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The Role of Gamification in Enhancing Student Engagement in Grades 4-6: A Systematic Literature Review

Peran Gamifikasi dalam Meningkatkan Keterlibatan Siswa di Kelas 4-6: Tinjauan Literatur Sistematis

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ABSTRACT
This research aims to examine the role of gamification in increasing the cognitive engagement of elementary school students in grades 4-6 in general learning contexts. Using a systematic literature review approach, this research analyzes various studies from indexed journals that discuss the impact of gamification elements, such as points, leaderboards, and challenges, on student motivation and engagement. The review results show that gamification consistently increases cognitive engagement, primarily through increasing intrinsic motivation and adapting to students' learning styles. In addition, teachers play an important role in the successful implementation of gamification in the classroom. However, these findings also demonstrate the limitations of the Indonesian educational context and the lack of longitudinal research on the long-term effects of gamification. Therefore, further research is needed to assess the effectiveness of gamification in the long term and in national educational contexts. Practical implications of this research include the integration of gamification in curriculum and teacher training for more effective implementation. This research makes a significant contribution to the understanding of how gamification can be applied to improve the quality of learning at the primary school level.
Keywords: Gamification, cognitive engagement, basic education, systematic literature review, intrinsic motivation, personalized learning

ABSTRAK
Penelitian ini bertujuan untuk mengkaji peran gamifikasi dalam meningkatkan keterlibatan kognitif siswa kelas 4-6 SD dalam konteks pembelajaran umum. Menggunakan pendekatan systematic literature review, penelitian ini menganalisis berbagai studi dari jurnal terindeks yang membahas dampak elemen-elemen gamifikasi, seperti poin, leaderboards, dan challenges, terhadap motivasi dan keterlibatan siswa. Hasil tinjauan menunjukkan bahwa gamifikasi secara konsisten meningkatkan keterlibatan kognitif, terutama melalui peningkatan motivasi intrinsik dan adaptasi terhadap gaya belajar siswa. Selain itu, guru memegang peran penting dalam kesuksesan penerapan gamifikasi di kelas. Namun, temuan ini juga menunjukkan keterbatasan pada konteks pendidikan Indonesia dan kurangnya penelitian longitudinal tentang efek jangka panjang gamifikasi. Oleh karena itu, penelitian lebih lanjut diperlukan untuk menilai efektivitas gamifikasi dalam jangka panjang dan dalam konteks pendidikan nasional. Implikasi praktis dari penelitian ini mencakup integrasi gamifikasi dalam kurikulum dan pelatihan guru untuk penerapan yang lebih efektif. Penelitian ini memberikan kontribusi yang signifikan terhadap pemahaman tentang bagaimana gamifikasi dapat diterapkan untuk meningkatkan kualitas pembelajaran di tingkat sekolah dasar.
Kata kunci: Gamifikasi, keterlibatan kognitif, pendidikan dasar, systematic literature review, motivasi intrinsik, personalisasi pembelajaran

1. Introduction

In the world of modern education, maintaining student engagement is a crucial challenge faced by educators, especially at the primary education level. Student engagement is

a complex concept, encompassing cognitive, emotional, and behavioral dimensions, and is closely linked to academic success and the development of critical thinking, analytical, and problem-solving skills. This is especially important for students aged 9-12 years, who are experiencing a transition to a more complex cognitive stage, as explained in Piaget's theory of cognitive development (Erneling, 2012; Arwin et al., 2022). Research shows that active participation in learning activities is associated with improved academic outcomes and mastery of social skills, further emphasizing the importance of encouraging engagement in the classroom (Abidin, 2023; Marinda, 2020). However, educators often face a decline in student motivation and engagement over time, especially when teaching methods are perceived as monotonous or less interactive. This disinvolvement can have negative impacts, including decreasing learning outcomes and increasing dissatisfaction with the educational process (Hakim, 2023; Susilaningsih et al., 2019). Therefore, it is critical for educators to explore innovative approaches that can increase student engagement. One approach that is gaining popularity in educational settings is gamification, which involves applying game elements to non-game contexts to increase motivation and engagement (Abidin, 2023; Kilag et al., 2022). Elements often used in gamification include reward systems, leaderboards, and challenges, which exploit students' competitive instincts and desire for achievement to create a more interactive and enjoyable learning environment (Hakim, 2023; Abidin, 2023).

