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Mapping the Intellectual Structure of Gamification Research in Education: A Bibliometric Perspective

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ABSTRAK

Karena pertumbuhan eksponensial jumlah makalah gamifikasi yang diterbitkan di bidang pendidikan, semakin sulit untuk menguraikan struktur dan dinamika intelektual bidang ini. Untuk itu, makalah ini bertujuan untuk memetakan struktur dan dinamika intelektual penelitian gamifikasi di bidang pendidikan melalui pendekatan bibliometrik. Data diekstrak dari basis data Scopus dan dianalisis dengan bantuan VOSviewer dengan fokus pada analisis jaringan kepenulisan bersama, sitasi, dan kemunculan bersama kata kunci. Menurut temuan, bidang ini memiliki sifat kolaborasi penulis yang berkelompok; beberapa penulis dan institusi secara signifikan berkontribusi pada pengembangan pengetahuan gamifikasi di bidang pendidikan. Analisis sitasi menunjukkan dominasi institusi tertentu di bidang ini seperti Universitas Tampere dan University College Dublin. Analisis kata kunci membuktikan konsentrasi penelitian yang signifikan pada konsep-konsep seperti gamifikasi, siswa, motivasi, pengajaran, pembelajaran yang berarti bahwa para peneliti sangat memperhatikan peningkatan praktik dan proses pendidikan. Pada saat yang sama, menurut visualisasi overlay, bidang ini berkembang ke arah pergeseran fokus dari studi yang murni berbasis teknologi ke studi yang berpusat pada pembelajaran. Studi ini menyimpulkan bahwa penelitian gamifikasi dalam pendidikan merupakan bidang yang matang dan interdisipliner dengan fondasi teoretis yang kuat, namun masih menawarkan peluang untuk kolaborasi yang lebih luas, integrasi teknologi, dan perluasan ke wilayah yang kurang terwakili. Temuan ini memberikan wawasan berharga bagi para peneliti dan praktisi dalam memahami perkembangan terkini dan memandu arah penelitian di masa mendatang.

Kata Kunci: *Gamifikasi, Pendidikan, Analisis Bibliometrik, VOSviewer*

ABSTRACT

Due to the exponential growth of the number of gamification papers published in education, it becomes increasingly difficult to outline the field's intellectual structure and dynamics. To this end, this paper intends to map the intellectual structure and dynamics of gamification research in education through a bibliometric approach. The data were extracted from Scopus databases and analyzed with the help of VOSviewer with a focus on analyzing co-authorship networks, citations, and co-occurrences of keywords. According to the findings, the field has a clustered nature of author collaboration; some authors and institutions significantly contribute to the development of gamification knowledge in the sphere of education. Citation analysis showed a domination of specific institutions in the field such as Tampere University and University College Dublin. Keyword analysis proved a significant concentration of research on concepts such as gamification, students, motivation, teaching, learning which means that the researchers pay much attention to the improvement of educational practices and processes. At the same time, according to overlay visualization, the field is developing towards shifting the focus from purely technology-based studies to learning-centered ones. The study concludes that gamification research in education is a mature and interdisciplinary field with strong theoretical foundations, yet it still offers opportunities for broader collaboration, technological integration, and expansion into underrepresented regions. These findings provide valuable insights for researchers and practitioners in understanding current developments and guiding future research directions.

Keywords: *Gamification, Education, Bibliometric Analysis, VOSviewer*

INTRODUCTION

Over the past decade, the integration of digital technologies into education has transformed how teaching and learning processes are designed and implemented (Deterding et al., 2011). One of the most prominent approaches emerging from this transformation is gamification, which refers to

the use of game elements such as points, badges, leaderboards, and challenges in non-game contexts to enhance user engagement and motivation (Nadi-Ravandi & Batooli, 2022; Sironi, 2016). In educational settings, gamification has gained considerable attention as educators seek innovative strategies to improve student participation, persistence, and learning outcomes. This trend is closely aligned with the broader movement toward learner-centered pedagogies and the increasing demand for interactive and engaging learning environments (Hsu & Chen, 2021; Sironi, 2016). Gamification in education is grounded in motivational theories, particularly self-determination theory and behaviorist principles, which emphasize the role of rewards, feedback, and autonomy in shaping human behavior. By incorporating game mechanics into instructional design, educators aim to foster intrinsic and extrinsic motivation among learners. Studies have shown that gamified learning environments can increase student engagement, enhance collaboration, and promote deeper learning experiences when appropriately designed (Huotari & Hamari, 2012; Koivisto & Hamari, 2019). However, the effectiveness of gamification is not universal, as its impact depends on factors such as context, implementation design, and learner characteristics.

