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Play, Learn, Grow: A Decade of Insights into Gamified Socio-Emotional Learning

Lim Seong Pek*, **Fatin Syamilah Che Yob**, **Venoth Nallisamy**
INTI International University
Negeri Sembilan, Malaysia

Rita Wong Mee Mee
National Defence University of Malaysia
Kuala Lumpur, Malaysia

Jun S Camara
Pangasinan State University
Pangasinan, Philippines

Choiril Anwar
Universitas Islam Sultan Agung
Semarang, Indonesia

Abstract. Gamified socio-emotional learning (SEL) is a new paradigm in education that incorporates game-based techniques to promote prosocial behavior, emotional intelligence, and student engagement. This study's goal is to examine the state, patterns, and thematic evolution of gamified SEL research from an interdisciplinary standpoint. This was accomplished through the use of performance analysis, co-citation analysis, and co-occurrence analysis in a bibliometric analysis. Based on predetermined search parameters, 122 peer-reviewed papers from the Scopus database were retrieved. VOSviewer was used for network mapping and visualization. The papers were published between 2015 and 2024. According to the findings, psychology, education, and human-computer interaction are the main fields contributing to research on gamified SEL. Digital treatments for neurodivergent learners, prosocial behavior, and emotional regulation are given special attention. Digital involvement through serious games, emotional-cognitive aspects of learning, and developmental psychology were the three main study clusters found by co-citation and co-occurrence analysis. According to this study, gamified SEL has a great deal of promise to help achieve Sustainable Development Goals (SDGs) 3 and 4 by fostering inclusive,

*Corresponding author: Lim Seong Pek, *seongpek.lim@newinti.edu.my*

stimulating, and cognitively uplifting learning settings. To assure fair and moral implementation in a variety of educational contexts, investigate long-term effects, and fortify theoretical frameworks, more research is required.

Keywords: emotional intelligence; digital interventions; mental wellbeing; adaptive gamification; student engagement

1. Introduction

Integrating gamification into teaching methods has attracted a lot of interest lately as a revolutionary way to improve learning outcomes and student engagement. According to Deterding et al. (2011), gamification— the use of game design elements outside of games—has gained popularity in a variety of educational fields as a way to inspire students, encourage teamwork, and produce immersive learning environments. Recent studies have confirmed that gamification significantly enhances student motivation, engagement, and learning outcomes (García-López et al., 2023).

Among its many applications, gamified socio-emotional learning (SEL) has demonstrated promise in addressing the growing need for students to enhance their academic knowledge while also developing their social and emotional intelligence. Socio-emotional learning, which encompasses the growth of self-awareness, self-management, social awareness, relationship skills, and responsible decision-making, is becoming a more significant component of holistic education (CASEL, 2020). However, traditional SEL interventions often struggle to sustain student engagement and ensure that these skills are applied effectively in real-world scenarios. Researchers and educators are now looking into innovative techniques like gamification to make SEL more engaging, dynamic, and effective (Maryana et al., 2024).

Global assessments show notable implementation gaps despite growing understanding of the significance of SEL. UNESCO (2023) reports that systematic and long-lasting SEL programs are absent from over 60% of schools worldwide. Furthermore, according to the OECD (2022), teachers in more than 40% of the nations polled say that a significant obstacle to successful SEL integration is a lack of training. The post-pandemic spike in teenage mental health problems—characterized by a 25% rise in anxiety and depression rates globally—exacerbates these worries (WHO, 2022). This escalating issue highlights the pressing need for creative strategies like gamification to foster students' emotional growth and resilience.

The importance of socioemotional learning in education cannot be overstated. Research has repeatedly demonstrated that SEL programs improve students' emotional well-being, behavioral issues, and academic performance (Zong & Yang, 2025). With rapid technological advancement and increasing social complexity, the ability to control emotions, build healthy relationships, and make moral decisions is more crucial than ever. However, despite the proven benefits of SEL, its implementation in classrooms is often hindered by issues such as low

student motivation, a lack of instructional time, and inadequate teacher preparation (Wu, 2023). These challenges show how innovative methods are needed to successfully integrate SEL into the curriculum while keeping students interested and promoting long-term engagement (Chung & Pan, 2023).

Gamification offers a fresh solution to these issues by harnessing the intrinsic motivational potential of games to create engaging and dynamic learning experiences. By adding elements like points, badges, leaderboards, challenges, and stories, gamification plays to students' natural desire for achievement, competition, and teamwork (Sailer & Homner, 2020). The application of gamification in SEL can transform abstract concepts such as empathy, self-control, and conflict resolution into tangible, achievable behaviors that students can practice in a safe environment. For instance, role-playing games can simulate real-world social settings, allowing students to experiment with different responses and think about their emotional and social ramifications. Similarly, cooperative games can enhance teamwork and communication, while competitive elements can motivate students to set and achieve their own goals (Yuliana & Palumian, 2023).

A thorough assessment of how the topic is developing at the nexus of education, psychology, and technology is lacking, despite the growing interest in gamified SEL. The majority of earlier studies have tended to treat gamification and SEL independently, without fully examining their intersections. By offering a thorough summary of the state of the research on gamified socio-emotional learning and its effects on student engagement, this bibliometric analysis aims to close these gaps. This study attempts to identify new research areas, highlight methodological benefits and drawbacks, and offer suggestions for additional study and practice by examining trends, patterns, and important themes in literature. The following research questions are examined by the analysis:
RQ1: What are the most prominent research trends, influential studies, and theoretical frameworks on gamified socio-emotional learning?