The application of gamification in education has been widely studied, especially at the higher education level, where it has been proven to be able to create a more dynamic and interesting learning atmosphere (Hakim, 2023; Kilag et al., 2022). However, its implementation at the elementary school level, especially for students in grades 4-6, still requires further research considering the unique cognitive and social development characteristics of this age group. At this stage, students are in the concrete operational phase of cognitive development, where they are starting to think logically but still need concrete experience to understand abstract concepts (Erneling, 2012; Arwin et al., 2022). Research shows that gamification can effectively increase cognitive engagement, which includes students' mental involvement during the learning process, including in problem solving and critical reflection (Abidin, 2023; Marinda, 2020). Despite its great potential, existing literature tends to emphasize affective and behavioral involvement more than cognitive involvement, indicating a research gap that needs to be explored further (Hakim, 2023; Abidin, 2023). In conclusion, the challenges in maintaining student engagement at the primary education level are significant, but innovative strategies such as gamification offer promising opportunities to increase students' cognitive engagement. As educators continue to strive to create more interactive and meaningful learning experiences, more research is needed to understand the specific impact of gamification on cognitive engagement in elementary school settings, especially for students in the critical developmental phases of grades 4-6.

Although the existing literature has documented the various benefits of gamification in increasing student engagement generally, studies specifically exploring the impact of gamification on the cognitive engagement of students in grades 4-6 are limited. Most studies focus on higher education or secondary school, and only a few explore the primary education context. In addition, students' cognitive engagement—which includes critical thinking skills, conceptual understanding, and problem solving—has received less attention in previous studies. Cognitive engagement is very important at the basic education level because at this stage, students are forming the foundations of thinking that will be used in ITnext level of education. Given the gaps in the literature, this study seeks to answer important questions: **How does gamification affect the cognitive engagement of students in grades 4-6 in the context of general learning?** Thus, this research is expected to provide a deeper understanding of the influence of gamification on the cognitive dimension of student involvement in learning.

The urgency of this research arises from the fact that basic education is the foundation for kekestudents' academic and social development in the future. At this level, students'

cognitive engagement is essential to ensure that they are not only emotionally or behaviorally engaged, but also truly understand the material being taught. In an increasingly technology-driven global context, it is important for education systems to adapt to new teaching methods that can facilitate student engagement more effectively. In addition, the gamification approach offers great potential for solving educational challenges in the digital era, especially among the younger generation who tend to be more responsive to technology and game mechanisms. This research is very important to determine whether the gamification approach is able to meet these demands, especially at the basic education level where students' cognitive foundations are being built. Furthermore, gamification is not just about delighting students, but also about how to create an interactive and meaningful learning environment where students can develop critical thinking skills, decision making, and analytical abilities that will help them in the future. Therefore, this research can be has made significant contributions not only to the field of basic education, but also to educational policies that focus on the application of technology and innovation in the classroom.

This research aims to:

1. Identify literature that has empirically examined the application of gamification in grades 4-6 in general education contexts.
2. Exploring the influence of gamification elements, such as rewards, challenges, and leaderboards on students' cognitive engagement in grades 4-6 elementary school.
3. Analyze factors that mediate or moderate the relationship between gamification and cognitive engagement, such as student learning styles, class characteristics, and gamification implementation design.
4. Fills the research gap related to cognitive engagement in the gamification literature which previously emphasized more on emotional engagement and student behavior.

By achieving these objectives, it is hoped that this research can make a real contribution to the existing literature and provide best practice practices) for educators who want to apply gamification in elementary school student learning. This research will provide new insights into how gamification approaches can be adapted to optimize the cognitive engagement of elementary school students, especially in general learning contexts in grades 4-6. This is not only important for educators iwant to develop innovative learning strategies, but also for educational policy makers who seek to introduce technology and innovation in the basic education curriculum. This research also contributes to the broader literature on gamification, cognitive engagement, and experience-based learning at the primary education level.

2. Methods

2.1. Research Design

This research uses a systematic literature review approach, where we filter and assess the quality of literature relevant topic gamification and cognitive engagement of students in grades 4-6 elementary school. This approach was carried out following PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure transparency and reliability in the literature screening process.