The rapid growth of gamification research in education has resulted in a diverse and fragmented body of literature. Scholars from various disciplines, including education, psychology, computer science, and instructional design, have contributed to this field, leading to a wide range of theoretical perspectives, methodologies, and application contexts. While this diversity reflects the richness of the field, it also poses challenges in understanding its intellectual structure, key themes, and research trends. Consequently, there is a need for systematic approaches to map and analyze the development of gamification research in education (Seaborn & Fels, 2015). Bibliometric analysis has emerged as a powerful method for examining the intellectual landscape of a research field. By analyzing patterns in academic publications, such as citation networks, co-authorship, and keyword co-occurrence, bibliometric techniques can provide insights into the evolution, structure, and dynamics of scientific knowledge. In the context of gamification in education, bibliometric analysis can help identify influential authors, core journals, dominant research themes, and emerging topics. This approach enables researchers to gain a comprehensive overview of the field and to uncover gaps that may guide future investigations (Donthu et al., 2021).

Despite the growing body of literature on gamification in education, there remains a lack of comprehensive bibliometric studies that systematically map its intellectual structure. Existing reviews often focus on specific aspects, such as effectiveness, design principles, or particular educational levels, rather than providing a holistic analysis of the field. As a result, researchers and practitioners may find it difficult to navigate the vast amount of information and to identify key directions for future research. Addressing this gap is essential for advancing theoretical development and improving the practical application of gamification in educational contexts. Although gamification has become a widely studied topic in educational research, the field lacks a clear and comprehensive understanding of its intellectual structure and development. The increasing volume of publications has led to fragmentation, making it difficult to identify core themes, influential works, and emerging research trends. Furthermore, the interdisciplinary nature of gamification research contributes to conceptual ambiguity and inconsistencies in terminology and methodology. Without a systematic bibliometric perspective, researchers may struggle to synthesize existing knowledge, recognize research gaps, and establish a coherent direction for future studies. Therefore, there is a need for a structured analysis that maps the intellectual landscape of

gamification research in education. This study aims to map the intellectual structure of gamification research in education through a bibliometric analysis.

RESEARCH METHODS

This study employs a bibliometric research design to systematically analyze the intellectual structure of gamification research in education. Bibliometric analysis is a quantitative approach used to evaluate patterns within academic literature, including publication trends, citation structures, and collaborative networks. This method is particularly suitable for mapping large volumes of scholarly data and identifying relationships among research components such as authors, keywords, and journals. By adopting this approach, the study aims to provide an objective and comprehensive overview of the development and organization of knowledge within the field of gamification in education (Donthu et al., 2021). The data for this study are collected from Scopus, which ensures the inclusion of high-quality peer-reviewed publications. A structured search strategy is applied using relevant keywords, including "gamification," "education," "learning," and related terms, within titles, abstracts, and keywords. The inclusion criteria focus on journal articles and conference papers published in English within a specified time frame to capture the evolution of the field. After the initial retrieval, the dataset is refined through a screening process to remove duplicates, irrelevant studies, and incomplete records. The final dataset is then exported in a compatible format for further bibliometric analysis. The analysis is conducted using VOSviewer, which facilitate visualization and interpretation of complex relationships within the dataset. Several analytical techniques are applied, including co-authorship analysis to examine collaboration patterns, co-citation analysis to identify influential works and intellectual foundations, and keyword co-occurrence analysis to uncover major research themes and emerging topics. The results are presented through network visualizations and descriptive statistics to illustrate the structure and dynamics of the field.

RESULTS AND DISCUSSION

A. Co-Authorship Analysis

The research starts by analyzing the co-authorship network to get an idea about the collaborative pattern in gamification research in education. The use of co-authorship analysis gives an understanding of the collaboration in the scientific world by indicating important players in research, the emergence of research groups, and the level of knowledge sharing in the area. Through such analysis, influential players and collaborative networks involved in gamification research can be identified.

1. Author-level Network

Co-Authorship Network of Gamification Research in Education is shown in Figure 1, which uses VOSviewer for its visualization. As shown by this graph, co-authorship is a network that shows interactions and collaborations between various researchers based on authorship linkages. The circles show individual researchers, while their sizes are an indication of their relative importance or influence within the network, which is also segmented into various colors showing different collaboration communities within it.

