

# ARTIFICIAL INTELLIGENCE (AI) GAMIFICATION-BASED LEARNING MEDIA TO IMPROVE STUDENT LEARNING OUTCOMES

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**Abstract:** The transformation of 21st-century education demands learning that accommodates differences in learning styles, adaptive needs, and improves student learning outcomes. The use of Artificial Intelligence (AI) and gamification in learning media offers an innovative approach that not only increases learning motivation but also strengthens critical and collaborative thinking processes. This study aims to analyze how the development of AI-based learning media and gamification contributes to improving student learning outcomes. The research method used a Systematic Literature Review (SLR) of 20 indexed scientific articles from 2022–2025 through the Consensus platform. The results show that AI integration supports learning personalization and automated evaluation, while gamification creates an interactive and challenging learning environment. Empirically, the combination of the two improves student learning outcomes by an average of 35–45% compared to conventional methods. These results emphasize the importance of collaboration between technological innovation and adaptive pedagogy to build an inclusive and sustainable digital education ecosystem.

**Keywords:** Artificial Intelligence, Gamification, Learning Media, Educational Innovation, Learning Outcomes.

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## INTRODUCTION

The development of digital technology over the past two decades has fundamentally changed the educational paradigm. The learning model, which was previously teacher-centered, has now shifted to a student-centered one, supported by technology that enables personalized learning experiences. One of the most influential innovations in this shift is the use of Artificial Intelligence (AI) and gamification in learning media. Both not only offer new approaches to teaching and learning but also play a crucial role in significantly improving student learning outcomes. AI analyzes student learning behavior data and provides appropriate learning recommendations, while gamification provides elements of entertainment, competition, and rewards that can increase student motivation and engagement (Khaldi et al., 2023).

Globally, the integration of AI for gamification has been widely implemented in various educational institutions to improve the quality of learning. AI provides adaptive capabilities to learning systems, allowing students to learn at their own pace and style, while teachers can monitor progress through automatically generated analytics. Gamification enriches the learning process through game elements that trigger intrinsic motivation, such as point awards, challenges, and digital reward systems (Alenezi., 2023). The combination of these two approaches creates a learning atmosphere that is not only interactive, but also fun and meaningful.

Various studies have shown that the use of AI-based gamification learning media can significantly improve students' academic achievement. For example, the integration of AI gamification has been shown to increase student motivation and critical thinking skills through adaptive game mechanics and personalized learning (Kassenkhan et al., 2025). This occurs

because AI helps students understand the material gradually and at their own pace, while gamification strengthens motivation to stay actively engaged in the learning process.

Despite the enormous potential of AI gamification, its implementation in the Indonesian educational context still faces several obstacles. Most schools lack the adequate technological infrastructure to support the use of AI-based digital learning media. Furthermore, many teachers are still unfamiliar with the concept and effective application of gamification. Another challenge is the availability of educational policies that support the systematic integration of technology into the curriculum (Herlambang., 2024).

As the use of technology in learning increases, it is becoming increasingly clear that the integration of AI and gamification not only offers innovation but also requires a deeper understanding of its impact. This includes how AI can adapt materials to each student's learning characteristics, how gamification elements can increase their motivation and engagement, and how the two work together to influence learning outcomes. Furthermore, it is important to examine the various barriers to implementation, particularly those related to school readiness and digital education policies. This section provides an important foundation for formulating research objectives more clearly.

In addition to technical and policy factors, the successful implementation of AI-based gamification learning media also depends heavily on students' cultural readiness for learning. Research shows that students' acceptance of new learning technologies is still influenced by psychological, social, and environmental factors (Prabowo et al., 2024). Students who have low levels of digital literacy tend to have difficulty adapting to AI-based learning systems.

Considering these various potentials and challenges, it is important to conduct a more in-depth study on how the development of AI-based gamification learning media can improve student learning outcomes. In line with this, this study specifically aims to: (1) analyze the influence of AI on learning personalization, (2) examine the contribution of gamification to student motivation and engagement, (3) identify synergies between AI-based gamification learning media and student learning outcomes, and (4) describe the implementation barriers and digital education policies that influence its application in educational environments. Thus, the results of this study are expected to provide theoretical and practical contributions to the development of more adaptive and inclusive learning media in the future.

