Gamification in Education: An Overview of the Literature

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Introduction

The concept of gamification, which is defined as the use of game design elements in cases outside the game context (Detering et al., 2011a), was first introduced by Nick Pelling in 2002 (Marczewski, 2013). Gamification was included in the documents in 2008 and popularized in 2010 at the Design, Innovate, Communicate, Entertain conference thanks to Jesse Schell (Birch, 2013; Deterding et al., 2011b; Xu, 2011). Google Trends reports the concept of gamification has a remarkable upward trend after the 2010s (Figure 1). This trend has also affected the gamification market, worth $10.19 million in 2020, and is expected to reach nearly $40 million by 2026 (Mordor Intelligence, 2021).

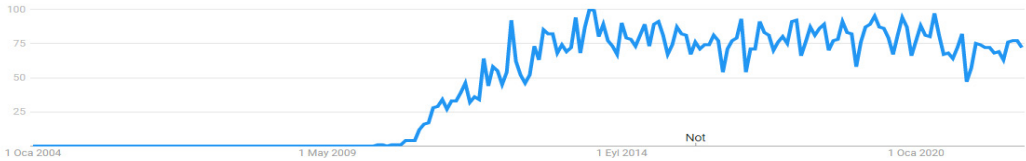

Figure 1. Google Trends Data (Keyword: Gamification)

Gamification as a concept is used effectively in many fields today. It first attracted attention in the marketing, trade, and advertising sectors (Fiş Erümit, 2016). Badges earned through check-ins with social media applications such as Foursquare and Swarm and the points collected on e-commerce sites and awards are examples of this issue (Huotari & Hamari, 2012). Gamification applications, which have gained significant momentum with commercial studies, have also started to be used in educational environments over time (Barna & Fodor, 2017; Kapp, 2012; Luo, 2021; Majuri, Koivisto, & Hamari, 2018; White & Shellenbarger, 2018).

Various websites and mobile applications have been developed for gamification, one of which is ClassDojo, which has a digital badge-based structure. ClassDojo is an in-class communication and digital badge application that brings teachers, parents, and students together. Students can be given badges through the application. Besides, thanks to ClassDojo, students' achievement level, homework performance, activity levels in the classroom can be followed with the virtual characters they create. The platform was used in many studies in the literature (Chiarelli, Szabo, & Williams, 2015; Marouf & Brown, 2021). Another educational example is Khan Academy. It is an online learning environment with free course materials worldwide. In this environment, it has gamification

elements such as points, badges, participation in learning tasks, and progress statistics on completing learning tasks (Simoes Redondo, & Vilas, 2013). Another application is the Web 2.0 application of "Kahoot." Using Kahoot, students are provided to answer the questions prepared in advance from their devices with internet access. Then, teachers can access detailed reports on the answers given by the students through the website. It is widely used at all levels of education (Basuki & Hidayati, 2019; Correia & Santos, 2017; Licorish et al., 2018).

Gamification

Different definitions of gamification have been made by many researchers (Kapp, 2012; Lee & Hammer, 2011; Sheldon, 2012; Zichermann & Cunningham, 2011). Zichermann and Cunningham (2011) define gamification in their book on gamification as "*the process of game-thinking and game mechanics to engage users and solve problems.*" Kapp (2012) defines it as "*using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems*." The most widely accepted definition was made by Deterding et al. (2011a). In their research titled "From Game Design Elements to Gamefulness: Defining Gamification," they used the concept of gamification and defined it as "*the use of game design elements in non-game contexts.*" This study also emphasized the similarities and differences with productivity games, applied gaming, game layer, fun ware, surveillance entertainment, behavioral games, and playful design, which are often confused with gamification.

Gamification has become a common subject of many fields such as marketing (Hofacker et al., 2016; Huotari & Hamari, 2012; Yang, Asaad, & Dwivedi, 2017), health (Ahmed et al., 2015; McCoy, Lewis, & Dalton, 2016; Sardi, Idri, & Fernández-Alemán, 2017), education (Caponetto, Earp, & Ott, 2014; Dicheva et al., 2015; Fan, Xiao, & Su, 2015; Kim et al., 2018; Nah et al., 2014; Sailer & Homner, 2020), tourism (Negruşa et al., 2015; Xu, Weber & Buhalis, 2013; Xu, Buhalis, & Weber, 2017), and business (Jakubowski, 2014; Kappen & Nacke, 2013; Kumar, 2013). This popularity has led to the emphasis on different aspects of gamification. However, in general, gamification is used to increase the loyalty and motivation of users.

