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PAPER

Ten Years of Gamification-Based Learning: A Bibliometric Analysis and Systematic Review

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ABSTRACT

Gamification-based learning is a recent trend that has received increasing attention in the last few years due to digital development. Gamification has emerged as a vital aspect of the educational setting, with gamified elements playing a crucial role in e-learning environments. The current study is motivated by the need to address a gap in the existing research on the utilization of gamification in education. This gap exists due to a lack of studies that monitor the developments and effects of gamification in the educational environment. It is important to conduct such studies to provide guidance for future research in the field of gamification. A bibliometric analysis and systematic literature review were conducted to understand and describe gamification and its potential for learning. The results of the bibliometric analysis revealed that the most frequently used keywords in the studies were gamification, game-based learning (GBL), motivation, and engagement. The majority of research published in this field was conducted in the United States, followed by Spain and Britain. The *Journal of Computers in Human Behavior* and the *Journal of Computers and Education* were the two journals that focused primarily on the field of GBL. The most famous authors in this field are Hamari, Juho, Patel, Mitesh S., Landers, and Richard N. The field is experiencing significant growth, with the number of studies increasing from 7 in 2012 to 917 in 2021. The systematic review has found that undergraduates are the most frequent participants in gambling activities. The game elements that are most utilized are points, leaderboards, and badges, while the learning outcomes most addressed are achievement, engagement, and motivation. The primary objective of this paper is to provide a comprehensive guide to scholars and research institutes, outlining the key areas of emphasis related to the subject of gamification. The systematic research also identified the key components of gamification that instructors and e-learning designers may rely on most frequently.

KEYWORDS

gamification, bibliometric analysis, systematic review

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1 INTRODUCTION

Gamification is one of the most prominent modern technologies that contributes to the provision of an educational system based on stimulation [1]. Its aim is to enhance the effective participation of learners and attract them to a more exciting and interesting environment, which will reflect on improving learning outcomes [2]. The philosophy of gamification is to design game elements and apply their attributes in environments with non-game-based learning contexts [3]. The aim is to link the educational situation to a set of challenges [4], making it more interactive and positively impacting the learner's behavior. This is achieved by motivating the learner to continue the learning process and complete the tasks required to earn rewards [5].

Gamification is related to a set of educational theories that have been repeatedly discussed in previous literature [6–11]. According to goal-setting theory, when the badge stimulus is presented immediately to the learner, the learner can measure his or her progress in relation to his or her goals. This, in turn, helps the learner determine if adjustments to strategies are needed or if it is better to continue pursuing the established goals [12]. Self-efficacy theory can assist in gamification practices that begin with small tasks of lower difficulty levels to help enhance learners' self-efficacy. Employing point systems, badges, and progress bars can stimulate self-efficacy by tracking progress and providing learners with direct feedback on their performance [13]. Self-determination theory is the premise of this theory, which can be linked to gamification by satisfying the need for autonomy. This is achieved by giving learners the autonomy to choose the tasks they would like to start with [14]. It also allows learners to share, compete, and cooperate with other learners, fulfilling the need for social interaction [15]. In order to satisfy the need for competence, the game elements that enhance the learner's desire, enthusiasm, and mastery of educational tasks can be employed [16]. Social comparison theory: The leaderboard is one of the most important tools for applying social comparison theory because it displays the learner's efforts and achievements in comparison with other learners. This comparison enhances the learner's self-confidence and motivates them greatly towards the learning process [17]. Flow Theory can help incorporate game elements, such as a badge motivator, to provide feedback and give learners indications that they are on the right track. This immediate feedback can contribute to sustaining the flow state [18]. Operant conditioning theory suggests that gamification can be applied through rewards badges, and points for completing tasks or providing correct answers to reinforce desired behavior [19].

Because gamification is of great importance, many studies have been directed towards revealing its effectiveness in learning. Studies have proven its contribution to enhancing motivation and participation [20], the acquisition of social competencies, and increased activity [21]. Moreover, it improves academic achievement, increases concept awareness [22], stimulates interactive learning [23], plays a role in facilitating the learning process, and contributes to psychological well-being [24]. Additionally, it supports learning performance and achievement [25].

The extensive range of previous studies on gamification necessitates a re-evaluation to identify how they can guide scientific research in the field of gamification. Furthermore, the existing empirical research focusing on gamification has identified specific factors that can impact learning outcomes. This calls for an in-depth analysis of these studies to ascertain the most effective strategies for implementing gamification in educational environments. The current study is justified by the significance of guiding scientific research in the field of gamification and the need to identify the variables that influence gamification and can be used to

enhance learning outcomes. Moreover, the outcomes of the ongoing study may pave the way for reliable strategies to utilize packaging in e-learning settings during the post-COVID-19 education period.