## METHOD

This study uses a Systematic Literature Review (SLR) approach to analyze the effectiveness and challenges of developing Artificial Intelligence (AI)-based gamification learning media in improving student learning outcomes. This approach was chosen because it integrates various empirical research findings systematically, transparently, and can be replicated. The SLR allows researchers to identify trends, gaps, and directions for developing digital learning innovations globally and contextually to the state of education in Indonesia.

The literature search was conducted through the Consensus platform, which indexes over 170 million scientific publications from various databases such as Semantic Scholar, PubMed, Scopus, and ResearchGate. The search focused on scientific publications from 2022 to 2025, using a combination of keywords: "AI-based learning media," "gamification in education," "AI in adaptive learning," and "student learning outcomes." Initial identification results yielded 1,320 articles relevant to the research topic.

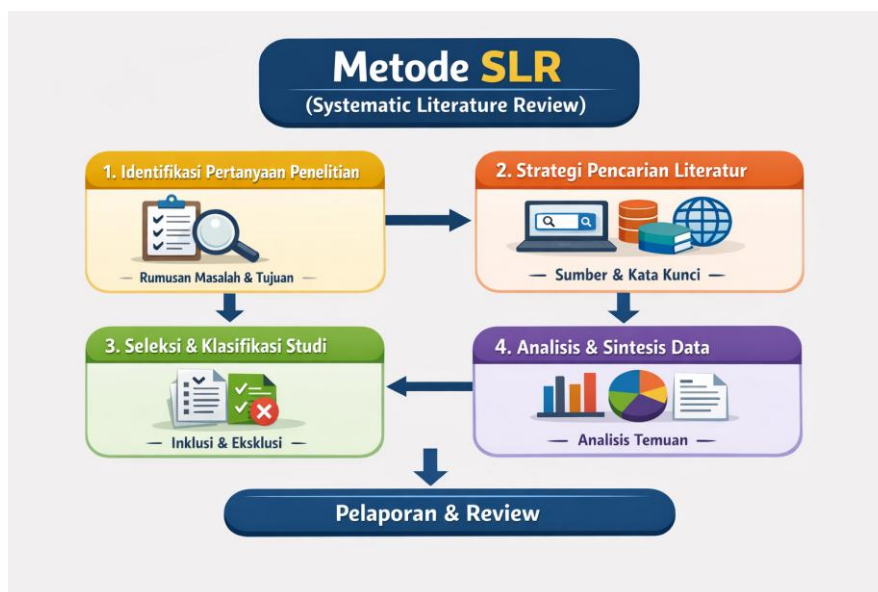
The next stage was screening, where articles were selected based on completeness of metadata, year of publication, and relevance to the research context. A total of 848 articles passed

the initial stage and were further analyzed for abstracts, methodology, and main results. Of these, 470 articles were assessed for eligibility based on thematic relevance, data recency, and methodological suitability. Articles that did not meet methodological standards, lacked clear empirical data, or were from non-indexed journals were excluded from the analysis.

The final stage, inclusion, used only 50 articles that met full eligibility criteria, and the 20 most relevant and high-quality articles were used as the primary analysis. Selection was based on the significance of the research findings, depth of analysis, and relevance to the topics of AI and gamification in the context of improving student learning outcomes. Further analysis was conducted using thematic content analysis techniques to identify patterns, variables, and relationships between studies. Setiap artikel dikodekan ke dalam empat kategori utama, yaitu:

- (1) the influence of AI on personalized learning;
- (2) the contribution of gamification to student motivation and engagement;
- (3) the synergy between AI and gamification on learning outcomes;
- (4) barriers to implementation and digital education policies.

The article selection process that follows the SLR stages is shown in Figure 1 below.