Elements of Gamification

Werbach and Hunter (2012) proposed a pyramidal structure consisting of three categories for gamification (Figure 2). Categories in this structure are dynamics, mechanics, and components. In evaluating this pyramid, it is necessary to start from the upper point. The gamification design process starts with the fundamental dynamics of needs. It continues with determining the mechanisms selected in line with the dynamics and the components connected to them (Bozkurt & Genç-Kumtepe, 2014).

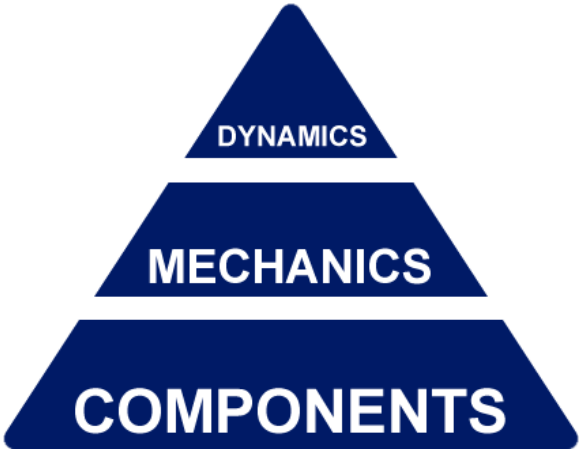

Figure 2. The Pyramid of Elements of Gamification (Adapted from Werbach and Hunter, 2012).

Dynamics is the "big picture" aspects of the gamified system that you have to consider and manage but which can never directly enter into the game." *Mechanics* is the "basic processes that drive the action forward and generate player engagement." *Components* is the "specific instantiations of mechanics and dynamics." (Werbach & Hunter, 2012). It is crucial to use gamification elements in tandem to design a successful gamification system. However, using a few of these elements and insufficient intrinsic and extrinsic motivations are the biggest obstacles to an effective gamification design. (Burke, 2016; da Rocha Seixas, Gomes, & de Melo Filho, 2016; Kapp, 2013; Werbach & Hunter, 2012).

The dynamics, mechanics, and components suggested by Werbach & Hunter (2012) are detailed in Table 1.

Table 1. Elements of Gamification (Werbach & Hunter, 2012)

Dynamics	**Mechanics**	**Components**
1. Constraints	1. Challenges	1. Achievements
2. Emotions	2. Chance	2. Avatars
3. Narrative	3. Competition	3. Badges
4. Progression	4. Cooperation	4. Boss Fights
5. Relationship	5. Feedback	5. Collections
	6. Resource acquisition	6. Combat
	7. Rewards	7. Content unlocking
	8. Transactions	8. Gifting
	9. Turns	9. Leaderboards
	10. Win states	10. Levels
		11. Points
		12. Quests
		13. Social graphs
		14. Teams
		15. Virtual goods

Gamification Design Models

For gamification to provide the expected effect, care should be given in the design and implementation phase, and a system configuration should be provided in accordance with the users' expectations (Domínguez et al., 2013). The following three items are critical for an effective and successful gamification design (Berber, 2018):

1. Clarifying the target
2. Knowing the target audience
3. Identifying expected behaviors

It is essential to use a model that will guide the process to realize a successful and effective gamification design. In this context, some models and frameworks have been developed by different researchers regarding gamification processes, which include the following:

1. D6 gamification model (Werbach & Hunter, 2012)
2. Octalysis Framework (Chou, 2014)
3. Hook Model (Eyal & Hoover, 2015)
4. Framework for Sustainable Gamification Impact (Al Marshedi, Wanick Vieira, & Ranchhod, 2015)
5. Gamification Design Model (Marczewski, 2017)

Relevant Literature

Systematic review studies on gamification generally yield positive results (Hamari, Koivisto, & Sarsa, 2014; Nah et al., 2014; Zicherman & Linder, 2010). On the contrary, some researchers criticized gamification (Haque, 2010; Lazzaro, 2011). However, effective and correct gamification design does not cause such problems. To this end, Bozkurt & Genç Kumtepe (2014) argue that gamification criticisms are generally related to design for consumer behavior.

The literature review indicates bibliometric studies, although not as much as compilation studies for gamification. These studies are directly related to gamification (López-Belmonte et al., 2020; Trinidad, Ruiz, & Calderón, 2021; Weiss, 2019; Yoon, 2019), health (Li et al., 2019; Macedo, Reis, & De-Bortoli, 2018), marketing (Nopliardy & Ukwueze, 2021), and education (Grosseck, Malita, & Sacha, 2020; Luo, 2021; Swacha, 2021).

