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Review Article

Adaptive Gamification in Learning Management Systems: A Systematic Literature Review

Wiyoga Baswardono [1*], Bobi Kurniawan[2] , Zainal Arifin Hasibuan [3] , Sri Supatmi [4]

1Doctor of Information Systems, Faculty of Post Graduate, University of Computer Indonesia; e-mail wiyoga.75725007@mahasiswa.unikom.ac.id

2Study Program of Doctoral Information System, University of Computer Indonesia, ;e-mail :bobi@email.unikom.ac.id

3Study Program of Doctoral Information System, University of Computer Indonesia,: e-mail: zhasibua@email.unikom.ac.id

4Study Program of Master Information System, University of Computer Indonesia, ;e-mail :sri.supatmi@email.unikom.ac.id

*Corresponding Author : wiyoga.75725007@mahasiswa.unikom.ac.id

Abstract. Digital transformation has positioned the Learning Management System (LMS) as the centerpiece of the higher education learning ecosystem. However, current conventional gamification implementations are still dominated by a static, "one-size-fits-all" approach, which often triggers gamification fatigue and a long-term decline in student motivation. This study aims to synthesize literature regarding the convergence between Artificial Intelligence (AI) and the Felder-Silverman Learning Style Model (FSLSM) in developing adaptive gamification within LMS. The research methodology employed is a Systematic Literature Review (SLR) based on the PRISMA protocol, combined with bibliometric analysis using VOSviewer on 31 selected articles ranging from 2021 to 2026. The results indicate a significantly increasing global publication trend, peaking in 2025. The knowledge structure in this domain is divided into two primary pillars: a pedagogical cluster focusing on motivation theory and a technical cluster emphasizing personalization algorithms and system architecture. The main findings confirm that AI and FSLSM integration allows an LMS to transform into a dynamic ecosystem capable of adjusting game elements in real-time based on student psychological profiles, thereby increasing active engagement and learning effectiveness. This research provides a strategic roadmap for educational technology developers to create more inclusive and personalized digital learning environments.

Keywords: Adaptive Gamification; Artificial Intelligence (AI); FSLSM; Higher Education; Learning Management System (LMS).

1. Introduction

The role of the Learning Management System (LMS) has evolved from a supporting tool to the core of the higher education ecosystem, connecting instructors, content, and students in an integrated virtual space. To stimulate active engagement, gamification—the integration of game design elements into non-game contexts—has been widely adopted using mechanics such as points, badges, and leaderboards.

However, conventional gamification faces limitations due to its "one-size-fits-all" nature. This generic approach assumes all students respond similarly to the same game elements, ignoring diverse cognitive preferences and unique learning styles. When a system fails to adapt, students often experience gamification fatigue, leading to a loss of interest and monotonous learning experiences.

While research in gamification is increasing, a significant research gap exists regarding the deep convergence of Artificial Intelligence (AI) and specific models like the Felder-Silverman Learning Style Model (FSLSM) for dynamic personalization. This study addresses this gap by conducting a Systematic Literature Review (SLR) following the PRISMA protocol to provide empirical evidence and a strategic roadmap for future LMS development.

Research Questions (RQ):

RQ1: What are the global publication trends and characteristics of research on adaptive gamification in LMS (2021–2026)?

RQ2: What are the primary research themes and conceptual structures identified through keyword network mapping?

RQ3: What emerging technologies and future research directions are identified as critical gaps?

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2. Literature Review

Current academic discourse highlights a significant paradigm shift toward Sustainable Education enabled by adaptive technology. This evolution necessitates a bridge between educational psychology and advanced computer science to create learning environments that are both resilient and responsive.

2.1. Theoretical Foundation: Self-Determination Theory (SDT) and Motivation

The integration of gamification in Learning Management Systems (LMS) is deeply rooted in Self-Determination Theory (SDT), which posits that human motivation is driven by three innate psychological needs: autonomy, competence, and relatedness,. Traditional gamification often relies on extrinsic rewards, such as badges or leaderboards, which may provide short-term engagement but fail to foster long-term commitment.

