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SYSTEMATIC LITERATURE REVIEW: GAMIFICATION IN MATHEMATICS LEARNING

Silvia Indarti[1], Liyana Sunanto[2]
Universitas Darul Ma'arif Indramayu [1,2]
Email: silviaindarti25@gmail.com[1], lyana.sunanto@gmail.com[2]

ABSTRACT

This study aims to analyze the implementation, trends, and research focus of gamification in mathematics learning using a Systematic Literature Review (SLR) approach. Following PRISMA guidelines, articles published between 2015 and 2025 were collected from databases including Google Scholar, DOAJ, Garuda, and Sinta. A total of 100 initial articles were identified, of which 15 met the inclusion criteria and were analyzed in depth. The findings indicate that gamification has a positive impact on students' motivation, engagement, conceptual understanding, and learning outcomes in mathematics. The dominant research domain is the development of gamification-based learning media, such as interactive applications, e-modules, and electronic worksheets, often designed using the ADDIE model. Other research areas include pedagogical impact, which highlights improvements in students' participation, enjoyment, and creative thinking, and technology integration, addressing challenges related to digital tools, teacher readiness, and infrastructure. Overall, gamification emerges as a promising pedagogical approach that can enhance learning experiences, foster active participation, and support the development of higher-order thinking skills. Despite these benefits, studies on long-term technology integration, sustainable implementation, and alignment with current curriculum frameworks remain limited. Future research is recommended to explore empirical effectiveness, teacher digital competence, sustainable integration of gamified learning, and its potential to promote critical thinking, problem-solving, and creativity in mathematics education.

Keywords : *Gamification; Mathematics; ADDIE Model; Systematic Literature Review.*

INTRODUCTION

Basic education plays a crucial role in shaping students' intellectual, social, and character development. At this level, students begin to build a foundation of

knowledge and skills that will serve as the basis for learning at subsequent levels. Therefore, learning at this stage must be designed to be meaningful, engaging, and adaptive to current developments, particularly the rapid growth of digital technology in students' daily lives (Hazmi et al., 2024; Saputra, 2024). In the context of basic education, mathematics is a key subject that functions to develop logical, analytical, critical thinking, and problem-solving skills essential for real life (Johannis et al., 2024).

However, various studies show that mathematics learning often faces challenges, including low student participation, limited motivation, minimal active involvement, and suboptimal conceptual understanding (Trisnani, 2024). These problems are reflected in national and international assessments. According to PISA 2022, Indonesian students' mathematics literacy remains significantly below the OECD average (OECD, 2023). Likewise, the results of Asesmen Kompetensi Minimum (AKM) reveal that a large proportion of elementary students are still at the "basic" level in numeracy and struggle with higher-order mathematical reasoning (Kemendikbudristek, 2023). These findings confirm that traditional learning methods are not fully effective in addressing students' needs in the digital era.

One increasingly used solution is gamification, an approach that integrates game elements such as points, badges, levels, and challenges into learning activities (Legowo, 2022; Ananda, 2024). Numerous empirical studies demonstrate that gamification can increase students' motivation, engagement, and understanding of mathematical concepts. For example, Agustin et al. (2025) found that gamification significantly improved learning outcomes and motivation in elementary mathematics. Similarly, a quasi-experimental study by Rijal and Maharani (2023) reported that the use of Kahoot-based gamification resulted in higher mathematics scores among elementary students. Meta-analytic evidence also shows that gamification has a strong positive effect on students' mathematics achievement in Indonesian schools (Billa & Malasari, 2025). The development of gamification-based learning media is often supported by the ADDIE model, which provides a structured and effective framework for creating digital instructional tools (Safitri, 2022; Anafi et al., 2021).

Despite the growing number of studies on gamification, systematic literature reviews specifically focusing on gamification in elementary mathematics learning remain limited. Most existing SLRs discuss gamification in general education or focus on secondary and higher education (Agustin et al., 2025). Research specifically mapping the domains, trends, development models, and technological integration of gamification at the elementary school level is still scarce. Moreover, no previous SLR has explicitly examined the alignment of gamification with Indonesia's Kurikulum Merdeka, even though digital and student-centered learning approaches are key

components of this curriculum framework (Putra & Sari, 2024).