2.2. Inclusion and Exclusion Criteria

- Inclusion: Studies published between 2013-2024, empirically based articles, experiments, or reviews that focus on gamification and engagement of elementary school students (grades 4-6), with a focus on general learning.
- Exclusions: Studies published before 2013, theoretical articles lacking empirical data, or studies not relevant to the 4-6 grade context.

2.3. Data source

Databases used to collect literature include Scopus, Web of Science, ERIC, and Google Scholar. Keywords used include “gamification”, “student engagement”, “cognitive engagement”, “elementary education”, and “grades 4-6”.

- Screening Process: After identifying suitable articles, further filtering is carried out based on abstract and full-text relevance. Studies that did not meet the criteria were immediately excluded from the analysis.
- Data Analysis: Articles Eligible participants were analyzed using a qualitative approach with the aim of identifying general patterns, research gaps, and main results relevant to the research questions. Each study was coded based on the gamification elements used, classroom context, as well as cognitive engagement outcomes.

3. Results

3.1. Characteristics of Selected Studies

From the literature screening carried out, Identified 50 articles that meet the inclusion criteria. These studies cover various contexts of the use of gamification in general learning, both through digital platforms and traditional strategies in the classroom.

3.2. The Most Effective Gamification Elements

Based on the analysis, it was found that rewards and challenges are the two elements most frequently used in gamification. These elements consistently increase students' cognitive engagement through increased motivation to solve problems and participate in learning activities.

3.3. The Impact of Gamification on Cognitive Engagement

Studies show that gamification can significantly increase cognitive engagement, particularly in problem-solving abilities and concept understanding. Students in grades 4-6 who participated in gamification activities were more motivated to engage in active and reflective learning compared to students who were not exposed to gamification.

3.4. Variation in Effectiveness Based on Context

The effectiveness of gamification appears to be greater in students with a kinesthetic learning style who tend to respond better to challenge-based activities and interactive tasks. However, students with a visual learning style also showed improvements in understanding the material when visual elements were used in gamification.

4. Discussion

4.1. The Relationship between Research Results and Student Cognitive Engagement

This research aims to understand how gamification influences the cognitive engagement of students in grades 4-6 in a general learning context. Cognitive engagement refers to the process in which students are mentally engaged in learning activities through critical thinking, problem solving, and decision making. Based on the results of the literature analysis that has been carried out, there are several important findings that are relevant to the research question posed: How does gamification affect the cognitive engagement of students in grades 4-6 in a general learning context?

The main findings from the literature that have been reviewed show that gamification is able to increase students' cognitive engagement through several mechanisms, including:

1. **Reward System Use and Cognitive Engagement.**

Implementation of reward systems, particularly through gamification elements such as points, badges, and trophies, has been shown to increase students' intrinsic motivation, especially in grades 4-6. This is in line with self-determination theory which states that intrinsic

motivation develops when individuals feel they have autonomy in their actions (Goswami, 2017). Reward systems not only provide external validation, but also foster a sense of accomplishment that is important for engaging students in demanding cognitive tasks, such as solving complex mathematical problems and abstract scientific concepts (Najjar & Salhab, 2022; Lewis et al., 2016).

Research shows that gamification can increase cognitive engagement by making learning more interactive and fun. For example, a study highlights that gamified learning environments promote behavioral, emotional, and cognitive engagement among students, thereby reducing cognitive load and improving the overall learning experience (Topu, 2023). Additionally, the integration of game elements has been shown to have a positive impact on students' attitudes towards learning, which is critical for maintaining high levels of cognitive engagement (Thongmak, 2018). This is especially relevant in educational contexts where sustained engagement is required to master challenging content. Furthermore, the effectiveness of reward systems in promoting cognitive engagement is supported by findings suggesting that direct rewards can increase intrinsic motivation by creating a connection between activities and outcomes achieved (Woolley & Fishbach, 2018). This suggests that when students receive recognition for their efforts in a timely manner, they are more likely to persist in their learning efforts, thereby achieving their educational goals. Additionally, perceptions of fairness in reward distribution are critical; research shows that when students feel that rewards are distributed fairly, their intrinsic motivation and creativity increase significantly (Sæther, 2020). In conclusion, evidence supports the idea that reward systems, particularly those incorporating elements of gamification, are effective in increasing students' intrinsic motivation and cognitive engagement. It is critical to create a learning environment where students are motivated to tackle complex tasks and achieve their learning goals.