RQ2: What emerging themes and interdisciplinary connections can be identified using co-occurrence analysis, and how do they influence future research?

2. Literature Review

The integration of gamification into socio-emotional learning (SEL) is a result of two important educational paradigms: the increasing focus on social and emotional competency development and the growing use of game-based strategies to boost student engagement. The research on gamified SEL is compiled in this literature review, which focuses on its theoretical foundations, empirical backing, and practical applications. The review is organized around three primary themes: (1) the theoretical underpinnings of gamification and SEL; (2) the impact of gamified SEL on student engagement and socioemotional outcomes; and (3) the challenge and opportunity of implementing gamified SEL interventions.

2.1 Theoretical Foundations Underpinnings of Gamification and SEL

The foundations of gamification are found in behavioral psychology and game design, specifically in the ideas of intrinsic and extrinsic motivation. Self-Determination Theory (SDT) states that the basic psychological needs for relatedness, competence, and autonomy are what propel intrinsic motivation (Ryan & Deci, 2000). By using game features like points, badges, leaderboards, and narratives—which offer instant feedback, a sense of achievement, and chances for social interaction—gamification takes advantage of these needs (Deterding et al., 2011). The objectives of SEL, which include helping students become more self-aware, self-management, socially conscious, relationship-savvy, and capable of making responsible decisions, are closely aligned with these components (CASEL, 2020).

The theoretical connection between gamification and SEL is further supported by the concept of experiential learning, which emphasizes learning through reflection on doing (Kolb, 1984). Because they provide a secure and supportive environment for students to practice socioemotional skills, interactive activities such as role-playing, simulations, and group challenges are frequently included in gamified SEL interventions. This immersive method not only boosts engagement but also facilitates the application of learnt material to practical scenarios. These theories offer a solid basis for comprehending the psychological and motivational processes underlying gamification, but it is also critical to look at how they are used in the particular setting of socioemotional learning.

2.2 Impact of Gamified SEL on Student Engagement and Socio-Emotional Outcomes

Empirical studies have demonstrated that gamified SEL enhances student engagement and socioemotional outcomes. Recent studies have shown that gamification significantly increases learners' intrinsic motivation, engagement, and perceived competence (García-López et al., 2023). Because internalizing socioemotional skills necessitates consistent engagement, these findings are particularly relevant to SEL.

Gamified SEL has been shown in numerous studies to enhance specific socioemotional skills. For instance, a study by Chung and Pan (2023) found that a gamified SEL program improved students' emotional regulation and empathy by providing them with the opportunity to practice these skills in a simulated environment. Similarly, (Maryana et al., 2024) discovered that gamified SEL activities enhanced middle school students' social skills and academic performance, suggesting that the engaging and interactive aspects of gamification can enhance the benefits of traditional SEL programs.

The role of narrative and storytelling in gamified SEL has also been studied. Presenting abstract socio-emotional concepts within the context of a narrative makes them more relatable and meaningful. For example, a study by Hikmah et al. (2024) demonstrated that a narrative-driven gamified SEL program significantly improved preschoolers' ability to recognize and regulate their emotions. The use of narratives not only boosts engagement but also encourages deeper emotional processing and self-reflection.

Collaborative gamified SEL exercises have been shown to enhance teamwork and communication skills. Cooperative games promote prosocial qualities like empathy, cooperation, and conflict resolution, per a study by Berdousis (2024). These findings demonstrate how important it is to design gamified SEL interventions that balance cooperative and competitive elements to meet the needs of students with different learning styles and goals.

2.3 Challenges and Opportunities in Implementing Gamified SEL Interventions

Despite the gamified SEL's encouraging potential, the literature has noted a number of opportunities and difficulties. One of the biggest challenges is the lack of consensus regarding the most effective gamification strategies for developing socioemotional skills. Some scholars emphasize the benefits of collaborative and narrative-driven approaches, while others highlight competitive features like leaderboards and badges (Berdousis, 2024). This variety of findings reveals a fragmented understanding of how specific game mechanics best align with SEL goals.

Another challenge is the findings' limited generalizability due to their focus on specific age groups or circumstances. For instance, the majority of research to date has been conducted in primary and secondary school settings, with relatively few studies looking at the effects of gamified SEL in higher education or non-formal learning environments (Maryana et al., 2024). This gap in literature highlights the need for more diverse and inclusive research that considers the unique needs and characteristics of different learner populations.

The long-term effects of gamified SEL on students' engagement and socioemotional development are not well understood. While short-term studies have demonstrated the immediate benefits of gamification, little is known about whether these benefits persist over time or lead to meaningful behavioral changes outside of the classroom. Longitudinal research is necessary to assess the viability and sustainability of gamified SEL interventions (Alenezi, 2023).

Additionally, individual differences such as personality traits, cultural background, and prior gaming experience have a significant impact on the efficacy of gamified SEL. Students who have played games frequently, for example, may respond differently to gamified interventions than students who haven't (Yuliana & Palumian, 2023). Cultural factors can also affect students' perceptions of gamification elements and their willingness to engage in SEL activities. Understanding these individual differences is necessary to create gamified SEL interventions that are inclusive and culturally sensitive.

3. Method

Bibliometric analysis is a powerful research method that is becoming more and more well-known in academia and beyond. It involves the quantitative analysis of scholarly publications to identify trends, patterns, and connections within a specific field of study. By carefully examining bibliographic information such as citations, authorship, keywords, and publication trends, bibliometric analysis

provides significant insights into the composition, significance, and development of scientific knowledge (Wider et al., 2024). Gamified socio-emotional learning (SEL) requires a bibliometric analysis in order to advance research and practice in this emerging field. This study provides a comprehensive understanding of the development, impact, and structure of the field through the use of performance analysis, co-citation analysis, and co-occurrence analysis (Supriyadi et al., 2023).

