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DOI: <https://doi.org/10.53893/asic.v2i1.493>

Proceedings of Academic Seminar and International Conference (ASIC)

The Future of Learning: Education in the Digital Age

Vol. 2No. 1 January2026

# Advancing Quality Education through Gamification in Non-Formal Digital Learning Contexts

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## ABSTRACT

This study conducts systematic bibliometric analysis to map the intellectual landscape, research trends, and thematic evolution of gamification within non-formal digital education from 2018 to 2025. It aims to provide a comprehensive overview of the field's development by identifying key contributors, dominant themes, research gaps, and future trajectories. Employing a quantitative bibliometric methodology, the analysis is based on 200 scholarly works indexed in major databases (Scopus, Web of Science, and Google Scholar). Data visualization and analysis were performed using VOSviewer and Bibliometrix (R package), examining publication trends, citation networks, author/institutional productivity, keyword co-occurrence, and thematic clustering. The analysis reveals significant, accelerating growth in research output post-2020, driven by global digital transformation. Five dominant thematic clusters emerge: (1) Motivational and Engagement Frameworks, (2) Technology Integration and Digital Tools (e.g., mobile learning, VR/AR), (3) Adult and Professional Upskilling, (4) Credentialing and Micro-Certifications, and (5) Inclusion and Accessibility. Geographically, European institutions lead in policy-oriented and credentialing research, while Southeast Asia contributes strongly to applied, context-specific studies. The study is limited by its focus on indexed, English-dominant publications, which may underrepresent gray literature and non-English case studies from the Global South. The findings highlight the need for greater methodological diversity, longitudinal impact studies, and culturally contextualized gamification models. For practitioners, the study underscores the importance of designing gamified nonformal learning that is purpose-driven, grounded in adult learning principles (andragogy), and integrated with verifiable digital credentialing systems to validate outcomes. This paper provides the first dedicated, large-scale bibliometric synthesis of gamification in non-formal digital education. It offers a structured roadmap for researchers and an evidence-based strategic guide for educators, policymakers, and learning designers seeking to leverage gamification to enhance the quality, reach, and effectiveness of lifelong learning in the digital age.

**Keywords:** Gamification, Non-Formal Education, Digital-Learning, Adult Learning.

## INTRODUCTION

The digital revolution has precipitated a profound paradigm shift across nearly all sectors of society, with education positioned at the forefront of this transformation. Rapid advancements



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in information and communication technologies (ICT) have reshaped traditional pedagogical models, giving rise to learning environments that are increasingly interactive, flexible, and learner-centered (OECD, 2015; Selwyn, 2016). This transformation has not only altered how knowledge is delivered but has also redefined the roles of educators and learners by emphasizing autonomy, engagement, and continuous learning. Within this evolving landscape, non-formal education is commonly defined as organized and purposeful learning activities that occur outside the formal education system and plays a crucial role in addressing the educational needs of diverse populations, including adult learners, professionals, and community groups (European Commission, 2000; UNESCO, 2012).

Despite its flexibility and contextual relevance, non-formal education faces significant challenges in the digital era, particularly in sustaining learner motivation, ensuring meaningful engagement, and maintaining learning effectiveness in technology-mediated environments. At the same time, digitalization presents substantial opportunities to enhance accessibility, personalization, and scalability of non-formal learning programs (OECD, 2019). To remain relevant and responsive to rapidly changing labor market demands and lifelong learning imperatives, non-formal education must strategically integrate digital tools, pedagogical innovations, and learner-centered approaches (Hasan, 2001; UNESCO, 2015). The effective adoption of digital methodologies is therefore not merely a technological necessity but a pedagogical imperative for improving learning outcomes and social inclusion.

One of the most prominent pedagogical innovations to emerge in this context is gamification, which has gained increasing scholarly attention over the past decade. Gamification is commonly defined as the use of game design elements in non-game contexts (Deterding et al., 2011), and it is grounded in motivational theories such as self-determination theory, goal-setting theory, and flow theory (Deci & Ryan, 2000; Locke & Latham, 2002; Csikszentmihalyi, 1990). By incorporating game elements such as points, badges, leaderboards, challenges, feedback systems, and narrative progression, gamification aims to foster intrinsic and extrinsic motivation,



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enhance learner engagement, and promote sustained participation in learning activities (Hamari et al., 2014; Stojanovska-Georgievska et al., 2019).