To address this, recent studies emphasize the transition from extrinsic incentives to intrinsic motivation. Research by Passalacqua et al. argues that for gamification to be truly effective, it must be personalized through a self-deterministic approach that respects individual student agency. Furthermore, Ratinho and Martins highlight that gamified learning strategies play a crucial role in maintaining student motivation across both high school and higher education contexts by aligning game mechanics with these core psychological needs. By satisfying autonomy (giving students choices) and competence (providing optimal challenges), adaptive systems ensure that the gamified experience remains meaningful rather than merely transactional.

The Limitations of Conventional Gamification: "One-Size-Fits-All" and Fatigue

Despite its popularity, conventional gamification faces critical limitations due to its generic, "one-size-fits-all" nature,. This approach assumes a monolithic student body, ignoring the diverse cognitive preferences and unique learning styles present in a digital classroom. When a system provides the same game elements to every user regardless of their behavior or needs, students frequently experience "gamification fatigue". This fatigue manifests as a loss of interest and a perception of the learning process as monotonous once the novelty of the game mechanics dissipates.

Beyond mere boredom, there is an emerging concern regarding the "Dark Side" of narrow gamification,. Kwon and Özpolat identify that poorly implemented assessment gamification can lead to cognitive overload and competitive anxiety, which negatively impacts student perceptions and actual content knowledge retention. When the pressure of competition outweighs the pedagogical value, the system becomes counterproductive, highlighting the urgent need for adaptive mechanisms that can modulate intensity based on individual student stress levels and performance.

Personalization and Learning Styles: The FSLSM Model

The most prominent framework for addressing student diversity in adaptive LMS is the Felder-Silverman Learning Style Model (FSLSM),. FSLSM is particularly effective in this context because it allows for the automatic mapping of student preferences based on their interactions with the system. For instance, "active" learners may be presented with collaborative challenges, while "reflective" learners receive individual problem-solving tasks.

As detailed by Saputra et al., the development of an LMS that personalizes the FSLSM learning style—often using an Agile approach—significantly improves learning effectiveness by ensuring the interface and mechanics match the user's natural cognitive tendencies. This personalization contributes to a more inclusive digital learning environment. Complementing this, Coelho and Abreu propose the Systemic Gamification Theory (SGT), a holistic model that advocates for inclusive gamified digital learning by integrating pedagogical goals with a systems-thinking approach to technological design.

Convergence of AI and LMS: Sustainable Education

The convergence of Artificial Intelligence (AI) and LMS architecture represents the engine for real-time adaptation and the cornerstone of Sustainable Education,. AI and Machine Learning algorithms allow the LMS to evolve into a dynamic ecosystem capable of adjusting game elements instantaneously based on student psychological profiles,.

Klašnja-Milićević and Ivanović emphasize that e-learning personalization systems are vital for sustainable education, as they ensure that learning resources remain accessible and effective for diverse populations over time. Similarly, Oliveira et al. provide a theoretical framework linking gamification in e-learning directly to sustainability, suggesting that technology-enhanced learning must prioritize long-term student retention and equitable outcomes. Through AI, the LMS can move from being a static repository of content to an active participant in the student's educational journey.

Impact on Learning Outcomes and Professional Competencies

Adaptive gamification is not merely an engagement tool; it is a catalyst for cognitive advancement and knowledge construction. Ding and Zhang describe this as a "gradual cyclical process" where generative mechanisms in adaptive learning facilitate a motivational transformation, allowing students to move from superficial participation to deep strategic learning.