Therefore, this study employs a Systematic Literature Review (SLR) to analyze research trends, domains, and gaps regarding the implementation of gamification in elementary mathematics learning over the past decade. The novelty of this research lies in systematically mapping (1) the development of gamification-based learning media, (2) implementation trends in mathematics classrooms, (3) integration with digital learning technologies, and (4) its potential alignment with the Kurikulum Merdeka. This review provides a comprehensive foundation for future research and for developing innovative pedagogical strategies to improve mathematics learning in elementary schools.

THEORITICAL REVIEW

Understanding Gamification

Gamification is an approach that uses game elements in non-game contexts to make activities more engaging, enjoyable, and motivating. It is generally defined as the incorporation of components such as points, challenges, and feedback into non-game activities to increase engagement without altering the primary purpose of the activity (Marisa et al., 2020; Baptista & Oliveira, 2019). This approach transforms routine tasks into interactive and meaningful experiences for learners.

In the field of education, gamification refers to the application of game principles and design to learning contexts to enhance participation, motivation, and overall learning effectiveness (Senabre, 2017; Pambudi et al., 2018). Through game mechanics, teachers can create learning environments that are more interactive and challenging, encouraging students to participate actively (Akhriza & Mumpuni, 2019). Unlike full-fledged games, gamification does not create a complete game but instead adopts selected game elements to foster motivation and behavioral change without altering the core learning objectives (Marisa et al., 2020).

Although not a new concept, gamification has gained increasing popularity due to rapid technological advancements and a deeper understanding of learning motivation. Conventional teaching methods are often insufficient to capture students' interest, leaving them disengaged and struggling to understand the relevance of the material (Almeida et al., 2023). By incorporating elements such as points, levels, rewards, competition, and challenges, gamification offers an innovative solution that creates a more dynamic, interactive, and enjoyable learning experience (Salsabila et al., 2022).

This approach is not merely a form of entertainment but an effective pedagogical strategy for improving motivation, engagement, and learning outcomes (Zeybek & Saygi, 2023). Through systems of points, levels, challenges, rewards, and leaderboards, students are encouraged to participate actively, complete tasks progressively, and experience a sense of achievement that strengthens intrinsic motivation. Furthermore, gamification enables teachers to tailor learning strategies

to the characteristics of their students, making learning more personalized, adaptive, and effective (Mattawang & Syarif, 2023).

Gamification in Education

Gamification in education has been extensively studied empirically and theoretically, demonstrating positive impacts on teaching and learning across various contexts. Rumianda et al. (2020) found that gamification increased student motivation and engagement in sociology learning, while Figueiredo and García-Peñalvo (2020) demonstrated increased motivation, creativity, and participation in computer programming learning. In an online context, Pratama et al. (2021) emphasized that elements such as points and challenges can make e-learning more engaging and improve student performance.

Rohmah's (2022) research also shows that gamification can increase engagement and learning achievement in vocational education, provided it is tailored to the learning characteristics and context. This approach has proven flexible and applicable to various fields, such as language, technology, and skills.

The main elements of gamification play a crucial role in creating meaningful learning experiences. (1) Points serve as indicators of progress and a source of student motivation (Lister, 2015; García-Iruela & Hijón-Neira, 2020). (2) Leaderboards foster healthy competition and a sense of accomplishment (Miller et al., 2016). (3) Rewards reinforce positive behavior and intrinsic motivation (Khuzzan et al., 2021). These three elements work together to enhance student motivation, engagement, and a sense of accomplishment, creating an interactive and enjoyable learning environment.

Overall, the literature shows that gamification has great potential to increase student motivation, participation, and learning outcomes at various levels of education, as well as providing direction for the development of learning innovations in the future.

Implementation of Gamification in Mathematics Learning

Gamification in mathematics learning is the application of game elements and principles to increase students' motivation, involvement and understanding of mathematical concepts (Muharram & Widani, 2021; Permata & Kristanto, 2020). This approach is based on the natural human tendency towards challenges, achievements and rewards to create meaningful learning experiences.

In practice, gamification integrates components such as points, levels, badges, leaderboards, challenges, and narratives relevant to the material (Ariyanto et al., 2023; Umar & Wiguna, 2020). Game-like challenges motivate students to complete tasks to earn points or symbolic rewards, while leaderboards foster healthy competition and narratives help make abstract concepts more contextual (Jusuf, 2016; Nurjannah et al., 2021).

