



## **EXPLORING THE FRONTIERS OF GAMIFICATION: A BIBLIOMETRIC ANALYSIS OF RESEARCH TRENDS AND INFLUENCES**

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### **Abstract:**

Gamification has become popular in industries. However, its presence in healthcare remains in the early stages. This study conducts a bibliometric analysis to explore gamification in a broad sense and its potential in healthcare. A bibliometric and network analysis (2011–2023) based on 5,240 papers from 8,722 scholars in the Scopus database identifies key scholars and influential articles. Publications are analysed by source title, citations, country, and institution. The results indicate that gamification is less applied in healthcare than in education and other fields. Bibliometric networks, such as co-occurrence networks of keywords and authors, are examined. A cluster-based content analysis further explores gamification in healthcare. Findings demonstrate a growing academic interest in gamification, with key research topics focusing on motivations for implementation, learning, healthcare, well-being, and social networks. The study highlights research gaps, particularly in linking gamification to healthcare. To address this, a multilevel framework is proposed to guide future research on gamification in healthcare.

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Bibliometric Analysis, Bibliometric Review, Gamification, Publication Analysis



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## Introduction

Gamification has become a well-established Human-Computer Interaction technique, transforming how systems, services, and everyday activities are experienced by users seeking game-like engagement. This approach has reshaped marketing practices, altered consumer behaviour, and substantially increased user participation (Feng et al., 2020). As a marketing instrument, gamification strengthens brand appeal, stimulates sales, and cultivates long-term customer loyalty (Lu & Ho, 2020). Although a growing body of reviews synthesises existing knowledge and maps out research gaps, most adopt qualitative methods, which constrains both replicability and breadth of coverage (Trinidad et al., 2021). Bibliometric studies, by contrast, offer a systematic and reproducible mode of analysis (Ahmi & Mohamad, 2019) and have been applied across disciplines ranging from management and medicine to education and computer science (Trinidad et al., 2021). The Gartner Emerging Technologies Hype Cycle traces the maturation of new technologies across five distinct phases (Gartner, 2023). Gamification entered the cycle in 2011 before sliding into the Trough of Disillusionment by 2014, and had disappeared from the cycle altogether by 2015, signalling either maturation or waning commercial interest (Gartner, 2015). Its re-emergence alongside the metaverse in the 2022 Gartner Hype Cycle, however, affirms its continued relevance. By incorporating immersive experiences and tracking technologies, the metaverse extends gamification's reach across education, entertainment, advertising, and health and fitness sectors (Statista, 2023).

Despite growing scholarly interest in the field, existing reviews remain largely qualitative in nature, which constrains both replicability and the breadth of coverage (Trinidad et al., 2021). Bibliometric approaches offer a more systematic and reproducible alternative (Ahmi & Mohamad, 2019), with demonstrated applicability across management, medicine, education, and computer science. This study addresses that gap by conducting a bibliometric analysis of gamification in healthcare, a domain where gamification has shown measurable benefits for user engagement (Bravo et al., 2021), learning outcomes (Allinjawi & Hussein, 2019), and health-related behaviours (Mocanu et al., 2023). To organise the analysis, this study adopts Context, Intervention, Mechanism, and Output (CIMO) logic (Denyer et al., 2008) as a structuring framework. This enables a systematic classification of gamification research according to the conditions under which interventions take place, the gamification approaches employed, the mechanisms they activate, and the outcomes they produce. Self-Determination Theory (SDT) (Ryan & Deci, 2000) further informs the analysis by surfacing the motivational mechanisms, both intrinsic and extrinsic, through which gamification interventions generate varying outcomes in healthcare settings.

This study makes three distinct contributions to the field. First, a CIMO-based architecture is developed to classify gamification interventions within healthcare research. Second, a bibliometric analysis is conducted to systematically map trends, identify key contributors, and reveal thematic clusters across the literature. Third, drawing on SDT and the proposed CIMO framework, the findings are synthesised to evaluate the efficacy of gamification interventions and to put forward theoretically grounded directions for future research and practice. The paper proceeds as follows. Section 2 reviews the theoretical background underpinning the study. Section 3 outlines the methodological approach. Section 4 presents the empirical results. Section 5 discusses the findings, including their theoretical and practical implications.

## Literature Review

The definition of "gamification" remains contested, varying considerably across contexts such as marketing, finance, health, and education (Schöbel et al., 2020). At its core, gamification refers to the application of game thinking and mechanics to modify user behaviour, enhance engagement, and address real-world problems through elements including competition, challenges, and social interaction (Zichermann & Cunningham, 2011). Game elements such as points, badges, leaderboards, levels, avatars, and feedback mechanisms provide a structured foundation for designing and understanding gamified systems (Zichermann & Cunningham, 2011; Lu & Ho, 2020), and are summarised in Table 1.

These game design elements collectively capture the components required to conceptualise and implement gamification (Zichermann & Cunningham, 2011; Al-Rayes et al., 2022; Ferro, 2021). Within the CIMO framework (Denyer et al., 2008), they function primarily as interventions that activate distinct motivational mechanisms, ultimately generating measurable outcomes. Viewed through the lens of SDT (Ryan & Deci, 2000), these interventions can be categorised according to the three core psychological needs they address, namely autonomy, competence, and relatedness, each associated with either extrinsic or intrinsic motivational pathways.

Progression-based mechanics such as levels, difficulty scaling, and progress bars reinforce the competence need by offering users tangible evidence of skill development and mastery (Sailer et al., 2017). Virtual currency systems, in turn, support autonomy by enabling self-directed decision-making within the gamified environment (Schöbel et al., 2020). Research suggests that the most effective gamification designs in healthcare tend to integrate both structural and narrative elements, activating multiple SDT needs rather than depending solely on extrinsic rewards. Excessive reliance on structural elements such as points and leaderboards risks eroding intrinsic motivation over time, a phenomenon known as the crowding-out effect (Deci et al., 1999), which underscores the theoretical case for balanced element design. Table 1 presents the key game elements alongside their theoretical alignment within this framework.