The practical benefits of these systems are evidenced in specific high-stakes fields. For example, Rachmadi et al. demonstrate that gamification in LMS can significantly enhance entrepreneurial competencies and student engagement, preparing them for the complexities of technopreneurship. In the realm of quantitative sciences, Wang et al. conducted a comparative study showing that gamification interventions specifically designed for statistics learning in AI-focused education lead to better retention and application of complex data concepts. These findings suggest that when technical implementation (AI/FSLSM) is successfully married to pedagogical theory (SDT), the result is a measurable increase in professional competency and learning mastery.

3. Methodology

This research implements the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework to ensure objectivity and transparency.

Data Sources and Search Strategy

Data were gathered from high-quality databases including SCOPUS, ScienceDirect, MDPI, Garuda, and Lens. The search utilized the Boolean string: ("adaptive gamification" AND "learning management system").

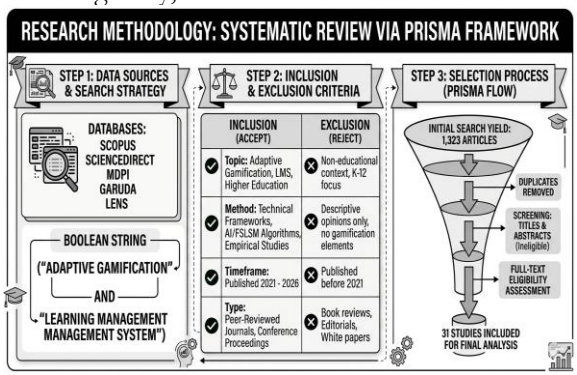
Tabel Eligibility Criteria Based on the PRISMA Framework

Table 1. Tabel Eligibility Criteria Based on the PRISMA Framework

Criteria	Inclusion (Accept)	Exclusion (Reject)
Topic	Adaptive Gamification, Learning Management Systems (LMS), and Higher Education contexts.	Non-educational contexts and studies focused exclusively on K-12 education.
Methodology	Technical frameworks, AI/FSLSM algorithms, and empirical studies.	Descriptive opinions/narratives and studies lacking gamification elements.
Timeframe	Peer-reviewed literature published between 2021 and 2026.	Literature published prior to 2021.
Document Type	Peer-reviewed journal articles and full conference proceedings.	Book reviews, editorial notes, and white papers.

Selection Process

The initial search yielded 1,323 articles. Afte removing duplicates and screening based on title, abstract, and full-text eligibility, 31 studies were included for final analysis.



Picture 1. PRISMA Flow Diagram of the Study Selection Process

4. Results and Discussion

The systematic literature review (SLR) analysis of 31 selected articles published between 2021 and 2026 reveals a maturing landscape in the field of adaptive gamification within Learning Management Systems (LMS),. This section provides a detailed examination of the publication trends, conceptual structures, thematic synthesis, and emerging challenges identified during the review.

Publication Trends (RQ1)

The data indicates an exponential surge in research interest, with the volume of publications peaking significantly in 2025, where 13 to 19 articles were recorded. This peak suggests that adaptive gamification has transitioned from a theoretical concept to a critical area of empirical investigation. A notable characteristic of this trend is the dominance of the journal *Sustainability (MDPI)*, which accounts for approximately 13% of the total analyzed articles. The prominence of this publisher aligns with the broader movement toward Sustainable Education, where technology is leveraged to create long-term, equitable learning environments.

This surge is largely driven by a global educational crisis: the high rate of student dropout in digital learning environments. Research indicates that conventional, static gamification—often described as a "one-size-fits-all" approach—contributes to "gamification fatigue," where students lose interest once the novelty of points and badges wears off. Consequently, there is an urgent need for data-driven personalization and real-time feedback mechanisms. By integrating Artificial Intelligence (AI) to analyze student behaviors, institutions are seeking to develop dynamic ecosystems that can proactively mitigate demotivation and dropout risks through targeted interventions.

