



Mapping Gamification Trends in HRM: A Bibliometric Exploration using RStudio

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ABSTRACT

Purpose: Gamification, the application of game-like elements in non-gaming contexts, has quickly become popular as one of the most effective persuasive strategies for encouraging useful behavioral changes in users. The gamification research in the field of HRM is expanding swiftly, moving from basic and fundamental questions like what and why to more complex ones like how, when, and when not to gamify for the employees. It still faces theoretical and empirical challenges to demonstrate the practical effects of gamification and strengthen the guiding principles for meaningful gamification designs. The paper aims to do a bibliometric analysis to characterize the structure and evolution of gamification as a scientific field.

Design/Methodology: Using the RStudio package, a bibliometric analysis of articles is conducted in gamification by extracting data from the Scopus database for sixteen years (2007-2023). The conceptual, intellectual, and social network structures of gamification research, as well as the dynamic and evolutionary features of the field, using techniques from science mapping and bibliometric performance analysis, are analyzed.

Findings: Bibliometric approaches are used to identify the top authors, top journals, and important topics. A thorough bibliographic network-based content analysis is then conducted. There are three main clusters that show the scope of the specialized field's study. Lastly, the study has identified critical research gaps to guide future research.

Practical implications: The purpose of this article is to examine the journal's predominant patterns about articles, authors, institutions, countries, journals, themes, and keywords. The study's findings will assist readers in fully comprehending the topic.

Limitations: The database utilized is exclusively from Scopus; it does not include information from other databases like Google Scholar, the Web of Science, etc. The available data is merely for sixteen years, from 2007 to 2023.

Keywords: Citation analysis, Gamification, HRM, Bibliographic coupling, Bibliometrics analysis, Co-occurrence analysis, Bibliometrics

1. INTRODUCTION

The term "gamification" was first coined officially in 2002 by Nick Pelling. In 2004, "Games for Change-G4C," another effort, was launched with the intention of transforming society via video games. In 2005–2007, Bunchball was established to offer its clients a gamified platform. By 2010, gamification had become widely recognized due to the widespread usage of the internet. Organisations began to adopt gamification in 2011 (McCormick, 2013). In 2011, Gamification was defined as "the use of game design elements in non-game contexts" (Deterding et al., 2011). Since then, gamification has rapidly grown into one of the most popular persuasive technologies used to encourage positive changes in user behavior by introducing game-like elements into non-gaming contexts. The most common outcome of gamification is increased user engagement and intrinsic motivation towards developing particular actions, usually viewed as dull or uninteresting. Initially used in the business and marketing domains, gamification's popularity quickly spread to other domains where human interaction exists, including healthcare, education, recruitment, energy saving, project management, crowdsourcing, and software development.

The workplace is rapidly becoming digital, and stakeholders are interested in technology design and development to take advantage of its benefits (Verhoef et al., 2021). Researchers and practitioners have become interested in this pattern, encouraging the creation of an innovative approach known as "gamification." Despite the rising importance of the topic in the literature, research on gamification in HRM still needs to be completed, and many authors call for more research on gamification in the field of HRM. With this study, the aim is to understand how the literature on HRM gamification has been evolving and the main trends and acknowledge its reported success.

Why do organizations gamify their systems? According to Oprescu et al., 2014, the long-term aim of companies who gamify their workplaces is to increase wellbeing and work satisfaction, and gamification is one way to achieve it. Many game mechanics may be applied in the entrepreneurial world which include the attribution of points, badges, leaderboards, countdowns, or even the application of puzzles (Nah et al., 2019). Existing research and evidence suggest that when inserted in a gamified system, individuals are likely to change their behavior by expressing more willingness to engage in tasks that are repetitive and making multiple attempts to expose themselves to failure, disregarding the risk of failure (Dale, 2014). This is the main essence of the epistemological framework currently driving researchers to learn and the argument for adopting gamification approaches.

When conducting literature reviews, four main methods are often employed: a) narrative, b) systematic, c) meta-analytic, and d) bibliometric (Cronin et al., 2008; Pare et al., 2015). The first two strategies are quite widespread, particularly the systematic one frequently employed to pinpoint a research void supporting a study or doctorate dissertation. This category includes most literature reviews carried out in the gamification sector. The majority of these studies are qualitative, which brings us to the two traditional weaknesses associated with this kind of work: the study's degree of completeness concerning covering all pertinent and available literature and the impossibility of replication, which is an essential requirement for any research work (Galvagno, 2017). The two other methods for conducting literature reviews provide a supplementary tactic in the shape of quantitative research. Applying statistical techniques to a vast collection of works' conclusions allows researchers to detect patterns or links. This is known as a meta-analysis study. In the topic of gamification, various meta-analyses have been carried out. For instance, for the past two years, a meta-analysis has been the method chosen to combine the impacts of gamification on behavioral, cognitive, and motivational learning outcomes (Sailer & Homner, 2020), the earlier quantitative studies in gamification (Baptista & Oliveira, 2019). Bibliometric studies also use statistical methods to "measure the 'output' of individuals/research teams, institutions, and countries, to identify national and international networks, and to map the development of new (multidisciplinary) fields of science and technology."

2. Review of the literature on bibliometric analysis

This research adopted bibliometric analysis, a word first used by Pritchard (1969), who claimed that it could be used in any study to measure the textual communication process (Gokhale et al., 2020). Bibliometric analysis is a methodology that measures, tracks, and analyses academic literature using various quantitative techniques (Roemer & Borchardt, 2015). It identifies the writers' publications, the most prestigious journals, approaches taken, and results (Duran Sanchez et al., 2014). Any field of study may be summarised using metadata (Milian et al., 2019). Large amounts of bibliographic material are analyzed by bibliometric approaches, which have been applied to many themes (Blanco-Mesa et al., 2017), countries (Mas-Tur et al., 2019), journals (Martínez Lopez et al., 2018), and other entities. Critical bibliometric analyses are found in the scientific literature. Encarnacao et al. (2022) conducted a retrospective bibliometric study of papers regarding work gamification. It was determined that gamification was one of the most critical developments in increasing employees' productivity inside the company. The findings showed that the number of papers produced has increased quickly in recent years.

3. Research Methodology

Bibliometric analysis is a widely recognized study strategy among researchers worldwide since it allows them to handle enormous volumes of data and deliver a high degree of research effect. This method aims to classify the published materials on a research topic by using a set of criteria for the examination and classification of the articles (Aria et al., 2017). Along with the present investigation, the analysis using Bibliometrix, which offers all the tools required to conduct an exhaustive bibliometric analysis in compliance with the Science Mapping Workflow is derived. Its fame is based on several factors, including the development, accessibility, and use of several bibliometric tools in the R package, a programming language for statistical analysis and visualization. The R package and its software-based bibliometric program, Biblioshiny is used. The first step in using R was obtaining the data from the Scopus bibliographic database. After that, the data was imported into RStudio, which helps with study topic analysis and dynamic visual export (Aria et al., 2017; Niknejad et al., 2021).

Bibliometric techniques evaluate bibliographic data by examining the subject of study and spotting noteworthy patterns. These create structural pictures and use research findings, such as themes and subjects (Ye et al., 2012). This approach finds links between various study topics and researchers and discusses the impact or influence of research activities. The bibliometric approach is often used to provide a journal's thorough overview. Bibliometrics is increasingly used in the literature to examine the growth and content of journals (Martinez-Lopez et al., 2018). Since Scopus is one of the largest databases of peer-reviewed literature, the bibliographic data for this study were taken from it states that it is among the most comprehensive citation databases.

3.1. Bibliometric Analysis Topology

The present study employed a six-step bibliometric methodological approach to solve the research subject matter (Figure 1). Step 1 is the knowledge obtained from a comprehensive review of the literature. In order to determine the research trends of the publications of the most significant journals, research works, institutions, and authors, the second step, Step 2b, offers a network analysis. This analysis aims to highlight the global network of collaboration among scholars. Step 2a focuses on thoroughly evaluating the field through bibliometric citation analysis. Step 3 presents content analysis, while Step 4 presents bibliographic coupling analysis. Additionally, Step 5 illustrates cluster analysis, which combines factorial analysis with MCA. In Step 6, the findings and possible directions for further research are finally presented and addressed.

Various bibliometric citation analysis measures were applied after 314 articles' bibliographic data were retrieved from the Scopus database. These measures included (i) illustrating an overview of research trends, (ii) testing Lotka's law, (iii) identifying the most relevant journals and articles, along with the most influential authors worldwide, (iv) illustrating the thematic map, and (v) developing the collaboration world map (Huber et al., 1998). Lotka's law describes how frequently authors publish in scientific journals. Its central claim is that, although a large percentage of writers only produce one piece, few writers are very productive in any field. The number of writers who publish x amount of papers is around $1/x^b$ of those who publish only one article, as per Lotka's law (Kumar et al., 1998; Egghe, 1993). Therefore, in a given scientific area, a high b value denotes a higher degree of author concentration, whereas a low value denotes the lack of a particular group of writers. The following is the general formula for Lotka's law:

$$x^n * y = c(1),$$

where x is the number of published articles, n is an exponent constant for a specific data collection, and y is the relative frequency of writers with frequency x number of articles.

A three-field plot based on a Sankey diagram has also been produced and has assisted in illuminating the links between journals, keywords, and nations in addition to Lotka's law. Furthermore, the underlying research cluster was examined, and the bibliographic coupling approach was employed to provide a map of current research trends. In the end, the Multiple Correspondence Analysis (MCA) approach was used, with the primary goal being to analyze the bibliographic data and compile it into a set of components. Employing this method may highlight the gaps in knowledge within a particular subject of science and provide an overview of the available literature.