Gamification also encourages interactive and collaborative learning through

teamwork, which strengthens both mathematical understanding and social skills (Kristanto, 2020; Matlan & Maat, 2021). The rapid feedback provided by the game system helps students monitor progress and enhances self-reflection.

Overall, gamification creates a fun, challenging and meaningful learning atmosphere, and has the potential to be an effective strategy in overcoming obstacles to learning mathematics and deepening students' mastery of concepts (Karmila Sari & Siti Nurani, 2021; Kitikedizah Hambali & Maimun Aqsha Lubis, 2022).

Systematic Literature Review (SLR)

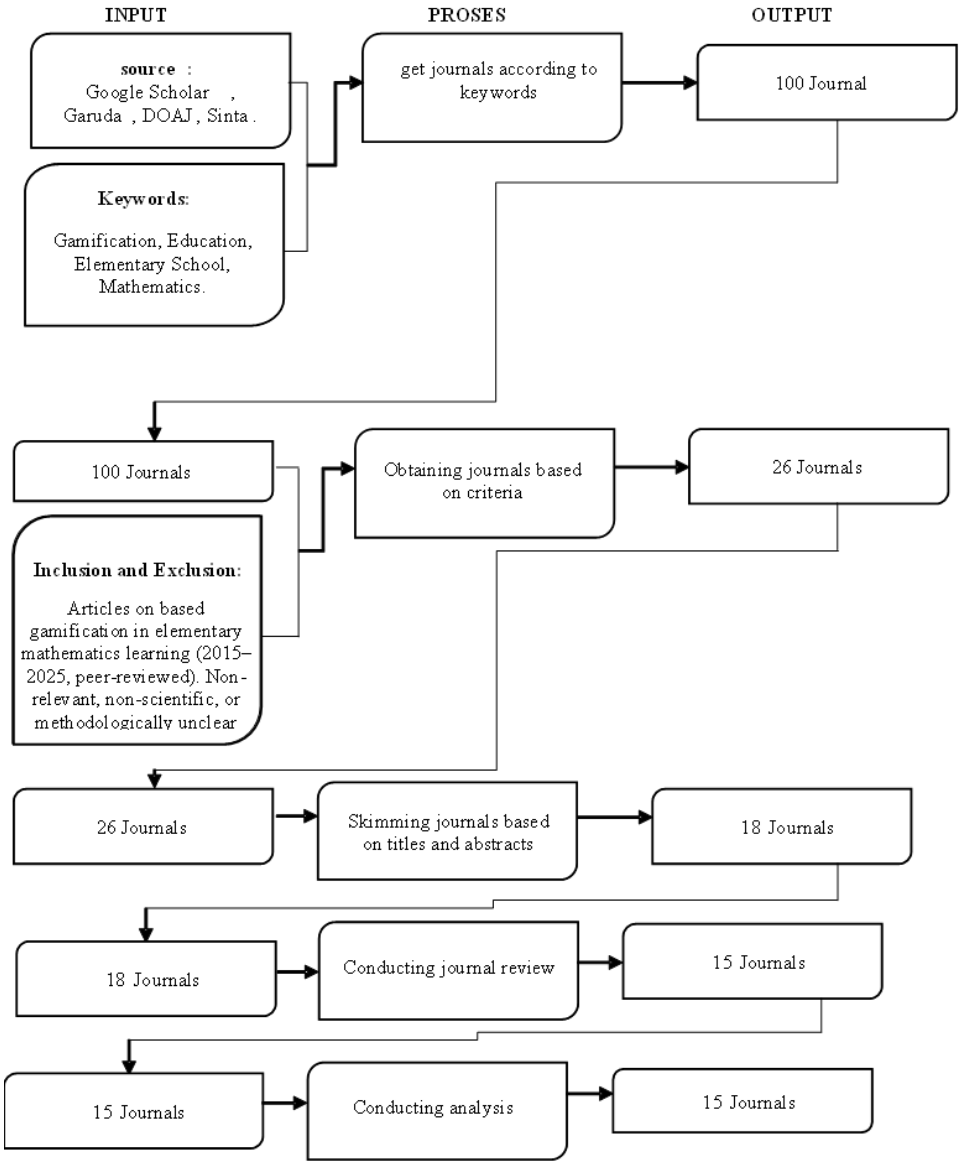
According to Perry & Hammond, a Systematic Literature Review (SLR) is a research approach that comprehensively identifies, evaluates, and interprets findings from previous studies relevant to a phenomenon or problem. Unlike primary studies, which collect original data, SLRs are secondary studies that analyze published research results to provide a more comprehensive and balanced picture (Andriani, 2021).