Performance analysis evaluates the productivity and influence of researchers, organizations, and countries in addition to the impact of journals and publications. This highlights significant individuals and seminal works that have impacted the field, laying the foundation for future research and collaboration. For example, it can help with funding decisions and collaborations by identifying the best universities for gamified SEL research (Por et al., 2024).

Co-citation analysis identifies the intellectual framework of the field by looking at the relationships between works that are often cited. By mapping clusters of co-cited studies, researchers can uncover foundational theories, interdisciplinary connections, and emerging paradigms. This is particularly useful in gamified SEL, where expertise from game design, psychology, and education converges to bridge disciplinary divides (Haruna & Isa, 2024).

Co-occurrence analysis looks at the relationships and frequency of keywords to find significant themes and trends. This analysis can shed light on understudied subjects like the use of gamified SEL in non-Western contexts or higher education, as well as novel subjects like the application of virtual reality or artificial intelligence. Researchers can close the gaps and align their work with the most recent advancements with the aid of these kinds of insights (Herlambang, 2024).

When combined, these analyses provide a thorough understanding of the field, enabling researchers to identify key areas for future study, expand on existing understanding, and identify areas for cooperation. Effective gamified SEL interventions can be developed and implemented with the help of evidence-based insights from bibliometric analysis. Ultimately, this research fosters innovation, enhances the coherence of the field, and ensures that research and practice align with the evolving needs of learners and society.

3.1 Search Strategy

The keywords "gam*" and "socio-emotion*" are at the core of the search strategy, which finds pertinent publications in the Scopus database. Variations of the terms, such as "gamification," "game-based," "socio-emotional," and "socio-emotionally," are guaranteed to be recorded by the use of wildcard characters (such as "gam"). This keeps the search relevant to the main topic while expanding its scope.

The interdisciplinary nature of the research is reflected in the combination of these keywords, which connect socio-emotional learning—a crucial field in psychology and education—with gamification, a concept originating in game design and behavioral psychology. The search makes sure that only publications that are

directly related to the topic are included by concentrating on titles, abstracts, and keywords (TITLE-ABS-KEY), which improves the analysis's precision.

Table 1: Inclusion Criteria for Bibliometric Analysis

Scopus Database	ALL
Time period	2015 to 2024
Search field	TITLE-ABS-KEY
Search keywords	"gam*" AND "socio-emotion*"
Document Type	Article, Review Article, Proceedings
Language	English

The chosen period, which runs from 2015 to 2024, encompasses the most current and pertinent advancements in the gamified SEL space. This time frame is noteworthy because it aligns with the growing awareness of socio-emotional learning as an essential part of holistic education and the growing interest in gamification as a tool for improving educational outcomes. A thorough examination of the academic landscape is ensured by the inclusion of articles, reviews, and proceedings. In order to maintain uniformity and accessibility, the restriction to English-language publications is a sensible choice.

Transparency and reproducibility are ensured by using the PRISMA flowchart (Figure 1) to record the search and screening procedure. The flowchart makes it easier to comprehend the methodology and evaluate the reliability of the results by clearly outlining the procedures used to find, filter, and include studies. This methodical approach supports best practices in scholarly research and strengthens the bibliometric analysis's credibility. 190 records were found in the Scopus database, a thorough and reliable source of academic literature, to start the search.

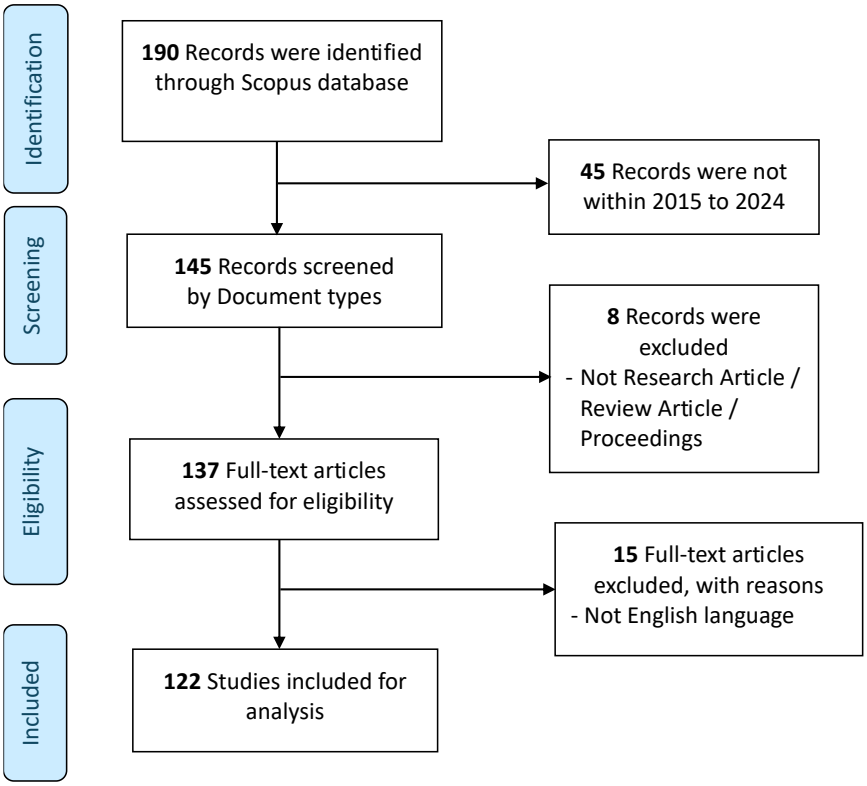

Figure 1: PRISMA Flowchart

The first criteria used to filter these records were their applicability to the subject of gamified SEL. 145 records remained after the inclusion criteria were applied, and these were further filtered by document type (procedures, review articles, and articles). By taking this step, the analysis was guaranteed to contain only peer-reviewed, high-quality publications. After eliminating non-English publications and records published outside of the designated time period (2015–2024), 122 studies were finally included for analysis out of the 137 full-text articles that were evaluated for eligibility. This thorough screening procedure guarantees that a solid and pertinent dataset serves as the foundation for the bibliometric analysis.