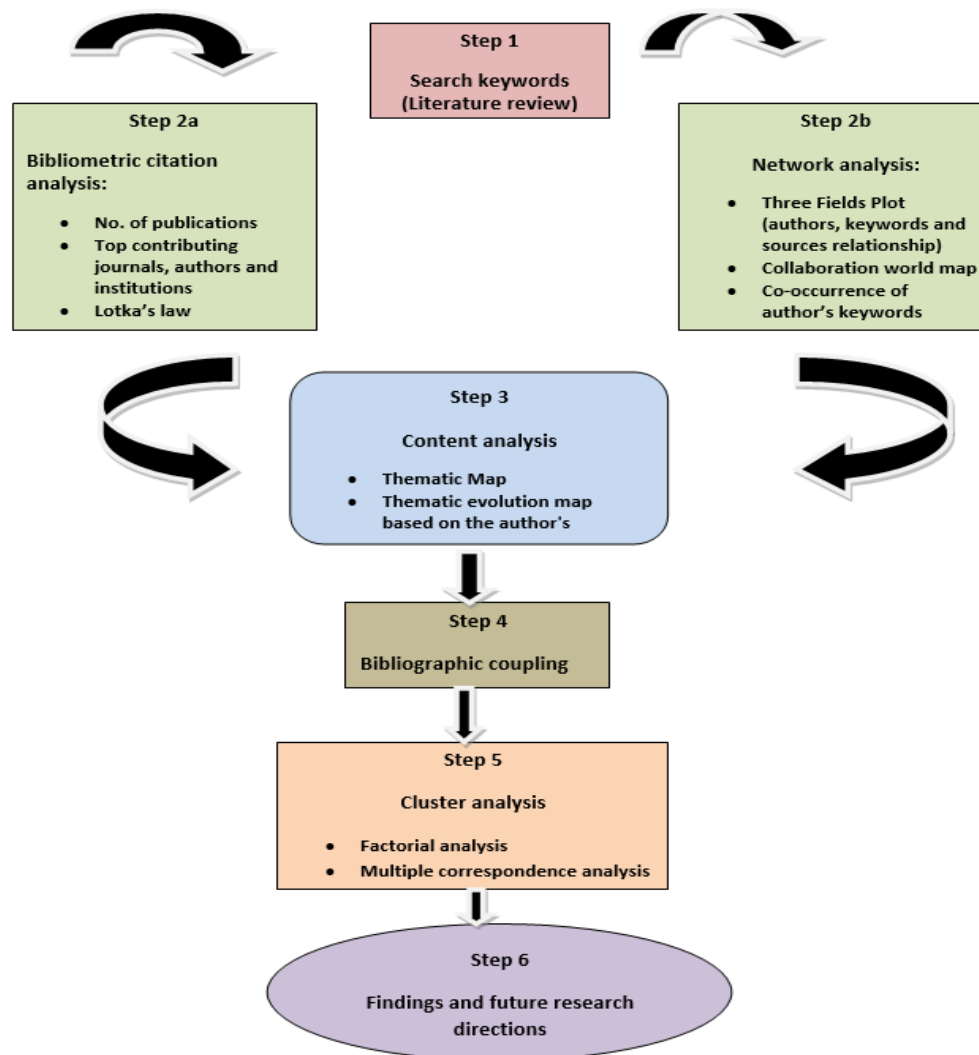


Figure 1: Bibliometric analysis workflow

Source: Author's compilation

3.2. Data Retrieval Process

The widespread database Scopus provided the foundation for gathering data for the bibliometric analysis in this work. The Scopus database was created by Elsevier in 2004. It functions as an interdisciplinary report repository. With over 24,000 current academic journal titles on a wide range of topics with a high degree of research interest, including life, social, and health sciences, it is one of the largest "peer-reviewed" databases globally. Scopus also has over 10,000,000 conference papers and over 230,000 book titles (Niknejad et al., 2021; Amodio et al., 2021). When it comes to content verification and quality, Scopus has the fewest "inconsistencies" when compared to other academic research databases (such as Google Scholar or Web of Science). Web of Science and Google Scholar provide accurate information; however, in some instances, they include duplicate or even triple copies of citations. Consequently, the same data may surface in several publications, leading to inaccurate statistical findings. Additionally, Scopus gives its users access to online tools for bibliometric analysis of their papers, including the ability to calculate the h-index and perform statistical research on publications using time-series frequency charts.

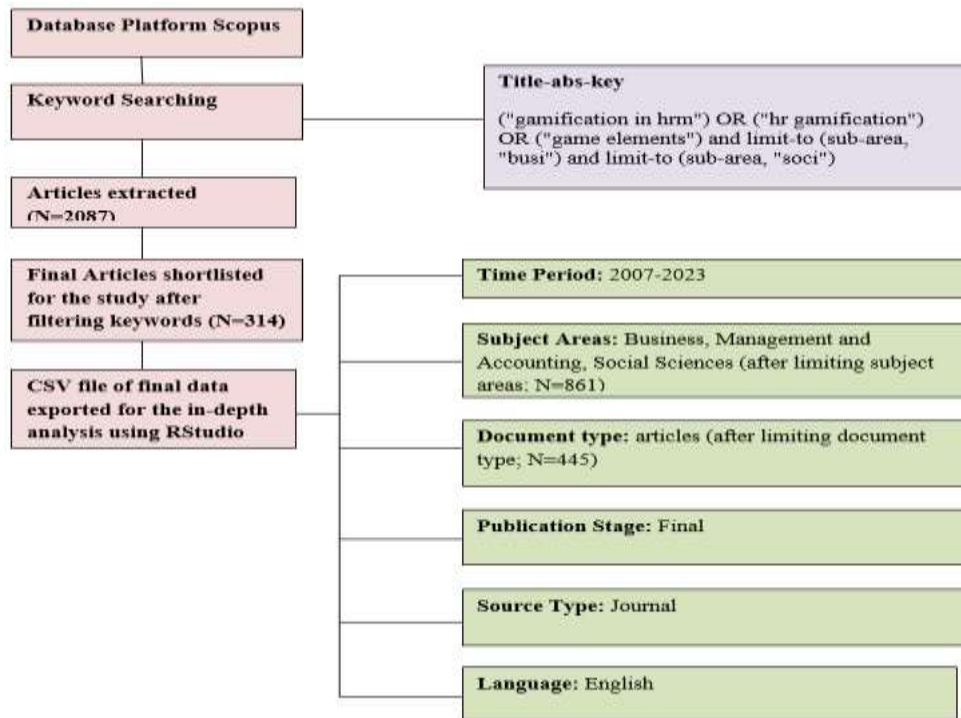


Figure 2: Flowchart of bibliometric data retrieval process

4. RESULTS AND ANALYSIS

4.1. Publication Timespan Trends

Table 1 shows the publishing history for the number of articles published per year between 2007 and 2023. Both the mean total citations per year and the mean total citations per article are shown. The number of papers published per year and the mean total number of citations received annually indicate the trends in publishing and citation. Figure 4 illustrates that the highest average citation per article occurred in 2015, with 144.92. Figure 3 and Table 1 present a summary and analysis of many articles that have addressed gamification trends over the years. As per the collected data, it is found that the articles on gamification in HRM show an increasing trend from 2015; prior to that there was very little research growth, and 2019 showed a gradual increase in the publication, with the maximum number of articles (46) published in 2021 and 2022. This indicates a persistent increase in interest in gamification in the field of HRM research. The mean total citation per article is shown in the first measure, while the mean citation per year is shown in the second. The findings of both metrics suggest that the number of citations for recently released works is low, which is expected given that new research takes time to become widely accepted and impact the academic community.

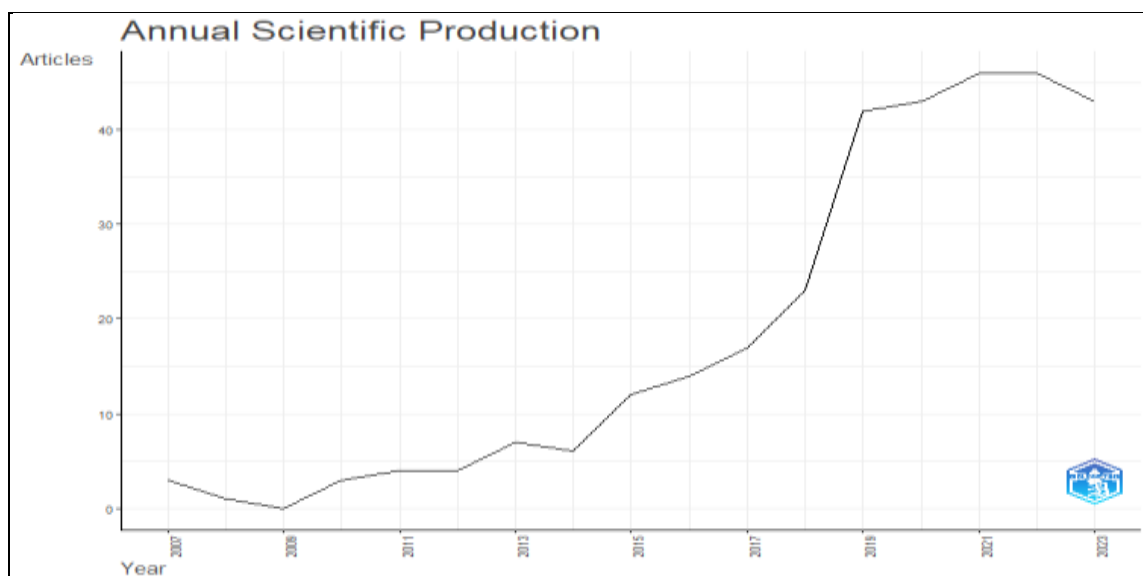


Figure 3: Publication over the years

Source: Bibliometric-R

Table 1: Detailed Publication and Citation trends

Year	N	Mean T.C. per article	Mean T.C. per year
2007	3	6	0.35
2008	1	96	6
2010	3	16.33	1.17
2011	4	42.75	3.29
2012	4	12.75	1.06
2013	7	25.86	2.35
2014	6	93.67	9.37
2015	12	144.92	16.1
2016	14	25.36	3.17
2017	17	17.47	2.5
2018	23	20.43	3.4
2019	42	24.93	4.99
2020	43	16.98	4.24
2021	46	12.96	4.32
2022	46	4.78	2.39
2023	43	1.02	1.02

Source: Prepared using M.S. Excel

The average annual citation in the gamification from 2007 to 2023 is displayed in Figure 4. With an average citation rate of 16.1 per year, the gamification in HRM articles released in 2015 is highly referenced papers that are regarded as quite outstanding, also depicted in Table 1. However, due to the inadequate quality of the yearly research output generated in this field, the average number of citations each year has declined since 2015.