**Table 1. Gamification Elements**

Game element	Definition	SDT Need	Motivation type
Feedback	Providing information about the user's interaction	Competence	Intrinsic
Points	Values in the system or the game world	Competence	Extrinsic
Badge	Icons or visual markers can be awarded for performing actions or achieving objectives.	competence	Extrinsic
Rewards	A player receives rewards after completing a task or assisting another player.	competence	Extrinsic
Leader boards	Ranking among other users based on points	Relatedness	Extrinsic
Difficulty	A part of a player's journey may include various obstacles and challenges that they must overcome.	competence	Intrinsic
Levels	A way of providing a sense of progress to a player	competence	Intrinsic
Avatars	Representation of the player	Autonomy	Intrinsic
Status	Defines a player's hierarchal status within a world.	Relatedness	Extrinsic
Currency	Virtual or real currency that can be used to obtain items	Autonomy	Extrinsic
Timer	A way of limiting how long it takes a player to complete an objective.	competence	Extrinsic
Mission	Goal-directed tasks that guide player progression	Autonomy	Intrinsic
Social sharing	Sharing achievements within a community	Relatedness	Intrinsic

Game mechanics, the foundational components of gamification, are employed by designers to initiate and sustain gameplay through objective setting, rule definition, and feedback mechanisms (Lu & Ho, 2020). From an SDT perspective, structural elements such as points, badges, and leaderboards primarily activate extrinsic motivation by supplying external rewards and enabling social comparison, thereby addressing the psychological needs for competence and relatedness respectively (Ryan & Deci, 2000). Leaderboards, for instance, motivate players through competitive ranking in a cost-effective manner (Zichermann & Cunningham, 2011), while surprise points sustain engagement by rewarding users with unexpectedly high scores, reinforcing continued participation through unpredictable reinforcement schedules (Schöbel et al., 2020).

Narrative and social elements such as avatars, storytelling, quests, and social sharing, by contrast, are more closely associated with intrinsic motivation, addressing the SDT needs of autonomy and relatedness. Avatars allow players to express individual identity and exercise personal choice, thereby supporting a sense of autonomy (Schöbel et al., 2020), while storytelling cultivates emotional investment and imaginative engagement, producing experiences that resonate more deeply with users (Sailer et al., 2017). Social elements including community interaction and collaborative missions address the need for relatedness, sustaining long-term engagement through meaningful interpersonal connections (Oliveira et al., 2021). Recognising the potential of game-based engagement to attract and retain consumers, many companies have incorporated gamification into their marketing and branding strategies. This

approach is intended to capture consumer attention and maintain sustained engagement over time (Oliveira et al., 2021). By embedding game elements into digital platforms such as social media, mobile banking, travel websites, and fitness applications, businesses can strengthen customer relationships and foster long-term loyalty (Qian et al., 2023). Evidence further suggests that gamification strategies enhance market efficiency within consumer service contexts (Hsu & Chen, 2018). Against this backdrop, the present study aims to map the evolution of gamification research over time through two lines of inquiry: a descriptive analysis identifying influential authors, institutions, and publications; and conceptual structure analysis tracking research trends and developments. Table 2 outlines the corresponding research questions and their justifications.

**Table 2. Research Questions**

<b>Descriptive Analysis</b>	<b>Description</b>	<b>Type of Analysis</b>
RQ1. What is the current state of publication on gamification research?	This question aims to establish a foundational understanding of the landscape of gamification research.	Document type, subject area, and source type
RQ2. What are the trends of publications that can be observed in gamification studies?	This question seeks to identify temporal trends in gamification research publications.	Publication by year
RQ3. Who are the most productive authors in the field of gamification?	This question focuses on identifying key researchers contributing significantly to the field.	Publication by author
RQ4. Which journals or sources are at the centre of ground-breaking gamification research?	This question identifies the core journals or sources publishing influential gamification research.	Publication by source title
RQ5. Which are the most highly cited articles in gamification research?	This question highlights the most influential articles based on citation counts.	Highly cited articles
RQ6. What are the most productive countries and institutions in gamification?	This question assesses the geographical and institutional distribution of gamification research output.	Publication by institution and country
<b>Conceptual Structure Analysis</b>		
RQ7. What is the research front in the gamification field?	This question aims to identify emerging themes and hot topics within gamification research.	Co-occurrence of author's keywords
RQ8. What research has evolved in the gamification field?	This question examines how research themes have developed and evolved.	Thematic map, thematic evolution, and factorial analysis

## Methods

This study employs bibliometric analysis to examine the research landscape, mapping the distribution patterns of scholarly articles on a given topic across a defined time period (Cooper, 2022). Bibliometrics offers a versatile analytical lens, enabling researchers to evaluate the performance of articles and journals, identify collaboration networks, track emerging research trends, and examine domain-specific knowledge structures (Donthu et al., 2021). To investigate the gamification literature, this study retrieved publications with "gamification" in their titles from the Scopus database, following the search protocol illustrated in Figure 1 (adapted from Zakaria et al., 2021). Following a systematic process of cleaning, standardisation, and deduplication using OpenRefine and biblioMagika, a final corpus of 5,240 publications was retained for analysis. Visualisation and interpretation of the data were carried out using OpenRefine, biblioMagika, VOSviewer, and Biblioshiny.