In the bibliometric study conducted by Swacha (2021), WoS, Scopus, and Google Scholar were used as data sets. Some of the results obtained from the research reveal that most of the gamification studies in education originated in the USA, Spain, England, and Germany. Notably, the top 10 countries constitute approximately 50% of the entire data set. In terms of publication types, conference proceedings constitute approximately 60% of the data set. The keywords frequently used in the studies emerged as gamification, motivation, and education. Within the scope of the research, the authors of the most cited and co-cited studies were also reported.

Another study is a bibliometric study evaluating studies between 2010 and 2014 (Martí-Parreño, Méndez-Ibáñez Alonso-Arroyo, 2016). The data set of the research consists of 139 articles collected over WoS. The research results show that the number of studies on gamification is increasing day by day; the journal with the most publications in this field is Computers & Education and noted that the institution is the National Taiwan University of Science and Technology.

In a study by Khatibi, Badeleh, and Khodabandelou (2021), researchers focused on gamification trends in higher education. The data set of the research was obtained from WoS, as in many bibliometric studies. 432 documents between the years 2010-2020 were examined within the scope of the research. The research results reported that after 2013, studies on gamification had increased remarkably. A large part of the research consists of conference proceedings, followed by articles. Spain has emerged as the most productive country in gamification, followed by the USA and England. "University of Duisburg-Essen" is among the leading institutions regarding the number of citations. Motivation, e-learning, and game-based learning are among the most used keywords.

Luo (2021) examined 4059 studies in the WoS database. The reason why the number is so high is due to the keywords used by the researcher. The researcher evaluated the studies between 1995 and 2020. The research results indicate that the most productive countries in gamification are the USA, Spain, and England, the institutions are "Coventry University," "Institution of Technology Carlow," and "European University of Valencia," and the journals are "Computers & Education," "Computers in Human Behavior," and "Games for Health Journal."

In addition to these studies, Grosseck, Malita, and Sacha (2020) focused on gamification studies in higher education, Pankiewicz and Abdiomar (2021) studied item-based educational systems in gamification, and Karahan and Gül (2021) conducted bibliometric studies on current trends on gamification of cultural heritage. This research is different and significant in evaluating scientific articles about gamification in educational environments.

Research Objective

This research aims to reveal the scientific research trends within the scope of gamification in education.

Sub-Objectives

1. What is the distribution of articles on the use of gamification in educational settings by year, WoS index, country, and publication language?
2. What is the distribution of the most cited articles and journals in articles on the use of gamification in educational settings?
3. What is the cooperation between the countries of the articles on the use of gamification in educational settings?
4. What is the relationship between the most cited authors and journals in articles on the use of gamification in educational settings?
5. What are the most studied concepts in articles on the use of gamification in educational settings?

Method

This research was designed in a descriptive survey model. In the analysis of the obtained data, bibliometric and descriptive analysis methods were used. There are two primary purposes in bibliometric research: performance analysis and scientific mapping (Cobo et al., 2011; Gutiérrez-Salcedo et al., 2018). Performance analysis describes the publication performance of authors, institutions, and countries. On the other hand, scientific mapping reflects the dynamics and structure of the scientific field through visualization methods (Cobo et al., 2011; Tang, Liao, & Su, 2018).

Research data were collected through the Web of Science Core Collection (WoS). The data were collected by detailed search with keywords for research. The criteria used in filtering the articles are shown in Table 2.

Table 2. Filtering Criteria

Topic	TS=((“gamifi*”) and (“education*”))
Documents Type	Article
WoS Categories	Education Educational Research, Education Scientific Disciplines, Education Special
Time Span	All Years
Indexes	SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI

As a result of the search made after the determined criteria, 798 articles were accessed (December 2021). WOS self-developed analysis system, Office programs, and VOSviewer 1.6.16 package software were used to analyze these articles.

Finding and Discussions

Considering the distribution of articles by year, it is reported that the number of studies on gamification is in a systematic increase every year. (Figure 3).