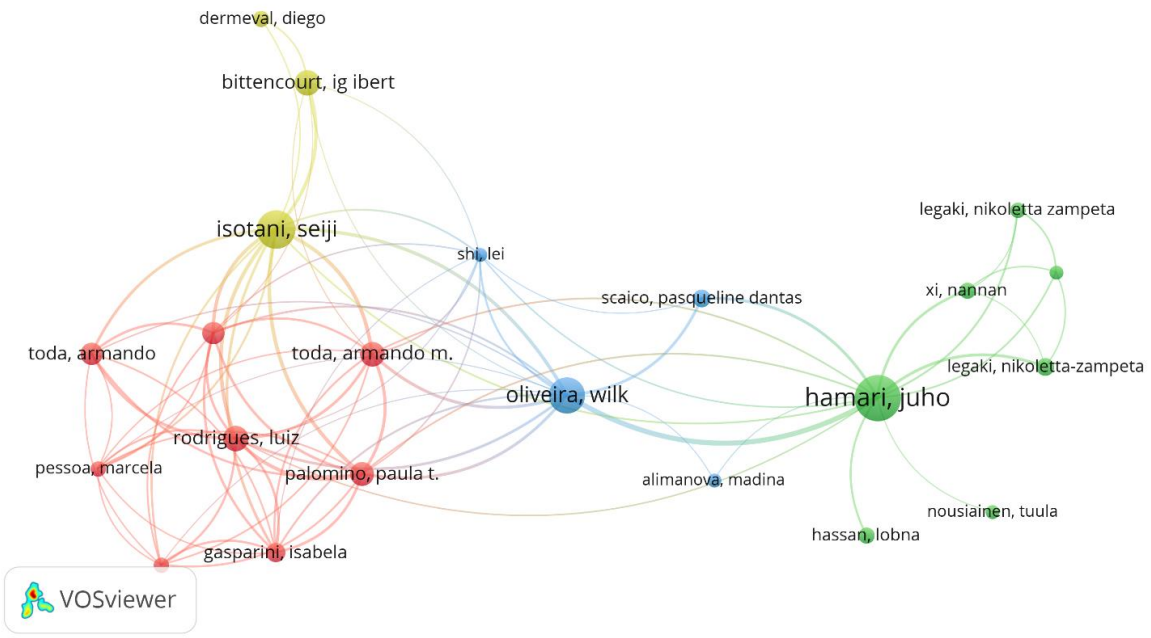

Figure 1. Author-level Visualization

Source: Data Analyzed

It is evident that the network visualization shows a number of unique clusters, meaning that there are several research groups working on gamification within the field of education. For example, the first group marked in red includes such researchers as Toda, Rodrigues, and Palomino. These researchers can be identified as some of the most active collaborators and contributors to the gamification topic. Another cluster highlighted in green features the name of Hamari, Juho, who is an important member of this influential group. Hamari plays a key role in the research network, which demonstrates his active participation in the development of gamification. Furthermore, the identification of the bridging authors like Oliveira, Wilk and Isotani, Seiji indicates that there is some kind of link between the clusters, which helps in sharing the knowledge across the clusters. The integration of diverse ideas becomes easier through them. Nevertheless, from an overall analysis, it can be seen that the structure is moderately fragmented, indicating that although collaboration exists, it is not evenly spread across all the clusters. It presents scope for further research in the future in order to increase cross-collaboration among the clusters, leading to more global integration.

2. Institution-level Network

Figure 2 below shows the citation network among institutions involved in gamification research in education as generated by VOSviewer. In the network diagram below, each node symbolizes an institution while the connections between the nodes are the citation relationships between them. The size of the nodes depends on the citation impact or influence of the institution, while the colors indicate clusters of institutions that are closely linked through citations.