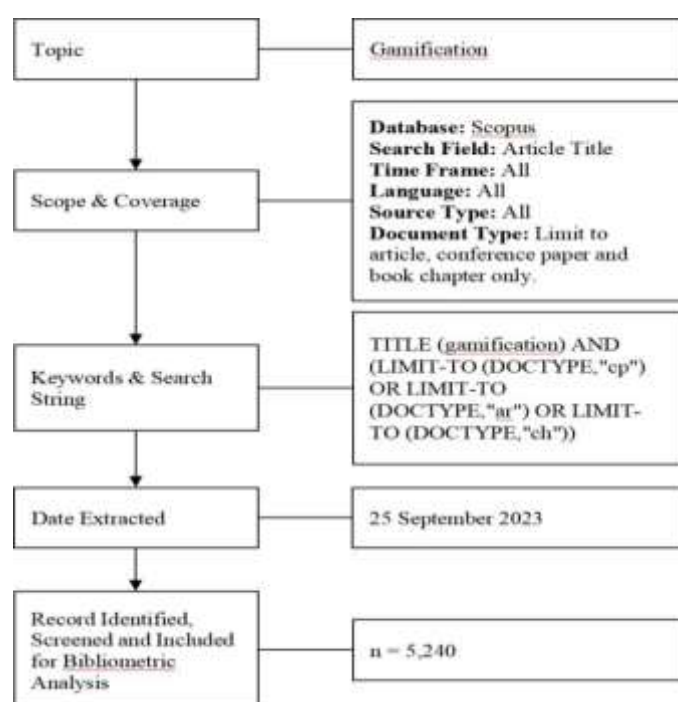


Figure 1. Flow Diagram of the Search Strategy.

## Results

### Current State of Publication

To address the first research question, this study examined the distribution of publications across three dimensions: literature type, subject area, and source type. Citation patterns were also analysed to assess the broader influence of gamification-related scholarship. As shown in Table 3, conference papers constitute the largest share of the corpus at 50.52%, followed by journal articles at 41.58%, with book chapters accounting for the remaining 7.9%. Table 4 presents the distribution across five source types, revealing that journals are the most prevalent category (41.49%), followed by conference proceedings (38.40%), while industry journals represent the smallest share at just 0.19%.

**Table 3. Document Type**

Document Type	Total Publications	Percentage (%)
Article	2179	41.58
Conference Paper	2647	50.52
Book Chapter	414	7.90
Total	5240	100.00

**Table 4. Source Type**

Source Type	Total Publications	Percentage (%)
Journals	2174	41.49
Conference Proceedings	2012	38.40
Book Series	702	13.40
Books	341	6.51
Trade Journal	10	0.19
Undefined	1	0.20
Total	5240	100.00

The literature was further classified by disciplinary field (Table 5), underscoring the inherently interdisciplinary character of gamification research. The primary contributing domains are social sciences (36.51%), engineering (25.19%), mathematics (13.32%), and business and management (11.85%). While computer science accounts for the largest single share at 63.63%, the findings reveal that gamification research extends well beyond this discipline, spanning fields as varied as medicine, environmental science, and chemical engineering.

**Table 5. Subject Area**

Subject Area	Total Publication	Percentage (%)
Computer Science	3334	63.63
Social Sciences	1913	36.51
Engineering	1320	25.19
Mathematics	698	13.32
Business, Management and Accounting	621	11.85
Decision Sciences	397	7.58
Medicine	343	6.55
Arts and Humanities	230	4.39
Psychology	230	4.39
Economics, Econometrics and Finance	173	3.30
Physics and Astronomy	135	2.58
Energy	132	2.52
Environmental Science	122	2.33
Health Professions	111	2.12
Materials Science	73	1.39
Nursing	48	0.92
Chemical Engineering	45	0.86
Biochemistry, Genetics and Molecular Biology	39	0.74
Multidisciplinary	34	0.65

Earth and Planetary Sciences	33	0.63
Neuroscience	29	0.55
Chemistry	25	0.48
Agricultural and Biological Sciences	23	0.44
Pharmacology, Toxicology and Pharmaceutics	10	0.19
Immunology and Microbiology	4	0.08
Dentistry	3	0.06
Veterinary	1	0.02
Undefined	1	0.02

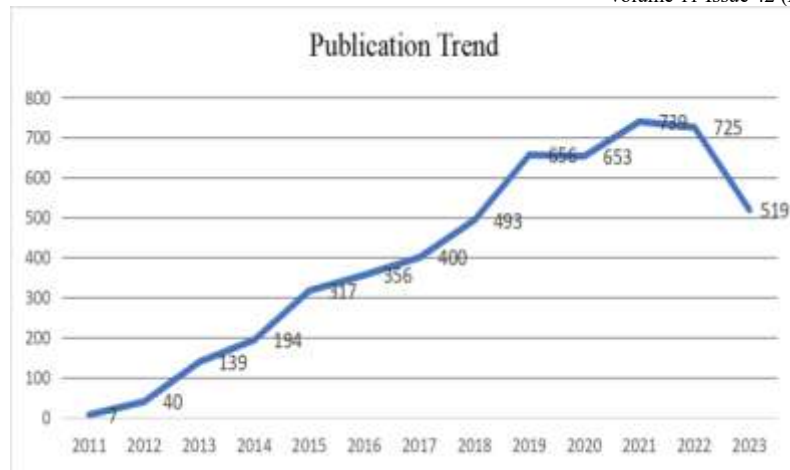
Table 6 illustrates the academic impact of gamification research. An average of 15.89 citations per paper and 6,404.38 citations per year collectively attest to the sustained and growing influence of the field. The data also points to a collaborative research culture, with an average of 3.26 authors per paper, suggesting that gamification scholarship is increasingly pursued through joint scholarly efforts rather than individual inquiry.

**Table 6. Citation Metrics**

Main Information	Data
Publication Years	2011 - 2024
Total Publications	5240
Citable Year	14
Number of Contributing Authors	17063
Number of Cited Papers	3857
Total Citations	83,257
Citation per Paper	15.89
Citation per Cited Paper	21.59
Citation per Year	6404.38
Citation per Author	4.88
Author per Paper	3.26
Citation sums within h-Core	55,496

### ***Publication Trends***

To address the second research question on what emerging trends can be observed in the gamification field, this study traces the developmental trajectory of gamification research over time. Figure 2 presents the annual publication output, yielding several notable insights. The earliest recorded publication in this domain dates to 2011, after which the field experienced sustained and rapid growth throughout its first decade, with publication volumes rising consistently between 2011 and 2021.