4. Results

The study is guaranteed to be based on a high-quality and pertinent dataset thanks to the stringent screening procedure, trend analysis, and impact metrics. The results show how gamified SEL is becoming more and more popular as a field, with the potential to change teaching methods and raise student achievement. Through a methodical review of the literature, this study advances our knowledge of the development of the field, highlights important trends and gaps, and lays the groundwork for further investigation and advancement in gamified SEL.

Figure 2's trend analysis displays the number of publications and citations during the given time frame. The graph probably shows an upward trend in publications and citations, indicating that gamified SEL is becoming more widely

acknowledged as a useful strategy for improving socioemotional growth and student engagement. This pattern is consistent with the increasing use of gamification in the classroom and the growing recognition of socioemotional learning as an essential part of a well-rounded education. Trend analysis highlights significant growth periods and identifies new areas of interest, offering insightful information about the field's development.

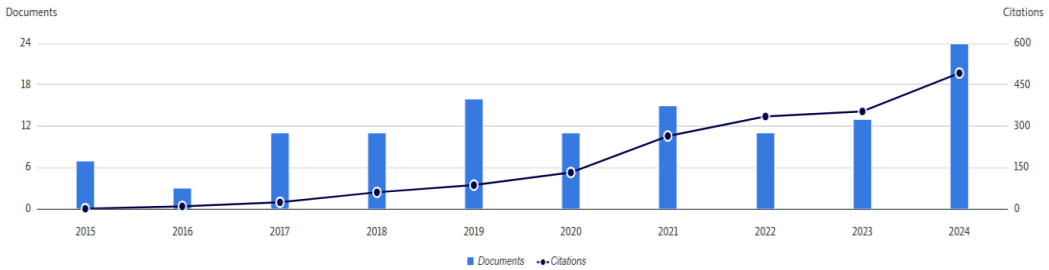

Figure 2: Quantity of publications and citations between 2015 and 2024

A total of 1,810 citations are gathered from the analysis of 122 articles published between 2015 and 2024, including 103 cited documents. This suggests that there is a substantial amount of scholarly interest in and influence from the expanding body of research on gamified SEL. Given the quantity of highly cited publications that have advanced our understanding of gamified SEL, the field's influence is further highlighted by its h-index of 21. These indicators show how developed the field is as well as how much room there is for expansion and innovation.

4.1 Performance Analysis

4.1.1 Documents

Brain-to-brain synchrony in parent-child dyads and the relationship with emotion regulation revealed by fNIRS-based hyperscanning by Reindl et al. (2018) is the most cited article in the dataset, earning 270 citations. This study offers empirical evidence of how emotion regulation appears in parent-child relationships, highlighting the importance of neurobiological interactions in socioemotional learning. The impact of serious games in socio-emotional learning for children with autism is highlighted in the second-highest cited work, "Emotiplay: a serious game for learning about emotions in children with autism," by Frindenson-Hayo et al. (2017), which has 107 citations and shows the potential of digital interventions in special education.

There is a growing interest in the ways that digital and gamified interventions can support mental health, as evidenced by other high-impact works that examine socio-emotional behaviors in crisis scenarios, such as Van de Groep et al. (2020) (102 citations) A daily diary study on adolescents' mood, empathy, and prosocial behavior during the COVID-19 pandemic. These widely cited works lay a solid groundwork for the field by highlighting how technology can promote behavioral development and socioemotional engagement.

4.1.2 Sources

Given its prominence in psychological and educational research on socio-emotional learning, Frontiers in Psychology is the most influential journal in this field, having published six papers and received 80 citations. With five published papers and a much higher number of citations (168), Computers in Human Behavior comes in second, indicating a close connection between gamification of socioemotional learning and human-computer interaction.

Furthermore, three papers in PLoS ONE have contributed 119 citations, underscoring the field's interdisciplinary nature and the value of open-access platforms in knowledge dissemination. Even though some sources, like the International Journal of Game-Based Learning and the CEUR Workshop Proceedings, have published several papers, they have not yet accumulated a substantial number of citations, indicating that their impact on gamified socio-emotional learning is still in its infancy.

4.1.3 Authors

With three publications and 89 citations overall, Kaufman, D. is the most prolific author in this field, indicating a strong emphasis on gamification and digital learning. Although Lavega-Burgués, P., and Prada, R. each contributed three papers, their citation counts are lower (13 and 17, respectively), suggesting that their work is still in its infancy and has not yet gained much traction. With two papers each and citation counts ranging from 11 to 16, several other authors, such as Costes, A., and Dietrich, T., have a moderate impact on the conversation surrounding gamified socio-emotional learning. This distribution points to a developing but specialized research community, with a few influential people spearheading the discussion and others helping it grow.