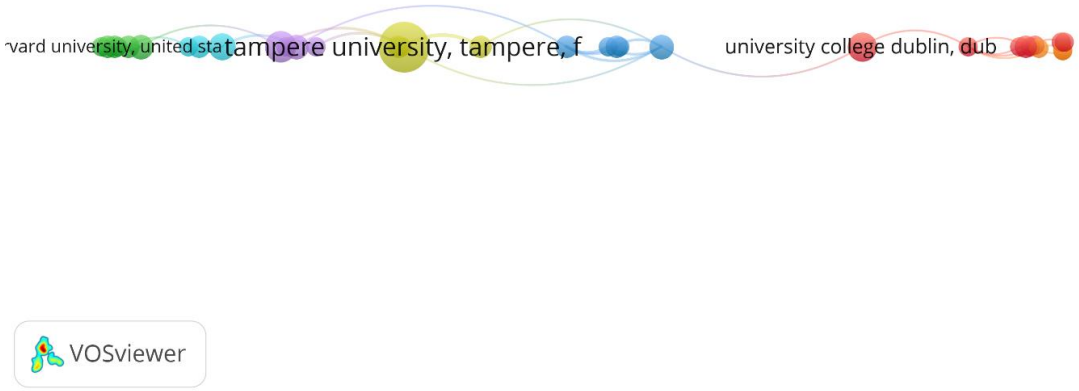

Figure 2. Affiliation-level Visualization

Source: Data Analysis

As is evident from the diagram above, there are institutions that act as major players in the citation graph. This is seen through the existence of Tampere University, which acts as one of the most important and influential nodes. From the size and position of this node, it is evident that its citation effect is quite significant. In other words, this means that research generated from this institution is highly regarded and cited often. Another notable node is that of University College Dublin. In addition, the network formation implies that citations among authors follow a segmented and linear pattern since clusters of authors share citations through few bridging connections instead of a web-like pattern of citations. In essence, the existence of citations among authors from different institutions does not occur randomly but follows defined paths. The lack of dense connections within some clusters means that there could be gaps in citation behaviors among researchers belonging to different educational institutions. Thus, increasing inter-institutional collaboration would contribute to better dissemination of knowledge and more coordinated global research on gamification in education.

3. Country-level Network

Figure 3 presents the keyword co-occurrence network based on countries contributing to gamification research in education. In the figure below, nodes stand for the countries, and links show co-occurrence relationships or collaboration between countries. The size of nodes shows the number of times a country contributed to the topic in question; whereas, the color denotes clusters of related countries in the same research field.

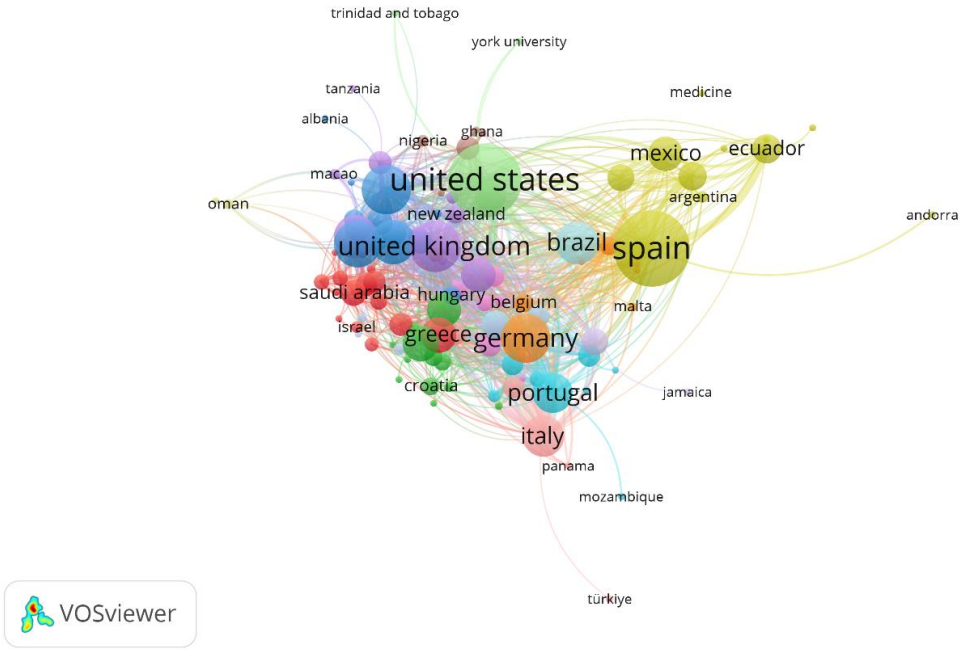

Figure 3. Country-level Visualization

Source: Data Analyzed

From the visualization above, one can conclude that the US, Spain, and UK are some of the most influential contributors to this field, based on the bigger size of their nodes and placement in the middle of the network. It is clear that these countries act as key players in the global research environment, contributing not only high-level productivity but also collaborations with other countries. In addition, Germany, Italy, Portugal, and Brazil are among those who significantly contribute to this field and form clusters, indicating their active involvement and cooperation, especially in Europe and Latin America.