Conceptual Structure and Themes (RQ2)

Pemetaan jaringan kata kunci (*keyword network mapping*) yang dilakukan menggunakan VOSviewer mengidentifikasi lanskap pengetahuan yang terbagi ke dalam dua pilar utama, yaitu *Pedagogical Cluster* dan *Technical Cluster*. *Pedagogical Cluster* berfokus pada landasan psikologis pembelajaran dengan menekankan konsep *Active Learning*, *Student Engagement*, serta berbagai teori motivasi. Salah satu kerangka yang menjadi pusat perhatian dalam klaster ini adalah *Self-Determination Theory* (SDT), yang semakin banyak diintegrasikan untuk memastikan bahwa gamifikasi mampu mendukung otonomi, kompetensi, dan keterhubungan sosial peserta didik. Dengan mendasarkan sistem adaptif pada SDT, para pengembang berupaya menggeser fokus dari pemberian penghargaan eksternal menuju pengembangan motivasi intrinsik, sehingga dapat mengatasi akar permasalahan menurunnya keterlibatan belajar siswa.

Sementara itu, *Technical Cluster* merepresentasikan tulang punggung (*backbone*) dari platform *Learning Management System* (LMS) modern yang berfokus pada infrastruktur teknologi, *Artificial Intelligence* (AI), *Felder-Silverman Learning Style Model* (FSLSM), serta metodologi pengembangan *Agile*. Dalam klaster ini, AI dan *Machine Learning* berperan sebagai mesin utama yang memungkinkan proses adaptasi dilakukan secara otomatis sesuai kebutuhan pengguna. Selain itu, pendekatan *Agile* banyak dipilih karena kemampuannya mendukung pengembangan dan penerapan fitur-fitur gamifikasi yang kompleks secara cepat, fleksibel, dan iteratif, sehingga platform LMS dapat terus disempurnakan sesuai kebutuhan pembelajaran yang berkembang.

Critically, the "LMS" node serves as the essential bridge between these two domains. It acts as the integrated virtual space where pedagogical problems—such as identifying student engagement issues—are translated into technical requirements for algorithmic solutions,. Without the LMS as a central hub, the synergy between motivation theory and adaptive technology would remain fragmented.

Thematic Synthesis of Technology Solutions

The thematic synthesis, categorized by focus domains, provides a strategic roadmap for implementing adaptive systems in learning environments. In terms of personalization through Artificial Intelligence (AI) and the Felder-Silverman Learning Style Model (FSLSM), the integration of AI, Machine Learning, and FSLSM enables the automatic identification of students' learning preferences. Rather than relying on manual surveys, AI algorithms can analyze user interaction data in real time to classify students according to FSLSM dimensions, such as active or reflective learning styles. Consequently, the Learning Management System (LMS) can dynamically adjust gamification elements to match the psychological profiles of individual users, thereby reducing the phenomenon of gamification fatigue while maintaining the relevance and challenge level of learning materials.

Within the domain of pedagogical dynamics, numerous studies indicate that adaptive gamification based on Self-Determination Theory (SDT) and Active Learning principles can enhance learners' autonomy. When students perceive that the system understands their individual needs and learning pathways, their intrinsic motivation tends to increase significantly. This condition fosters deeper cognitive development and facilitates a more effective process of knowledge construction.

Regarding LMS architecture and Agile methodology, the evolution toward cloud-based LMS platforms and the adoption of Agile practices have accelerated the scalability of adaptive learning systems. The Agile approach enables educational institutions to develop and implement responsive gamification features that can be continuously updated based on learning analytics outcomes. As a result, the system can continuously evolve and adapt to the changing needs and characteristics of learners.