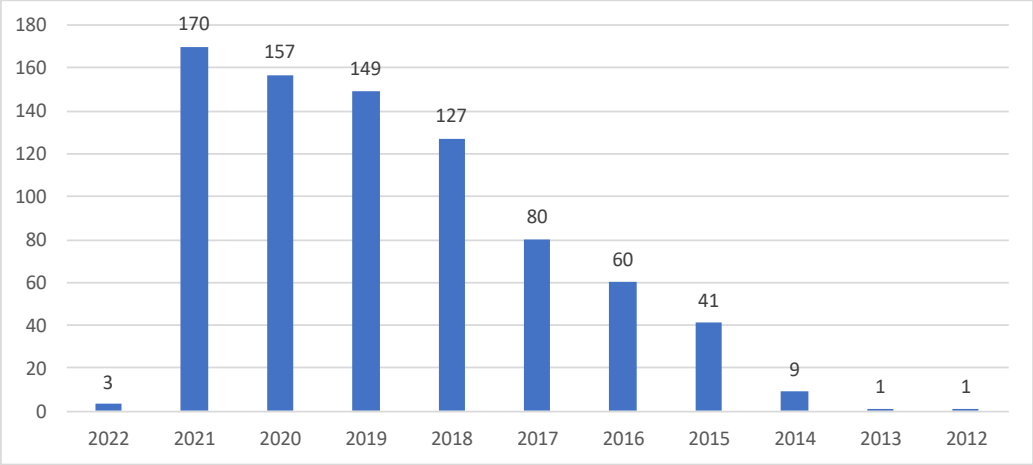

Figure 3. Distribution of Articles by Year

Figure 3 shows that most of the publications on the subject were published between the years 2018-2021. Namely, 170 articles in 2021, 157 articles in 2020, 149 articles in 2019, and 127 articles in 2018. For the year 2022, it is seen that there are three articles as of December 2021. The developments in educational technologies can explain the current situation, teaching and learning strategies (Khatibi, Badeleh, & Khodabandelou, 2021), and the spread of gamification. This finding demonstrates that gamification studies carried out in educational environments will increasingly continue. Studies in the literature also support this result (Grosseck, Malita, & Sacha, 2020; Khatibi, Badeleh, & Khodabandelou, 2021; López-Belmonte et al., 2020; Luo, 2021; Swacha, 2021; Trinidad, Ruiz, & Calderón, 2021).

When the distribution of articles by WoS index is examined, it is noteworthy that most of them were indexed in ESCI (Emerging Sources Citation Index) (n=459), followed by SSCI (Social Sciences Citation Index) with 258 articles, and SCI-Expanded (Science Citation Index Expanded) with 145 articles (Figure 4).

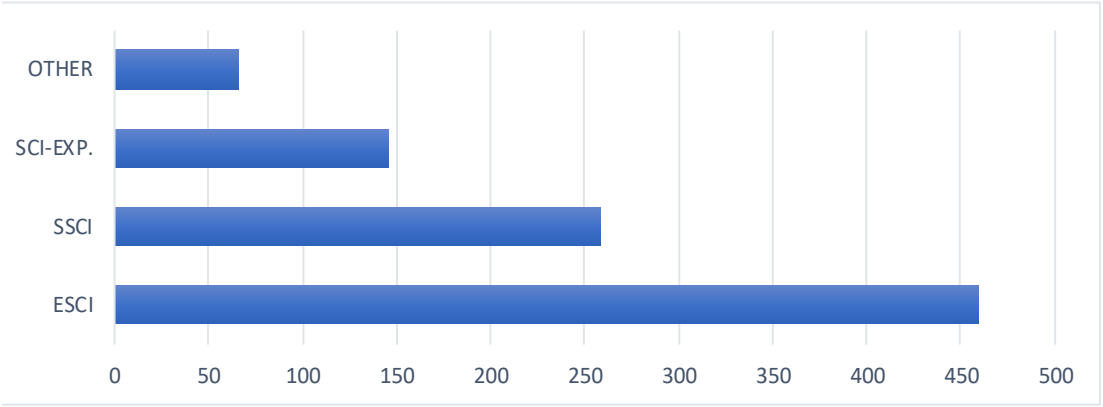

Figure 4. WoS Index Distributions of Articles

Within the scope of the research, the number of articles on gamification that countries have were examined. The ten countries with the most articles are shown in Figure 5.