Also, the analysis shows a great interconnectedness of the nodes that can demonstrate that the field of gamification studies in education is a truly international area. Nevertheless, there are several nodes which can be regarded as peripheral, namely smaller or less often used countries, demonstrating the lack of participation or weak involvement in the international scientific community. The situation proves the existence of an imbalance, as developed countries contribute more actively to the field, whereas emerging countries do not have enough opportunities to develop their own research activity in this domain. Also, the presence of various clusters demonstrates how regional studies work as researchers tend to cooperate more often on a regional basis.

B. Citation Analysis

Further investigation of the theoretical background of the discipline is carried out by means of citation analysis in order to determine the key publications, authors, and sources in the domain of gamification in education. The citation analysis allows researchers to evaluate the influence and reputation of scientific papers on the academic level. Thus, it helps to reveal the key contributions to the development of the topic under discussion.

Table 1. Top Cited Literature

Number of Citations	Author'(s)	Title
1974	(Seaborn & Fels, 2015)	Gamification in theory and action: A survey
1540	(Koivisto & Hamari, 2019)	The rise of motivational information systems: A review of gamification research
1472	(Dicheva et al., 2015)	Gamification in education: A systematic mapping study
1449	(Domínguez et al., 2013)	Gamifying learning experiences: Practical implications and outcomes
1254	(Plass et al., 2015)	Foundations of Game-Based Learning
1053	(Huotari & Hamari, 2012)	Defining gamification - A service marketing perspective
1028	(Dichev & Dicheva, 2017)	Gamifying education: what is known, what is believed and what remains uncertain: a critical review
959	(Zhai et al., 2021)	A Review of Artificial Intelligence (AI) in Education from 2010 to 2020
718	(Koivisto & Hamari, 2014)	Demographic differences in perceived benefits from gamification
676	(Subhash & Cudney, 2018)	Gamified learning in higher education: A systematic review of the literature

Source: Scopus Database, 2026

C. Keyword Co-Occurrence Analysis

Apart from collaboration patterns and citation patterns, this research work examines keyword co-occurrence patterns so as to find out the structure and the dynamics of gamification research in education. Through examining the keyword co-occurrence patterns, it is possible to reveal some of the key topics and the connections between key concepts of gamification research in education. As a result of analyzing keyword co-occurrence patterns, we will get a picture of the research area, its key focus points and major dynamics of development.

1. Network Visualization

Figure 4 shows the co-occurrence network of keywords used in gamification studies in the field of education, generated using VOSviewer. In this network, nodes are used to indicate the keywords retrieved from the database, while links are used to demonstrate the number of times these keywords occur in conjunction with each other in the same articles. The size of each node demonstrates the importance or frequency of occurrence of the particular keyword, while the colors indicate clusters of similar topics in this body of literature.