2. Challenges and Development of Critical Thinking Skills

The integration of gamification elements, such as puzzles and multilevel missions, has been proven to improve students' critical thinking skills, especially among students aged 9-12 years who are at the concrete operational stage in their cognitive development. At this stage, students begin to think logically, but often require visual aids or manipulatives to facilitate their understanding (Lorenzo & Sánchez-Martínez, 2022). Gamification provides structured and progressive challenges, which force students to solve problems creatively and innovatively, thereby honing their critical thinking skills (Alsadoon, 2023; Kim & Castelli, 2021). Research shows that when students are engaged in gamification-based learning environments, they are more likely to think deeply about the tasks assigned to them, which in turn increases their cognitive engagement (Daramola, 2022; Huang & Yeh, 2017). The effectiveness of gamification in promoting cognitive engagement can be attributed to its ability to create an interactive learning atmosphere that motivates students to participate actively. For example, gamification strategies have been linked to increased student motivation and engagement, as evidenced by research showing statistically significant improvements in these areas in students who were exposed to gamified learning compared to those who were not (Alsadoon, 2023; Zainuddin, 2023). Additionally, gamification elements such as narratives, progressions, and challenges have not only proven effective in increasing cognitive engagement, but also in emotional and social learning outcomes, making them more effective than traditional educational methods (Najjar & Salhab, 2022; Dichev & Dicheva, 2017) .

Furthermore, certain gamification activities, such as escape rooms and puzzle-solving tasks, have been identified as particularly effective in promoting critical thinking. These activities require students to collaborate, manage their knowledge, and solve complex problems within certain time constraints, thereby strengthening their cognitive skills (Sánchez et al., 2022; Huang & Yeh, 2017). The structured nature of these challenges aligns well with the developmental needs of students in this age group, allowing them to engage with content meaningfully while developing essential problem-solving skills (Heliawati et al., 2022; Coughlin,

2023). In conclusion, applying gamification in an educational context not only improves students' critical thinking skills, but also significantly increases their cognitive engagement. The structured challenges in a gamification-based learning environment encourage students to think critically and creatively, thereby preparing them for more complex problem-solving tasks in their academic journey.

3. Leaderboards and Healthy Competition to Spur Cognitive Engagement

The integration of leaderboards in educational settings has been proven to encourage healthy competition among students, especially those in grades 4-6, who are at a crucial stage of social development. This competitive environment can significantly increase cognitive engagement, as students are motivated to improve their performance by comparing their results with their peers. Research shows that when students know their position on the leaderboard, they tend to put more effort into assignments that require logical and analytical thinking, thereby deepening their understanding of the material (Iskrenovic-Momcilovic, 2020; Adkins-Jablonsky et al., 2021) . Leaderboards not only serve as a motivational tool but also as an assessment instrument that provides insight into students' understanding of the subject matter. For example, several studies show that gamification strategies, including the use of leaderboards, can transform traditional learning environments into more dynamic and enjoyable experiences. This transformation encourages students to more actively engage with the content, as they seek to improve their rankings (Rincón-Flores & Santos-Guevara, 2021; Adkins-Jablonsky et al., 2021). The competitive nature of these leaderboards can also stimulate students to explore deeper concepts and seek a deeper understanding of the subject matter, which is important for cognitive development (Fischer et al., 2018).

Furthermore, the use of quiz-enriched learning platforms, such as Kahoot!, has been shown to improve the quality of student learning by encouraging engagement and motivation. The platform creates a fun and enjoyable atmosphere that increases knowledge retention and encourages students to actively participate in their learning process (Iskrenovic-Momcilovic, 2020; Adkins-Jablonsky et al., 2021). The competitive elements inherent in these systems, such as earning points and rising rankings on leaderboards, have been shown to significantly increase student engagement and motivation, ultimately contributing to better academic outcomes (Rincón-Flores & Santos-Guevara, 2021; Adkins -Jablonsky et al., 2021). In conclusion, strategic implementation of leaderboards in educational contexts can effectively increase cognitive engagement among students. By encouraging a healthy competitive environment, educators can motivate students to develop their analytical skills and deepen their understanding of subject matter, ultimately leading to a more effective learning experience.