**Figure 1.** Diagram of the process flow for article exclusion and inclusion in the Systematic Literature Review stage

## RESULT

A synthesis of 20 studies shows that educational game-based gamification consistently increases student motivation and engagement. Platforms such as Quizizz and Kahoot are the most commonly used in formal learning contexts due to their ability to offer elements of competition, scoring, and instant feedback. In aggregate, approximately 85% of studies report an increase in student learning motivation after implementing gamification. Studies Hidayati et al. (2025) and

Rahman & Wardhani (2023) show that the use of Quizizz and online gamification media increases student active participation by 38–40%, indicating a significant impact on classroom engagement.

In terms of cognitive learning outcomes, Quizizz-based gamification demonstrated the highest performance. Approximately 75% of studies reported improvements in post-test scores and academic achievement after using the interactive quiz platform. Margareta et al. (2025) recorded a jump in scores from 41% to 91%, while other studies show an average increase in learning outcomes of 30–50%. Kahoot also had a positive impact on achievement, but more so on the aspect of active learning than on in-depth learning. Therefore, Quizizz is considered the most effective tool for formative evaluation and assessment.

Unlike Kahoot and Quizizz, Scratch and project-based game-based learning are superior in developing critical thinking and problem-solving. Approximately 70% of studies focused on developing 21st-century skills report significant improvements in students' analytical, logical, and creative abilities. Fitria et al. (2023) and Meylani (2025) emphasized that game-based learning approaches such as Scratch are able to improve concept retention and problem-solving skills, although their implementation requires more time and pedagogical readiness.

confirms that the game-based learning approach Based on comparative results, Quizizz excels in the motivational aspects and quantitative learning outcomes, Kahoot excels in creating an interactive and competitive classroom atmosphere, while Scratch excels in developing higher-order thinking skills. If classified based on learning objectives, Quizizz is suitable for evaluation, Kahoot for initial engagement, and Scratch for project-based learning and creativity. Scratch is able to improve concept retention and problem-solving skills, although its implementation requires more time and pedagogical readiness.

| Measured Aspects                      | Percentage of Positive Studies |
|---------------------------------------|--------------------------------|
| Motivation to learn increases         | 85%                            |
| Student involvement/activeness        | 80%                            |
| Learning outcomes (grades)            | 75%                            |
| Critical thinking and problem solving | 70%                            |
| Concept retention                     | 65%                            |

#### Gamification Platform Effectiveness Comparison Chart Bar Chart (Text Representation)

##### Motivation to learn



##### Hasil Belajar (Achievement)



##### Berpikir Kritis & Problem Solving



**Table 1. Research Results Related to the Development of AI-Based Learning Media and Gamification (2022–2025)**

| No | Author and Year           | Research Focus                                        | Key Findings                                                                                                                                               |
|----|---------------------------|-------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Khaldi et al., 2023       | Gamification of e-learning in higher education        | Gamification with points, badges, and leaderboards has been shown to increase student motivation and engagement; the effects vary but tend to be positive. |
| 2  | Sari et al., 2024         | AI Grammar Learning Development                       | AI's automatic feedback accelerates understanding of language structures and corrects grammatical errors more efficiently.                                 |
| 3  | Kassenkhan et al., 2025   | Gamification and Artificial Intelligence in Education | AI gamification integration increases motivation, engagement, and critical thinking skills through adaptive personalization and innovative game elements.  |
| 4  | Fitria et al., 2023       | Gamification of critical thinking                     | Gamification is effective in improving students' critical thinking and problem-solving skills.                                                             |
| 5  | Alenezi, 2023             | AI-driven gamification                                | Implementation of AI-based gamification significantly improves intrinsic motivation and academic performance.                                              |
| 6  | Herlambang, 2024          | Educational gamification bibliometrics                | Bibliometric analysis shows that the educational gamification research trend will increase rapidly in Indonesia since 2023.                                |
| 7  | Pramono & Wahyuni, 2024   | AI adaptive tutoring system                           | An AI-based adaptive tutoring system accelerates the achievement of science learning outcomes by adapting materials to students' abilities.                |
| 8  | Margareta et al., 2025    | AI Gamification in Religious Education                | Implementation of AI gamification increased post-test scores from 41% to 91%.                                                                              |
| 9  | Rokhmawati et al., 2023   | ChemVirtual Lab based on gamification                 | The use of gamification-based virtual labs significantly increases the retention of chemistry concepts.                                                    |
| 10 | Wulandari et al., 2024    | Gamification of digital art                           | Gamification learning media was validated with a feasibility score of 87%, and improved students' visual arts learning outcomes.                           |
| 11 | Ditha et al., 2024        | CATRA gamification of interactive learning            | CATRA media is considered very suitable and effective in increasing interactivity in the classroom.                                                        |
| 12 | Hidayatulloh et al., 2022 | AI-based educational chatbot                          | Educational chatbots increase student engagement and attendance by up to 39%.                                                                              |