**Figure 2. Publication Trend**

### *Publication by Author*

In response to the third research question, ‘Who are the most influential authors in the field of gamification?’. This study analysed the ten most influential authors in the field. As shown in Table 7, the most productive author is Juho Hamari. He is affiliated with Tampere University. Hamari has the most papers cited with 8607, followed by Nacke (6752), Koivisto (4739) and Landers (1318). This comprehensive analysis provides insight into each author's research performance, particularly in terms of productivity and influence in the gamification field.

**Table 7. Productive Authors**

Full Name	Current Affiliation	TP	TC
Hamari, Juho	Tampere University	57	8607
Isotani, Seiji	University of Sao Paulo	37	921
Nacke, Lennart	University of Waterloo	28	6752
Toda, Armando M.	University of Sao Paulo	25	440
Gasca-Hurtado, Gloria Piedad	Universidad Medellin	20	99
Gasparini, Isabela	Santa Catarina State University	19	359
Oliveira, Wilk	Tampere University	16	234
Klock, Ana C.	Tampere University	16	339
Korn, Oliver	Offenburg University	15	348
Rodrigues, Luiz	University of Sao Paulo	14	147

### *Publication by Source Title*

To address the fourth research question on which journals and publications occupy a central position in ground-breaking gamification research, Tables 8 and 9 present a breakdown of key source titles across journals and conference proceedings. Among conference venues, Lecture Notes in Computer Science records the highest total publications (TP = 303), establishing it as a leading outlet for gamification scholarship, alongside a notably high total citation count (TC = 2,698). The ACM International Conference Proceeding Series ranks second with a TP of 207. Particularly noteworthy is the Proceedings of the Annual Hawaii International Conference on System Sciences, which achieves a remarkably high TC of 3,447 despite a comparatively modest publication count, suggesting that a small number of highly influential works can exert

a disproportionate impact on the research community. Taken together, these metrics offer meaningful insight into the relative influence and significance of different source titles within the gamification literature.

**Table 8. Most Active Source Titles based on Journals**

Source Title	TP	TC	Category
Communications in Computer and Information Science	101	577	Computer science
Advances in Intelligent Systems and Computing	89	545	Computer science
Lecture Notes in Networks and Systems	50	63	Computer network and communication
Sustainability (Switzerland)	44	754	Computer networks and Communication
International Journal of Emerging Technologies in Learning	36	699	Education

**Table 9. Most active Source Titles based on Conference**

Source Title	TP	TC	Category
Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	303	2698	Computer science
ACM International Conference Proceeding Series	207	2506	Human-Computer interaction
CEUR Workshop Proceedings	146	497	Computer science
Proceedings of the Annual Hawaii International Conference on System Sciences	57	3447	Engineering
Proceedings of the European Conference on Games-based Learning	56	385	Human-Computer interaction

**Highly Cited Document**

Addressing Question 5, ‘Which are the most highly cited articles?’ among the 5240 studies, the most cited articles are selected. As organised in Table 10, The most influential paper is "From Game Design Elements to Gamefulness: Defining 'Gamification'" by Deterding et al. (2011), which has received 4,702 citations, establishing a foundational definition of gamification. Following this, Hamari et al. (2014)'s literature review, "Does Gamification Work? - A Literature Review of Empirical Studies on Gamification", ranks second with 2,592 citations, providing a comprehensive synthesis of empirical research on gamification effectiveness.

**Table 10. Articles Ranked by Citation**

Author(s)	Title	Cites
Deterding, Dixon, et al. (2011)	From game design elements to gamefulness: Defining "gamification"	4702
Hamari et al. (2014)	Does gamification work? - A literature review of empirical studies on gamification	2592
Seaborn & Fels (2015)	Gamification in theory and action: A survey	1360
Deterding, O'Hara, et al. (2011)	Gamification: Using game design elements in non-gaming contexts	1119
Dicheva et al. (2015)	Gamification in education: A systematic mapping study	995
Hanus & Fox (2015)	Assessing the effects of gamification in the classroom: A longitudinal study on intrinsic motivation, social comparison, satisfaction, effort, and academic performance	979
Sailer et al. (2017)	How gamification motivates: An experimental study of the effects of specific game design elements on psychological need satisfaction	865
Koivisto & Hamari (2014)	Demographic differences in perceived benefits from gamification	542
Simões et al., (2013)	A social gamification framework for a K-6 learning platform	515
Huotari & Hamari (2017)	A definition for gamification: anchoring gamification in the service marketing literature	514

**Publication by Institution**

Addressing the question, ‘What are the most influential and active countries and institutions in gamification?’ the most ten active institutions in the field of gamification are shown in Table 11. Bina Nusantara University (BINUS) tops the list with the highest TP (64), demonstrating its strong position in gamification. Bina Nusantara University is followed by Tampere University (47) and the University of Sao Paulo (37). Tampere University stands out with the highest number of citations and collaborations. This reflects its significant global impact.