4. Personalization and Customization of Learning Styles through Gamification

The integration of gamification elements in education has been shown to significantly increase the personalization of the learning experience, allowing students to interact with course material according to their individual learning pace and preferences. This personalization is critical in encouraging cognitive engagement, as it allows students to choose challenges that suit their unique learning styles, thereby encouraging deeper analytical thinking without the pressure that often occurs in traditional educational methods. Research shows that gamification is effective in meeting diverse learning needs. For example, Hussein et al. highlighted the positive impact of gamification on skill development among students with special needs, emphasizing the role of gamification in improving cognitive and personal skills through customized learning experiences (Hussein et al., 2023). Similarly, Davis et al. found that students appreciated the personalized nature of gamification-based courses, which allowed them to track progress and engage in fun learning activities (Davis et al., 2018). This is in line with Kocakoyun and Özdamlı's statement that gamification creates an effective learning environment by combining motivational components that are appropriate to the user experience (Kocakoyun & Özdamlı, 2018).

Additionally, gamification's ability to encourage a sense of autonomy among students is also important. Park et al. discusses how gamification environments empower students to actively participate and take control of their learning experiences, which increases their motivation and engagement (Park et al., 2021). Hürsen and Bas also support this view, noting that gamification positively influences students' motivation in science education, reinforcing the idea that personalized learning approaches can improve educational outcomes (Hürsen & Bas, 2019). The literature also suggests that gamification can reduce the isolation felt by some students in conventional educational settings. For example, Suryatama points out that gamification allows for personalized feedback and flexible learning pacing, which is especially beneficial for students who struggle with traditional teaching methods (Suryatama, 2023). This adaptability is important in creating an inclusive learning environment that caters to a variety of learning styles and preferences.

Overall, personalization and adaptation of learning styles through gamification not only increases student engagement but also encourages deeper cognitive skills by enabling them to navigate their educational journey in a way that suits individual needs. Evidence from various studies emphasizes the transformational potential of gamification in education, making it a valuable tool in modern pedagogical practice. These findings are in accordance with the research objective, namely to analyze the factors that mediate or moderate the relationship between gamification and cognitive engagement. A gamification design that is flexible and adaptive to students' learning styles allows them to be more mentally involved in the learning process, because they feel the learning is more relevant and suited to their needs.

4.2. Discussion of Moderating Factors

One important contribution of this research is the identification of factors that mediate or moderate the relationship between gamification and cognitive engagement. Based on the results of the analysis, there are several factors that play an important role, namely:

1. Student Learning Style

The effectiveness of gamification in an educational context is greatly influenced by students' learning styles. Research shows that students with a visual learning preference are more effective at interacting with gamification elements that incorporate graphics and data visualization, while those with a kinesthetic learning style benefit more from interactive and physical activities. For example, Liew et al. found that the majority of medical students showed a unimodal learning preference, with the kinesthetic learning style being the favorite among some participants (Liew et al., 2015). However, the study also reported the presence of significant multimodal learning styles, indicating a more complex landscape of learning preferences (Liew et al., 2015). Additionally, Pereira et al. emphasized the importance of aligning gamification strategies with students' learning styles to improve cognitive engagement and performance (Pereira et al., 2019). They argue that various gamification mechanisms have different impacts on students depending on their individual learning preferences, making it important to implement adaptive educational interventions. This adaptability is also supported by Li and Chu, who highlight that gamification can facilitate learning by providing external stimuli that suit various learning styles, although they caution that such stimuli can sometimes undermine intrinsic motivation (Li & Chu, 2020).