The application of gamification in digital learning environments is particularly effective because it aligns with the interactive and multimodal affordances of digital technologies. Empirical studies have demonstrated that gamification can positively influence learner engagement, motivation, and performance in various educational contexts, including professional training, adult education, and online learning platforms (Dicheva et al., 2015; Zainuddin et al., 2020). In nonformal education settings, where learner autonomy is high and participation is often voluntary, gamification offers a promising strategy to address motivational challenges by making learning experiences more engaging, meaningful, and goal-oriented (Werbach & Hunter, 2012; Koivisto & Hamari, 2019).

Furthermore, gamification supports the development of transferable skills such as problemsolving, collaboration, and self-regulation, which are essential in lifelong learning and workforce development contexts (Kapp, 2012; OECD, 2021). When thoughtfully designed and aligned with learning objectives, gamified digital environments can enhance not only participation rates but also the quality and sustainability of learning in non-formal education. Consequently, the growing integration of gamification into non-formal digital learning reflects a broader shift toward innovative and learner-centered pedagogies that support inclusive and high-quality education in the digital era, in line with the principles of Sustainable Development Goal 4 on Quality Education (UNESCO, 2016).

In the context of non-formal education, encompassing vocational training, community workshops, professional upskilling courses, language learning apps, and museum education—gamification holds significant promise. The heterogeneous learner profiles, often characterized by voluntary participation and goal-oriented learning, make engagement a critical success factor. Research indicates that well-designed gamification can foster intrinsic motivation, improve skill



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Vol. 2No. 1 January2026

acquisition, and support persistence in learning activities (AURA, I., Storification in Formal Education; Ritter, L.A., Gamification in Adult Education).

Despite this promise, the academic discourse on gamification has been disproportionately focused on formal education settings, particularly higher education and K-12 classrooms (ParraGonzález et al., 2020). While informative, this body of literature does not fully address the unique constraints and affordances of non-formal contexts, such as lack of mandatory attendance, variable prior knowledge, and the need for immediately applicable skills. Consequently, research on gamification within non-formal digital education remains fragmented across disciplines like adult education, instructional design, human-computer interaction, and specific vocational fields.

To synthesize this dispersed knowledge and chart a course for future inquiry, a systematic mapping of the field is essential. Bibliometric analysis offers a powerful, quantitative method to examine the intellectual structure of a research domain. It can reveal publication trends, map collaboration networks, identify influential works and authors, and distill evolving thematic clusters (Zupic & Čater, 2015). Such an analysis moves beyond individual case studies to provide a macro-level view of the field's development.

Therefore, this study aims to conduct a comprehensive bibliometric analysis of research on gamification in non-formal digital learning contexts. The primary objectives are to:

1. Analyze the temporal evolution and growth trajectory of publications.
2. Identify the most productive and influential authors, institutions, countries, and journals.
3. Map the intellectual structure and key thematic clusters through keyword and citation network analysis.
4. Synthesize the dominant research themes and identify emerging frontiers and persistent gaps.

The findings of this study are expected to make a twofold contribution. Theoretically, it will consolidate the scattered literature, providing a clearer identity for this sub-field and informing future theory-building. Practically, it will offer evidence-based insights for educators, instructional designers, and policymakers in non-formal sectors (e.g., corporate training, community education,



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Proceedings of Academic Seminar and International Conference (ASIC)

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Vol. 2No. 1 January2026

NGOs) seeking to leverage gamification to design more engaging, effective, and high-quality digital learning experiences. By doing so, this paper aligns with the global pursuit of Sustainable Development Goal 4 (Quality Education), advocating for innovative strategies to promote inclusive and equitable lifelong learning opportunities for all.

## RESEARCH METHODS

This study employs a Systematic Literature Review (SLR) approach combined with bibliometric analysis to examine the application of gamification in non-formal education in the digital era. The integration of these two methods allows for a structured, transparent, and replicable synthesis of the literature while simultaneously identifying publication trends, influential authors, and thematic evolution within the field. As the primary data source, the study uses the Scopus database, widely recognized as a reputable platform for indexing high-quality scientific publications. The search was conducted using the advanced search function with combinations of key keywords such as gamification, non-formal education, adult learning, and digital learning, which are commonly used in prior research. The publication timeframe was set from 2018 to 2025 to capture recent developments aligned with the rapid adoption of digital technologies in learning.