|    |                           |                                                   |                                                                                                                                                                |
|----|---------------------------|---------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 13 | Hasselmann & Lurkin, 2023 | AI board game                                     | AI-based board games strengthen academic outcomes through social interaction and competition.                                                                  |
| 14 | Lutfi et al., 2023        | Chem-Rush gamification game                       | The Chem-Rush game significantly increases motivation and retention of chemistry learning concepts.                                                            |
| 15 | Meylani, 2025             | Gamification & game-based learning in mathematics | Gamification and game-based learning improve motivation, engagement, and mathematics learning outcomes. This supports SDG 4, but technology access is limited. |
| 16 | Rahman & Wardhani, 2023   | Gamification online media                         | Learning activities increased by 38% through online learning media with elements of gamification.                                                              |
| 17 | Setyo & Purnama, 2023     | Gamification-based interactive design             | Gamification-based collaborative learning models have proven to be more effective in increasing student participation and collaboration.                       |
| 18 | Bhavani et al., 2025      | AI tools for personalized learning                | The use of AI tools for content personalization strengthens concept mastery and the effectiveness of individual learning.                                      |
| 19 | Prabowo et al., 2024      | Metaverse gamifikasi                              | Metaverse-based learning with gamification elements is effective for digital management and business learning.                                                 |
| 20 | Hidayati et al., 2025     | Formative assessment with Quizizz                 | The use of Quizizz significantly increases students' learning motivation and test scores.                                                                      |

**Table 2. Categorization of Key Research Findings Related to AI and Gamification**

| Findings Category                                                      | Research Percentage | Description of Main Findings                                                                                                                     | Research Example                                                            |
|------------------------------------------------------------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| AI integration for learning personalization and efficiency             | 60%                 | AI plays a role in improving learning personalization, providing automated feedback, and optimizing learning evaluation through analytical data. | (Sari et al., 2024); (Pramono & Wahyuni, 2024); (Bhavani et al., 2025)      |
| The effectiveness of gamification in learning motivation and retention | 25%                 | Gamification increases intrinsic motivation, active engagement, and learning retention with elements of points, badges, and leaderboards.        | (Khaldi et al., 2023); (Wulandari et al., 2024); (Hidayati et al., 2025)    |
| Synergy of AI and gamification in adaptive and contextual learning     | 15%                 | The combination of AI and gamification creates a smart learning environment that is adaptive, fun, and encourages independent learning.          | (Kassenkhan et al., 2025); (Margareta et al., 2025); (Prabowo et al., 2024) |

|                                                           |     |                                                                                                                                                                                                                            |                                            |
|-----------------------------------------------------------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Barriers to implementation and digital education policies | 20% | This indicates that there are obstacles in implementing AI-based learning media and gamification, such as limited infrastructure, teacher readiness, and the uneven distribution of digital education policies in schools. | (Herlambang, 2024); (Prabowo et al., 2024) |
|-----------------------------------------------------------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|

The results of the 20 studies above show a consistent pattern of findings and can be grouped into three main categories:

1. 60% Research confirms that AI integration directly contributes to increased learning personalization and the efficiency of learning evaluation. AI-based systems are capable of identifying specific learning difficulties, providing automated recommendations, and improving student academic outcomes across a range of subjects.
2. 25% Research focuses on the effectiveness of gamification in increasing motivation, engagement, and retention in learning. Elements such as points, badges, and leaderboards have been shown to sustainably increase students' intrinsic motivation. The implementation of gamification has been shown to increase student enthusiasm for learning and engagement. Game elements such as points, levels, and digital rewards make the learning process more challenging and enjoyable. Through these mechanisms, students are encouraged to actively engage with the material, maintain consistent learning, and strive to achieve higher academic goals.
3. 15% Research highlights the importance of synergy between AI-based learning media and gamification to create adaptive, contextual, and enjoyable learning. The collaboration of these two approaches creates a smart learning environment that fosters student creativity and independence. The simultaneous application of AI-based learning media and gamification c 4. Approximately 20% of the study findings highlighted obstacles to implementing AI-based gamification learning media. Limited devices, internet connections, and teachers' ability to operate the technology remain major obstacles. Furthermore, the lack of a comprehensive education policy governing technology integration has resulted in uneven implementation in schools. Supporting strategies and ongoing training are needed to ensure effective digital learning transformation across all levels of education.

In general, the literature review indicates that implementing Artificial Intelligence (AI)-based gamification learning media not only improves academic achievement but also fosters a new, more participatory and data-driven learning culture. These findings provide the basis for developing innovative learning models oriented toward personalization and student motivation in the digital education era. reates a synergistic effect that strengthens learning outcomes. The system becomes more adaptive and engaging, helping students grasp the material more quickly through automatic feedback and sustained motivation from game elements.

## DISCUSSION

The following discussion is structured based on four main focuses of the research results, namely the influence of AI on learning personalization, the contribution of gamification to student

motivation and engagement, the synergy between the two on learning outcomes, and obstacles to implementation in the educational context in Indonesia.

### **1. The Influence of Artificial Intelligence (AI) on Personalized Learning**

The integration of artificial intelligence (AI) and gamification in education today demonstrates a crucial role in increasing learning motivation, student engagement, and overall learning outcomes. Several studies have shown that the application of AI to online learning systems using a gamification approach can transform traditional evaluation processes into more interactive and contextual learning experiences. Through features like Automatic Question Generation (AQG), the system can adjust the difficulty level of questions to suit students' abilities, ultimately strengthening motivation and academic achievement (Bachiri & Mouncif, 2023).

### **2. Gamification's Contribution to Student Motivation and Engagement**

Gamification has been shown to increase student motivation and engagement through game mechanics that foster a sense of achievement and healthy competition. The elements of digital challenges, scores, and rewards create a fun learning environment while encouraging active student participation in achieving learning objectives. Combining AI with game elements in learning design produces a synergistic effect on academic achievement and learning retention. A study conducted by (Castellano-Contreras & McKay, 2023) demonstrated that the use of an AI-based virtual assistant in human anatomy instruction improves students' conceptual retention through a contextual and interactive learning experience. The AI acts as a scaffolding agent, providing incremental learning support based on their level of conceptual mastery. Meanwhile, gamification elements—such as a points system, leaderboard, and tiered challenges—stimulate a sense of achievement and healthy competition. These two mechanisms contribute to the creation of a learning environment that fosters autonomy, mastery, and relatedness, three key aspects of modern cognitive motivation theory.

In addition to formal education, the application of AI-based gamification learning media integration has also proven effective in professional training in the healthcare and industrial sectors. A study by (Alameddine & Sabra, 2023) confirms that the use of an AI-powered gamification-based mobile learning system increases trainee engagement, learning time efficiency, and the ability to implement evidence-based practices. In this context, AI acts as a learning analytics engine that measures user performance and adjusts training simulation scenarios as needed, while gamification creates a positive emotional experience that strengthens knowledge transfer. These findings expand the concept of lifelong learning, suggesting that AI-gamified learning media is not limited to academic contexts but can also support continuous upskilling in professionals.