4.1.4 Organizations

With four papers apiece, Simon Fraser University and Universitat de Lleida lead the field in institutional contributions, demonstrating their commitment to gamification and socioemotional learning. Three documents each from organizations like Reichman University, Tampere University, and the Instituto de Engenharia de Sistemas e Computadores (Lisboa) demonstrate international cooperation in developing this field. The University of Toronto and Griffith University are two other noteworthy contributors that have produced three documents highlighting the global scope of research on gamified socio-emotional learning. The existence of universities in Europe, North America, and Australia shows how widely academics are interested in using digital tools to improve socioemotional skills.

4.1.5 Countries

With 23 publications and 329 citations, the United States leads the world in research output, demonstrating its supremacy in this area in terms of both volume and impact. Despite producing fewer papers (13), the UK has amassed the most citations (442), indicating that research conducted in the UK has had a major impact on scholarly discourse. Canada, Germany, and Spain all make significant contributions; Germany produces 11 papers with an astounding 359 citations, while Spain produces 12 papers with 106 citations. The inclusion of Portugal,

Finland, China, and Australia in the top 10 indicates that research on gamified socio-emotional learning is extending outside of Western contexts and incorporating a variety of viewpoints and applications. However, China's research in this area is still gaining recognition, as evidenced by its relatively low citation count (16) despite five documents.

4.2 Co-Citation Analysis

By looking at how frequently two documents are cited together, the co-citation analysis finds the major foundational works in gamified socio-emotional learning. The most influential works with at least two citations each were highlighted after a threshold of 74 was established. The interconnectedness of research studies was highlighted by the establishment of 95 links with a total link strength of 114.

From statistical power analysis (Cohen, 1992) to active learning strategies (Adams et al., 2018), video game effects (Anderson & Bushman, 2001), and social-emotional development (Hoffman, 1996), the top ten most co-cited articles address a wide range of subjects. According to these citations, research on gamified socio-emotional learning incorporates elements from a variety of fields, such as psychology, education, and human-computer interaction.

4.2.1 Top Co-Cited Articles

With five citations, Adams et al. (2018)'s study on the use of escape rooms to promote active learning is the most co-cited. This indicates a keen academic interest in leveraging game-based learning environments to improve students' problem-solving abilities and level of engagement. With three citations, Cohen (1992) offers a statistical basis for study, highlighting the importance of thorough data analysis in this field.

The relationship between socio-emotional learning and special education is also reflected in the frequent co-citation of Baron-Cohen and Wheelwright (2004), which examines empathy in people with autism. Notably, Buckley & Anderson (2012) and Anderson and Bushman (2001), which address the behavioral and cognitive impacts of video games, are also heavily cited, supporting the continuous discussion regarding the dual role that video games play in promoting both potential hazards and beneficial socioemotional learning outcomes.

Table 2: Top Ten Most Co-Cited Articles

Rank	Authors	Title	Citations
1	Adams et al. (2018)	Can you escape? Creating an escape room to facilitate active learning	5
2	Cohen (1992)	Statistical power analysis	3
3	Baron-Cohen & Wheelwright (2004)	The empathy quotient: an investigation of adults with Asperger syndrome or high functioning autism, and normal sex differences	3
4	Anderson & Bushman (2001)	Effects of violent video games on aggressive behavior, aggressive cognition, aggressive affect, physiological arousal, and prosocial behavior: A meta-analytic review of the scientific literature	2
5	Buckley & Anderson (2012)	A theoretical model of the effects and consequences of playing video games	2
6	Gentile et al. (2014)	The general learning model: Unveiling the teaching potential of video games	2
7	Harrington & O'Connell (2016)	Video games as virtual teachers: Prosocial video game use by children and adolescents from different socioeconomic groups is associated with increased empathy and prosocial behaviour	2
8	Hoffman (1996)	Empathy and moral development	2
9	Zimet et al. (1988)	The multidimensional scale of perceived social support	2
10	De Schutter & Vanden Abeele (2010)	Designing meaningful play within the psycho-social context of older adults	2

4.2.2 Co-Citation Analysis by Clusters

Each of the four clusters that make up the co-citation network represents a different area of study in gamified socioemotional learning. The results indicate that although digital platforms and video games have great potential as tools for socioemotional learning, their effects need to be thoroughly investigated in a variety of settings and age groups. A balanced approach is necessary when creating gamified interventions that optimize learning benefits while minimizing potential risks, as evidenced by the growing body of research on empathy, social interaction, and digital engagement.

The significance of social support, social connectivity, and digital engagement in educational settings is emphasized by Cluster 1. The Multidimensional Scale of Perceived Social Support by Zimet et al. (1988) emphasizes the significance of supportive networks for socioemotional health. In their discussion of creating meaningful play for senior citizens, De Schutter & Vanden Abeele (2010) emphasize the value of social play for mental well-being. This cluster is extremely pertinent to comprehending the wider social aspects of gamification in education since Trepte et al. (2012) and Domahidi et al. (2014) help by looking at how online gaming promotes social connections

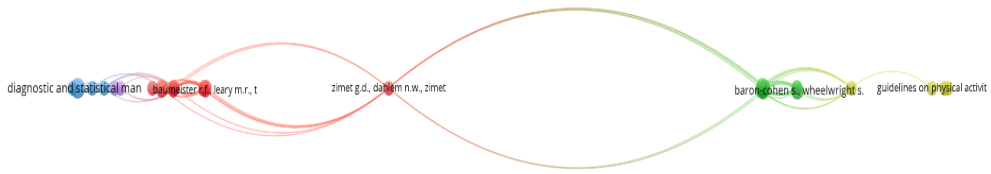

Figure 3: Co-citations Analysis (VOSviewer Visualisation)

Cluster 2 investigates how playing video games affects empathy and prosocial behavior on an emotional and cognitive level. A psychological foundation is established by Baron-Cohen and Wheelwright (2004), who define empathy and discuss how it varies among neurodiverse populations. While Gentile et al. (2014) present the General Learning Model, highlighting the educational potential of video games, Anderson and Bushman (2001) investigate the contentious effects of violent video games.