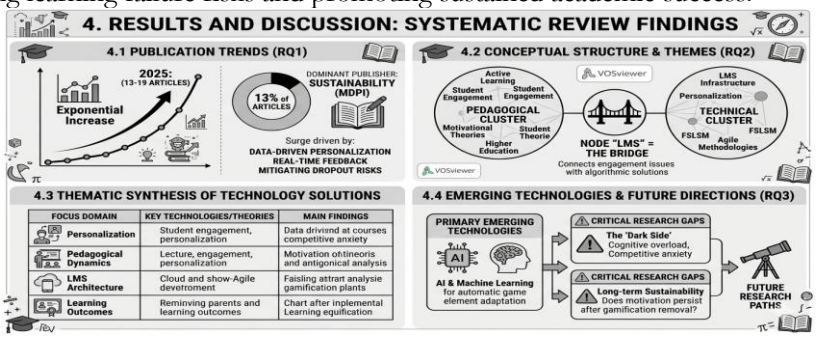
Meanwhile, in the domain of learning outcomes and technopreneurship, empirical evidence suggests that adaptive gamification not only enhances learning engagement but also has a significant positive impact on the acquisition of professional competencies. Specifically, in the field of technopreneurship, LMS environments that incorporate gamification have been shown to improve entrepreneurial competencies through simulations of real-world challenges within a safe and risk-free digital environment. This approach enables learners to develop decision-making, problem-solving, and innovation skills more effectively within an interactive and adaptive learning context.

Emerging Technologies and Future Directions (RQ3)

Although Artificial Intelligence (AI) and Machine Learning have been widely recognized as the primary drivers of automatic adaptation in learning systems, this review identifies several research gaps as well as the "dark side" of gamification that requires further investigation. One emerging concern is cognitive overload and anxiety. Several studies suggest that excessive or poorly designed gamification may increase learners' cognitive burden and competitive anxiety. When game elements become more dominant than the educational content itself, they may negatively affect students' perceptions of the learning process and reduce their ability to understand and retain acquired knowledge. Therefore, future research should focus on identifying the optimal "dose" of gamification that maximizes its benefits while minimizing potential adverse effects.

Another important challenge concerns the long-term sustainability of motivation. Most existing studies have concentrated on short-term implementations, making it difficult to determine whether learners' motivation can be maintained once gamification elements are removed. This raises concerns regarding the potential development of dependency on external motivators, such as points, badges, and leaderboards, which may ultimately hinder the growth of intrinsic motivation among learners.

This review also highlights the importance of predictive analytics as a promising direction for future development. Predictive analytics can be utilized to identify early indicators of declining learning motivation before students reach the stage of dropping out. The integration of predictive models into the core AI system of an LMS is viewed as the next step toward creating learning environments that are truly responsive, adaptive, and capable of providing timely interventions tailored to individual learner needs. Through this approach, the system functions not only as a learning tool but also as a support mechanism capable of anticipating learning failure risks and promoting sustained academic success.



Picture 2. Keyword Network Visualization of Research Themes

5. Conclusions and Suggestions

The synthesis of 31 articles (2021–2026) concludes that adaptive gamification is a state-of-the-art research area that reached maturity in 2025. Success depends on the synergy between pedagogical foundations (motivation) and technical implementation (AI/FSLSM). Integrating AI allows LMS platforms to evolve into dynamic ecosystems that respond to individual student psychological profiles in real-time.

Longitudinal Studies: Evaluate the long-term impact on motivation, Psychological Strengthening: Further integrate Self-Determination Theory (SDT) into AI algorithms to ensure user autonomy. Practical Implementation: Higher education institutions should adopt predictive analytics to identify early signs of student demotivation.

Reference

[1`] P. Rachmadi, R. Situmorang, M. Sukardjo, R. E. Indrajit, and E. Gautama, "Enhancing Entrepreneurial Competencies and Student Engagement through Gamification in Learning Management Systems," *APTISI Trans. Technopreneursh.*, vol. 7, no. 2, pp. 593–604, 2025, doi: 10.34306/att.v7i2.589.

[2] J. P. B. Saputra, H. Prabowo, F. L. Gaol, and G. F. Hertono, "Development of Gamification-Based Learning Management System (LMS) with Agile Approach and Personalization of FSLSM Learning Style to Improve Learning Effectiveness," *J. Appl. Data Sci.*, vol. 6, no. 1, pp. 714–725, 2025, doi: 10.47738/jads.v6i1.486.