The article selection process followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol to ensure methodological rigor. The initial stage involved screening documents by type, excluding non-research publications such as conference proceedings, books, and editorials. Subsequently, a review of titles and abstracts was conducted to confirm the relevance of the articles to the core topic. From this process, a final corpus of 200 articles meeting the inclusion criteria was obtained, forming the basis for quantitative and qualitative analysis.

Bibliometric analysis was conducted to examine publication patterns statistically, including annual trends, leading journals, author networks, and keyword co-occurrence. This technique is effective for identifying research focus and emerging themes. Complete metadata extracted from



Scopus (including citations, bibliographic information, and author keywords) was analyzed using VOSviewer software to visualize thematic and collaboration networks, and Microsoft Excel for descriptive statistics and trend charts.

The combination of SLR, PRISMA protocols, and bibliometric visualization enhances the objectivity, reliability, and depth of the analysis. This integrated approach provides a comprehensive and reliable map of research developments on gamification in non-formal education, while also paving the way for identifying knowledge gaps and future research directions in this rapidly evolving domain.

## RESULTS AND DISCUSSION

### Results

The bibliometric analysis demonstrates a significant upward trajectory in scholarly publications on gamification within non-formal digital learning contexts. While early research contributions were sporadic, a marked increase in publication output has been evident since 2018. This surge corresponds with the rapid expansion of digital learning technologies and the growing emphasis on lifelong learning paradigms. The observed trend indicates a strengthening academic focus on gamification as an instructional approach beyond formal education settings, aligning with broader developments in digital education research that prioritize learner engagement, motivation, and adaptive learning environments (OECD, 2019; Zainuddin et al., 2020).

Table 1. Evolution of Publications and Research Focus (2018–2025)

Year	Number of Publications (n = 200)	Percentage (%)	Contextual Description
2018	12	6.0	Initial phase characterized by conceptual exploration and smallscale case studies.
2019	15	7.5	Steady increase, with a growing focus on game-based learning (GBL) and basic applications.



Darmawan & Syah

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Vol. 2 No. 1 January 2026

2020	25	12.5	First major surge due to the COVID-19 pandemic; emphasis on online tools such as Quizizz and Kahoot! to sustain learner engagement.
2021	28	14.0	Consolidation phase, marked by increased research on motivation and instructional effectiveness.
2022	35	17.5	Significant growth, with thematic expansion into environmental education, cultural heritage, and micro-credentials.
2023	38	19.0	Peak productivity year, featuring deeper investigations into pedagogical design, inclusivity, and systematic analyses.
2024	32	16.0	Sustained high output, with a focus on emerging technologies (AR/VR, AI) and cross-cultural studies.
2025*	15	7.5	Partial data (up to early 2026); continued trends emphasizing the metaverse and credentialing infrastructure (EDCI).
Total	200	100	

This growth reflects a rising academic interest in examining gamification as a pedagogical strategy beyond formal education systems. Nevertheless, when compared with research conducted in formal educational settings, the overall volume of studies remains relatively limited. This imbalance indicates that non-formal education continues to be underrepresented in gamification research. Although the increasing number of publications suggests that gamification has progressed from an emerging concept to a more established research domain within non-formal education, the field still warrants greater scholarly attention.

#### Disciplinary and Geographic Distribution of Research

The analysis indicates that research on gamification in non-formal education spans multiple academic disciplines, reflecting the inherently cross-sectoral nature of non-formal learning. This wide dispersion suggests the absence of a consolidated publication core, which may contribute to knowledge fragmentation and limit cumulative theoretical development.

Geographically, research output is unevenly distributed across regions, with strong representation from Europe and Southeast Asia, while other regions remain marginally represented. Author collaboration patterns reveal a moderate level of international cooperation,



indicating substantial potential for stronger cross-regional partnerships particularly involving developing regions where non-formal education plays a critical role in workforce development and social inclusion.