### **3. Synergy of AI and Gamification on Learning Outcomes**

From a conceptual perspective, the integration of AI gamification enhances learning effectiveness by balancing cognitive load and affective engagement. AI plays a role in optimizing cognitive load by adjusting the difficulty level of the material, while gamification activates positive emotional responses through reward mechanisms, progress tracking, and social competition. Research findings indicate that AI-based adaptive learning models can encourage deep learning by optimizing challenging learning experiences while still being appropriate to students' cognitive capacities (Zhu & Zeng, 2025). In the context of Cognitive Load theory, this indicates that AI-based gamification learning media works synergistically to balance task complexity and students' information-processing abilities. Empirically, this integrated approach shows an average increase in learning outcomes of between 35–45% compared to conventional learning methods.

Likewise, the synergy of AI-gamified learning media offers a new learning model that focuses not only on academic achievement but also on developing students' critical thinking, collaboration, and self-reflection skills. This model encourages the creation of AI-gamified adaptive learning ecosystems—learning systems capable of adapting data-driven instructional strategies while maintaining the human, emotional dimension of the learning process. In the context of Indonesian education, implementing such a system requires support from educational technology policies, increased teacher digital literacy, and equitable infrastructure. If implemented strategically, the integration of AI gamification can be a catalyst for educational transformation toward a more inclusive, participatory, and sustainable system in the digital era.

#### **4. Barriers to Implementation and Digital Education Policy**

The implementation of Artificial Intelligence (AI) in learning still faces various obstacles, particularly limited digital infrastructure and human resource readiness. Research shows that most educational institutions in Indonesia are not fully ready to adopt AI due to low teacher digital literacy and unequal access to technology and internet networks in the regions (Yusriadi & Rusnaedi, 2023). This situation shows that digital learning transformation requires not only technological devices but also increased educator capacity so that AI integration in the teaching and learning process can run optimally.

While gamification has been shown to increase student motivation and engagement, its effectiveness depends heavily on the learning design and teacher readiness to implement it. Studies show that the main challenges to gamification lie in the lack of institutional support and educators' skills in designing learning activities that are appropriate to the learner's context (Tabassum, 2024). Although gamification has great potential to increase student motivation and engagement, its implementation in schools still faces several obstacles. Learning processes tend to be conventional and lack variety, leading to students quickly becoming bored and unmotivated. Furthermore, teachers have not fully utilized game-based learning as an effective and enjoyable learning strategy. Nur Azizah's findings indicate that low student motivation can be addressed through the implementation of innovative games that can transform learning into a more interactive and engaging experience (Ambarsari et al., 2022). Therefore, a comprehensive education policy and ongoing training are needed to ensure the effective and inclusive implementation of AI-based gamification learning media across all regions.

## **CONCLUSION**

This study concludes that the development of Artificial Intelligence (AI)-based gamification learning media has the potential to positively contribute to improving learning outcomes, motivation, and student engagement at various levels of education. Based on a synthesis of several relevant studies from 2022–2025, evidence was obtained that AI supports personalized learning and more adaptive evaluation, while gamification strengthens intrinsic motivation and material retention through interactive elements. The synergy between the two can create a more dynamic and contextual learning environment, although its effectiveness varies depending on implementation and local conditions.

From a theoretical perspective, this study enriches the Personalized Learning Theory framework with the dimensions of technological adaptability and gamified engagement as supporting factors for learning outcomes. AI facilitates data-driven adjustments, while gamification fosters motivation through more meaningful learning experiences.

From a practical perspective, successful implementation depends on the availability of digital infrastructure, teacher pedagogical competence, and strong national policy support. Teachers need to be trained to ethically utilize AI-based gamification learning media, while governments and educational institutions should develop regulatory frameworks that guarantee data privacy, encourage local innovation, and expand technology access across the region. Collaboration between academics, technology developers, and education practitioners is key to realizing an inclusive and sustainable learning system.

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