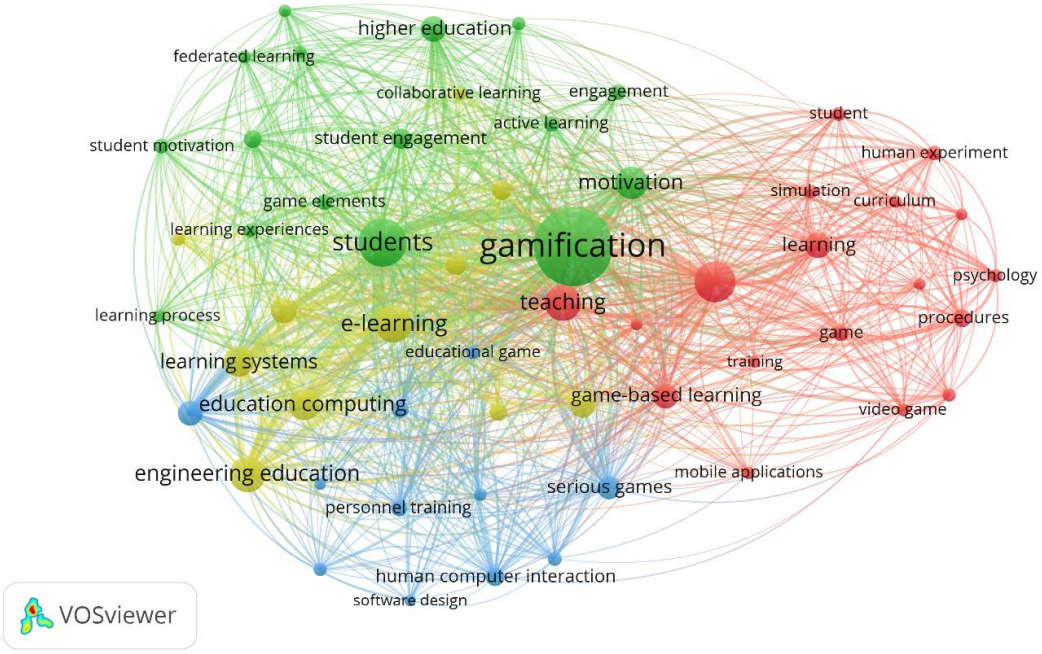

Figure 4. Network Visualization

Source: Data Analyzed

Figure 4 Clearly, the network has highlighted the keyword of gamification as the centermost and dominant one due to its largest node and the placement at the center of the network. This implies that the keyword of gamification forms the core idea around which the whole research area revolves. The keywords surrounding the center are those that have a direct connection with gamification, and they include keywords such as students, motivation, teaching, and learning. From the above finding, it can be concluded that the application of gamification research has mainly focused on engaging learners. The clusters identified from the network are quite numerous and each one represents a distinct direction in which the research has been applied. For instance, the green cluster highlights the aspect of education and psychology, and includes keywords such as students, motivation, engagement, higher education, and active learning.

On the other hand, the red cluster is indicative of a more experimental and application-based approach to the study of gamification. This can be evidenced from the fact that some of the keywords in this category include learning, game, simulation, curriculum, and psychology. This implies that the researchers in this cluster are more concerned about the practical application of gamification in learning scenarios and the impact of this phenomenon in real-life situations. In addition, this can also be seen from the fact that the keywords such as human experiment and procedures are used in this category. On the other hand, the blue cluster is more indicative of the technological facet of gamification. Keywords in this category include human-computer interaction, serious games, software design, and mobile applications.

Moreover, the cluster of yellow color seems to link education and technology together based on the keywords like e-learning, education computing, engineering education, and game-based learning. It is evident that there is integration between these disciplines as gamification finds its application in the digital learning systems and specific areas of education. The connection between all clusters shows that the study of gamification in education is well-integrated.

2. Overlay Visualization

Figure 5 shows an overlay of the visualization of the keywords used in gamification research in education. This visualization was created by VOSviewer. In contrast to the previous network visualization, Figure 5 contains the aspect of time, which is shown by the color assigned to each node. Here, each node represents the average year of publication related to each keyword. As such, this visualization shows the development of research areas as well as new research interests that have emerged over time in gamification research in education.