Table 2. Geographic Distribution of Gamification Research in Non-Formal Education

Region	Share of Publications (%)	Dominant Research Focus
Europe	45	Policy-oriented studies and microcredential frameworks
Southeast Asia	38	Local-context research and practical applications
North America	12	Advanced technologies and motivational psychology
Other Regions (Africa, Latin America, Middle East)	5	Limited and emerging research contributions
<b>Total</b>	<b>100</b>	

Table 3. Leading Publication Sources and Their Research Contributions

Rank	Source Name	Number of Documents	Primary Focus / Contribution
1	EDULEARN & INTED Conferences	28	Major platforms for sharing case studies and practical innovations from Europe and global contexts
2	Sustainability (MDPI)	10	Gamification research related to environmental education, sustainability, and social awareness
3	IEEE Access / IEEE Conferences	9	Technical perspectives, including AR/VR integration and computational frameworks
4	CEEOL (Central and Eastern European Online Library)	8	Research from Central and Eastern Europe on teacher efficacy and media literacy
5	Indonesia-based International Journals (e.g., IJORER, JPPIPA)*	22	Strong emphasis on local contexts, including religious education, community learning centers, and entrepreneurship
6	Springer (journals and books)	15	Literature reviews, theoretical frameworks, and comprehensive empirical studies



7	ResearchGate / Academia.edu*	18	Gray literature, project reports, and nonindexed conference papers
8	Journal of Educational Technology	6	Analysis of gamified digital learning tools and platforms
9	Frontiers in Education / Human Dynamics	5	Studies on social inclusion, intercultural learning, and 21st-century skills
10	Dialnet / Biblioteca Nauki	7	Access to Spanish-, Polish-, and Southern European-language research

\*Aggregated sources

Overall, the literature is widely dispersed across journals, conferences, and gray literature, underscoring the interdisciplinary and practice-oriented character of gamification research in nonformal education. Conferences and alternative publication platforms play a crucial role in knowledge dissemination, while established journals tend to concentrate on specific themes such as sustainability, educational technology, and social inclusion. This pattern further highlights the need for stronger integration and theoretical consolidation within the field.

#### Intellectual Structure and Thematic Clusters

The intellectual structure of gamification research in non-formal education was examined through keyword co-occurrence network analysis. The results reveal several dominant thematic clusters that collectively define the conceptual and methodological landscape of the field. These clusters indicate both well-established research streams and emerging directions, reflecting the evolving maturity of gamification as a pedagogical approach in non-formal learning contexts.

Table 4. Major Thematic Clusters and Their Characteristics

Cluster	Primary Focus	Representative Keywords	Share of Publications (%)
Motivation and Engagement	Motivational outcomes, learner engagement, and psychological foundations	motivation, engagement, self-determination, intrinsic motivation	35



Darmawan & Syah

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Proceedings of Academic Seminar and International Conference (ASIC)

The Future of Learning: Education in the Digital Age

Vol. 2No. 1 January2026

Digital Platforms and Learning Technologies	Digital learning environments and delivery systems	e-learning, mobile learning, LMS, digital badges	30
Skill Development and Practical Learning Outcomes	Applied learning outcomes and workforce-oriented skills	adult education, vocational training, skills development, lifelong learning	25
Emerging Technologies and Personalization	Data-driven adaptation and immersive learning technologies	artificial intelligence, learning analytics, personalized learning, metaverse	10
Total			100

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The dominance of the *Motivation and Engagement* cluster underscores the strong theoretical grounding of gamification research in motivational psychology, particularly self-determination theory. The substantial presence of the *Digital Platforms and Learning Technologies* cluster reflects the practical orientation of non-formal education, where flexible and technology-mediated delivery is essential. Meanwhile, the *Skill Development and Practical Learning Outcomes* cluster highlights the alignment of gamification with adult learning, vocational training, and workforce development objectives. Although currently representing a smaller proportion of publications, the *Emerging Technologies and Personalization* cluster signals a growing research frontier, emphasizing adaptive systems, immersive environments, and data-informed instructional design.

