levels of learning motivation ($t = 7.854$, $p < 0.05$) and self-confidence ($t = 6.732$, $p < 0.05$). This analysis provides strong evidence that the changes in scores in the experimental group were not the result of chance, but rather the result of the intervention provided through the Gamification game. This difference is further visualized through graphs depicting the increase in pretest and posttest scores in each group.

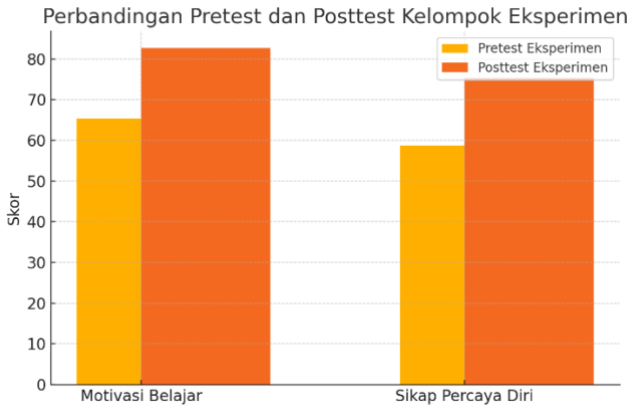

Fig 1. Comparison of Pretest and Posttest of Experimental Group

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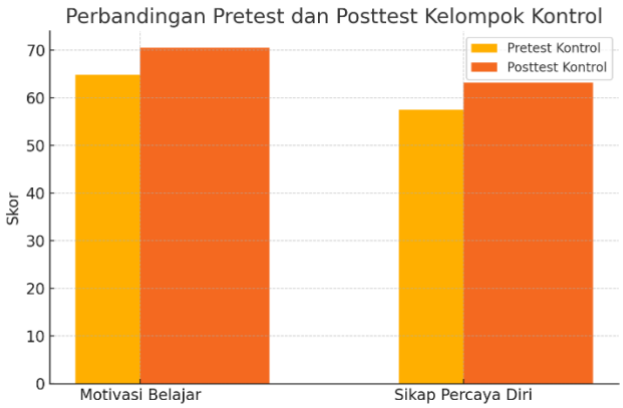

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Fig 2. Comparison of Pretest and Posttest of Control Group

The graph shows that the experimental group experienced a higher improvement compared to the control group in both learning motivation and confidence. This visualization not only supports the quantitative data from the previous table but also provides an intuitive picture of the effectiveness of Gamification games as a learning medium.

Discussion

The results showed that the use of Gamification games had a significant impact on increasing students' learning motivation and self-confidence. The experimental group showed an increase in the average learning motivation score from 65.3 in the pretest to 82.7 in the posttest, while the control group only increased from 64.8 to 70.5. Similar findings were also seen in self-confidence, where the experimental group increased from 58.7 to 75.3, while the control group increased less from 57.5 to 63.2. These findings suggest that competitive and collaborative elements in Gamification, such as leaderboards and daily challenges, successfully created a learning environment that supported active student engagement.

These findings support Bandura's self-efficacy theory, which explains that an individual's belief in his or her ability to succeed plays an important role in learning. Competition elements in Gamification, such as leaderboards, provide encouragement to students to perform better, while collaboration elements support the development of confidence through shared success. These findings are in line with previous research. Zou et al. (2021) showed that collaborative and competitive game modes in digital games can increase students' motivation and confidence compared to individual modes. The element of competition, as implemented in Gamification, encourages students to perform better, while the element of collaboration supports the development of self-confidence through shared success. In the context of STEM education, game-based learning has also been shown to have positive effects on student motivation and behavior (Hung et al., 2014).

Furthermore, constructivism theory also supports these results, as gamification allows students to construct knowledge through meaningful hands-on experiences. According to Plass et al. (2013b), the competition and collaboration elements in gamification help to create emotional engagement, which in turn reinforces cognitive learning. The use of real-time feedback is also in line with intrinsic motivation theory, where achievement-based rewards increase student motivation and engagement.

In addition, well-designed digital-based games can increase students' cognitive, emotional, and behavioral engagement, as suggested by Pareto et al. (2012). This is reinforced by research in language learning, where educational games improve students' vocabulary attainment, motivation and confidence (Subhash & Cudney, 2018). Gamification, with its gamification approach, supports these findings by creating a fun, competitive and challenging learning experience. Elements such as real-time feedback and achievement-based rewards play an important role in driving student engagement.

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This research supports the idea that fun and interactive learning environments can provide better learning outcomes than conventional approaches.

However, there are some limitations that can be identified in this study. The heterogeneity of the student population may affect the effectiveness of gamification-based game interventions. As stated by (Arztmann et al., 2022), factors such as socioeconomic status, migration background, and special educational needs have the potential to moderate the impact of game-based learning. In the context of this study, student heterogeneity in terms of technology access and digital skills may be a challenge that needs to be addressed in future research.

The novelty of this research lies in the application of Gamification at the primary education level. Most previous research has focused on higher education or professional training, so this research provides new insights into how gamification elements can be applied to improve young students' learning motivation and confidence. Elements such as daily challenges and leaderboards provide tangible examples of how extrinsic motivation can be transformed into intrinsic motivation when students feel rewarded for their efforts.

The findings also have practical implications for educators and educational technology developers. Educators can integrate gamification elements into the traditional curriculum to create a more engaging and relevant learning environment for students. Meanwhile, educational technology developers can utilize these findings to develop more inclusive learning tools, ensuring that all students, regardless of their background, can experience the benefits of technology-based learning.

Overall, the results of this study show that the use of educational games such as Gamification can be an effective learning strategy, especially if the game design pays attention to collaborative and competitive aspects that can maximize student engagement. By creating an engaging learning experience, games such as Gamification not only improve learning outcomes but also have a positive impact on student confidence. Further research is needed to explore the full potential of this approach in various educational contexts, including how gamification can support more specific individual learning needs.

CONCLUSION

Gamification can be an effective learning strategy, especially if the game design takes into account collaborative and competitive aspects that can maximize student engagement. The findings support the importance of gamification-based learning approaches to create inclusive and engaging learning experiences for all students. Further research is needed to address the existing gaps and ensure the sustainability of the benefits of this approach in various educational contexts. The use of educational games such as Gamification provides a great opportunity in improving the quality of learning. . Therefore, Gamification developers are advised to add personalization features to better suit the individual needs of students, so that each student can get a more adaptive and in-depth learning experience. Teachers are also expected to utilize Gamification as a complement to traditional learning to create a more dynamic and engaging learning environment. Further research is needed to explore the long-term impact of using gamification on students' motivation and confidence, including how factors such as socio-economic background and special needs affect the effectiveness of gamification.

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