Furthermore, Kek & Huijser (2011) and Juandi (2021) emphasized that SLR is designed to identify and compile scientific findings comprehensively based on specific research questions through structured, open, and replicable stages, so that the results are objective and reliable.

Thus, the SLR method plays a crucial role in building a deep understanding of an issue through a systematic and transparent process. As a secondary study, the SLR not only reflects the results of previous research but also provides a strong scientific basis for evidence -based decision-making and further research development

RESEARCH METHOD

This study used the Systematic Literature Review (SLR) method to identify, examine, and evaluate various previous research findings relevant to the study topic (Fitriani & Putra, 2022). This approach follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines through journal selection, screening based on inclusion criteria, keyword coding, data extraction, and analysis of selected articles (Chiu et al., 2023). The entire methodological process is depicted in Figure 1, which shows the systematic flow from the input to the output stages of the literature analysis.



The first step in this research was to conduct an initial search of various journals from national and international databases such as Google Scholar, Garuda, DOAJ, and Sinta using the keywords "Gamification", " ADDIE ", "Education", "Elementary School", and "Mathematics". The initial search results obtained 100 potentially relevant journals. Next, inclusion and exclusion criteria were applied, where articles discussing the application of gamification based on the ADDIE model in mathematics learning in elementary schools, published between 2015–2025, and are peer-reviewed articles were included, while non-scientific articles, irrelevant, or without a clear methodology were excluded. Based on this screening, 26 journals remained that met the initial requirements.

The next step was screening the titles and abstracts, which initially resulted in 18 potentially relevant articles. A more detailed evaluation was then conducted using predefined inclusion and exclusion criteria to ensure scientific rigor. Relevance was determined based on: (1) alignment with the topic of gamification in elementary

mathematics learning, (2) use of the ADDIE development model or clear instructional design methodology, (3) research conducted at the elementary school level, and (4) publication within the 2015–2025 timeframe. Articles were excluded if they did not meet these criteria, such as studies lacking clear methodology, focusing on non-elementary students, or discussing gamification without application to mathematics learning. After this process, 15 articles remained and were included in the final analysis.

RESULTS AND DISCUSSION

Based on an analysis of 15 selected studies, research on the development and application of gamification in education shows several consistent patterns. First, the majority of studies focus on the development of gamification-based learning media and digital applications across various subjects, including mathematics, social studies, language learning, science, informatics, and early childhood literacy. Second, all studies employed the ADDIE development model, which consistently produced learning products with high validity, feasibility, practicality, and effectiveness based on expert validation, user testing, and learning outcome assessments. Third, the integration of gamification elements—such as points, levels, badges, challenges, rewards, interactive visuals, and competitive features—demonstrated a strong positive impact on students' motivation, engagement, and learning outcomes across different grade levels. Overall, the findings indicate that gamification is a highly relevant and adaptive instructional innovation capable of enhancing learning interest, conceptual understanding, and active participation. The systematic summary of these studies is presented in Table 1.

Table 1Research Analysis Results

No.	Article Title	Research result
1.	Pengembangan Gamifikasi pada Pelajaran Matematika SD dengan Metode ADDIE untuk Meningkatkan Minat Belajar Siswa Syuhada et al. (2024)	Testing of 11 respondents yielded an average SUS score of 82.95%, which falls into the excellent category. These findings suggest that gamification can increase student interest in learning mathematics at the elementary school level, particularly in basic operations such as addition, subtraction, multiplication, and division. Furthermore, this gamification-based learning resource can be an effective alternative to enhance the teaching and learning process in the classroom.
2.	Pengembangan e-modul interaktif berbasis gamifikasi pada pembelajaran teks fabel Fatimah et al. (2023)	The use of the *Komiknesia* gamification-based e-module has a significant positive impact on the learning process. This e-module is not only effective in improving students' learning outcomes in identifying the intrinsic elements of fables but also enhances their motivation and active engagement through interactive features and attractive comic-