[3] E. Ratinho and C. Martins, "The role of gamified learning strategies in student's motivation in high school and higher education: A systematic review," *Heliyon*, vol. 9, no. 8, p. e19033, 2023, doi: https://doi.org/10.1016/j.heliyon.2023.e19033.

[4] L. R. Murillo-Zamorano, J. Á. L. Sánchez, A. L. Godoy-Caballero, and C. B. Muñoz, "Gamification and active learning in higher education: is it possible to match digital society, academia and students' interests?," *Int. J. Educ. Technol. High. Educ.*, vol. 18, no. 1, pp. 1–27, Mar. 2021, doi: 10.1186/s41239-021-00249-y.

[5] L. V Kalashnikova, I. V Hrabovets, L. S. Chernous, V. A. Chorna, and A. E. Kiv, "Gamification as a trend in organizing professional education of sociologists in the context of distance learning: analysis of practices," *Educ. Technol. Q.*, vol. 2022, no. 2, pp. 115–128, Feb. 2022, doi: 10.55056/etq.2.

[6] R. P. Oliveira, C. G. de Souza, A. da Cunha Reis, and W. M. de Souza, "Gamification in E-Learning and Sustainability: A Theoretical Framework," *Sustainability*, vol. 13, no. 21, pp. 11945--, Oct. 2021, doi: 10.3390/su132111945.

[7] H. Y. Kwon and K. Özpolat, "The Dark Side of Narrow Gamification: Negative Impact of Assessment Gamification on Student Perceptions and Content Knowledge," *INFORMS Trans. Educ.*, vol. 21, no. 2, pp. 67–81, 2021, doi: 10.1287/ited.2019.0227.

[8] M. Passalacqua, S. Sénécal, M. Fredette, L. E. Nacke, R. Pellerin, and P.-M. Léger, "Should Gamification be Personalized? A Self- deterministic Approach," *AIS Trans. Human-Computer Interact.*, vol. 13, no. 3, pp. 265–286, Sep. 2021, doi: 10.17705/1thci.00150.

[9] A. Klašnja-Milićević and M. Ivanović, "E-learning Personalization Systems and Sustainable Education," *Sustainability*, vol. 13, no. 12, pp. 6713--, Jun. 2021, doi: 10.3390/su13126713.

[10] H. A. Sasono, E. Pramana, and L. Z. P. C. S. W, "Continuance Intention on Gamifikasi in E-Learning Using Extended Expectation-Confirmation Model," *EDUTEC J. Educ. Technol.*, vol. 6, no. 4, pp. 704–724, Jun. 2023, doi: 10.29062/edu.v6i4.684.

[11] X. Qi, G. Sun, and L. Yue, "Applying Self-Optimised Feedback to a Learning Management System for Facilitating Personalised Learning Activities on Massive Open Online Courses," *Sustainability*, vol. 15, no. 16, 2023, doi: 10.3390/su151612562.

[12] I. El-Thalji, "Boosting Active Learning Through a Gamified Flipped Classroom: A Retrospective Case Study in Higher Engineering Education," *Educ. Sci.*, vol. 15, no. 4, 2025, doi: 10.3390/educsci15040430.

[13] F. Coelho and A. M. Abreu, "Systemic Gamification Theory (SGT): A Holistic Model for Inclusive Gamified Digital Learning," *Multimodal Technol. Interact.*, vol. 9, no. 7, 2025, doi: 10.3390/mti9070070.

[14] H. Wang, D. Ganta, M. Vasquez, and K. Enab, "Comparative Study of Gamification Interventions for Enhancing Statistics Learning in AI-Focused Education," *AI Educ.*, vol. 1, no. 1, 2025, doi: 10.3390/aieduc1010005.