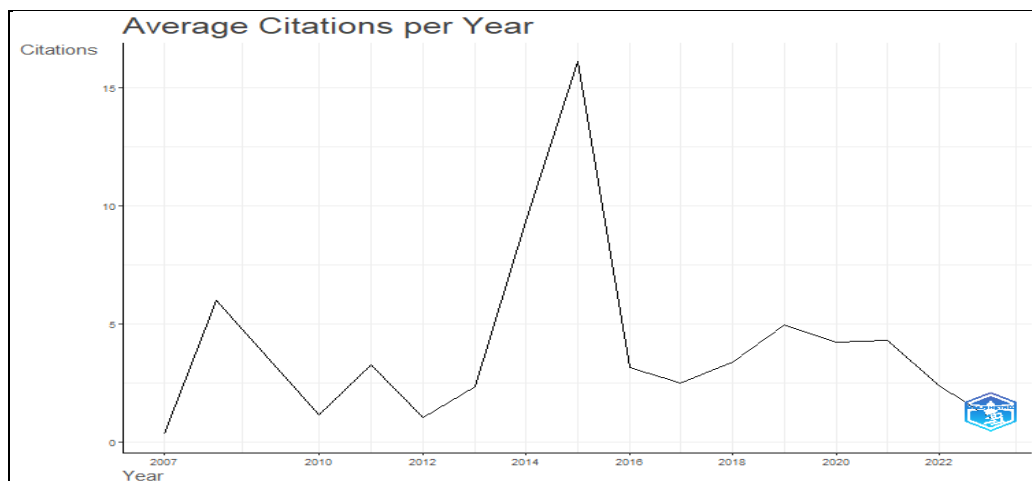


Figure 4: Average Citations per year
Source: Bibliometric-R

4.2. Gamification in HRM: A Discrete Research Domain

Based on the gamification concept in HRM research, authors' scientific production (Table 2) indicates that 843 authors have only published one scientific article on the topic under study. Findings, however, indicate that the three authors have only contributed to a maximum of five publications that have been published. Therefore, gamification's contribution to HRM may be classified as a distinct study field with a high level of authorship concentration.

Table 2: Author's productivity through Lotka's Law

N.Articles	N.Authors	Freq/Proportion of Authors
1	843	0.931491713
2	44	0.048618785
3	11	0.012154696
4	4	0.00441989
5	3	0.003314917

Source: Prepared using M.S. Excel

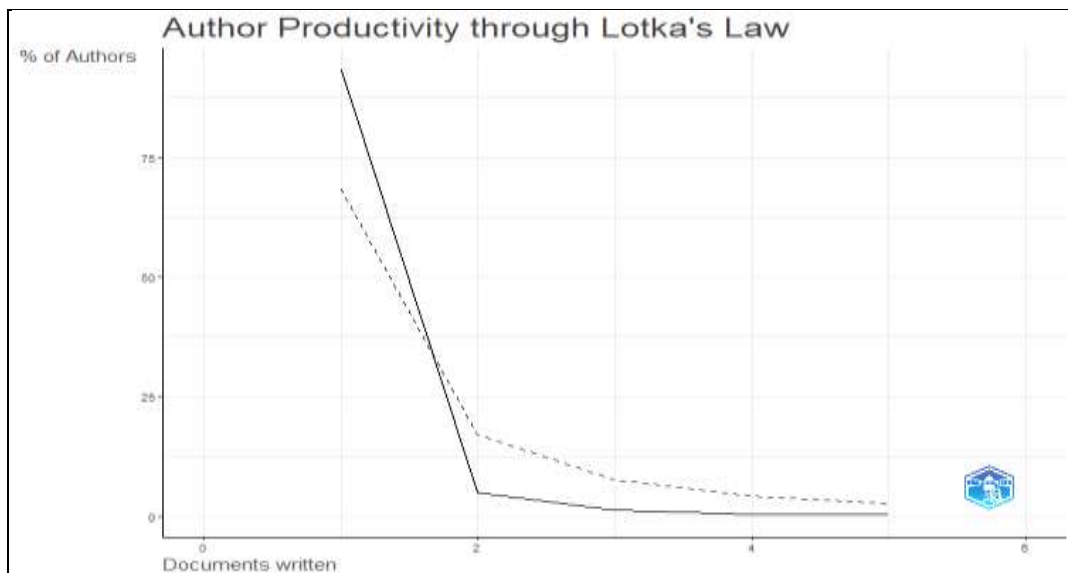


Fig 5: Author Productivity through Lotka's Law
Source: Bibliometric-R

4.3. Most Influential Journals, Authors, Institutions, and Documents
Top Contributing Journals

Figure 6 displays the top 25 journals that have published articles on gamification in HRM and demonstrates the distribution of the various most influential publications. According to the figure, "Education and Information Technologies" is the most prolific journal, ranking first with thirteen articles. With a score of six articles, Computers and Education, Journal of Educational Computing Research, and Simulation and Gaming are all in second place. The majority of the journals published four or three papers among the top 25 journals. The corpus of gamification in HRM has been significantly impacted by "Education and Information Technologies," which is in the frontier journal with the most papers published in the study subject (13) throughout the research timespan 2007–2023. The h-index of the most relevant journals in the subject area is displayed in Table 4 with their respective frequencies.

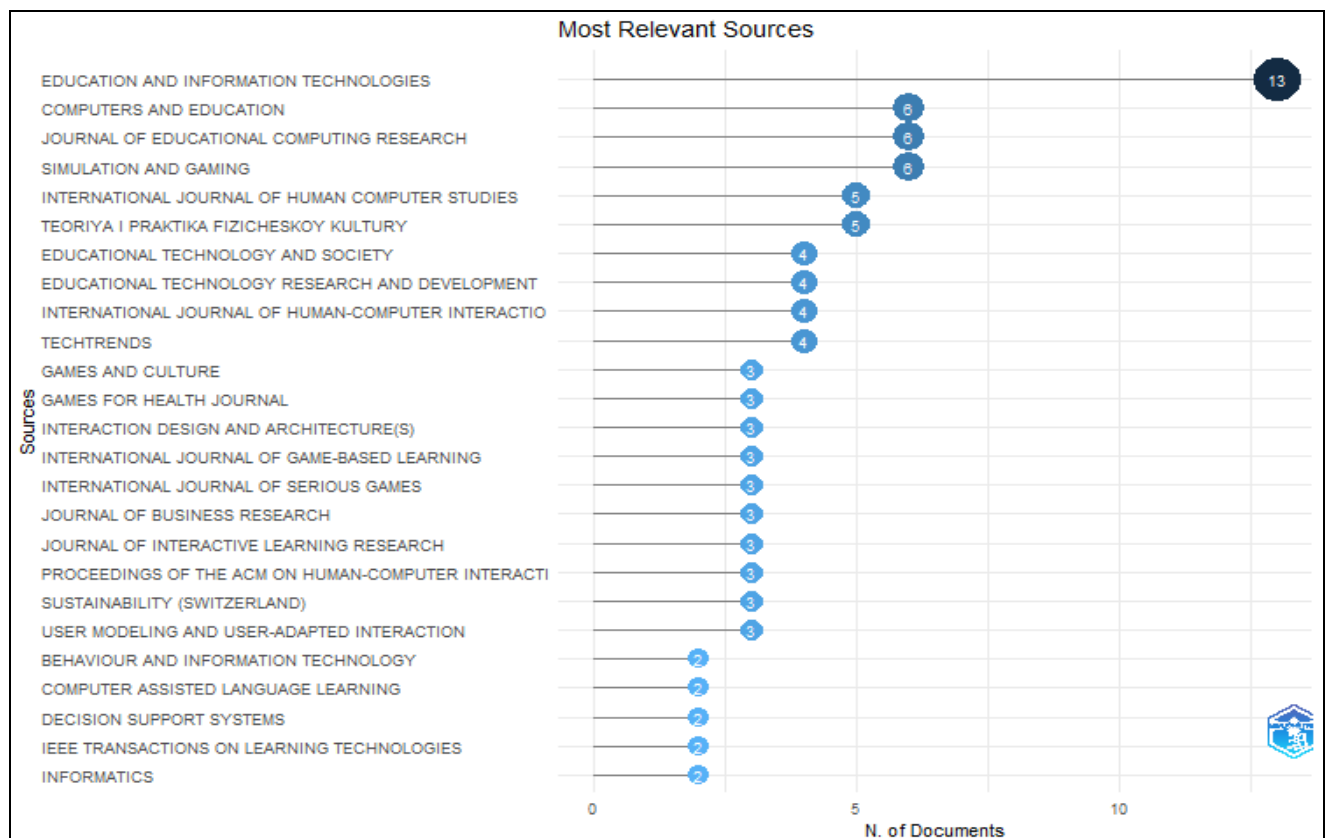


Figure 6: Most relevant sources

Source: Bibliometric-R
Table 4: Mostrelevant journals in the research field

Sources	No. of Articles	h-Index	Rank	Frequency
EDUCATION AND INFORMATION TECHNOLOGIES	13	8	1	13
COMPUTERS AND EDUCATION	6	6	2	6
JOURNAL OF EDUCATIONAL COMPUTING RESEARCH	6	3	3	6
SIMULATION AND GAMING	6	5	4	6
INTERNATIONAL JOURNAL OF HUMAN-COMPUTER STUDIES	5	4	5	5
TEORIYA I PRAKTIKA FIZICHESKOY KULTURY	5	1	6	5
EDUCATIONAL TECHNOLOGY AND SOCIETY	4	4	7	4
EDUCATIONAL TECHNOLOGY RESEARCH AND DEVELOPMENT	4	3	8	4
INTERNATIONAL JOURNAL OF HUMAN-COMPUTER INTERACTION	4	4	9	4
TECH TRENDS	4	2	10	4
GAMES AND CULTURE	3	3	11	3
GAMES FOR HEALTH JOURNAL	3	3	12	3
INTERACTION DESIGN AND ARCHITECTURE(S)	3	2	13	3
INTERNATIONAL JOURNAL OF GAME-BASED LEARNING	3	2	14	3
INTERNATIONAL JOURNAL OF SERIOUS GAMES	3	2	15	3
JOURNAL OF BUSINESS RESEARCH	3	3	16	3
JOURNAL OF INTERACTIVE LEARNING RESEARCH	3	3	17	3
PROCEEDINGS OF THE ACM ON HUMAN-COMPUTER INTERACTION	3	1	18	3
SUSTAINABILITY (SWITZERLAND)	3	2	19	3
USER MODELING AND USER-ADAPTED INTERACTION	3	3	20	3
BEHAVIOUR AND INFORMATION TECHNOLOGY	2	1	21	2
COMPUTER-ASSISTED LANGUAGE LEARNING	2	2	22	2
DECISION SUPPORT SYSTEMS	2	2	23	2
IEEE TRANSACTIONS ON LEARNING TECHNOLOGIES	2	2	24	2