		based visuals. Its visual and gamified presentation helps students understand concepts more easily while encouraging independent learning. In addition, teachers benefit from well-structured, systematic, and ready-to-use learning materials. Overall, the *Komiknesia* e-module creates a more enjoyable and meaningful learning experience, aligns with students' needs, and is suitable for implementation on a wider instructional scale.
3.	Gamification of Mathematics Learning Media Mobile-Based in Public Elementary Schools Sindangmulya II Jatawitika et al. (2024)	This study concludes that the gamification-based discovery learning multimedia is valid, feasible, and effective, as shown by expert validation, positive user responses, and significant improvement in pretest–posttest results. Its impact on learning includes increasing student motivation, engagement, and understanding through interactive game elements, while also supporting more active and student-centered learning.
4.	Pengembangan Pembelajaran Gamification Berbatuan Media Prodigy untuk Meningkatkan Minat Siswa pada Pembelajaran Matematika Fauziyah (2022)	Prodigy is an ICT-based learning media that combines game elements and mathematical materials, thus increasing students' interest in learning mathematics. The five-step *ADDIE development model* of analysis, design, development, implementation, and evaluation was applied in this mixed-methods research approach, which combines quantitative and descriptive qualitative analysis. A questionnaire was used as a research tool and data collection method. Based on the findings, 84.4% of elementary school students were proven to be more interested in learning mathematics when Prodigy media was used.
5.	Gamifikasi Pembelajaran Huruf Hijaiyah dan Bahasa Arab: Studi Kasus PAUD Terpadu Mutiara Yogyakarta Majid dan Huda (2020)	The gamification-based learning program for introducing hijaiyah letters and basic Arabic at PAUD Terpadu Mutiara has shown a strong positive impact on children's learning. The findings indicate that the use of gamification-based learning significantly enhances children's motivation, enthusiasm, and active engagement through interactive and enjoyable activities. With its four main menus—learning, Arabic language, singing, and playing—the gamification approach helps children more easily understand hijaiyah letters and basic vocabulary by turning the learning process into a playful experience. Moreover, this approach aligns with the BCCT model, supports the development of each child's individual potential, and creates a more engaging, meaningful, and

		developmentally appropriate learning environment for early childhood education.
6.	Pengembangan E-LKPD Berbasis Gamifikasi untuk Meningkatkan Keterampilan Berpikir Kreatif dan Motivasi Belajar IPS Siswa di Sekolah Dasar Nuha (2025)	The research findings show that the creation of gamification-based E-LKPD with the ADDIE model stages produces a practical and efficient product for use in the educational process. First, the ADDIE paradigm was successfully used to compile the E-LKPD, which was deemed practical for students to use. Second, 91% of teachers responded positively to the feasibility test results, placing them in the very feasible group. Third, the use of gamification-based E-LKPD was proven to improve students' creative thinking skills, as evidenced by the increase in pre-test scores from 72% to 82% afterward. The results of the paired sample t-test showed a significant difference, with a significance value of 0.000 < 0.05. Fourth, the increase in pre-test scores from 75% to 76% afterward with a significant t-test result (sig. 0.000 < 0.05) indicates that this teaching material can also increase students' learning motivation. As a result, the gamification-based E-LKPD was deemed practical, successful, and beneficial for improving students' original thinking skills and their motivation to learn about Indonesia's geography.
7.	Pengembangan E-Module Matematika Gamifikasi Berbasis Problem Based Learning untuk Meningkatkan Motivasi Belajar Setyaningrum (2023)	The research findings indicate that the problem-based learning-based mathematics gamification e-module created with the ADDIE model is considered valid, useful, and efficient for use in educational settings. With an average score of 4.5 from media experts and 4.3 from material experts, the e-module's validity is considered very high. Practically, the e-module achieved results of 82% (very good category) in the follow-up trial and 76.5% (good category) in the limited trial. In terms of effectiveness, student learning motivation increased by 8.5% after using the e-module, and learning outcomes also improved, as seen from the percentage of pre-test completion which increased from 22.5% (incomplete category) to 77.4% (complete category) in the post-test. Because it meets the requirements of validity, practicality, and effectiveness and can improve student motivation and learning outcomes, the problem-based learning-based mathematics gamification e-module is considered feasible for use.
8.	Pengembangan Pembelajaran Gamifikasi Berbasis Proyek Software	The findings of this study indicate that the project-based gamification learning design used in developing interactive multimedia software