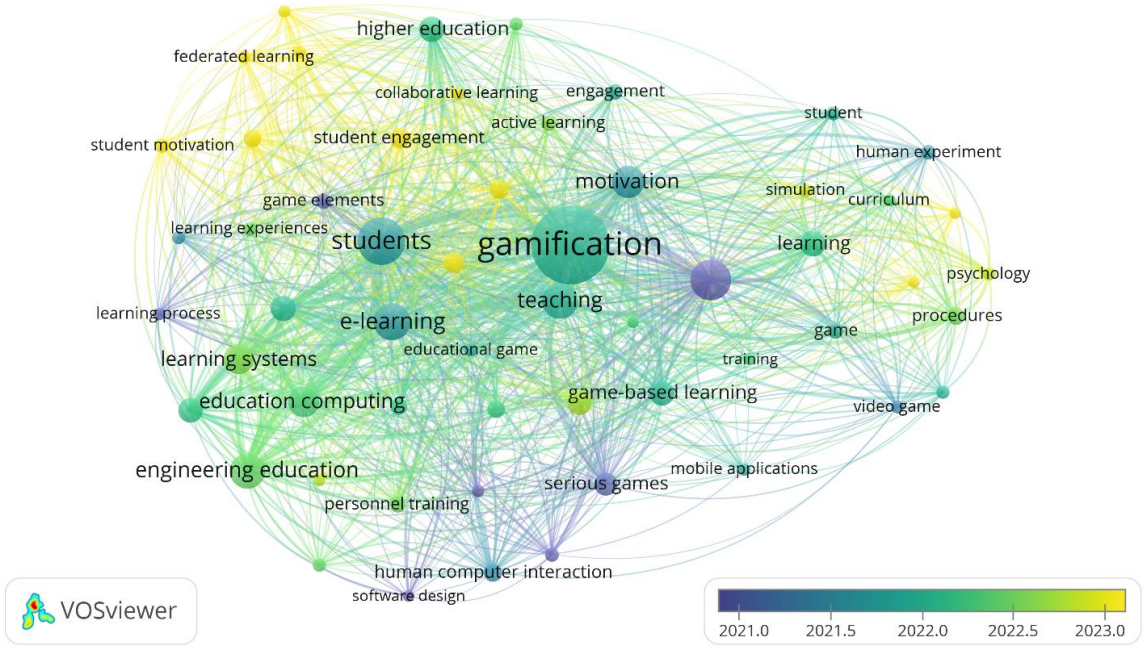

Figure 5. Overlay Visualization

Source: Data Analyzed

According to the diagram, previous topics, which have been marked in blue and purple colors, are mostly associated with technology-related and system-related topics like human-computer interaction, software design, and serious games. The implication is that when the study of gamification began in the education sector, it was largely driven by technological advancement and the incorporation of gaming elements into computer-based educational systems. In other words, the emphasis at that point was mainly on the construction of the learning platform itself. With the development of the field, attention was drawn towards pedagogical and learner-oriented topics, indicated by green-colored nodes like gamification, learners, motivation, education, and learning.

This indicates that scholars started moving away from mere implementation issues in favor of investigating the pedagogic implications of gamification. The rising popularity of these terms indicates the emergence of an interest in studying the effects of gamification on learners. Some recent trends in research, as shown by the yellow nodes, include topics such as student motivation, engagement, collaborative learning, and higher education. It can be seen from this trend that current research is becoming more and more inclined towards improving the efficiency of game techniques in particular educational settings, especially higher education. Moreover, the advent of these topics also shows an inclination towards the social and psychological dimensions of learning.

3. Density Visualization

Figure 6 below shows the density map showing co-occurrences of keywords in gamification research in education that was produced by means of using VOSviewer. In this map, colors represent the strength or degree of occurrence of keywords, whereby the regions of high density and frequent co-occurrences are depicted by warm colors (yellow) while those of low density and frequent co-occurrences are shown by cool colors (from green to blue).