Source: Prepared using M.S. Excel

SOURCES GROWTH

Regression analysis using the method known as "Locally Estimated Scatterplot Smoothing" (LOESS) creates a smooth line through a scatterplot to illustrate the variety of publications over time. Figure 7, based on the analysis, shows that the growth of the top twenty-five journals is considered. This figure indicates that the Journal published more articles from the beginning, and in 2022, it published the maximum number of articles. From 2019 onwards, "Computers and Education," "Simulation and Gaming," and "Educational Science and Technology" show a rapid increase in publication. Despite the other journals' consistent rise in articles over the previous few years, this may point to the establishment of a field of interdisciplinary research study.

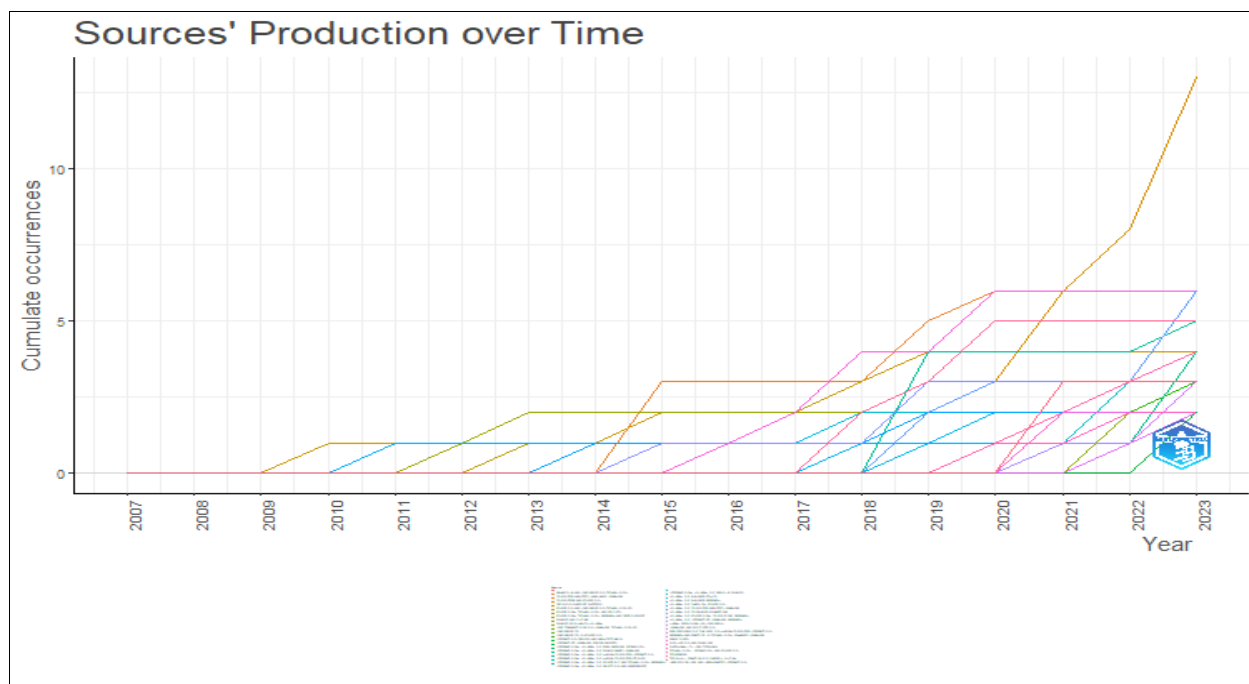


Fig 7: Source’s Production over Time
Source: Bibliometric-R

TOP CONTRIBUTING AUTHORS

During the bibliometric study, a review of the most well-known authors might aid in defining the research area (Marcucci et al., 2021). The researchers with the most significant influence on the research community in the topic under study are shown in Table 5, and an integrated metric of the fractionalized articles of each author shows the percentage of their co-authored publications. The most productive authors in this discipline with the most publications were Behl A, Isotani S, and Rodrigues L. With four published articles each, Halifax S, Oliveira W, Palomino PT, and Toda AM are the second most productive authors, whereas the remaining 60% of authors only generated a maximum of three publications each.

Table 5: Most Impactful Authors

Authors	Articles	Articles Fractionalized	h- Index
BEHL A	5	1.566	5
ISOTANI S	5	0.726	4
RODRIGUES L	5	0.767	3
HALIFAX S	4	0.8666	1
OLIVEIRA W	4	0.601	3
PALOMINO PT	4	0.601	3
TODA AM	4	0.601	3
CHU SKW	3	0.559	2
HU X	3	0.476	3
KLEMKE R	3	0.916	3
NACKE LE	3	0.575	1
SERNA A	3	0.666	1
SOBOLEVA EV	3	0.7833	1
SPECHT M	3	0.916	3
XIE H	3	0.75	3
ZAINUDDIN Z	3	0.559	2
ZHANG R	3	0.75	1
ZOU D	3	0.75	3
ALEXIOU A	2	0.75	2
AN Y	2	2	1
ANTONACI A	2	0.583	2
BENITEZ J	2	0.583	2
BEUTELSPACHER L	2	0.476	1
BITRIÁN P	2	0.583	1
BUIL I	2	0.583	1

Source: Prepared using M.S. Excel

The authors' collaboration network is shown in Figure 8, where each node represents an author, and the edges denote the co-authorship relationship between them (Chen et al., 2022). The purple cluster is the most significant and fundamental author collaboration network; the blue cluster has four author networks, the green and grey clusters have three author networks, and the various cluster shows the weakest collaboration network—it has only two author networks. Notably, neither of the clusters is linked, indicating that there is ample room to improve the overall author collaboration within the gamification of HRM.

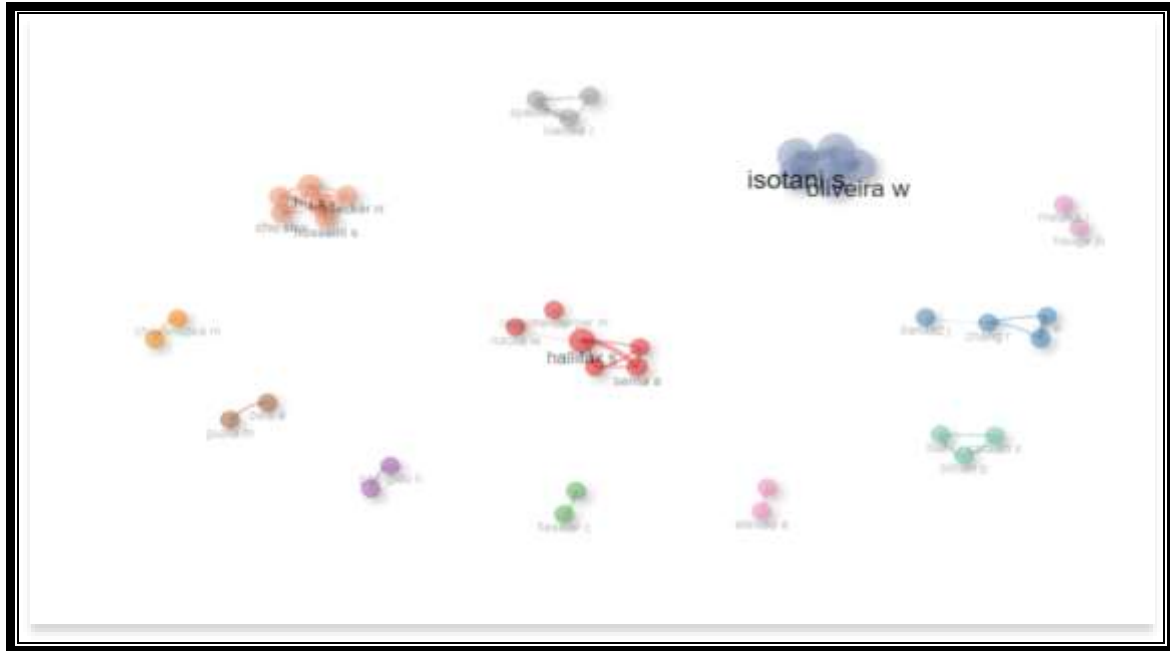


Fig 8: Author Collaboration Network
Source: Bibliometric-R

Lastly, Table 6 lists the most important scholarly publications related to gamification in HRM. Scientific publications based on qualitative and quantitative analyses are included in the table below. Additionally, some of them have investigated how gamification affects the motivation, learning, performance, satisfaction, and engagement of the employees in the organization.