**Table11. Most Productive Institutions**

Institution Name	Country	TP
Bina Nusantara University	Indonesia	64
Tampere University	Finland	47
University of Sao Paulo	Brazil	37
University of Monterrey	Mexico	35
Universiti Teknologi Malaysia	Malaysia	32
University of Granada	Spain	30
Queensland University of Technology	Australia	30
Universiti Teknologi MARA	Malaysia	30
University of Waterloo	Canada	28
Universiti Kebangsaan Malaysia	Malaysia	26

**Publication by Countries**

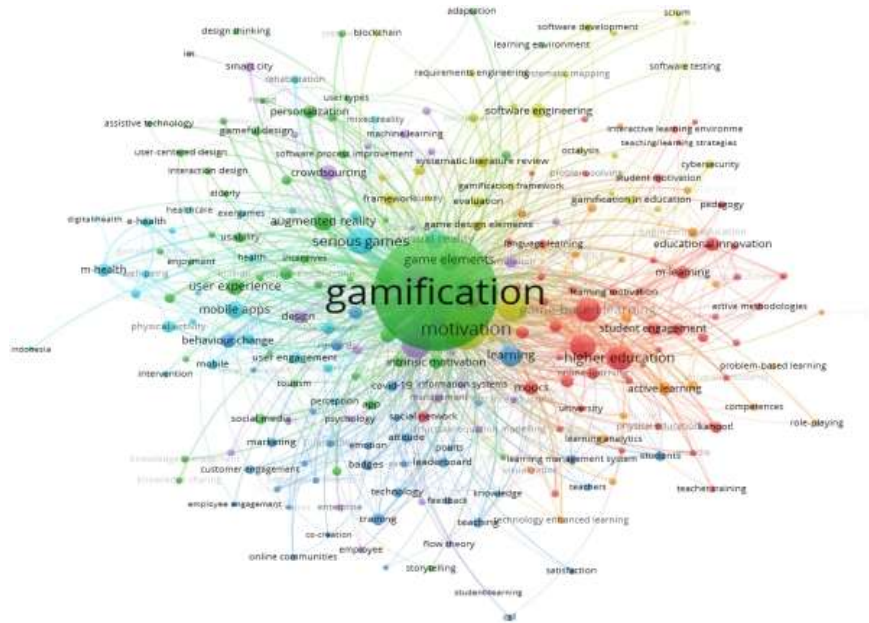
Table 12 presents the most influential countries in gamification research. The United States emerges as the dominant research hub, leading in total publications (TP = 617) and recording a total citation count (TC = 15,158) that reflects its considerable reach and influence within the global scientific community. Spain and Germany similarly demonstrate strong overall research impact, while the United Kingdom and Indonesia contribute notable publication output to the field.

**Table 12. Top 10 most Productive Countries**

Country	TP	TC
United States	617	15158
Spain	499	7364
Germany	451	13052
United Kingdom	329	12438
Indonesia	286	1255
Brazil	261	2344
China	221	2100
Malaysia	216	1516
Portugal	192	3122
Italy	184	2042

**Co-occurrence Analysis of Author’s Keywords**

This study employed VOSviewer (van Ech, N.L & Waltman, 2014) to construct a co-occurrence network of author keywords, and Biblioshiny (Aria & Cuccurullo, 2017) to conduct a complementary thematic analysis. Together, these tools facilitated a detailed examination of the field's evolution and prospective research directions (Bajaj et al., 2022). The dataset comprised 7,894 author keywords in total. To isolate the most substantively significant terms, a minimum occurrence threshold of ten was applied, yielding 241 keywords that were subsequently organised into seven distinct clusters, as illustrated in Figure 3.



**Figure 3. Network Visualisation of the Author’s Keywords**

Education (cluster1): Cluster 1 centres on educational innovation, encompassing active, cooperative, and digital game-based learning facilitated through platforms such as Kahoot! and Moodle. Research within this cluster examines how these approaches enhance problem-solving, pedagogical practice, collaboration, and self-paced learning. Despite the recognised benefits of game-based learning, concerns persist regarding the sustainability of its effects over time. Sanchez et al., (2020) contend that gamification tends to be effective for short-term tasks but may struggle to sustain engagement in the longer term, particularly among lower-achieving students. This points to a clear need for longitudinal studies capable of assessing the lasting impact of gamification in educational settings. The prominence of keywords such as "teacher training" and "teacher education" within this cluster further highlights the importance of equipping educators with adequate digital competence. Sampedro-Martín et al., (2023) assert that initial teacher training programmes should integrate gamification and technological innovation as core components, with a view to fostering critical thinking and eco-social education. Such preparation is considered essential for the successful and sustained adoption of these approaches in practice.

Gamification Design and Experience (cluster 2): Cluster 2 encompasses 49 items, highlights gamification, including game design, mechanics, and elements, with emphasis on user-centered design, personalization, and self-determination theory. Digital badges play a key role in education, particularly in nursing, by enhancing engagement and skill recognition (Swacha, 2021). Studies examine gamification's effectiveness in organisational social networks (Oprescu et al., 2014), mobile communication (Bouca, 2012), and game-based learning (Kim & Lee, 2012). Pivec & Hsu, (2020) focus on gamification's role in sustainability. Jun et al., (2020) analyse its impact on customer participation in social value co-creation, while Encarnação et al., (2021) explore enterprise gamification adoption. Personality traits influence gamification preferences: extroverts favour points, levels, and leaderboards, whereas those high in openness show less interest in avatar-based incentives (Buckley & Doyle, 2016). Simionescu et al., (2017) highlight gamified student assessment, using automated evaluation to enhance accuracy and critical thinking, grounded in Self-Determination Theory (van Roy & Zaman, 2019). Gamified learning often supports knowledge management and sharing (Quecano, 2022).

Behaviour Change and Sustainability (cluster 3): Cluster 3 explores motivational elements in fostering sustainable behaviour and organisational innovation during the COVID-19 pandemic. It examines gamification's role in behaviour change, learning, and sustainability, emphasising learning management systems, technology, and meaningful gamification to boost engagement and performance. Studies highlight gamification's impact on student motivation in online learning. Azar & Tan, (2020) found that the gamification catalysis framework enhanced motivation, while Marisa et al., (2020) showed that goal setting and feedback improved engagement and intrinsic motivation. Gamification also aids crisis communication. Spanellis et al., (2021) used participatory design to align traditional beliefs with medical advice, building trust and encouraging preventive measures. Sustainability is another focus. Prakash & Manchanda, (2021) Integrating Gamification into Economic, Social and Environmental Sustainability for Participation and Shifting Attitudes.