This viewpoint is supported by Harrington and O'Connell (2016), who show how prosocial video games can improve social skills and empathy. A theoretical foundation is provided by Hoffman's (2001) work on Empathy and Moral Development, which emphasizes the influence of socioemotional learning on behavior.

The psychological state of flow and its use in autism interventions are at the heart of Cluster 3. A key component of gamified learning, deep engagement and intrinsic motivation are described by Csikszentmihalyi's (1990) Flow Theory. Barajas et al. (2017) investigate serious games as therapeutic tools for children with autism, while Bölte et al. (2010) talk about cutting-edge technologies for autism spectrum disorders. This cluster emphasizes how immersive and flexible learning settings help neurodiverse students develop their socioemotional abilities.

Cluster 4 looks at how mobile technology affects kids' learning and development. Concerns regarding technology dependence and its long-term effects on socioemotional development are raised by Radesky et al. (2016)'s investigation of how mobile devices are used to control children's emotions. Zosh et al. (2015) highlight how digital interventions can influence early childhood learning experiences by comparing the language parents use in traditional versus electronic learning tools. This cluster is important for comprehending how gamified learning on mobile devices affects the cognitive and emotional development of young children.

Table 3: Co-citation Cluster

Cluster No and Colour	Cluster Labels	No. of Articles	Representative Publications
Cluster 1 (Red)	Social Interaction and Digital Learning	10	Cohen (1992); Zimet et al. (1998); De Schutter & Vanden Abeele (2010); Ristau (2011); Trepte et al. (2012); Baumeister & Leary (1995); Domahidi et al. (2014); Cornwell et al. (2008)
Cluster 2 (Green)	Empathy, Video Games, and Learning Outcomes	8	Baron-Cohen & Wheelwright (2004); Griffith et al. (2020); Anderson & Bushman (2001); Gentile et al. (2014); Harrington & O'Connell (2016); Hoffman (2001)
Cluster 3 (Blue)	Flow Theory and Autism Interventions	4	Csikszentmihalyi (1990); Bölte et al. (2010); Barajas et al. (2017)
Cluster 4 (Yellow)	Mobile Technology and Child Development	4	Radesky et al. (2016); Zosh et al. (2015)

4.3 Co-Occurrence Analysis

The co-occurrence analysis looks at keywords that appear frequently in research studies to identify important thematic areas in gamified socio-emotional learning. With a minimum threshold of 56 occurrences, the dataset's 1,368 keywords yield 911 links with a total link strength of 3,196. "Female" (39 occurrences, 430 link strength) and "male" (40 occurrences, 445 link strength) are the next most common keywords, with "human" appearing 47 times and having the highest total link strength (487). The human-centered focus of this field is reflected in other noteworthy keywords, such as "child" (27 occurrences), "emotion" (17 occurrences), and "psychology" (16 occurrences). Terms like "human-computer interaction," "video game," and "serious games" indicate a keen interest in the interactive and digital components of socioemotional learning.

4.3.1 Top Co-Occurring Keywords

According to the most common keywords, human behavior, psychological research, and experimental techniques are the main foci of gamified socioemotional learning research. The terms "human experiment" (17 occurrences, 166 link strength) and "controlled study" (20 occurrences, 243 link strength) imply an emphasis on intervention-based research and empirical validation. The addition of "physiology" (11 occurrences, 128 link strength) and "major clinical study" (12 occurrences, 134 link strength) emphasizes the field's interdisciplinary nature by fusing cognitive science, psychology, and human-computer interaction.

Table 4: The 15 most frequent keywords in the co-occurrence analysis

Rank	Keyword	Occurrences	Total Link Strength
1	artificial intelligence	69	128
2	artificial intelligence	35	72
3	education	32	57
4	Generative ai	24	41
5	chatgpt	22	52
6	higher education	20	40
7	students	20	60
8	ai	19	27
9	knowledge	16	27
10	artificial intelligence (ai)	14	23
11	model	14	41
12	acceptance	11	40
13	translation	11	4
14	chatbot	10	18
15	machine learning	9	15

The frequency of "emotion"-related terms (17 occurrences) and "emotions" (15 occurrences) highlights the main idea of emotional growth and control in gamified learning settings. This is further supported by the keyword "psychology" (16 occurrences, 185 link strength), which shows that many studies use psychological theories to evaluate socioemotional learning outcomes. Further highlighting the significance of early education and child-focused learning interventions are the terms "child" (27 occurrences, 295 link strength) and "children" (12 occurrences, 89 link strength).

4.3.2 Co-Occurrence Analysis by Clusters

Each of the three main clusters that make up the co-occurrence network represents a different area of study in gamified socioemotional learning. The results indicate that although gamification holds promise as a tool for improving social behavior and emotional intelligence, more research should be done to examine its long-term effects across various age groups and educational settings. Furthermore, given the abundance of empirical research, additional experimental studies utilizing neurological and physiological measures to confirm the efficacy of gamified interventions may be possible.