Table 6: Most impactful documents

Paper	Total Citations	T.C. per Year	Normalized TC
DICHEVA D, 2015, EDUCATIONAL TECHNOLOGY AND SOCIETY	1026	114	7.079
SAILER M, 2014, INTERACT DES ARCHITECTURE	241	24.1	2.572
CARVALHO MB, 2015, COMPUT EDUC	239	26.5555	1.649
KALOGIANNAKIS M, 2021, EDUC SCI	201	67	15.513
CAGILTAY NE, 2015, COMPUT EDUC	154	17.11	1.062
BITTNER JV, 2014, J CONSUM MARK	144	14.4	1.537
LIEBEROTH A, 2015, GAMES CULT	143	15.888	0.986
INSLEY V, 2014, INT J RETAIL DISRTIB MANAGE	104	10.4	1.11
TOBON S, 2020, DECIS SUPPORT SYST	100	25	5.89
ZARZYCKA-PISKORZ E, 2016, TEACH ENGL TECHNOL	98	12.25	3.864
WARREN SJ, 2008, J RES TECHNOLOG EDUC	96	6	1
CINQUIN P-A, 2019, COMPUT EDUC	91	18.2	3.65
VANDERCRUYSSSE S, 2013, EDUC TECHNOL RES DEV	90	8.181	3.48
HOWARD MC, 2020, COMPUT EDUC	84	21	4.947
TONDELLO GF, 2019, INT J HUM COMPUT STUD	83	16.6	3.329
ÖZHAN ŞÇ, 2020, J EDUC COMPUT RES	82	20.5	4.83
SMIDERLE R, 2020, SMART LEARN ENVIRON	82	20.5	4.83
WOODCOCK J, 2018, SOCIOL REV	82	13.666	4.0127
ANTONACI A, 2019, INFORMATICS	75	15	3.008
WOLF T, 2020, J BUS RES	69	17.25	4.064

TOP CONTRIBUTING AFFILIATIONS

Table 7 lists the most significant institutions that disseminate research on gamification in the study field to aid businesses in operating more efficiently and in making wiser judgments. Most research-related publications come from the top five institutions spread across many sites. The University of Sao Paulo is the institution that has published the most (19 papers) on the subject of research. The University of Lyon is in second place with twelve published papers, followed by the University of Hong Kong and Bremen in third place with ten articles, and the University of Alberta in fifth place with eight publications.

Table 7: Most relevant institutions

Affiliation	Articles
UNIVERSITY OF SÃO PAULO	19
UNIVERSITY OF LYON	12
THE UNIVERSITY OF HONG KONG	10
UNIVERSITY OF BREMEN	10
UNIVERSITY OF ALBERTA	8
UNIVERSITY OF AVEIRO	8
HEINRICH-HEINE-UNIVERSITÄT DÜSSELDORF	7
ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS	6
FEDERAL UNIVERSITY OF ALAGOAS (UFAL)	6
FEDERAL UNIVERSITY OF TECHNOLOGY-PARANÁ (UTFPR)	6
NANYANG TECHNOLOGICAL UNIVERSITY	6
NATIONAL HEALTHCARE GROUP (NHG)	6
OPEN UNIVERSITY OF THE NETHERLANDS	6
PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE	6
THE EDUCATION UNIVERSITY OF HONG KONG	6
UNIVERSIDAD DE ALICANTE	6
UNIVERSITY OF ALABAMA	6
UNIVERSITY OF AMSTERDAM	6
UNIVERSITY OF KONSTANZ	6
UNIVERSITY OF MARYLAND	6

4.4. Network, Content, Bibliographic Coupling and Cluster Analysis

Figure 9 presents the innovative three-field plot, which presents the interchange among the authors (right side) of the plot, the keywords (middle row), and the sources (left side) within the research domain of gamification in HRM. Each of the twenty-five examples highlighted prominent terms such as gamification, personalization, game elements, game-based learning, motivation, etc., along with the authors' names and sources. The author observed that most of the articles published in the study area are through education and information technologies. Generally, the term gamification is focused on by various authors, which include behla isotonic s, Oliveira, etc.

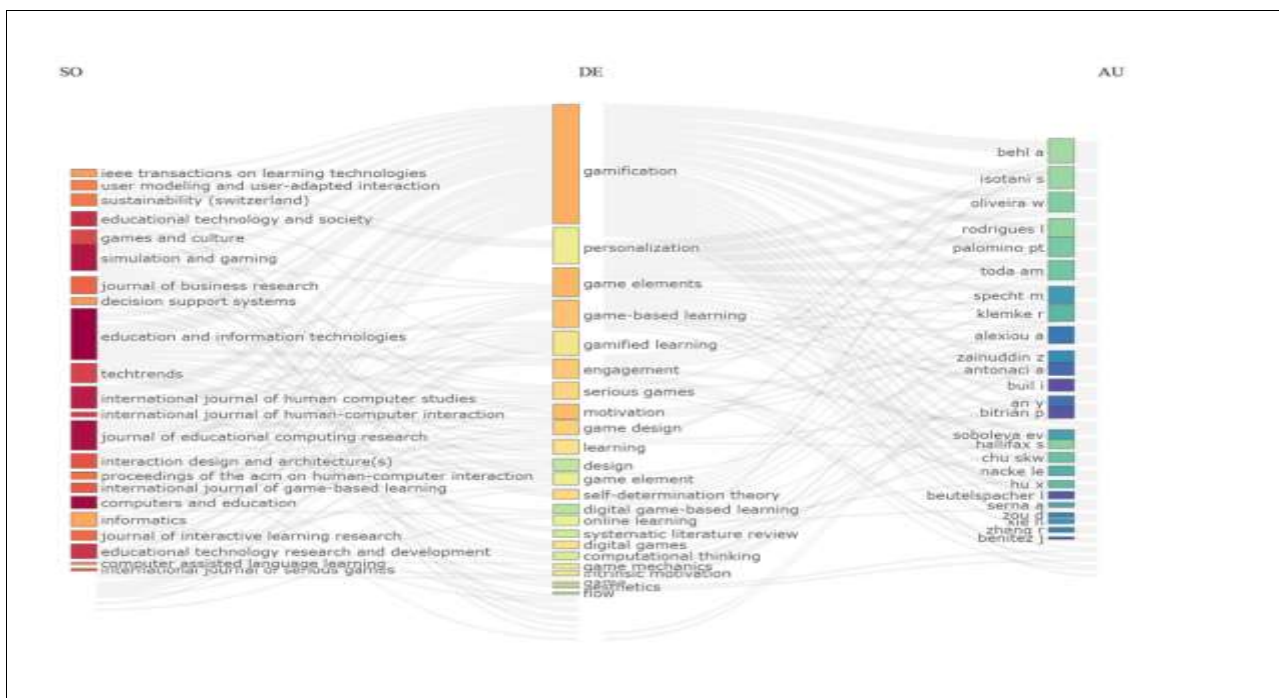


Fig 9: Three- Fields Plot
Source: Bibliometric-R

Moreover, Figure 10 presents the authors' geographical collaboration in the research domain of gamification in HRM. Bibliometrics, frequently referred to as Biblioshiny, was the instrument used to realize the visualization of this scientific partnership. This spatial cooperation analysis aims to draw attention to the social organization of the research community in the area under study. The writers are represented by the graph's nodes, and their co-authorship is shown by the linkages. The map indicates that most of the scientific collaborations on the subject originated in Germany. The most robust scientific channel is between Germany-Netherlands and Germany-Norway. The country-specific collaboration shows that Germany, the U.K. and the USA have highly collaborated; other countries like India, Canada, France are less collaborative.

The country collaboration network is also represented in Figure 11. The networking is presented through various clusters, i.e., red, green, blue, purple, yellow, pink, and brown. The red color cluster shows the network between the countries USA, Germany, Brazil, UK, Canada, Belgium, Finland, Thailand etc. Each node highlights the country, and the edges indicate their collaboration. The red cluster shows the most robust collaboration, whereas the pink cluster shows the weakest collaboration.