Based on the integration of the results of previous studies on the subject of gamification to reach conclusions that include a set of facts and generalizations associated with it and contribute to the development of a road map for researchers that explains what others have concluded [26], there is an urgent need for a scientific methodology and logical procedures aimed at collecting and synthesizing previous studies, revealing the various results that were reached, and giving meaning to those results [27]. Biometric analysis research and systematic review are the appropriate methodologies for reviewing such previous studies [28]. Bibliometric analysis and systematic review are among the most recent methods used to determine the general direction of scientific research [29]. They serve as a scientific resource through which research gaps can be identified [30] and are a useful tool for mapping the literature on gamification [31]. It also helps highlight current developments, hot spots, growth, and trends related to gamification [32].

Thus, the purpose of this study is to conduct a bibliometric study and a systematic review to describe gamification and how it has evolved over time. The study aims to identify the school stages, game elements, and most common educational outcomes by answering the following questions:

- (*RQ1*): What are the most common words in the field of game-based learning (GBL) during the past 10 years?
- (*RQ2*): Which countries have made the largest contributions to GBL during the past 10 years?
- (*RQ3*): What are the leading journals in the field of GBL during the last 10 years?
- (*RQ4*): Who are the most influential authors in the field of GBL over the past 10 years?
- (*RQ5*): What is the amount of growth in GBL studies over the past 10 years?
- (*RQ6*): What are the most common educational stages in the field of GBL during the past 10 years?
- (*RQ7*): What have the most popular game elements in the last 10 years?
- (*RQ8*): What are the most common learning outcomes measured in the field of GBL during the past 10 years?

2 LITERATURE REVIEW

The concept of gamification is a relatively recent term in the field of education, as it originates from a broad perspective on the utilization of game elements [33]. Gamification is defined as the use of game elements and game design technology in non-game contexts that are unrelated [34]. Iacono et al. [35] and Parra-González et al. [36] indicated that gamification can be expressed in an educational model to motivate learners by incorporating game elements. This approach aims to enhance immersion, enjoyment, and participation by capturing learners' attention and interest, thereby encouraging continued learning. The gamification system relies on a set of tools known as game elements. Each of these elements serves a specific purpose. Among these elements, the leaderboard provides a visual representation that allows learners to see their ranking compared to others [37]. Points represent a quantitative assessment of a learner's progress when completing a specific task [38]. Levels are designed to motivate learners to progress gradually from one stage to a more

advanced one [39]. Badges are visual representations awarded to learners upon completing a set of educational achievements [20]. Progress bars visually display a learner's progress and completion of educational stages [40].

The significance of using gamification lies in its capacity to enhance students' cognitive development rates while also improving their task completion skills [41]. Gamification enhances student productivity, boosts morale, and promotes greater student engagement with the curriculum [42]. Furthermore, gamification could potentially be used to provide adaptive stimuli that enhance collaborative learning processes in a highly engaging manner [32]. Gamification enhances the learning process, increases students' engagement, and encourages interaction with educational material. Additionally, it serves as a motivational factor for students, leading to the expansion of their knowledge and the development of their cognitive abilities [43]. Undoubtedly, all of the aforementioned factors can serve as valid reasons for implementing digital gamification elements, such as points, badges, levels, and leaderboards, to promote self-regulated learning skills [44], enhance digital resilience [45], improve virtual well-being [46], and alleviate cognitive perception anxiety [47].

Prior literature has extensively examined gamification from various perspectives. Studies utilized a qualitative technique to assess the effectiveness of gamification in enhancing and developing digital platforms [23]. The effectiveness of gamification in enhancing learning outcomes, such as engagement [33], happiness [12], and self-regulated learning [48], has also been studied. Several more researchers have employed alternative approaches to evaluate the impacts of gamification in the educational environment. The study conducted by Porto and his research team [49] aimed to do a post-analysis of numerous studies focused on gamification. The study's findings demonstrated that gamification effectively increased participation rates and motivated students to complete tasks. In a similar context, Bai and his colleagues [50] conducted a study using dimensional analysis to demonstrate that the factors contributing to students' well-being and happiness with gamification tend to be twofold. Firstly, gamification serves as a potent tool for fostering students' enthusiasm. Secondly, it offers immediate feedback and fulfills the cognitive needs of students. According to a two-year longitudinal study conducted by Butz et al. [51], gamification has been shown to enhance content attention processes and improve students' retention rates of acquired information. In addition to several other literary works that examine the mechanics of developing educational settings based on design characteristics associated with gamification, the objective is to create environments that have a more significant impact on learning outcomes [52–55]. Undoubtedly, all the preceding evidence strongly supports the current study's focus on the importance of conducting a biometric study and a systematic review. These approaches will shed light on the prevailing patterns in the field of gamification research, both in terms of the research framework employed across global databases and the influence of gamification's design variables on learning outcomes.