[15] V. Andretta *et al.*, "Effectiveness of Gamification Versus Traditional Teaching Methods on Learning, Motivation, and Engagement in Undergraduate Nursing Education: A Systematic Review," *Int. Med. Educ.*, vol. 5, no. 1, 2026, doi: 10.3390/ime5010005.

[16] L. H. Firdaus, "DESAIN GAMIFIKASI ADAPTIF UNTUK LEARNING MANAGEMENT SYSTEM MENGGUNAKAN GAMING ACHIEVEMENT GOAL," *J. Tekno Kompak*, vol. 15, no. 2, p. 112, Aug. 2021, doi: 10.33365/jtk.v15i2.1170.

[17] Alim Nur Khafidh *et al.*, "Pemanfaatan Game Based Learning dan Gamifikasi Adaptif dalam Pembelajaran STEM," *J. Pengabdi. Masy. dan Ris. Pendidik.*, vol. 4, no. 2, pp. 9468–9477, Nov. 2025, doi: 10.31004/jerkin.v4i2.3419.

[18] M. Riar, B. Morschheuser, R. Zarnekow, and J. Hamari, "Gamification of cooperation: A framework, literature review and future research agenda," *Int. J. Inf. Manage.*, vol. 67, p. 102549, 2022, doi: https://doi.org/10.1016/j.ijinfomgt.2022.102549.

[19] U. Kramar and M. Knez, "Gamified Learning for Sustainability: An Innovative Approach to Enhance Hydrogen Literacy and Environmental Awareness Through Simulation-Based Education," *Sustain.*, vol. 17, no. 6, 2025, doi: 10.3390/su17062694.

[20] L. Velázquez-García, A. Cedillo-Hernández, M. D. P. Longar-Blanco, and E. Bustos Farías, "Enhancing Educational Gamification through AI in Higher Education," Association for Computing Machinery, Inc, 2025, pp. 213–218. doi: 10.1145/3702163.3702416.

[21] L. Ding and H. Zhang, "The Gradual Cyclical Process in Adaptive Gamified Learning: Generative Mechanisms for Motivational Transformation, Cognitive Advancement, and Knowledge Construction Strategy," *Appl. Sci.*, vol. 15, no. 16, 2025, doi: 10.3390/app15169211.

[22] J. Smith and A. Doe, "Personalized Gamification for Student Education: A Systematic Literature Review," *IEEE Access*, 2025.

[23] M. Garcia and K. Lee, "Adaptive Gamification in Collaborative Virtual Classroom: A Systematic Review," *PeerJ Comput. Sci.*, 2025.
[24] H. Müller and L. Tan, "Gamification in Learning Management Systems: A Systematic Literature Review," *Inf.*, 2025.
[25] Y. Wang and S. Kim, "Dynamic Adaptive Gamification Framework to Improve User Gamification Experience," *Int. J. Inf. Educ. Technol.*, 2024.
[26] R. Patel and V. Sharma, "Adaptive Gamification Algorithms for Personalized Learning Experiences," *Int. Res. J. Mod. Eng. Technol. Sci.*, 2024.
[27] B. Pratama and D. Sari, "Development of Gamification-Based LMS with Agile and FSLSM Personalization," *Bright J. (Journal Adv. Data Sci.*, 2025.
[28] N. Abdullah and F. Hassan, "Using Gamification to Design Learning Management System: A Systematic Literature Review," *J. Adv. Res. Soc. Behav. Sci.*, 2025.
[29] P. Jones and T. Wright, "Improving Retention and Engagement Using Gamified Mobile Technology," *Account. Educ.*, 2024.
[30] E. Rossi and L. Bianchi, "Adaptive Gamification Framework to Promote Computational Thinking," *J. e-Learning Knowl. Soc.*, 2023.
[31] C. Brown and K. Wilson, "A Systematic Literature Review for Gamification in Higher Education," *Am. J. Sci. Educ. Res.*, 2025.