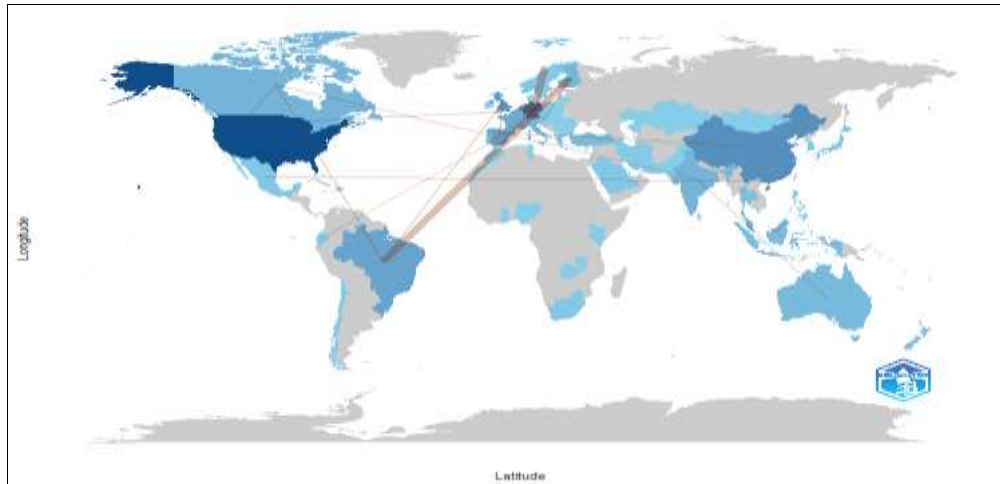


Fig 10: Country Collaboration Map
Source: Bibliometric-R

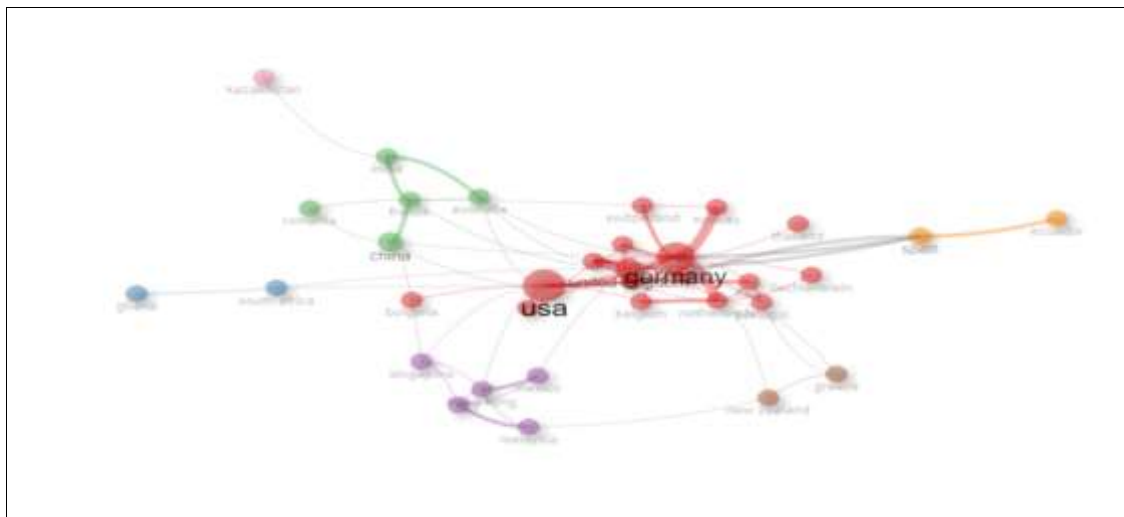


Fig 11: Country Collaboration Network
Source: Bibliometric-R

The author's keyword co-occurrences to determine the research gaps and potential avenues for further study in gamification in HRM were examined. Keywords make up the most thought-out start to a scholarly research piece. By examining the co-occurrence network, researchers may promptly ascertain the research hotspots and future orientations of an academic area (Bian et al., 2021). Figure 12 of this article displays a co-occurrence network for terms; the data indicates three groups, denoted by the colors green, red, and blue. Words represent the vertex, and the size of a node is proportional to its frequency. These colors represent various clusters, and their distance from one another shows relatedness. The green cluster highlights gamification, game elements, intrinsic motivation, gamified learning, user experience, player types etc. The red cluster is dominated by game design, video games, and game design learning, and the blue cluster indicates aesthetics and narrative. Keyword co-occurrence analysis develops a network of themes and their relationships in a scientific field. Themes and keywords with a high betweenness value significantly influence development in the study area.

Such words connect other research topics (Ye et al., 2020). Figure 12 shows a substantial difference in ranking based on the occurrence and betweenness; the keywords "gamification" and "motivation" offered the highest betweenness among all others, i.e. 1005.72 and 45.58, respectively, followed by the keyword "game-based learning" i.e. 45.21.

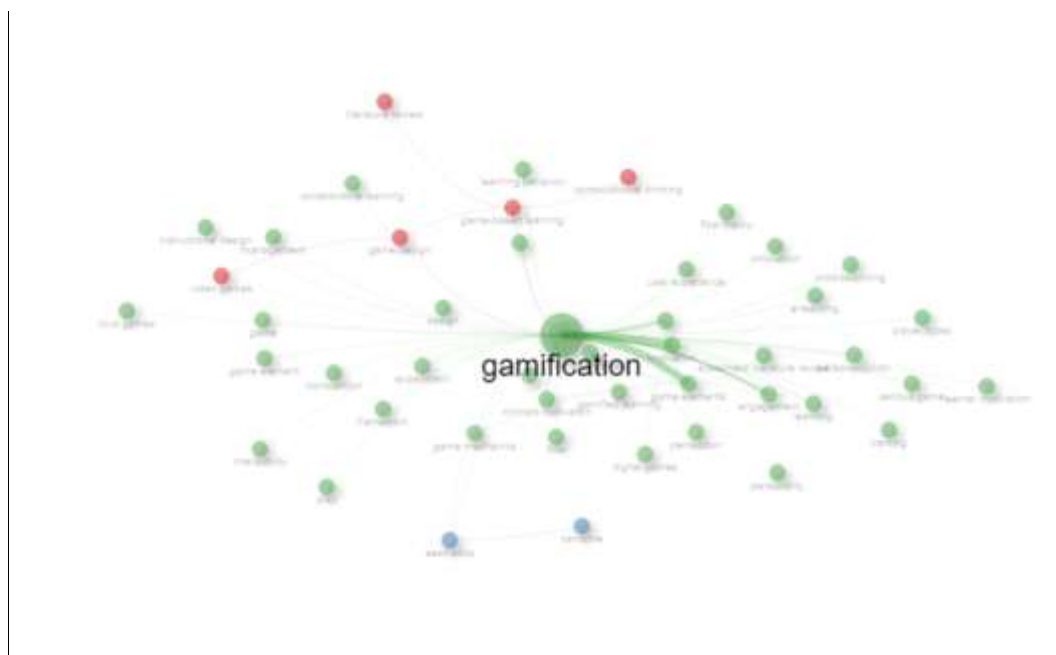


Fig 12: Co-occurrence of author keywords
Source: Bibliometric-R

Figure 13 shows the thematic trend from 2016 onwards, a year from which slightly more continuity was given to human and human-computer interaction. As can be seen, the works that include gamification, game design, and game elements have emerged since 2020 and have maintained a slight upward trend to the present day (2023). Figure 14 shows the most relevant keywords used in the papers, which include gamification, game elements, motivation, human-computer interaction, game design, etc., through the word cloud. The most relevant words used in the study field can be easily reflected by the figure.

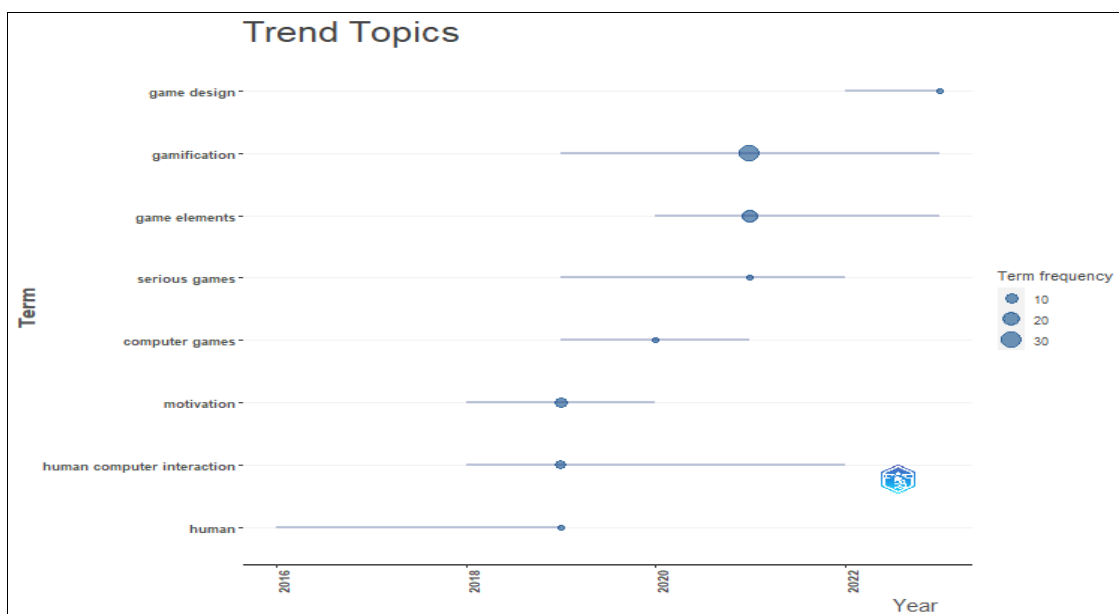


Fig 13: Topic trend
Source: Bibliometric-R



Fig 14: Word Cloud
Source: Bibliometric-R

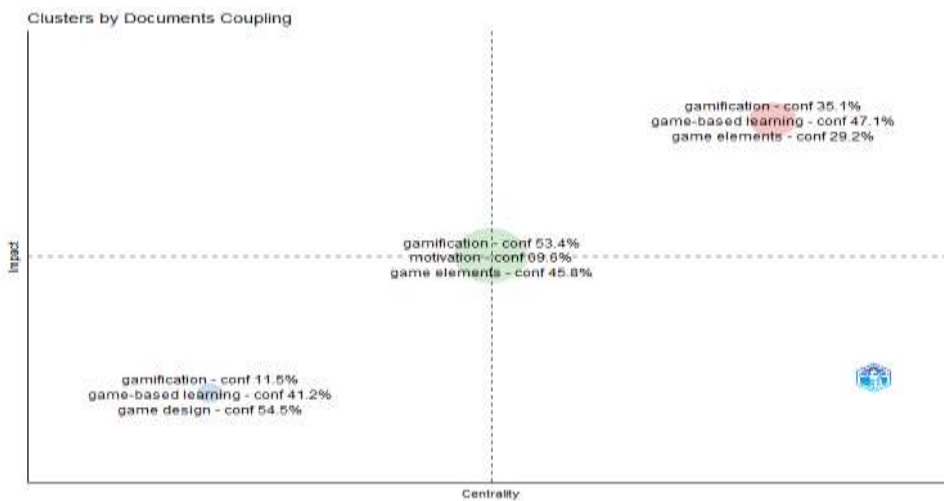


Fig 15: Clusters by Documents Coupling
Source: Bibliometric-R

Figure 15 represents the three main clusters formed by the coupling of documents. The first cluster is about gamification, game-based learning, and game elements, which consists of 82 articles with (2.73) impact. The second cluster, about gamification and motivation, consists of 72 articles. The third cluster is about game design and game-based learning, with 96 articles and (0.4) impact. The gamification theme is centrality, as depicted in the figure above, where the clusters are formed with 250 documents in the walkstrap method.