Teaching and Motivation (Cluster 4): Teaching and Motivation (Cluster 4): This cluster (29 projects) focuses on education, motivation and systematic literature review. It explores pedagogical approaches including gamification, game design and assessment, as well as key themes such as framing, experimentation, collaboration and teamwork. In addition, software

engineering education, methodology and project management appear in this group, highlighting the use of gamification in improving educational outcomes. Gamified interactions enable psychological needs to be met and as well as enhance autonomous motivation and promote user engagement (Bravo et al., 2021). In marketing, companies integrate gamification into mobile applications to enhance the digital experience. Merhabi et al., (2021) identified four gamification-driven co-creation activities: customer service, insight sharing, word-of-mouth promotion, and random tasks. Blockchain's presence in this cluster reflects its role in gamification. The pandemic underscored the need for reliable online product information, yet consumer scepticism persists. D'Apice et al., (2021) proposed a model using permissioned blockchains for supply chain management and permissionless blockchains for consumer feedback. Social gamification mechanisms enhance engagement, fostering trust and community status.

**Technology and Engagement (cluster 5):** This cluster (29 items) focuses on technology and engagement, covering AI, computer science, design, e-commerce, and games. It examines user engagement through flow theory, the technology acceptance model, and interaction, with key themes like data mining, IoT, machine learning, smart cities, and student learning. The goal is to explore technology's role in enhancing engagement and optimizing systems. AI and gamification are of particular interest (Faghihi et al., 2017). Yordanova, (2020) discusses how gamification can support AI's impact on industries and human behaviour. This group of studies also explores the use of gamification in smart cities (Rebelo et al., 2020) and accessible systems (Jadán-Guerrero et al., 2023).

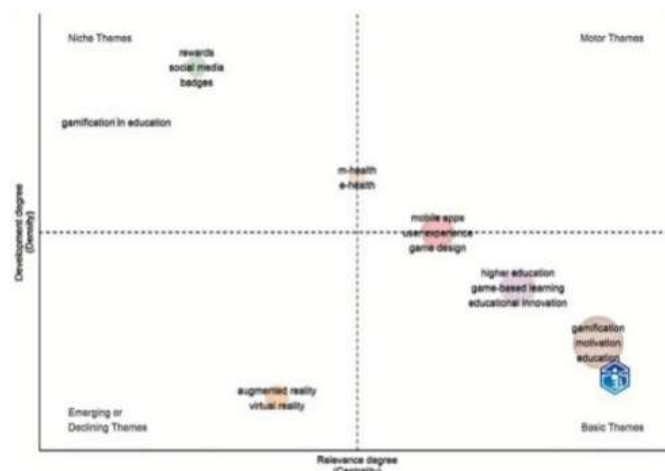
**Health and Well-being (cluster 6):** Health and Well-Being (Cluster 6): This cluster (27 projects) concentrates on health enhancement, focusing on improving physical and mental health through e-health technologies. It explores the use of gamification in mobile apps, virtual reality to increase user engagement and improve health outcomes. Gamification is increasingly being used in healthcare, including medical education, interventions and promoting physical activity (Ryu et al., 2018; Goel et al., 2021). For example, gamified pre-surgical processes can help reduce anxiety in children through immersive experiences (Ryu et al., 2018). Interventions based on virtual coaching can adjust the level of play according to the user's health status, leading to increased motivation and cognitive engagement (Mocanu et al., 2023). This group of studies also included perception, engagement and self-efficacy and examined the health benefits of gamification. Gamification elements in fitness apps have increased engagement and competition mechanisms (Feng et al., 2020).

**Learning strategy (cluster 7):** This research group (20 projects) has studied how to enhance learning engagement and effectiveness through proactive, adaptive, collaborative, and problem/project-based learning strategies. Research shows that gamification can enhance listening, comprehension and problem-solving abilities (O'Donovan et al., 2013), and when combined with active blended learning, it promotes skill development without affecting learning outcomes (Lameras & Moumoutzis, 2015). Some studies suggest that gamified courses may reduce intrinsic motivation and satisfaction, but academic performance still depends on students' motivation (Hanus & Fox, 2015). Combining gamification with the Inquiry-based Community (COI) framework can enhance the participation in programming courses (Azmi et al., 2017). In adaptive learning, e-learning systems that integrate gamification and visualization tools can customize content based on students' backgrounds and interests, enhancing engagement, collaborative learning, and computational thinking (Allinjawi & Hussein, 2019). In addition, the co-occurrence network analysis of gamification research

reveals core concepts and themes, providing an important reference for understanding trends and identifying research gaps.

### *Thematic Map of the Author's Keywords*

The thematic map, based on relevance and development, comprises four quadrants: (1) Driving themes—highly relevant, well-developed with strong momentum; (2) Niche themes—mature with significant momentum but less central to mainstream research; (3) Emerging or declining themes—less developed, still evolving; (4) Essential themes—developing but lacking a strong core. Figure 4, generated via Bibliometrix R, illustrates these themes and their connections within gamification research. Our analysis reveals seven clusters representing different areas of research in gamification. These can be described using keywords and their central metrics.