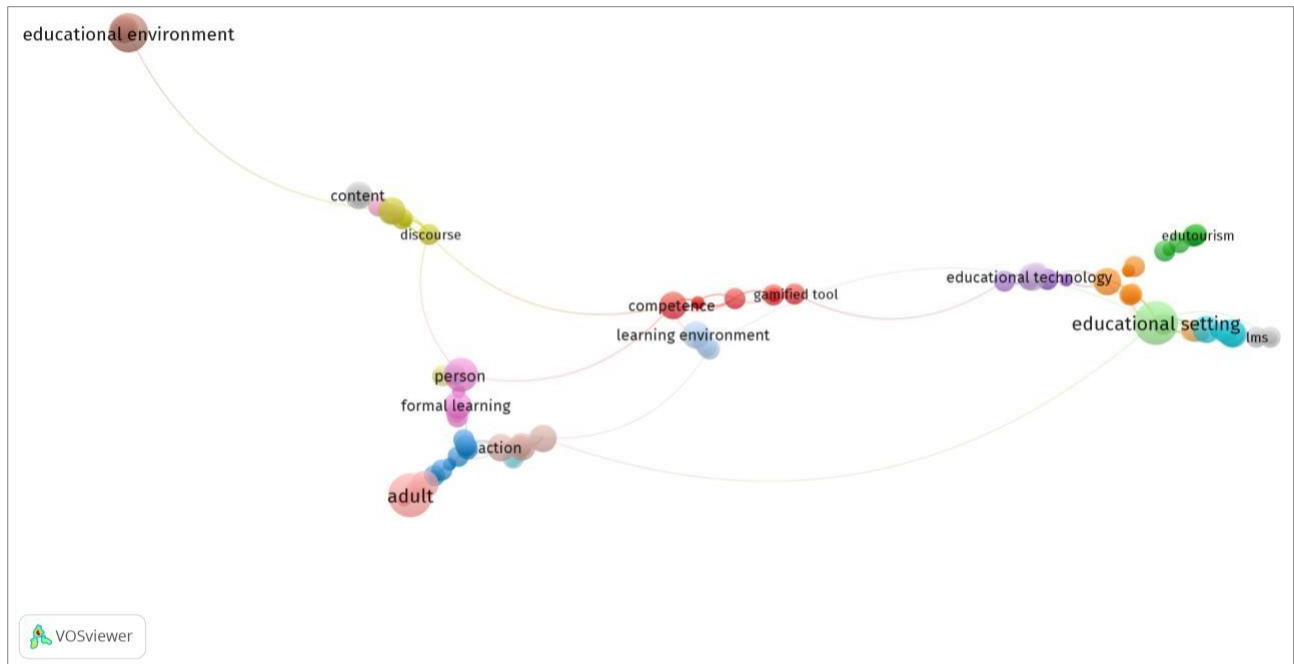


Figure 1. Keyword Co-occurrence Network (VOSviewer)

Figure 1 illustrates the keyword co-occurrence network generated using VOSviewer, revealing the intellectual structure of gamification research in non-formal education. The visualization identifies several color-coded thematic clusters that represent interconnected research domains and conceptual orientations within the field. Based on the VOSviewer clustering results and supported by findings from the preceding bibliometric analysis, five major research clusters were identified. Each cluster reflects a distinct thematic emphasis, methodological orientation, and degree of maturity within the literature.

Table 5. Interpretation of Thematic Research Clusters Based on Keyword Co-occurrence Analysis