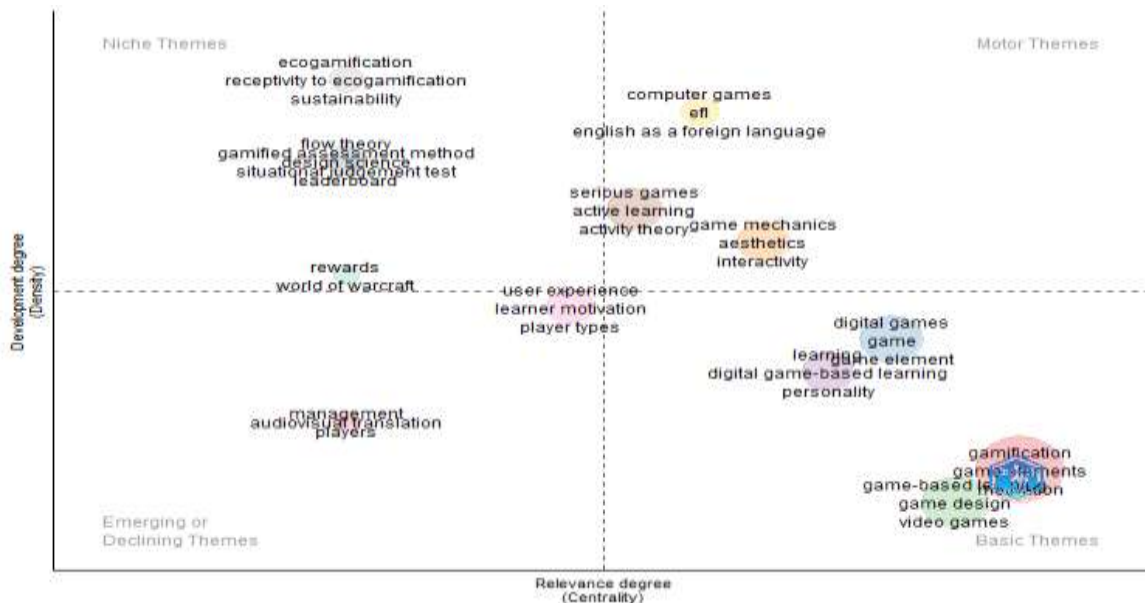


Fig 16: Thematic map based on author's keywords
Source: Bibliometric-R

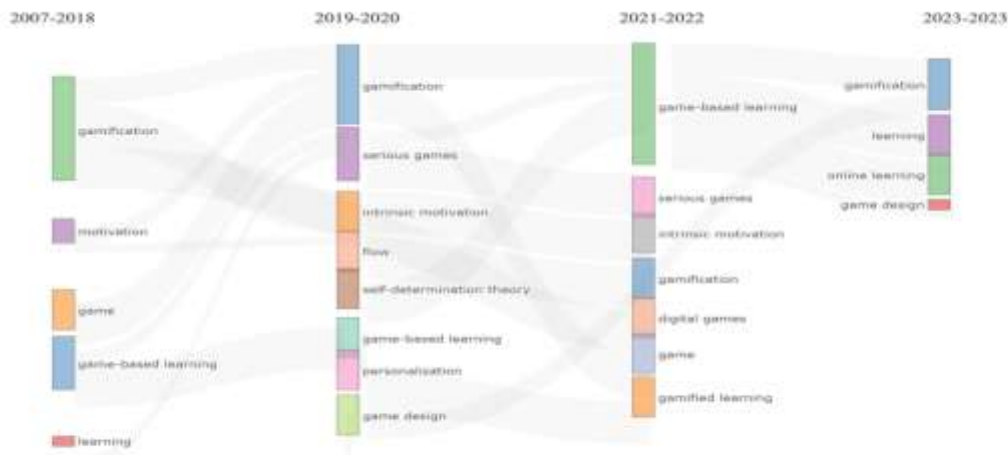


Fig 17: Thematic evolution map based on author’s keywords
 Source: Bibliometric-R

The thematic map of authors' keywords, shown in Figure 16, illustrates the research topics derived from the conceptual structure of the documents that were part of the Bibliometric study. The map is separated into four quadrants, each symbolizing a research theme related to the subject under study. Furthermore, the sizes of the clusters emphasize the percentage of terms. Density and centrality are the two dimensions used in the theme map. The internal relationships between the writers' keywords serve as a gauge for the density dimension, which shows how each topic has developed. The significance of each subject is determined by the second dimension, called centrality, which is based on external connections between the authors' keywords. In addition, the map displays four themes: (i) The topics most developed in the literature are the motor themes, which are shown in the upper-right quadrant and are distinguished by both high density and centrality. (ii) The fundamental themes have not yet been fully developed; they are shown in the lower-right quadrant and are characterized by high centrality but low density. (iii) The well-developed and highly specialized niche themes, which are peripheral in the overall examined area, are displayed in the upper-left quadrant of the map and are distinguished by high density and low centrality. and (iv) the developing themes, which are marked by low centrality and density and are located in the bottom-left corner of the map (Ampese et al., 2022).

The primary themes of the thematic map presented in Figure 16 indicate emerging technologies like digital games, digital game-based learning, personality, game design, and video games in the study field area. It was discovered that bibliographies combining sustainability and gamification are rare. By linking them, businesses can achieve not only the ability to engage and motivate employees but also the ability to divert the employees towards ecologically responsible behaviors. Furthermore, emerging themes illustrate that audiovisual translation and management are essential for gamification.

Figure 17 presents the thematic evolution map based on the authors' keywords and illustrates the importance of gamification in the field of HRM. A particular kind of flow diagram called a Sankey energy diffuence diagram is used in the illustration to show the theme progression. In this work, the theme change over time in the field of study research using a Sankey diagram is visualized. Understanding the historical development of the circumstances in which the various gamification-related HRM themes have been flowing is helpful. The sense of quantitative data like theme flow, thematic flow direction, and conversion connections can be made in Fig. 17 (Soundarara Jan et al., 2014).

In terms of the Multiple Correspondence Analysis (MCA) approach, this grid combines the keywords plotted out on a two-dimensional map with co-word analysis (Document Word). Considering the following measurements: The MCA technique classifies the keywords of the original retrieved articles based on (i) the frequency of each keyword and (ii) the joint reference of the keywords in each recovered document. The positions of the points and their distribution along each dimension are used to understand the MCA approach's conclusions. Accordingly, the distribution of words is more similar the closer they are represented on the Conceptual Structure Map.

In Figure 18, 4 clusters are represented with different colors. The most significant cluster is purple, and the smallest cluster is red. The cluster in purple color highlights the strong connection between emerging topics like gamification, game elements, gamified learning, instructional design, personalization, and their impact on the training, intrinsic motivation and user experience. The green cluster also shows closely related terms like digital games, video games, and serious games and their effect on the people's learning, engagement, personality and interactivity. Conversely, the blue cluster illustrates the link between aesthetics, flow and game mechanics. The smallest cluster (red) relates game-based learning, game design and computational thinking.

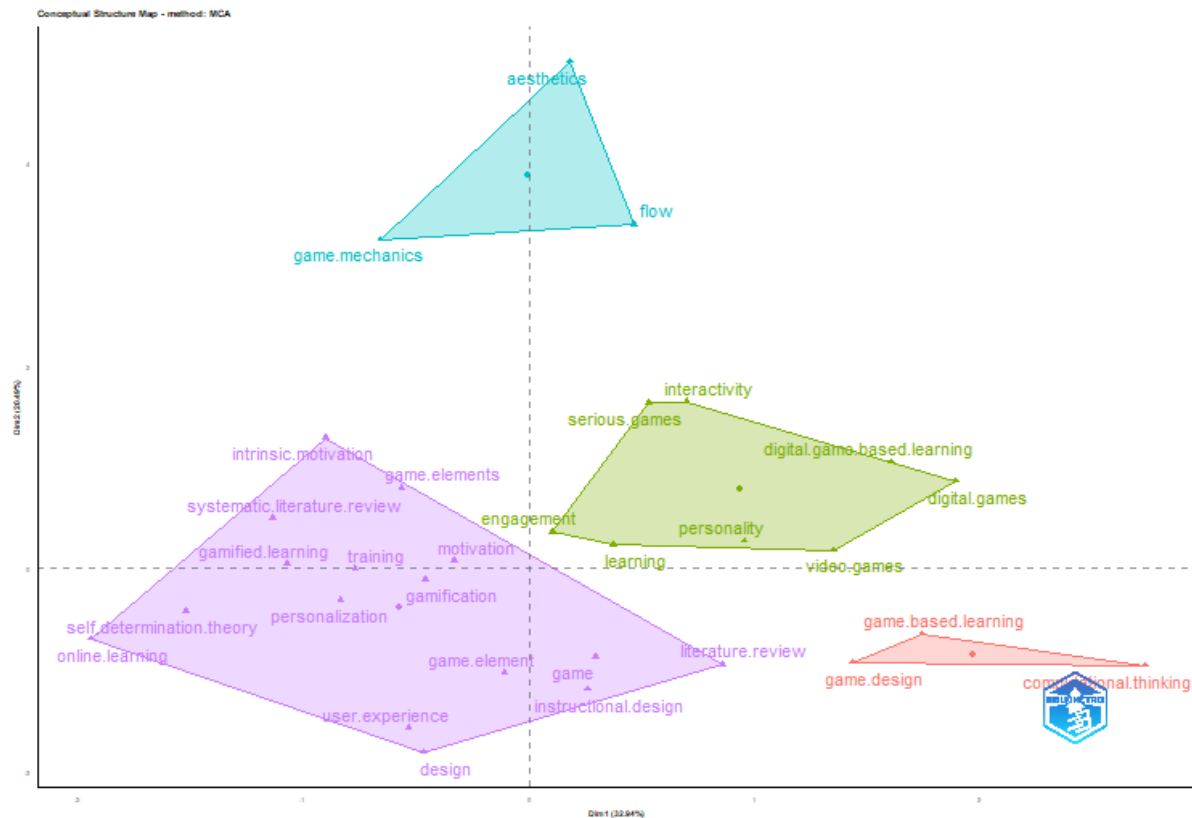


Fig 18:Factorial analysis based on the MCA method
Source: Bibliometric-R

5. Conclusion

The study aims to give the results of a bibliometric analysis of the current state of research on gamification in HRM. It will also provide a comprehensive overview of gamification in order to identify the knowledge map. Bibliometric analysis identifies the major trends in the field of study and the research patterns in journals or scientific domains. As a result, the research article intends to determine the publication trend of gamification in HRM from 2007 to 2023 and provide valuable data to the researchers and stakeholders of the organizations. Biblioshiny in the RStudio software package is used to extract data from the Scopus database for a bibliometric study of 314 publications in gamification. The number of publications has steadily increased in 2015, reaching 43 in 2020 and a maximum of 46 articles published in 2022. The articles published in 2015 are highly cited papers, with an average annual citation of 144.92, suggesting that the articles are highly remarkable. The "Education and Information Technologies," which has produced thirteen papers, is the most productive. In this theme, the USA is the most cited country. As a result, Germany and the Netherlands are the second and third most cited countries, respectively. The scientific production of the USA country is the highest, whereas India is very behind compared to other countries. The author, Behl A, has five articles that are most relevant to the field of study. In contrast, Isotani S and Rodrigues L are the top second and third relevant authors, respectively. In summary, by highlighting key topics and illustrating new developments, this bibliometric research accurately captures the state of gamification in HRM. The results of the bibliometric study demonstrated how vital gamification is to the evolution of the human resource management research field. Organizations may gain from integrating this cutting-edge technology into HRM in several ways, including improved employee learning, productivity, engagement, and intrinsic motivation. It is also helpful in figuring out the field's current knowledge and potential future study areas.