	Multimedia Interaktif Azman et al. (2023)	received positive responses from both validators and student participants. Despite limited literature on project-based gamification, the research shows that this model can be effectively implemented even individually, and traditional gamification activities though rarely applied still contribute to increased student interest, engagement, and self-determination. Overall, the project-based gamification design not only proves feasible and meaningful for learning but also demonstrates a positive impact by enhancing motivation and making the learning process more enjoyable, thus serving as a useful foundation for future research.
9.	Pengembangan Gamifikasi Dalam Pembelajaran Bahasa Jawa Dengan Pendekatan Addie Untuk Siswa Sekolah Dasar Hilmy (2025)	The evaluation results show that the developed game meets both technical and functional feasibility criteria, making it suitable for use as a learning medium. The integration of local culture and gamification elements has proven effective in increasing learner engagement and motivation. In addition to serving as an alternative medium for vocabulary learning, the game also fosters polite speech behavior aligned with Javanese social norms, thereby providing a more meaningful, culturally relevant, and enjoyable learning experience.
10.	Pengembangan Aplikasi Mobile dengan Pendekatan Gamifikasi dalam Pembelajaran Matematika di Sekolah Dasar Bantun et al. (2023)	The results of this study, obtained through three different testing techniques, indicate that the mobile educational game application has a positive impact on mathematics learning. The UAT results show that the application received an excellent rating from teachers, with a final score of 85%, demonstrating its effectiveness in supporting teaching and enhancing interactivity in mathematics instruction. Black-box testing further confirms that all components function as intended, reflecting strong and reliable application performance. In addition, the n-gain analysis of pretest and posttest scores for second-grade students shows a significant improvement in mathematical understanding, with an n-gain value of 0.76 categorized as high. These findings prove that the mobile educational game effectively increases student engagement and facilitates better comprehension of mathematical concepts, making it a valuable tool for improving mathematics learning in elementary schools.
11.	Pengembangan Gamifikasi Untuk Meningkatkan Motivasi Belajar Dan Hasil Belajar	The results of the study indicate that the gamified learning media developed is highly feasible for use in the learning process based on evaluations from media, material, and language experts. The media

	Materi Sistem AC Khoiruddin dan Iskandar (2024)	was shown to increase students' learning motivation to a moderate level and also improve learning outcomes within the same category. In addition, the gamified learning media received excellent responses from students, demonstrating that it is effective, engaging, and well-accepted as a supportive learning tool.
12.	Pengembangan Media Pembelajaran Interaktif Berbasis Web dengan Pendekatan Gamifikasi Pada Materi CSS Dasar Nur et al. (2023)	The web-based interactive learning media using a gamification approach for basic CSS material was developed through a research and development method using a modified ADDIE model, utilizing technologies such as HTML, CSS, JavaScript, Firebase Realtime Database, Ace Editor, Cropper.js, and Netlify. Validation results show very high levels of validity, with scores of 82.75% for material and 82.96% for media, indicating that the product is appropriate for trial implementation. Additionally, the integration of gamification in the learning process provides a positive impact by increasing student motivation, engagement, and enjoyment, making the learning of CSS concepts more interactive and effective.
13.	Gamifikasi dalam Kelas Informatika: Strategi Inovatif untuk Meningkatkan Motivasi dan Keterlibatan Siswa Mertayasa et al. (2025)	This study produced gamified learning content for Grade VII Informatics using the ADDIE model, which was proven to be valid, practical, effective, and received very positive responses from both teachers and students. The findings indicate that gamification serves as an innovative learning alternative that enhances students' motivation and learning outcomes through interactive activities aligned with the Merdeka Curriculum. Theoretically, this research strengthens the existing literature on the effectiveness of gamification in ICT/Informatics education, while practically, the product can be utilized by teachers to increase students' active participation in the classroom.
14.	Pengembangan Media Pembelajaran Ipa Berbasis Gamifikasi Untuk Meningkatkan Minat Belajar Siswa Kelas VII di SMP Muhammadiyah Cipanas Ramdhani & Wicaksono (2025)	Based on the analysis and effectiveness testing, the gamification-based learning media developed using the ADDIE model proved to be practical, highly feasible, and effective in improving learning quality on the topic *Earth and Its Satellites*. Validation by material experts, media experts, and science teachers resulted in an average feasibility score of 88.83%, while small- and large-group trials achieved 91.70% and 92.80%, respectively—both falling into the "Highly Feasible" category. The media's effectiveness was further demonstrated by a significant increase in students' learning outcomes,