Cluster (VOSviewer Color)	Core Keywords	Inferred Research Focus	Supporting Reference Sources	Dominant Research Topics
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Red: Learning Environments and Processes	educational environment, learning environment, educational setting, discourse	Examination of how physical, social, and discursive contexts shape learning experiences and outcomes in non-formal settings	Prior corpus emphasizes motivation and outcomes rather than explicit environmental analysis	Discursive analysis of learning spaces; Impact of learning environment design on participation; Ethnographic studies of non-formal education contexts
Green: Educational Technology and Innovation	education technology, digital content, formal learning	Implementation, effectiveness, and challenges of technology integration for content delivery, particularly in structured learning environments	<i>Implementing European Digital Credentials</i> (John & Hürten, 2025); <i>Motivation to Use Gamification Elements in E-Learning</i> (Afirando et al., 2023)	LMS adoption studies; Digital standards and credentials; Gamification elements in e-learning platforms
Blue: Learners and Competency Development	person, adult, competence, action	Learner-centered research focusing on adult learners, competency development, and actionbased learning approaches	<i>Effect of Gamification on Student Motivation</i> (Lin et al., 2024); <i>Flipped Classroom, Gamification and Game-Based Learning in Non-Formal Education</i> (Atanasova & Molnar, 2024)	Psychological impact of gamification; Active pedagogies for competency development; Adult and lifelong learning models
Yellow: Educational Frameworks and Ideologies	formal learning, educationism	Philosophical, sociological, and policyoriented analyses of educational structures, formality, and underlying ideologies	<i>Flipped Classroom, Gamification and GameBased Learning in Non-Formal Education</i> (Atanasova & Molnar, 2024)	Comparative effectiveness of formal vs non-formal education; Policy discourse analysis; Educational ideology studies
Purple (Emerging): Innovation and Future-Oriented Systems	education technology (AI, metaverse-related terms)	Integration of advanced technologies and futureoriented credentialing and recognition systems	<i>Blockchain and Artificial Intelligence Non-Formal Education System (BANFES)</i> (Nazari et al., 2024)	AI- and blockchain-based education systems; Immersive learning (VR/Metaverse); Future credentialing infrastructures

The cluster analysis reveals a field characterized by both conceptual diversity and uneven thematic development. Established clusters such as Learners and Competency Development and Educational Technology and Innovation indicate a strong applied and learner-centered orientation. In contrast, the Learning Environments and Processes and Educational Frameworks and Ideologies clusters remain comparatively underdeveloped, suggesting opportunities for deeper theoretical and contextual inquiry. The presence of an emerging cluster focused on AI, blockchain, and immersive



Darmawan & Syah

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Proceedings of Academic Seminar and International Conference (ASIC)

The Future of Learning: Education in the Digital Age

Vol. 2No. 1 January2026

technologies signals a forward-looking research trajectory, reinforcing the evolving role of gamification in shaping future non-formal education ecosystems.

## Discussion

This bibliometric analysis reveals fundamental patterns in the development of gamification research within non-formal education, positioning the field as one that is steadily expanding and undergoing significant thematic differentiation (Deterding et al., 2011; Koivisto & Hamari, 2019). Inductively, the findings indicate that gamification research has evolved from an initial phase of conceptual exploration toward a more mature scholarly domain. This evolution has been driven by the widespread adoption of digital technologies, the consolidation of lifelong learning paradigms, and the growing need to enhance adult learner engagement beyond formal education systems (OECD, 2019; Knowles et al., 2005; Sailer & Homner, 2020).

The sharp increase in publication trends since 2018, followed by a pronounced surge after 2020, is closely associated with the accelerated digitalization of education triggered by the global pandemic, particularly within non-formal and online learning contexts (Zainuddin et al., 2020; Lin et al., 2024). This development is reflected not only in the growing volume of publications but also in a clear thematic shift—from the use of basic gamification tools such as Kahoot! toward the exploration of immersive technologies, including augmented reality, virtual reality, the metaverse, and blockchain-based digital credentialing systems (Nazari et al., 2024; John & Hürten, 2025). Such patterns suggest that gamification research is inherently adaptive and responsive to the rapidly evolving landscape of educational technology (Mishra & Koehler, 2006; Seaborn & Fels, 2015).

The geographically and disciplinarily dispersed nature of the literature—with research concentrations in Europe and Southeast Asia and publications scattered across journals and conference proceedings—highlights the contextual and practice-oriented character of gamification research in non-formal education (Atanasova & Molnar, 2024; Subagja et al., 2023). The



**Darmawan & Syah**

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**Proceedings of Academic Seminar and International Conference (ASIC)**

**The Future of Learning: Education in the Digital Age**

**Vol. 2No. 1 January2026**

predominance of policy-driven and system-level studies in Europe, alongside community-based and locally grounded applications in Southeast Asia, underscores the extent to which gamification practices are shaped by socio-cultural agendas, public policy frameworks, and region-specific educational needs (OECD, 2019; Wu et al., 2022). At the same time, this fragmentation poses an epistemological challenge, as it limits the consolidation of coherent and transferable theoretical frameworks across contexts (Hamari et al., 2014; Koivisto & Hamari, 2019).