Hellberg's study reinforces this idea by showing that gamification can significantly increase motivation and engagement, especially among students with active learning styles who may have difficulty with traditional educational methods (Hellberg, 2023). This is also supported by Siddiquei and Khalid, who explored the link between personality traits, learning styles, and academic performance, showing that understanding these dynamics is critical to optimizing e-learning environments (Siddiquei & Khalid, 2018). Furthermore, the VARK model, as discussed by Paiboonsithiwong et al., categorizes learning styles into visual, auditory, reading/writing, and kinesthetic, providing a framework for adapting gamification strategies to

meet the needs of diverse learners (Paiboonsithiwong et al., 2016). In conclusion, the integration of gamification in educational settings must consider variations in student learning styles to maximize cognitive engagement and learning outcomes. By adapting gamification elements to align with these learning styles, educators can create more effective and inclusive learning experiences.

2. Classroom Characteristics and Teacher Support

Classroom characteristics, including the number of students and the quality of teacher-student relationships, significantly influence the effectiveness of gamification in increasing cognitive engagement among students. Research shows that effective classroom management and supportive teacher behavior are critical to the successful implementation of gamification strategies. For example, several studies found that positive relationships between teachers and students create a conducive learning environment, which is essential in increasing student motivation and engagement (Pérez-Salas et al., 2021; Parnes et al., 2020; "Relationality and student engagement in higher education", 2023). Relational dynamics between teachers and students enhance the learning experience, because students who feel supported are more likely to engage cognitively with learning material ("Relationality and student engagement in higher education", 2023; Roorda et al., 2011; Burns, 2020).

The teacher's role as an active facilitator in the gamification process is also very important. Teachers who actively support and guide students in gamification-based learning experiences help maintain students' focus on cognitive learning goals. Other findings show that teacher support in the form of emotional and instructional plays an important role in promoting deep student involvement in learning content (Parnes et al., 2020; Fitriyani, 2021; Sinuhin, 2022). The existence of supportive relationships between teachers and students has been associated with better academic outcomes, including higher levels of cognitive engagement and improved performance on learning tasks (Quin, 2016; Parnes et al., 2020; Pérez-Salas et al., 2021).

An effectively managed classroom environment with supportive interactions also contributes greatly to the success of a gamification strategy. Research shows that when teachers create an environment that encourages participation and collaboration, students are more likely to experience increased motivation and engagement (Casimiro, 2016; Zainuddin et al., 2021). The collaborative nature of gamification-based learning, combined with strong support from teachers, can lead to increased cognitive engagement, as students feel more connected to their peers and the learning process (Casimiro, 2016; Oktaviati & Jaharadak, 2018). In conclusion, successful implementation of gamification in the classroom is greatly influenced by the number of students, the quality of the teacher-student relationship, and the classroom management strategies used by the teacher. Teachers who actively facilitate gamification-based learning experiences and build supportive relationships with students are likely to see significant improvements in cognitive engagement and academic performance.

4.3. Research Implications

The findings from this research provide important implications for educational practitioners, especially elementary school teachers. Gamification, if designed and implemented appropriately, can be a highly effective tool for increasing students' cognitive engagement. This is especially relevant in grades 4-6, where cognitive engagement is crucial in building a student's academic foundation for the next level of education. In addition, this research also provides new insights for curriculum developers and education policy makers, who can consider gamification as an innovative approach in efforts to improve the quality of learning at the elementary school level. Flexible and adaptive gamification designs also offer opportunities to meet students' diverse learning needs, ensuring that each student can be optimally engaged in the learning process.

4.4. Limitations and Recommendations for Further Research

Although the findings of this study provide significant contributions, there are several limitations that need to be considered. One of them is reliance on available literature, most of which comes from overseas research. Further research is needed to explore the application of gamification in the specific Indonesian educational context. In addition, more in-depth research regarding the long-term impact of gamification on students' cognitive engagement also needs to be carried out, especially in the context of improving academic outcomes and mastery of critical thinking skills. Further research could also focus on developing more integrated gamification models and the national curriculum as well assess how specific elements of gamification, such as group-based challenges or collaborative projects, can be used to increase cognitive engagement more effectively.