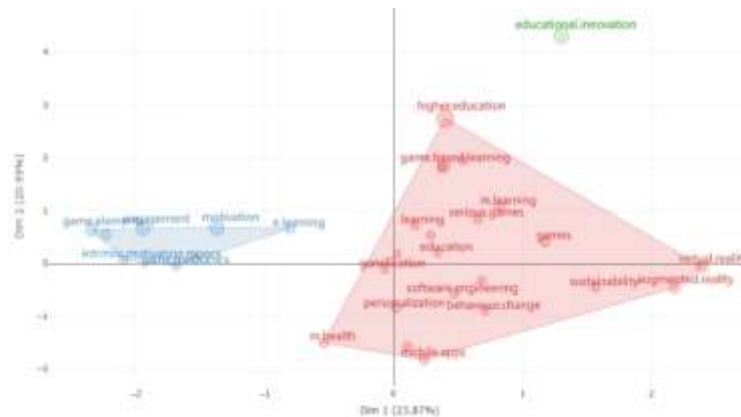


**Figure 4. Thematic Map in Gamification Research**

Cluster 1 (Mobile apps) highlights the integration of user experience and game design to create engaging, functional apps. Cluster 2 (Rewards) focuses on social media and badges as incentives to motivate participation. Cluster 3 (Higher education) represents foundational themes like game-based learning and educational innovations, central to contemporary pedagogy. Cluster 4 (Augmented/Virtual reality) covers emerging technologies with potential for innovative applications in education, training, and entertainment. Cluster 5 (Gamification) emphasizes established game-based strategies to enhance student motivation and learning outcomes across educational levels. Cluster 6 (Gamification in education) underlines motivation and engagement as essential elements, showing how game design boosts intrinsic and extrinsic motivation. Cluster 7 (mHealth) reflects an emerging field using mobile devices to support healthcare, patient engagement, and remote monitoring. Overall, the map illustrates current research foci and future directions in gamification.

### *Factorial Analysis*

Factor analysis explores keyword relationships in gamification research using thematic maps. Multiple Correspondence Analysis (MCA) simplifies these connections, revealing hidden themes and patterns in keyword co-occurrences. This method enhances understanding by highlighting significant correlations, aiding future research and gamification strategies. MCA-generated word maps provide alternative interpretations, as shown in Figure 5.

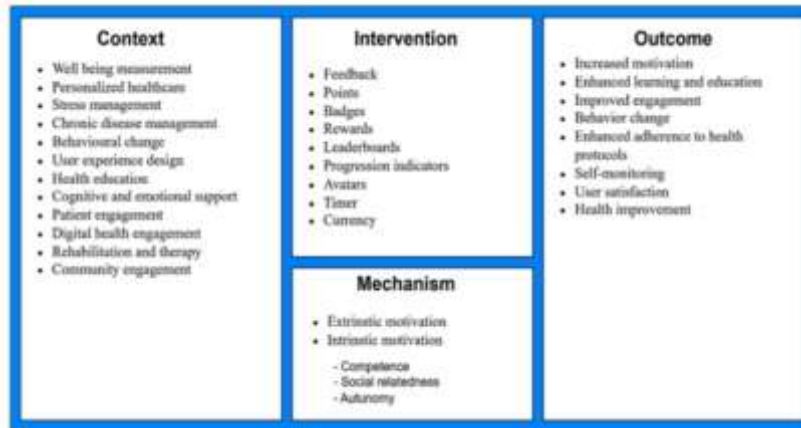


**Figure 5. Co-word Map**

The three primary clusters identified in the analysis represent distinct thematic orientations within gamification research. The red cluster reflects well-established research themes, encompassing the role of gamification across education, society, and learning. This includes higher education, game-based and mobile learning, serious gaming, technology integration, virtual and augmented reality, personalisation, behavioural change, sustainability, and marketing (Green & Hannon, 2007; Buckley & Doyle, 2016; Lu & Ho, 2020). The blue cluster centres on core design considerations, with particular attention to usability, user experience, and sustained engagement, addressing practical concerns such as interface simplification and the facilitation of meaningful interaction (Deterding et al., 2011; Lu & Ho, 2020). The green cluster, by contrast, highlights niche and emerging themes in educational innovation, foregrounding new pedagogical approaches, technology integration, teacher training tools, and online learning resources, with an emphasis on improving learning outcomes and surfacing underexplored research directions (Sampedro-Martín et al., 2023; Green & Hannon, 2007; Landers & Callan, 2011).

### ***Content Analysis***

This study used the CIMO framework proposed by Denyer et al., (2008) to synthesize the findings of the literature review. Given that gamification is an emerging field, the CIMO framework is particularly well suited to explore the impact and application of gamification in this field (Abril et al., 2024). Figure 6 shows the CIMO framework used in this study, the components of which are discussed in detail in the next section.



**Figure 6. CIMO Framework**

**Context:** Research to individuals, relationships, institutions, and medical care system as the centre (Padilha et al., 2022). The main goal is to improve the quality of life of individuals by providing personalized health care services. Involves addressing key areas such as well-being measurement, stress management, health education and behaviour change to create user-centered care solutions. **Intervention:** Gamification intervention is increasingly being used in healthcare to promote behavioral change and achieve health goals. By combining elements such as points and badges, gamification can enhance players' stickiness, enthusiasm and compliance with health protocols (Zichermann & Cunningham, 2011; Ferro, 2021). Gamification tools typically provide personalized feedback and real-time progress tracking, and support self-monitoring and proactive health management (Lewey et al., 2022). Integrating community-based features such as social connections and collaborative challenges can further increase participation, reduce isolation, and promote shared responsibility for health outcomes (Cheng et al., 2019).

**Mechanism:** The design of gamification intervention starts with the expected goals, which determine the intervention methods and the adopted mechanisms (Deterding, 2019; Landers, 2014). Understanding these design mechanisms is crucial for evaluating the applicability of gamification. According to the SDT (Deci & Ryan, 1985), an individual's participation stems from both intrinsic and extrinsic motivations. Intrinsic motivation stems from the satisfaction of ability, autonomy and social connections. For example, badges can enhance the sense of competence, meaningful choices promote autonomy, and community interaction strengthens social connections (Sailer et al., 2014). Extrinsic motivation relies more on rewards and feedback. Emotional mechanisms can also reduce negative emotions (such as worry about failure) and enhance positive emotions (such as pleasure and empathy). Furthermore, cognitive mechanisms further drive motivation through goal orientation and a sense of mastery (Sailer et al., 2014; Shi et al., 2017).