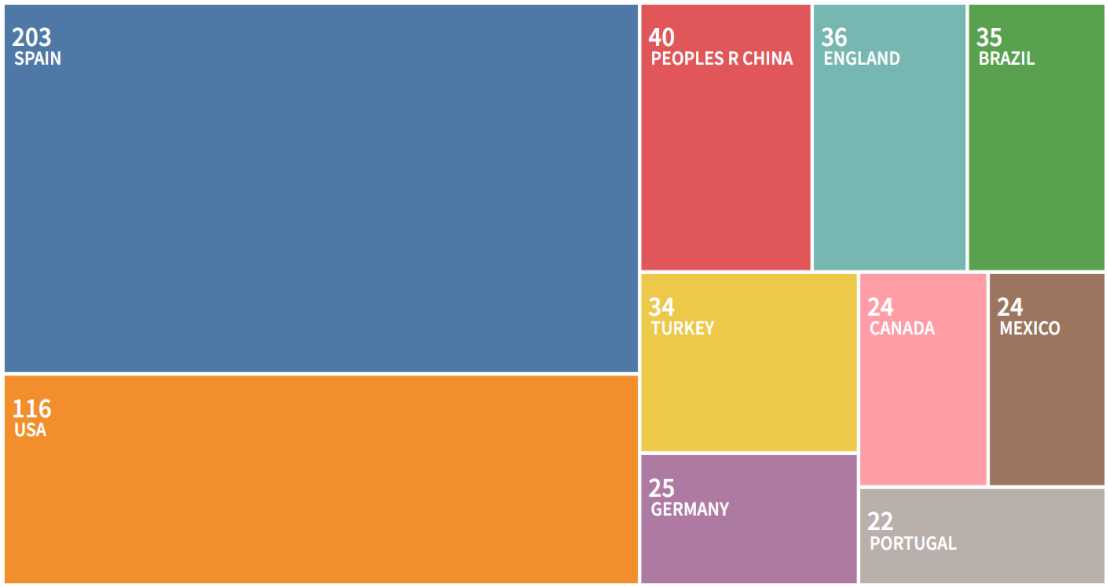

Figure 5. Distribution of Articles by Country

A quarter of the articles on gamification were conducted by Spanish researchers (n=203; 25.43%). Spain is followed by the USA (n=116; 14.53%), China (n=40; 5.01%), England (n=36; 4.51), Brazil (n=35; 4.38%), and Turkey (n=34; 4.26%), respectively. These six countries published approximately 60% of the total number of articles. It is seen that there are studies with similar results in the literature (Grosseck, Malita, & Sacha, 2020; Khatibi, Badeleh, & Khodabandelou, 2021; López-Belmonte et al., 2020). In the study conducted by Swacha (2021), the USA takes first place. This difference is thought to be due to the difference in the data sets of the two studies because the relevant study data was taken from Scopus. The finding that 81 countries in the world are producing studies in this field is one of the remarkable results of this research. This result is also consistent with the findings of Swacha (2021) and Grosseck, Malita, & Sacha (2020).

In terms of the publication language of the studies, they are generally written in English (639), followed by Spanish (n=125) and Portuguese (n=19) (Figure 6). English is a common language used in international literature, so this is an expected result. The fact that Spanish and Portuguese are at the forefront may be related to many articles in these geographies.

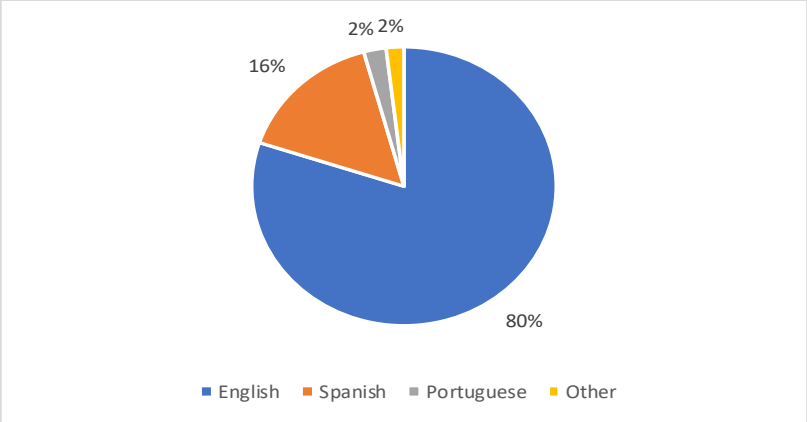

Figure 6. Distribution of Articles by Publication Language

The information on the 10 most cited articles out of 798 articles examined within the scope of the research is shown in Table 3. While creating the data set, no restrictions were made in terms of the number of citations and publications.