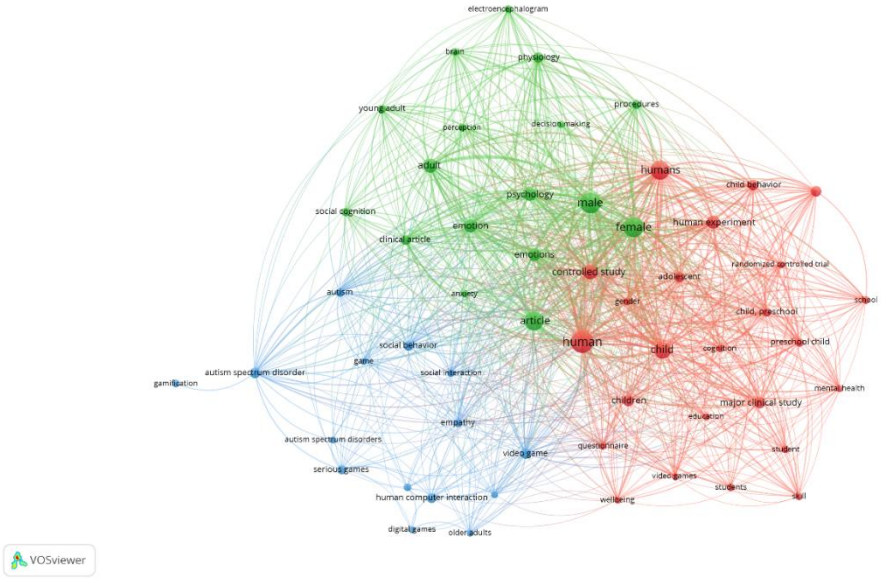

Figure 4: Co-Occurrence Analysis (VOSviewer Visualisation)

Developmental psychology and the use of controlled experimental research to comprehend socioemotional learning are the main topics of Cluster 1. The frequent use of the terms "child," "child development," and "child behavior" indicates that a large portion of the research focuses on younger populations and examines the effects of gamified interventions on their cognitive and emotional development. The focus on "human experiment" and "controlled study" emphasizes how important it is to use exacting empirical methods in order to validate learning outcomes. This cluster of studies probably looks at how gamified socioemotional learning impacts children's and adolescents' emotional intelligence, self-regulation, and behavioral development.

With a focus on gender, cognitive functions, and emotional control, Cluster 2 embodies the psychological and physiological facets of socioemotional learning. The terms "emotion," "emotions," and "psychology" imply a close relationship to affective science and emotional intelligence, suggesting that a lot of research examines the impact of gamified interventions on students' emotional health. The terms "physiology" and "clinical article" suggest that some research uses biological and neurological viewpoints, perhaps evaluating engagement and emotional reactions in gamified learning environments through methods like neuroimaging or biometric feedback.

Especially in relation to video games and serious gaming, Cluster 3 emphasizes the interactive and digital components of socioemotional learning. The prevalence of the terms "video game," "serious games," and "human-computer interaction" indicates that this field of study looks into the ways in which digital settings can promote social-emotional growth. The use of "autism" and "autism spectrum disorder" suggests a strong emphasis on neurodivergent learners and an investigation into how gamified interventions can improve social behavior and empathy in kids with autism. The inclusion of "social behavior" serves to further

support the cluster's focus on the ways that interactive digital experiences impact socioemotional development and interpersonal skills.

Table 5. Co-Occurrence Analysis on Gamified Socio-Emotional Learning

Cluster No and Colour	Cluster Label	Number of Keywords	Representative Keywords
Cluster 1 (Red)	Developmental Psychology and Experimental Studies	24	Humans,' children,' humans,' supervised study,' human experiment,' child behavior,' child development,' major clinical study,' children,' adolescent'
Cluster 2 (Green)	Psychological and Physiological Dimensions of Learning	17	'Male,' 'female,' 'article,' 'adult,' 'emotion,' 'psychology,' 'emotions', 'physiology,' 'clinical article,' 'procedures'
Cluster 3 (Blue)	Digital Learning and Human-Computer Interaction	15	'Social behavior,' 'video games,' 'serious games,' 'human computer interaction,' 'autism spectrum disorder,' 'autism,' 'empathy'

5. Discussion

The thorough bibliometric synthesis of gamified socio-emotional learning (SEL), an area that has not received enough attention in the literature to date, is a significant novelty of this study. The advantages of gamification and the significance of SEL have both been the subject of separate studies in the past, but few have methodically charted the junction of both fields over time.

This study is one of the first to find the structural, conceptual, and thematic outlines of gamified SEL research using a triadic bibliometric technique, which combines performance analysis, co-citation analysis, and co-occurrence analysis. The study provides a distinctive data-driven framework for comprehending how gamified SEL has developed across disciplines by identifying foundational theories like Self-Determination Theory, Flow Theory, and the General Learning Model alongside emerging themes like digital interventions for neurodivergent learners and narrative-based emotional regulation.

The visualization of multidisciplinary knowledge convergence through bibliometric grouping is another innovative addition. In addition to highlighting prevailing themes, the co-citation and co-occurrence network maps also point to underrepresented fields that provide rich opportunities for further research, such as the incorporation of artificial intelligence, longitudinal assessments, and non-Western contexts.

Furthermore, this study closes the gap between scholarly understanding and real-world policy consequences by coordinating the thematic findings with global educational priorities such as SDG 4 (Quality Education) and SDG 3 (Good Health and Well-Being). The study stands out as a crucial resource for educators, designers, and researchers looking to create inclusive, emotionally intelligent

digital learning environments because of its twin focus on mapping the applied potential and intellectual history of gamified SEL.