		indicated by a High N-Gain score, along with positive student responses regarding the media's attractiveness, motivational impact, and ease of use. The integration of gamification had a clear positive impact by increasing learning interest, focus, active participation, and students' conceptual understanding through visual and interactive experiences, while also fostering an enjoyable and healthy competitive learning atmosphere.
15.	Penerapan Gamifikasi Pada Pembelajaran Huruf Dan Angka Untuk Anak Usia Dini Berbasis Android Wisnumurti (2023)	Based on the results of this study, it can be concluded that the ADDIE method used in the development process is appropriate and effective as an instructional design model. The Construct 2 game engine proved suitable for creating an Android-based gamified learning media for introducing letters and numbers. The integration of gamification elements in the application successfully increased learners' motivation, enjoyment, and engagement during the learning activities. The Android-based Gamification Application for Early Childhood Letter and Number Learning provides a positive user experience by offering comfort, ease of use, and an enjoyable learning atmosphere for PAUD students in Karanggintung Village. Overall, the application enhances students' understanding and motivation in learning basic literacy and numeracy concepts.

Based on an analysis of 15 selected studies, the implementation of gamification in various learning domains—from mathematics, language, social studies, informatics, to early childhood education—demonstrates its strong potential as an innovative and interactive learning approach. All studies consistently used the ADDIE development model, producing gamified learning media and applications that were validated as feasible, practical, and effective by experts, teachers, and students. Gamification elements such as points, badges, levels, challenges, rewards, narratives, and interactive game-based activities were shown to significantly increase student motivation, engagement, and enjoyment during learning. In addition, these gamified products contributed to improvements in learning outcomes, conceptual understanding, creative thinking skills, and independent learning across grade levels—from early childhood to junior high school. Overall, the findings highlight that gamification serves as a relevant, adaptive, and pedagogically beneficial approach that enhances both learning experiences and learning achievement. The summarized findings of the 15 articles are presented in Table 2.

Table 2Grouping of Journal Categories

No	Author	Year	Domain	Focus	Object	Method
1	Syuhada et al.	2024	Media Development	Mathematics gamification to increase learning interest	Elementary school students	ADDIE
2	Fatimah et al.	2023	Interactive E-Module	Gamification-based e-module (Komiknesia) for fable text learning	Junior high school students	ADDIE
3	Jatawitika et al.	2024	Gamified Multimedia	Mobile-based discovery learning with gamification	Elementary school students	ADDIE
4	Fauziyah	2022	Gamification & ICT	Prodigy gamification media to increase math interest	Elementary school students	ADDIE
5	Majid & Huda	2020	Early Childhood Gamification	Gamified hijaiyah & Arabic learning	PAUD students	ADDIE
6	Noah	2025	Gamified E-LKPD	Gamification-based E-LKPD for Social Studies	Elementary school students	ADDIE
7	Setyaningrum	2023	Gamification E-Module	PBL-based gamification e-module to increase motivation	Elementary school students	ADDIE
8	Azman et al.	2023	Project-Based Gamification	Gamified interactive multimedia development	Vocational/high school students	ADDIE
9	Hilmy	2025	Cultural Gamification	Gamified Javanese language learning	Elementary school students	ADDIE
10	Bantun et al.	2023	Mobile Learning	Gamified mobile app for mathematics	Elementary school students	ADDIE
11	Khoiruddin & Iskandar	2024	Gamified Media	Gamification for AC system material	Vocational students	ADDIE
12	Nur et al.	2023	Web-Based Gamification	Gamified web media for basic CSS	High school/vocational students	ADDIE
13	Mertayasa et al.	2025	Informatics Gamification	Gamified content for Grade VII Informatics	Junior high school students	ADDIE