Table 3. Top 10 Most Cited Articles

	Article	Author(s)	Year	Journal	Citation
1.	Gamifying learning experiences: Practical implications and outcomes	Domínguez et al.	2013	Computers & Education	651
2.	Assessing the effects of gamification in the classroom: A longitudinal study on intrinsic motivation, social comparison, satisfaction, effort, and academic performance	Hanus & Fox	2015	Computers & Education	574
3.	Gamification in education: A systematic mapping study	Dicheva et al.	2015	Journal of Educational Technology & Society	498
4.	An empirical study comparing gamification and social networking on e-learning	De-Marcos et al.	2014	Computers & Education	262
5.	Foundations of game-based learning	Plass et al.	2016	Educational Psychologist	220
6.	A mobile gamification learning system for improving the learning motivation and achievements	Su & Cheng	2015	Journal of Computer Assisted Learning	184
7.	Gamification for Engaging Computer Science Students in Learning Activities: A Case Study	Ibanez et al.	2014	IEEE Transactions on Learning Technologies	164
8.	Digital badges in education	Gibson et al.	2013	Education and Information Technologies	142
9.	Gamification in assessment: Do points affect test performance?	Attali & Arieli-Attali	2015	Computers & Education	136
10.	A multilevel analysis of the effects of external rewards on elementary students' motivation, engagement and learning in an educational game	Filsecker & Hickey	2014	Computers & Education	125

Table 3 shows that the most cited article is Domínguez et al. (2013), followed by Hanus

& Fox (2015) and Dicheva et al. (2015). These three articles are well above the curve.

Information on the top 10 most cited journals is shown in Table 4. 27 journals with at least 50 citations were included in the analysis process.

Table 4. Top 10 Most Cited Journals

	Journal	Article Count	Citation	Total link strength	Citation Per Article
1.	Computers & Education	35	2844	346	81.25
2.	Educational Technology & Society	4	514	129	128.5
3.	Interactive Learning Environments	14	313	72	22.35
4.	Journal of Computer Assisted Learning	6	296	50	49.33
5.	IEEE Transactions on Learning Technologies	8	262	45	32.75
6.	International Journal of Emerging Technologies in Learning	41	241	98	5.87
7.	Education and Information Technologies	20	231	109	11.55
8.	Education Psychologist	1	220	11	220
9.	International Journal of Engineering Education	21	169	46	8.04
10.	Electronic Journal of E-Learning	10	147	27	14.7

When Table 4 is examined, it is seen that the most-cited journal is "Computers & Education" (n=2844). It is noteworthy that this journal received approximately 2000 more citations than the closest journal. Namely, the second-ranked journal, "Educational Technology & Society," received a total of 504 citations. In this context, studies in the literature partially support this result (López-Belmonte et al., 2020; Luo, 2021).

The results of the co-authorship analysis made to reveal the cooperation between countries regarding the articles produced are shown in the network map in Figure 7. Countries with at least one article on the research topic were included in the analysis process. Links were selected as the weight unit.

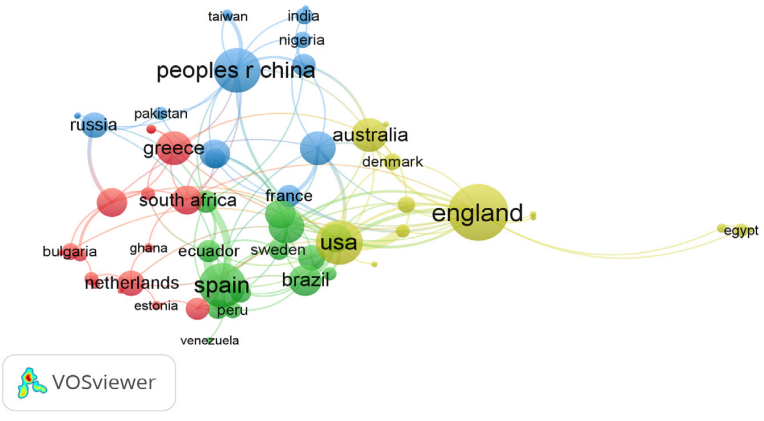

Figure 7. Co-Authorship Collaboration of the Countries

As a result of the analysis, the leading countries in the context of co-authorship are England (n=19), Spain (n=14), China (n=14), and the USA (n=14). Additionally, according to the network analysis results, countries were gathered under four different clusters. There are also similar results in the literature (Grosseck, Malita, & Sacha, 2020; López-Belmonte et al., 2020). In the cooperation between the two countries, it is indicated that there is a closer relationship between Spain and Mexico (link strength=6), the USA, and South Korea (link strength=8). According to the results obtained, geographical location does not directly affect the cooperation between countries. It is significant to note that developed countries are generally at the center of each cluster and cooperate with other countries.

The co-citation results for the authors are shown in the network map in Figure 8. 110 authors with at least 20 citations were included in the analysis process.