**Outcome:** The effects of implementing gamified interventions in healthcare represent outcomes (Abril et al., 2024). Gamification in healthcare aims to enhance patient engagement and adherence to health protocols, ultimately improving health outcomes. For example, gamification platforms enable personalized healthcare by tailoring interventions to individual needs, such as fitness goals, chronic disease management, and mental health support. These personalized approaches improve the quality of care and ensure that interventions are tailored to the patient (Lewey et al., 2022). Gamification also enhances healthcare delivery by promoting sustained behavioral change through mechanisms such as rewards and progress

indicators. Gamification reduces complications and improves the long-term effectiveness of interventions through personalized health solutions (Zhao et al., 2020). These results not only improve patient satisfaction, but also help build sustainable and effective healthcare systems (Pannese et al., 2016).

## Discussion

This bibliometric

review of 5,240 documents broadens the existing body of knowledge on gamification in healthcare, drawing on Scopus data processed through bibliMagika (Ahmi, 2024), VOSviewer (van Ech, N.L & Waltman, 2014), and Biblioshiny (Aria & Cuccurullo, 2017). First, output in the field expanded rapidly between 2011 and 2021, with conference papers accounting for the largest share of publications, a pattern consistent with gamification's applied and fast-moving research culture. Contributions cut across computer science, social sciences, and engineering, yet healthcare disciplines such as medicine and health professions remain markedly underrepresented, pointing to a clear opening for cross-disciplinary work. Juho Hamari of Tampere University stands out as the field's most productive scholar; Bina Nusantara University leads on institutional output, and the United States dominates at the country level. Among journals, *Computers in Human Behavior* claims the highest citation density, accounting for five of the field's most cited articles, while *Lecture Notes in Computer Science* tops conference proceedings by volume (303 publications).

Co-occurrence keyword analysis reveals seven thematic clusters that together map the intellectual boundaries of gamification research. Education (Cluster 1) is the field's dominant application domain, reflecting its deepest scholarly roots and the largest concentration of cumulative research effort. Gamification Design and Experience (Cluster 2) captures the theoretical and methodological core of the field, with Self-Determination Theory appearing as a consistently applied analytical framework across studies. Behaviour Change and Sustainability (Cluster 3) and Teaching and Motivation (Cluster 4) jointly address the motivational and behavioural dimensions of gamification across organisational, educational, and health-related settings. Cluster 5, Technology and Engagement, reflects the field's growing convergence with artificial intelligence, the Internet of Things, and smart systems. Health and Well-being (Cluster 6), though the smallest cluster at 27 items, represents a strategically significant frontier whose modest size speaks more to untapped potential than to limited relevance. Learning Strategy (Cluster 7) rounds out the map, affirming gamification's continued value in adaptive and personalised educational design. The pronounced size gap between education-centred clusters and the health cluster makes one point difficult to ignore: gamification's application in healthcare is still in its early stages, and the gap between what the field has achieved and what it could offer to clinical and public health contexts remains wide open for future investigation.

The evolution of gamification research can be categorized into three pivotal phases: the foundational period (2011–2015), which focused on conceptual definition and the establishment of systematic evaluative frameworks; the application period (2016–2020), characterized by a shift toward empirical studies in e-health and software engineering education; and the deepening period (2021–2023), where research priorities migrated toward personalization, serious games, and mobile health (mHealth). Thematic mapping reveals that mobile applications have emerged as a core driving theme, while gamification in education has reached research maturity. Notably, the robust growth of mHealth positions it not only as a central research focus but as a potential paradigm setter for the next decade of gamification

inquiry. This study integrates the CIMO framework and Self-Determination Theory to reveal that healthcare gamification succeeds only when it satisfies the basic psychological needs for competence, autonomy, and relatedness. While context-aware designs enhance patient adherence, a critical tension remains: most systems prioritize short-term extrinsic rewards (points/rankings) over the intrinsic drivers (narrative/social) required for long-term behavior change. To evolve, the field must transition from capturing brief attention to fostering durable health habits. This requires a strategic shift toward narrative-driven models, AI personalization, and deep collaboration between clinicians, behavioral scientists, and game designers.

### ***Theoretical Implications***

Gamification research has attracted great interest from various sectors, including academia, IT companies, and educational and research institutions. This is the first document to systematically identify gamification research's knowledge structure and outcomes on a global scale without limiting the language in which articles are published. Academics can use this to increase their comprehension of the different paradigms that advance the interdisciplinary field of gamification studies. Current researchers can enhance their knowledge of research gaps, frontiers, and potential topics in this context. Using factorial analysis, the study identified broad themes such as behavior change, game-based learning, motivation, educational technology, and user experience. These thematic frameworks facilitate comprehension of the principal research trajectory and establish the basis for forthcoming inquiries. This process enhances the foundation of the gamification field's theoretical framework.

### ***Practical Implications***

This research project employs scientometrics to investigate and analyse gamification studies within academic settings. Nevertheless, the findings of the current research have significant relevance for practitioners, who can benefit from them in various ways. In particular, it offers an opportunity to reinforce the retention of knowledge about the subject of gamification research. Organisers (e.g., managers of businesses and schools) could potentially find benefit from the results of this research by gaining a deeper understanding of the behavioural intentions of their stakeholders. As gamification is frequently optimized with user experience and engagement, managers may find the results of this research beneficial in better understanding their customers (Schöbel et al., 2020). The results of our investigation indicate that gamification deserves further research on a global scale. Organizations studying the impacts of gamification need to consider relevant research findings. In conclusion, our network analysis can facilitate collaborations that generate value between organizations in developing and developed countries.

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