14	Ramdhani & Wicaksono	2025	Science Gamification	Gamification for Earth and Its Satellites	Grade VII students	ADDIE
15	Wisnumurti	2023	Early Childhood Gamification	Android-based gamification for letters and numbers	PAUD students	ADDIE

Based on the analysis of 15 selected journals on the implementation of gamification in learning, three main themes were identified. The first theme, Pedagogical Impact, highlights the effects of gamification on student motivation, active participation, conceptual understanding, and creative thinking skills. Out of the 15 studies, 10 reported increased student motivation, 9 reported improved learning outcomes, and 5 indicated enhanced creative thinking skills. Gamification was implemented through elements such as points, levels, badges, challenges, rewards, narratives, and interactive game-based activities, which were shown to increase student engagement and enjoyment. The second theme, Technology Integration Challenges, emphasizes teacher readiness, infrastructure, and technological adaptation as critical factors for successful gamification. Only a few studies addressed these aspects, indicating that research on long-term technology integration and teachers' digital competence remains limited. The third theme, Media Development Dominance, shows that the majority of studies (12 out of 15) used the ADDIE model to develop gamified media, such as e-modules, E-LKPD, mobile applications, and web-based multimedia. These studies focused on the validity, practicality, and effectiveness of gamified learning media, while research on long-term implementation and technology adaptation remains scarce. Overall, the findings indicate that gamification is a relevant, adaptive, and effective instructional innovation that enhances motivation, active participation, conceptual understanding, and students' thinking skills. However, further research is needed to explore technology integration, teacher readiness, and the impact on higher-order thinking skills.

Figure 1Gamification Research Domains

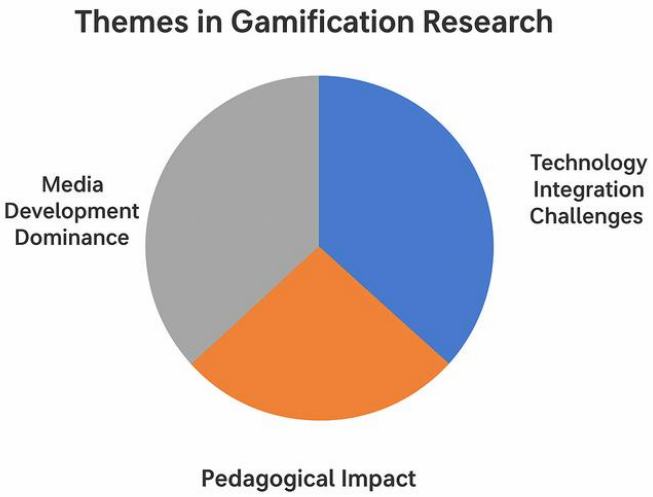


Figure 2 illustrates the distribution of research themes in gamification studies for elementary mathematics, based on an analysis of 15 journals, revealing three main focuses: Media Development (36%), which emphasizes creating and validating digital gamified learning materials such as interactive applications, e-modules, and electronic worksheets (LKPD) with game mechanics; Technology Integration Challenges (36%), addressing technological readiness, teacher competency, and the integration of digital tools to support gamified learning environments; and Pedagogical Impact (28%), examining the effects of gamification on student motivation, engagement, and learning outcomes. Overall, research is heavily concentrated on digital media development and implementation, with limited attention to long-term technology adaptation and the impact on higher-order thinking skills, suggesting that future studies should focus more on technological readiness and fostering advanced cognitive skills.

CONCLUSION

This review reveals that research on gamification in elementary mathematics learning is predominantly oriented toward the development and implementation of digital media. These studies emphasize how interactive platforms such as learning applications, e-modules, and electronic worksheets can enhance engagement and conceptual understanding. The findings also show that gamification can be applied directly in classroom activities to improve students' motivation, learning outcomes, and active participation. However, investigations on long-term effectiveness, technological readiness, and teachers' digital competence remain limited. Therefore, future research should move beyond media creation toward exploring sustainable integration of technology, strengthening teacher capacity, and evaluating how gamification supports higher-order thinking skills such as critical thinking, creativity, and problem-solving.

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