5. Conclusion

5.1. Summary of Key Findings

This research aims to examine how gamification can affect the cognitive engagement of students in grades 4-6 in the context of general learning. Based on a systematic literature review, some of the main findings that emerged from this research are:

1. Gamification as an Effective Tool to Increase Cognitive Engagement
   Gamification has been proven to increase students' cognitive engagement through the use of elements such as reward systems, challenges, leaderboards, and personalization of learning styles. Students who engage in gamification activities show higher levels of critical thinking, better motivation, and increased problem-solving abilities.
2. The Positive Effect of Gamification on Students' Intrinsic Motivation
   Elements in gamification such as points, badges and levels are able to encourage students' intrinsic motivation, so that they are more involved in the learning process without feeling forced. This plays an important role in creating a more enjoyable learning experience, which in turn increases students' overall cognitive engagement.
3. The Flexibility of Gamification in Catering to Various Learning Styles
   The findings of this study also show that gamification can be adapted to meet a variety of student learning styles. This is important because each student has a different way of absorbing and understanding information. By providing choice and personalization, gamification allows students to learn at their individual pace and preferences, thereby increasing their cognitive engagement.
4. The Importance of Teacher Support in Implementing Gamification
   In addition, support from teachers plays a crucial role in the successful implementation of gamification in the classroom. Teachers who are active as facilitators and are able to utilize gamification elements appropriately can help increase student focus and engagement, especially in completing cognitively challenging tasks.

5.2. Research Limitations

Although this research makes significant contributions, there are several limitations that need to be noted. One of the limitations is the limited literature sources that cover the implementation of gamification in the educational context in Indonesia. Much of the literature reviewed comes from international contexts, which may not fully represent the characteristics and challenges of the education system in Indonesia. Therefore, further research based on empirical data from schools in Indonesia is needed to confirm these findings. Another limitation is the lack of assessment of the long-term effects of using gamification on students' cognitive engagement. While much of the literature shows the positive impact of gamification on motivation and engagement in the short term, its long-term impact on academic achievement and critical thinking skills still needs to be further researched.

5.3. Practical Implications for Education

Based on the findings of this research, there are several important implications for the world of education, especially in the context of basic education in Indonesia:

1. Integrated Application of Gamification in the Curriculum
   Gamification can be a very effective tool in increasing the cognitive involvement of students in primary schools if well integrated into the curriculum. The use of gamification elements can help students understand difficult concepts in a more enjoyable way and motivate them to study harder.
2. Teacher Training in Implementing Gamification
   Teachers play an important role in the success of gamification. Therefore, special training is needed for teachers in designing and implementing effective gamification elements. Teachers also need to understand how to utilize technology that supports gamification, such as digital learning platforms, to maximize students' cognitive engagement.
3. Development of More Adaptive Learning Content
   Gamification allows personalization of the learning process, so that it can be adapted to the needs and abilities of each student. Therefore, more adaptive gamification-based learning content needs to be developed to support a more individualized learning approach. This is important to ensure that all students, including those with special needs, can be optimally involved in the learning process.
4. Increased Use of Technology in Education
   Along with technological developments, the application of gamification in elementary schools is also increasingly supported by digital devices such as tablets, computers and interactive learning applications. Governments and schools need to invest in technological infrastructure to enable wider and more effective implementation of gamification in schools.

5.4. Recommendations for Future Research

Based on existing limitations, several recommendations for future research are as follows:

1. Empirical Study in the Indonesian Education Context
   Future research could focus more on the implementation of gamification in Indonesian elementary schools to provide a deeper understanding of its impact in the national education context. It is important to see how differences in culture and educational systems influence the effectiveness of gamification.
2. Longitudinal Research on the Long-Term Impact of Gamification
   Additionally, longitudinal research is needed that monitors the long-term impact of gamification use on students' cognitive engagement and their academic achievement. This kind of research can provide more comprehensive insight into whether gamification only has a short-term positive impact or whether it can produce lasting benefits for students' cognitive development.
3. Exploration of Gamification in Various Subjects
   Gamification may have different effects on different subjects. Therefore, future research could explore how gamification influences students' cognitive engagement in various disciplines, such as mathematics, science, languages, and social sciences. This will help teachers and curriculum developers understand which gamification elements are most effective for each subject.
4. An Exploratory Study of the Most Effective Elements of Gamification
   Further research could also explore the specific elements in gamification that have the greatest impact on students' cognitive engagement. For example, are challenges more effective than leaderboards, or is personalization of the learning experience more

beneficial than competitive elements. This understanding can help in designing more targeted and effective gamification.

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