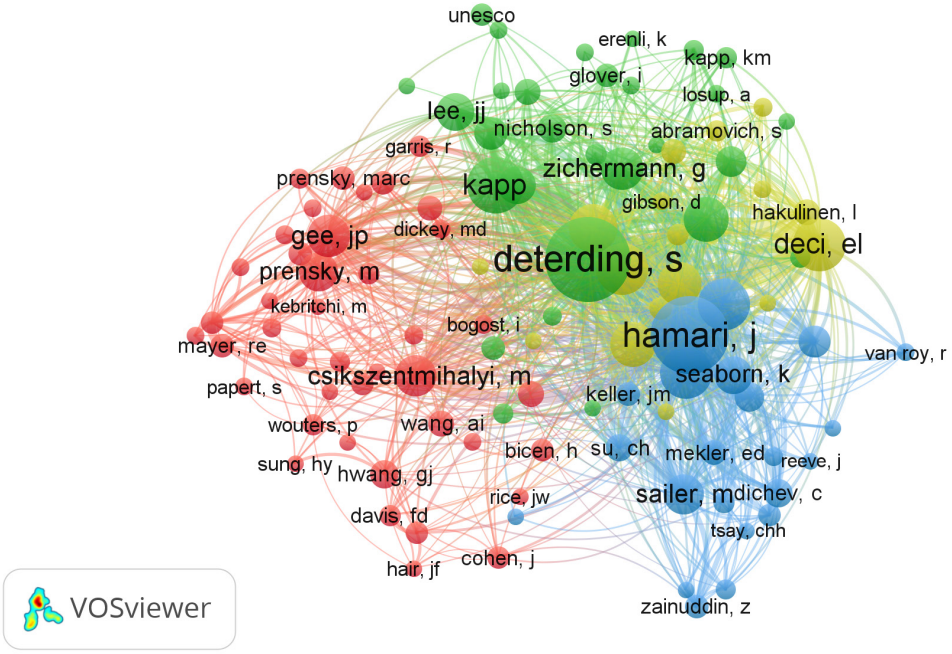

Figure 8. Co-Citation Analyses of the Authors

Figure 8 reports that the authors are gathered under four different clusters. The circle size is related to the number of citations. Deterding (n=349), Hamari (n=302), and Kapp (n=172) are among the leading authors in terms of co-citation. The study results conducted by Swacha (2021) are in line with this study's findings. Besides, considering that these authors are renowned scientists who direct the field of gamification, this is an expected result.

The results of the co-citation analysis in the context of the journals are similar to the results of the citation analysis. The analysis results, which included 184 journals with at least 20 citations, are shown in Figure 9.

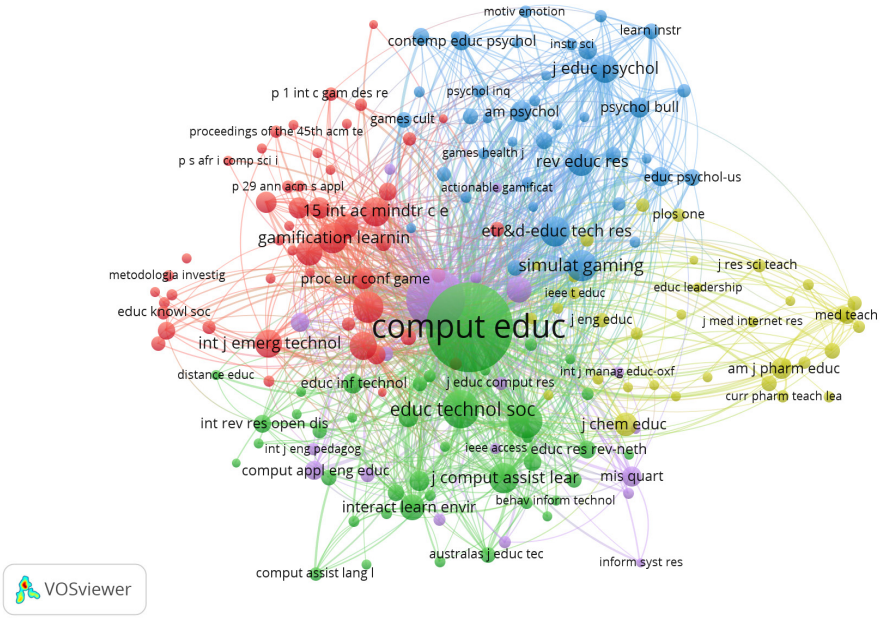

Figure 9. Co-Citation Analyses of the Journals

When Figure 9 is examined, it is seen that the journals are gathered in 5 different clusters. When the network map is considered in general, it is notable that the journals "Computers & Education" and "Computers in Human Behavior" are ahead by far. When the green cluster is examined, they are generally technology-oriented journals. Computers & Education, at the center of this cluster, received 1658 co-citations. Journals in the blue cluster are mostly psychology-based journals. Journal of Educational Psychology (n=172) is among the prominent journals. In the red cluster, there are journals about gamification. One of the journals that draw attention here is Gamification Learning (n=202). The purple cluster is the journals about education and training. Computers in Human Behavior (n=776) is also one of the remarkable journals. In the yellow cluster, there are health-centered journals. Journal of Chemical Education (n=121) is one of the leading journals in terms of co-citations. The results obtained by Grosseck, Malita, and Sacha (2020) are similar to this study.