6. LIMITATIONS AND FUTURE DIRECTIONS

A few limitations apply to this bibliometric study as well. For instance, the data used in this research was sourced solely from the Scopus database on November 20, 2023. This study does not consider data from other databases, such as the Web of Science or Google Scholar. These database sources could be used for additional investigation. Only the English language is used, and the data gathered from the sources is restricted to the following subject areas: social sciences, business, management, and accounting. Because of this, the conclusions and interpretations might probably have been altered if the information had been acquired later or from other databases (Zemigala, 2019). The bibliometrics packages employed in this study include some

methodological bias. Therefore, to allow future researchers to utilize different tools and methodologies like Cite space, VOS viewer, etc., there is a need to declare some standards and criteria.

Furthermore, the sample comprises just 314 papers, as more would need to illustrate the gamification in HRM adequately. Specific themes and subjects, such as gamification for workers and workplace gamification, are either understudied or unexplored in this discipline. It would be excellent to observe how these themes and topics should make the study area more accurate so researchers can examine them for future research. This bibliometric analysis shows that, although relatively new, the subject is developing moderately and has an average distribution of publications, authors, and locations.

7. References

1. Amodio, P.; Brugnano, L.; Scarselli, F. (2021). Implementation of the PaperRank and AuthorRank indices in the Scopus database. *J. Informetr*, 15, 101206.
2. Ampese, L.C.; Sganzerla, W.G.; Di Domenico Ziero, H.; Mudhoo, A.; Martins, G.; Forster-Carneiro, T. (2022). Research progress, trends, and updates on anaerobic digestion technology: A bibliometric analysis. *J. Clean. Prod.*, 331, 130004.
3. Aria, M., & Cuccurullo, C. (2017). Bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal Of Informetrics*, 11(4), 959-975. <https://doi.org/10.1016/j.joi.2017.08.007>
4. Bian, J., Liao, Y., Wang, Y., & Tao, F. (2021). Analysis of firm CSR strategies. *European Journal Of Operational Research*, 290(3), 914-926. <https://doi.org/10.1016/j.ejor.2020.03.046>
5. Blanco-Mesa, F., Merigó, J. M., & Gil-Lafuente, A. M. (2017). Fuzzy decision making: A bibliometric-based review. *Journal of Intelligent & Fuzzy Systems*, 32(3).
6. Chen, H.; Jin, Q.; Wang, X.; Xiong, F. (2022). Profiling academic-industrial collaborations in bibliometric-enhanced topic networks: A case study on digitalization research. *Technol. Forecast. Soc. Chang.*, 175, 121402.
7. Dale, S. (2014). Gamification: Making work fun or making fun of work? *Business information review*, 31(2), 82-90.
8. Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From Game Design Elements to Gamefulness: Defining "Gamification". In A. Lugmayr, H. Franssila, C. Safran, & I. Hammouda (Eds.), *Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments* (pp.9-15). <https://doi.org/10.1145/2181037.2181040>.
9. Durán Sánchez, A., Álvarez-García, J., Río-Rama, D., & Cruz, M. (2014). Active tourism research: A literature review. *ROTUR*, 8, 62-76.
10. Egghe, L. (1993). Consequences of Lotka's law in the case of fractional counting of authorship and of first author counts. *Math. Comput. Model.*, 18, 63-77.
11. Encarnação, R., Dias, M. F., Reuter, J., & Amorim, M. (2022). A BIBLIOMETRIC REVIEW ON WORK GAMIFICATION. *EDULEARN22 Proceedings*, 10514-10522.
12. G. Baptista and T. Oliveira, (2019). "Gamification and serious games: A literature meta-analysis and integrative model," *Comput. Hum. Behav.*, 92, 306-315.
13. G. Paré, M.-C. Trudel, M. Jaana, and S. Kitsiou, (2015). "Synthesizing information systems knowledge: A typology of literature reviews," *Inf. Manage.*, 52 (2), 183-199. doi: 10.1016/ j.im.2014.08.008.
14. Gokhale, A., Mulay, P., Pramod, D., & Kulkarni, R. (2020). A bibliometric analysis of digital image forensics. *Science & Technology Libraries*, 1, 18. <https://doi.org/10.1080/0194262x.2020.1714529>
15. Huber, J.C. (1998). The underlying process generating Lotka's Law and the statistics of exceedances. *Inf. Process. Manag.*, 34, 471-487.
16. Kumar, S.; Sharma, P.; Garg, K.C. (1998). Lotka's law and institutional productivity. *Inf. Process. Manag.*, 34, 775-783.
17. M. Galvagno, (2017) "Bibliometric literature review: An opportunity for marketing scholars," *MercatiCompetitività*, 4, 7-15. doi: 10. 3280/MC2017-004001.
18. M. Sailer and L. Homner, (2020). "The gamification of learning: A meta-analysis," *Educ. Psychol. Rev.*, 32 (1), 77-112. doi: 10.1007/s10648-019-09498-w.
19. Marcucci, G.; Ciarapica, F.; Poler, R.; Sanchis, R. (2021) A bibliometric analysis of the emerging trends in silver economy. *IFAC-Pap.*, 54, 936-941.
20. Martínez-López, F. J., Merigó, J. M., Valenzuela-Fernández, L., & Nicolás, C. (2018). Fifty years of the European Journal of Marketing: A bibliometric analysis. *European Journal of Marketing*, 52(1/2), 439-468. <https://doi.org/10.1108/EJM-11-2017-0853>
21. Mas-Tur, A., Modak, N. M., Merigó, J. M., Roig-Tierno, N., Geraci, M., & Capecchi, V. (2019). Half a century of quality & quantity: A bibliometric review. *Quality & Quantity*, 53(2), 981-1020. <https://doi.org/10.1007/s11135-018-0799-1>
22. McCormick, T. (2013, July/August). Anthropology of an idea gamification. *Foreign Policy*, 201, 26-27.
23. Milian, E. Z., Spinola, M. D. M., & Carvalho, M. M. (2019). Fintechs: A literature review and research agenda. *Electronic Commerce Research and Applications*, 34, 100833. <https://doi.org/10.1016/j.elerap.2019.100833>.

24. Nah, F. F. H., Eschenbrenner, B., Claybaugh, C. C., & Koob, P. B. (2019). Gamification of enterprise systems. *Systems*, 7(1), 13.
25. Niknejad, N.; Ismail, W.; Bahari, M.; Hendradi, R.; Salleh, A.Z. (2021) Mapping the research trends on blockchain technology in food and agriculture industry: A bibliometric analysis. *Environ. Technol. Innov.* 21, 101272.
26. Opreescu, F., Jones, C., & Katsikitis, M. (2014). I PLAY AT WORK—ten principles for transforming work processes through gamification—*frontiers in psychology*, 14, 5.
27. P. Cronin, F. Ryan, and M. Coughlan, (2008). "Undertaking a literature review: A step-by-step approach," *Brit. J. Nursing*, 17 (1), 38–43. doi: 10.12968/bjon.2008.17.1.28059.
28. Pritchard, A. (1969). Statistical bibliography or bibliometrics. *Journal of Documentation*, 25(4), 348–349. <https://doi.org/10.1108/ebo26482>
29. Roemer, R. C., & Borchardt, R. (2015). Meaningful metrics: A 21st-century librarian's guide to bibliometrics, altmetrics, and research impact.
30. S. Deterding, R. Khaled, L. E. Nacke, and D. Dixon, (2011). "Gamification: Toward a definition," in *Proc. ACM CHI Conf. Hum. Factors Comput. Syst.*, 1–4. <http://gamification-research.org/wp-content/uploads/2011/04/02-Deterding-Khaled-Nacke-Dixon.pdf>
31. Shoeb, M., Aslam, A., & Aslam, A. (2022). Environmental Accounting Disclosure Practices: A Bibliometric and Systematic Review. *International Journal Of Energy Economics And Policy*, 12(4), 226–239. <https://doi.org/10.32479/ijeep.13085>
32. Soundararajan, K., Ho, H., & Su, B. (2014). Sankey diagram framework for energy and exergy flows. *Applied Energy*, 136, 1035–1042.
33. Verhoef, P. C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Qi Dong, J., Fabian, N., & Haenlein, M. (2021). Digital transformation: A multidisciplinary reflection and research agenda. *Journal of Business Research*, 122, 889–901.
34. Ye, N., Kueh, T., Hou, L., Liu, Y., & Yu, H. (2020). A bibliometric analysis of corporate social responsibility in sustainable development. *Journal Of Cleaner Production*, 272, 122679. <https://doi.org/10.1016/j.jclepro.2020.122679>
35. Zemigala, M. (2019). Tendencies in research on sustainable development in management sciences. *Journal Of Cleaner Production*, 218, 796–809. <https://doi.org/10.1016/j.jclepro.2019.02.009>