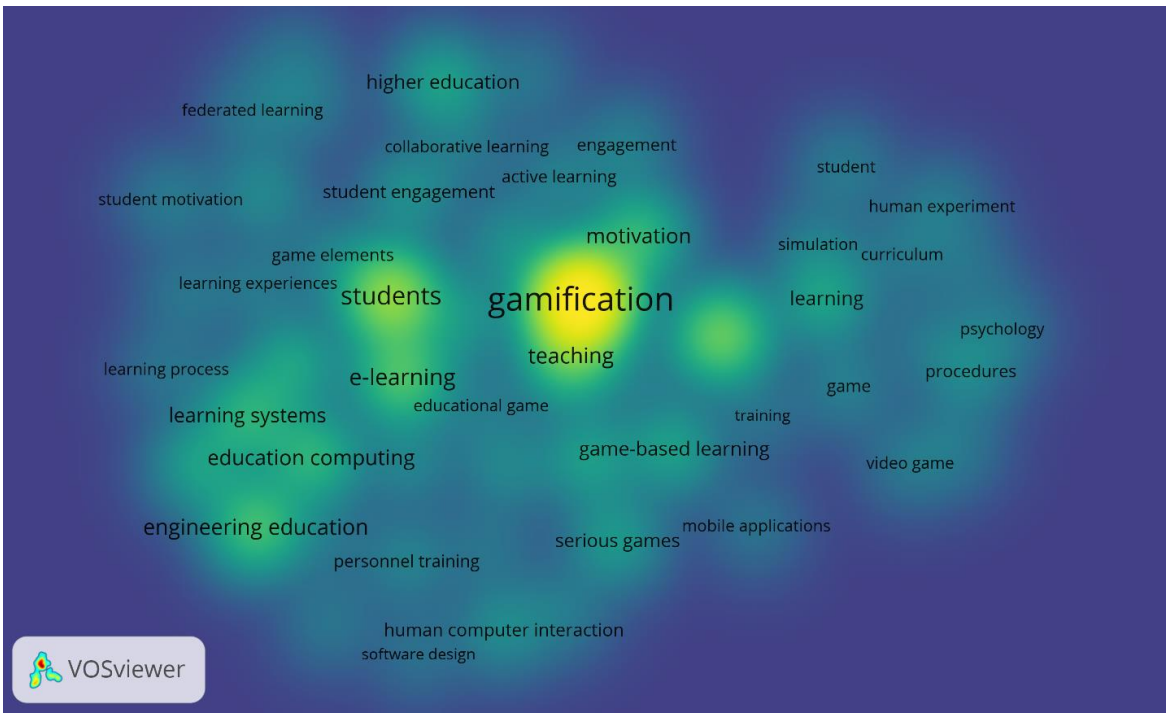

Figure 6. Density Visualization

Source: Data Analyzed

As is evident from the visualization, the keyword "gamification" is the most prominent one that appears to be at the very center of the map, highlighted by the yellow color that is the brightest on the map. In this way, the visualization shows how gamification is the main subject in the area, as the focal point from which the rest of the topics can be considered. The high-density clusters near this keyword include such words as students, motivation, teaching, and e-learning, thus implying that the key aim of all this literature is to enhance student engagement and motivation through gamification techniques. Unlike this, less dense zones, symbolized by green and blue tones, contain terms like human-computer interaction, software design, mobile application, and video game. Although these issues may be related to the topic and relevant, they seem to occupy an auxiliary position on the map. The marginality of the latter denotes the fact that despite the importance of technology and systems issues, they receive far less attention compared to educational considerations. The above shows that the sphere has developed towards the prioritization of educational benefits over technological developments.

Discussion

From the results of the bibliometric analysis conducted in this paper, it can be clearly seen how well the intellectual structure and development trend of gamification studies in the educational

domain have been revealed. In particular, based on the study of co-authorships, it becomes clear that gamification is an area that operates under conditions of clustered cooperation, in which scientists usually cooperate within certain circles but do not create an integrated global network. As seen from the data provided, some leading scholars, such as Hamari and Isotani, play a central role in developing this field. Through citation analysis, it can be seen that the theoretical background of gamification research in education relies on only a few select organizations and scholars. The universities like the University of Tampere and University College Dublin are at the forefront when it comes to developing quality academic research, as seen in their citations. Although the involvement of these institutions in knowledge development is commendable, it shows the dominance of select institutions in theory and practice advancement. On the downside, however, there is a concentration of knowledge generation that might lead to a narrow view if left unchecked.

Furthermore, the keyword co-occurrence analysis reveals how the core of this area is highly focused on concepts such as gamification, learners, motivation, learning, and teaching. Such results prove that the major aim of gamification studies in education is engaging learners and improving educational outcomes. The existence of various clusters, from pedagogical and psychological aspects to technological and system ones, proves how interdisciplinary this field is. In turn, the interdisciplinary nature of the studied area permits using educational, psychological, and technological theories and models for analyzing it. Overlaying the visualization provides a temporal element to this analysis, where a definite progression can be observed in terms of the nature of the research conducted over time. The earliest research was heavily focused on technical issues, such as Human-Computer Interaction (HCI) and software design, which corresponds to the early stages of gamification system development and deployment. Later, pedagogical goals became the central theme, and greater attention began to be devoted to motivation, engagement, and learning. Contemporary trends indicate a shift towards more sophisticated concerns, such as collaboration, higher education, and learner-centric approaches.

This visualization makes clear the prevalence of the core topics but also identifies the areas which have not been researched to a sufficient degree. While subjects relating to student engagement and academic performance are well-researched, it seems like technological elements and applications in this field have received relatively little attention. It would be helpful to examine how the use of artificial intelligence and adaptive learning technology can be incorporated into gamified education programs. There might be a need to expand the scope of study geographically, as well.

CONCLUSION

The current bibliometric analysis provides an effective framework through which the structure and evolution of research on gamification within education can be captured. From the findings, it is evident that there are specific collaborative clusters and institutions that define the field under study, while conceptually, the field revolves around issues such as engagement, motivation, and learning outcomes. With regard to the evolution of research in the field, it is worth noting that the orientation has moved from being predominantly technology oriented to one that is pedagogical and learner focused. This aspect underscores the fact that this area is well developed. However, there are still avenues through which improvements in areas such as global collaboration and utilization of emerging technologies can be made.

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