Common word analysis was carried out to analyze the most used keywords within the scope of the research. 91 of a total of 1966 terms repeated at least 5 times were included in the analysis process. The size of the circles in the image represents the frequency of using the keywords, and the color of the circles represents the publication years of the studies in which the words were used.

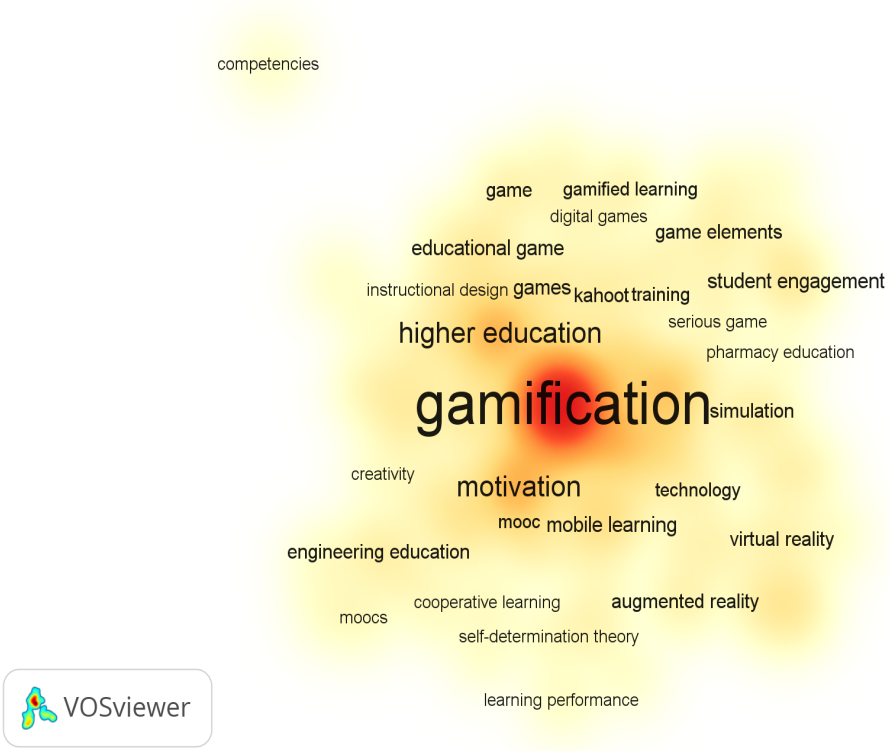

Figure 10. Most Used Terms in Keywords

Figure 10 reflects that the keywords frequently used in the articles are gamification (n=469), higher education (n=67), motivation (n=66), and game-based learning (n=54). This result is similar to many studies in the literature (Grosseck, Malita, & Sacha, 2020; Swacha, 2021; Trinidad, Ruiz, & Calderón, 2021).

Conclusion

In this study, in which articles on gamification in educational environments were examined, the following conclusions were obtained:

1. The articles were published in 2002 and 2022. The peak publication was between the years 2018-2021.
2. Articles are generally indexed by ESCI.
3. Spain and the USA are far ahead of other countries regarding the number of published articles.
4. English was generally preferred as the publication language of the articles.
5. Most cited studies were made by Domínguez et al. (2013), Hanus & Fox (2015), and Dicheva et al. (2015).
6. "Computers & Education," "Educational Technology & Society," and "Interactive Learning Environments" are the most cited journals.

7. The most cooperating countries are England, Spain, China, and the USA.
8. The most co-cited authors are Deterding, Hamari, and Kapp.
9. "Computers & Education" and "Computers in Human Behavior" are the most commonly cited journals.
10. Gamification, higher education, and motivation keywords are the most preferred keywords by the authors in the articles.

Suggestions

Suggestions for future studies include the following:

1. The data set of the research is limited to WoS only. More comprehensive studies can be carried out by including other databases.
2. Results can be compared using different analysis techniques.
3. This research is limited to articles only. Other academic studies can be included or evaluated separately and compared in other studies.

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**** The ten most cited studies.***

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