5.1 Theoretical Implications

One of the primary theoretical implications is the application of emotional intelligence theories to digital learning environments. The frequent use of terms like "emotion," "empathy," and "social behavior" implies that gamified socio-emotional learning is crucial for the development of emotional intelligence. Traditional models of emotional intelligence, such as Goleman's framework, focus primarily on interpersonal interactions in everyday situations. However, these theories need to be broadened to account for the unique ways that emotions are formed, expressed, and managed in gamified virtual environments as digital learning gains traction (Marougkas et al., 2023). Future theoretical frameworks should look into how students' social connections, self-control, and emotional awareness are affected by digital interactions (Bakıxanova, 2024).

Another important theoretical contribution is the use of reinforcement in the General Learning Model (GLM) as a foundational framework for understanding the behavioral and cognitive impacts of gamified socio-emotional learning. Research indicates that playing video games and serious games affects feelings, thoughts, and actions, which helps students learn (Ocaña et al., 2023). The findings highlight the need to advance this model by demonstrating that game-based socioemotional learning aligns with the core principles of the GLM. Future research should explicitly distinguish between the different types of digital game-based interventions, such as role-playing games, serious games, and interactive simulations, and their unique effects on emotional development (Arzone et al., 2020).

Furthermore, the findings demonstrate how Self-Determination Theory (SDT) and Flow Theory can be applied to gamified socioemotional learning. According to Redondo-Rodríguez et al. (2022), the co-citation analysis illustrates how gamification promotes deep engagement and provides students with the chance to participate in emotionally charged learning. SDT also highlights the importance of intrinsic motivation in game-based learning. The combination of these theories suggests that gamified environments where students feel empowered and challenged have a higher chance of helping them develop important socio-emotional skills. Future research should look at how the balance of challenge and reward in gamified learning fosters personal growth and emotional engagement (Lee & Loo, 2021).

5.2 Practical Implications

Beyond theoretical advancements, gamified socio-emotional learning has significant practical applications in education, mental health, and digital policy. One of the most important implications is the use of game-based learning in classrooms to encourage social and emotional development. The focus on "children," "child development," and "controlled study" in the co-occurrence analysis draws attention to the growing use of gamified learning materials in classrooms. Teachers can use serious games to teach empathy, self-control, and prosocial behavior, and adaptive gamification techniques can accommodate a

variety of learning needs (Setia et al., 2024). Furthermore, immersive simulations can provide students with real-world scenarios to practice emotional regulation and decision-making in a safe environment (Karunasekara et al., 2022).

Another significant practical application is the use of gamified interventions to assist neurodivergent learners, particularly those with autism spectrum disorder (ASD). The inclusion of "autism spectrum disorder" in the co-occurrence analysis highlights the potential benefits of digital interventions for neurodivergent individuals in enhancing their social and emotional skills. Virtual reality simulations and serious games can help autistic students learn nonverbal cues, develop their social awareness, and practice real-life interactions in a safe, stress-free environment (Ramírez et al., 2023). Special education and therapy can benefit greatly from these resources, which provide engaging and dynamic methods for social-emotional development.

Gamified socio-emotional learning has real-world applications in the areas of mental health and wellness. The strong relationship between empathy, emotional regulation, and game-based learning shows that digital tools can be used effectively in mental health interventions. For example, gamified cognitive behavioral therapy (CBT) applications can help people manage stress and anxiety by combining interactive exercises that foster emotional self-awareness and problem-solving skills (Thakkar et al., 2024). Similar to this, mindfulness-based games can lower stress and build emotional resilience, facilitating easy access to mental health services for a diverse population (Soler-Dominguez et al., 2024).

6. Conclusion

Gamified socio-emotional learning, which combines cognitive science, psychological theories, and technology-enhanced learning, is a revolutionary approach to education, mental health, and digital engagement. With solid theoretical underpinnings in emotional intelligence, flow theory, and human-computer interaction, the bibliometric, co-citation, and co-occurrence analyses show that research in this area is growing quickly. Furthermore, a trend toward empirical validation of gamified interventions is indicated by the growing number of neuroscientific and experimental studies.

The results highlight that game-based learning is not only a fun teaching tool but also a powerful way to develop social skills, emotional intelligence, and empathy in a variety of populations, including kids, neurodivergent learners, and people in therapy. From a practical standpoint, gamified socio-emotional learning can greatly improve social and emotional growth in schools, especially in elementary and secondary education. Teachers can provide students with worthwhile opportunities to grow in self-awareness, emotional regulation, and prosocial behavior by combining serious games, adaptive digital simulations, and immersive role-playing experiences.

Additionally, gamification has the potential to improve mental health by providing scalable and easily accessible interventions for emotional well-being through interactive mindfulness applications and game-based cognitive

behavioral therapy. However, to guarantee responsible and long-lasting implementation, ethical issues pertaining to digital dependency, data privacy, and equitable access must be carefully addressed.

Gamified socio-emotional learning has a positive impact on two important Sustainable Development Goals (SDGs) of the UN: SDG 3: Good Health and Well-Being and SDG 4: Quality Education. This study supports SDG 4, which calls for inclusive, equitable, high-quality education that fosters opportunities for lifelong learning for all, by improving socioemotional skills through game-based learning. Gamification techniques offer useful and entertaining teaching resources that promote emotional learning, especially for students who might find it difficult to learn using conventional techniques.

Furthermore, this strategy is in line with SDG 3, which emphasizes promoting everyone's well-being and guaranteeing healthy lives. The incorporation of game-based interventions into mental health support, specifically in the areas of social skill development, emotional regulation, and stress management, highlights how digital tools can enhance psychological well-being in general.

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