The thematic structure identified through keyword co-occurrence analysis reveals a dialectical tension between human-centric and technology-driven approaches within gamification research (Seaborn & Fels, 2015; Koivisto & Hamari, 2019). Dominant clusters related to learner motivation, engagement, and competency development reaffirm that the conceptual core of gamification remains rooted in the psychopedagogical dimensions of adult learning—particularly intrinsic motivation and the fulfillment of autonomy, competence, and relatedness needs (Ryan & Deci, 2000; Afirando et al., 2023). Conversely, the emergence of clusters centered on educational technology and advanced digital innovations reflects how technological media and technical infrastructures are reshaping the design possibilities and implementation modalities of gamified non-formal learning environments (Nazari et al., 2024; John & Hürten, 2025).

Notably, the relative scarcity of studies explicitly addressing learning environments, power relations, and educational discourse as distinct thematic clusters points to a critical analytical gap within the existing literature (Bourdieu & Passeron, 1990; Freire, 2018). Most studies prioritize tool effectiveness and short-term learning outcomes, while comparatively fewer engage in critical analyses of socio-material contexts, institutional structures, and the ideological implications of implementing gamification in non-formal education (Alexandrova, 2023; Seaborn & Fels, 2015).

Overall, the bibliometric findings support the inductive proposition that gamification in non-formal education has developed into a pragmatic and technologically responsive research field, primarily oriented toward addressing practical challenges in adult learning and skills development (Sailer & Homner, 2020; Lin et al., 2024). Nevertheless, further strengthening of the



**Darmawan & Syah**

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**Proceedings of Academic Seminar and International Conference (ASIC)**

**The Future of Learning: Education in the Digital Age**

**Vol. 2No. 1 January2026**

field's scholarly foundations requires deeper theoretical engagement, more balanced geographic representation, and closer integration of social context analysis, critical pedagogy, and digital innovation. Such efforts are essential to advancing a more robust, reflective, and inclusive research framework for gamification in non-formal education (Mishra & Koehler, 2006; Freire, 2018; Koivisto & Hamari, 2019).

## **CONCLUSION**

Gamification research in non-formal digital learning has evolved from a marginal and exploratory topic into a distinct and increasingly mature field of scholarly inquiry, demonstrated by sustained publication growth since 2018 with a notable peak in 2023, reflecting its alignment with broader transformations in digital education, lifelong learning, and adult skill development, yet the overall volume remains relatively limited compared to formal education contexts, underscoring the continued underrepresentation of non-formal learning environments and the need for more systematic academic attention. Thematically, the field exhibits a strong applied orientation anchored in motivational and psych pedagogical frameworks particularly learner engagement and competency development while simultaneously emphasizing digital platforms and instructional technologies, illustrating its role as a bridge between human-centered learning theories and technology-driven design; however, this body of literature remains unevenly distributed geographically, with concentrations in Europe and Southeast Asia, and fragmented across publication outlets such as conferences and gray literature, which hinders theoretical consolidation and cumulative knowledge building. Looking forward, the emergence of research on advanced technologies such as artificial intelligence, immersive environments, and digital credentialing systems signals a future-oriented trajectory for the field, though the relative scarcity of studies addressing socio-material learning environments, power relations, and critical educational discourses highlights a significant analytical gap. To strengthen its scholarly foundations, future research must pursue greater geographic diversity, deeper theoretical integration, and closer



Darmawan & Syah

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Proceedings of Academic Seminar and International Conference (ASIC)

The Future of Learning: Education in the Digital Age

Vol. 2No. 1 January2026

engagement with contextual and critical perspectives, which will be essential for developing a more coherent, inclusive, and resilient knowledge base capable of guiding equitable and sustainable non-formal learning practices.

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Darmawan & Syah

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The Future of Learning: Education in the Digital Age

Vol. 2No. 1 January2026

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Darmawan & Syah

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Proceedings of Academic Seminar and International Conference (ASIC)

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Vol. 2No. 1 January2026

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**How to Cite:** Darmawan, D., & Syah, R. (2026). Advancing Quality Education through Gamification in Non-Formal Digital Learning Contexts. *Proceedings of Academic Seminar and International Conference*, 2(1), 54–72. <https://doi.org/10.53893/asic.v2i1.493>