3 METHODOLOGY

In the context of the research questions mentioned and the volume of the data to be collected and processed, a two-stage approach was employed, consisting of bibliometric analysis and systematic literature review. The first stage involved bibliometric analysis to identify research on gamification, databases, and information sources. The research was based on studies published in globally recognized international databases, such as the Web of Science. The keywords for the search process

to obtain a wide range of studies that dealt with the topic of gamification were also identified (gamification, gamification education, gamification learning, gamified, gamify, gameful, gaming elements, gamified application). The search strings "AND" and "OR" were also relied upon. Besides, the studies published in English between 2012 and 2021 were identified, covering a period of ten years. The search protocol followed this format:

gamification (All Fields) OR gamified (All Fields) OR gamify (All Fields) OR gamiful (All Fields) OR "gaming elements" (All Fields) OR gamified application (All Fields) AND education (All Fields) and 2021 or 2020 or 2019 or 2018 or 2012 or 2013 or 2014 or 2015 or 2016 or 2017 (Publication Years) and Article (Document Types) and English (Languages).

The first phase of the study addressed research inquiries ranging from one to five. By using bibliometric analysis in the first phase, the following findings were ascertained:

- The prevailing terms in the domain of GBL throughout the last decade.
- The countries have made the most significant contributions to GBL during the last decade.
- The prominent journals in the field of GBL over the last decade.
- The writers who have had the most impact on the field of GBL in the last decade.
- The magnitude of expansion in GBL research during the last decade.

The second stage is the systematic review. This section presents a set of studies selected based on the bibliometric analysis conducted, taking into account the selection and exclusion criteria. The selection criteria included studies with quartile preference (Q2 and Q1). The studies related to learning outcomes included the presence of sufficient information about the effect of the gamification component on learning outcomes, the author's experimental studies (quantitative, qualitative, or mixed methods), and the selection of journals and studies with an impact factor. The exclusion criteria included studies that did not demonstrate the gamification component used, studies that did not focus on learning outcomes, and studies published solely as abstracts. After completing this stage, during which a collection of literature was gathered, the researcher reviewed and examined the studies to ensure that only the relevant ones were chosen based on the specified criteria. The review was conducted through the following steps: reading the titles and abstracts to make sure they are related to the main topic of the study, to make sure that there are no duplicate studies and delete duplicate ones, exclude studies that are not related to the main topic of the study, do not have the necessary data, tabulating and organizing the data (coding studies), based on a coding model developed to include the following elements: (the journal's name, the journal's impact factor in the last year, the journal's impact factor in the last five years, the author's name, the author's impact factor, publication year, research title, coefficient research effect, type of gamification element, learning outcome, study stage, research method). Figure 1 shows the two phases of the search.

The second phase of the study addressed research inquiries ranging from six to eight. During the second step, the systematic review technique was used to determine the following:

- The prevailing educational phases in the realm of GBL throughout the last decade.
- The gaming aspects that have gained the greatest popularity in the last decade.
- The most common learning outcomes measured in the field GBL during the past 10 years.

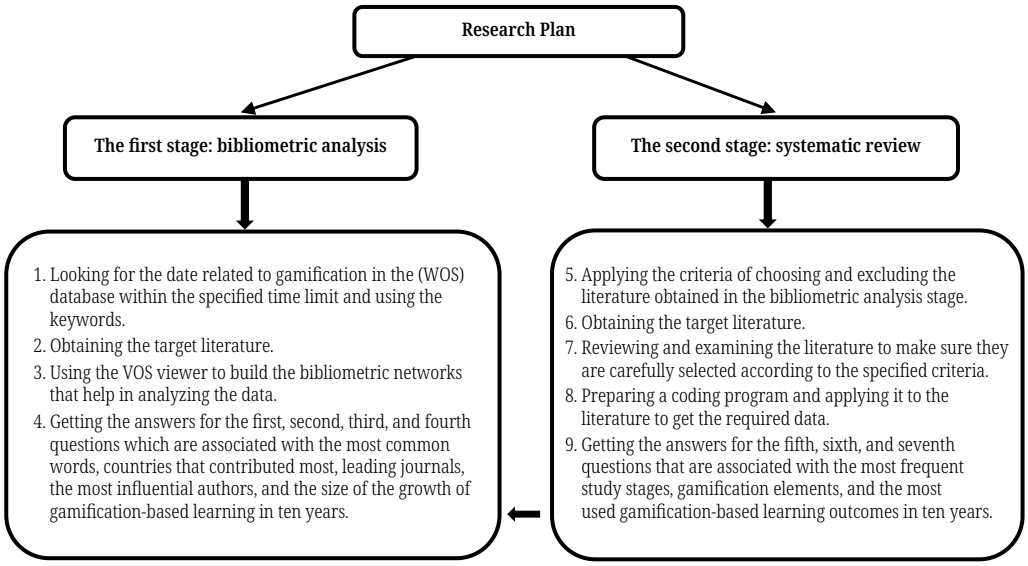

Fig. 1. Research plan

The bibliometric analysis in the first stage yielded a total of 3196 papers. As for the results of the systematic review, after applying the strict selection and exclusion criteria that were identified, 3043 papers were excluded. A total of 153 studies that met most of the criteria were identified. The 153 studies were carefully and meticulously reviewed by reading each study several times to understand its content, procedures, methods used, results presented, and comparing and discussing all information. After this careful process, the systematic review included 52 studies. Figure 2 shows the PRISMA procedure that was followed.

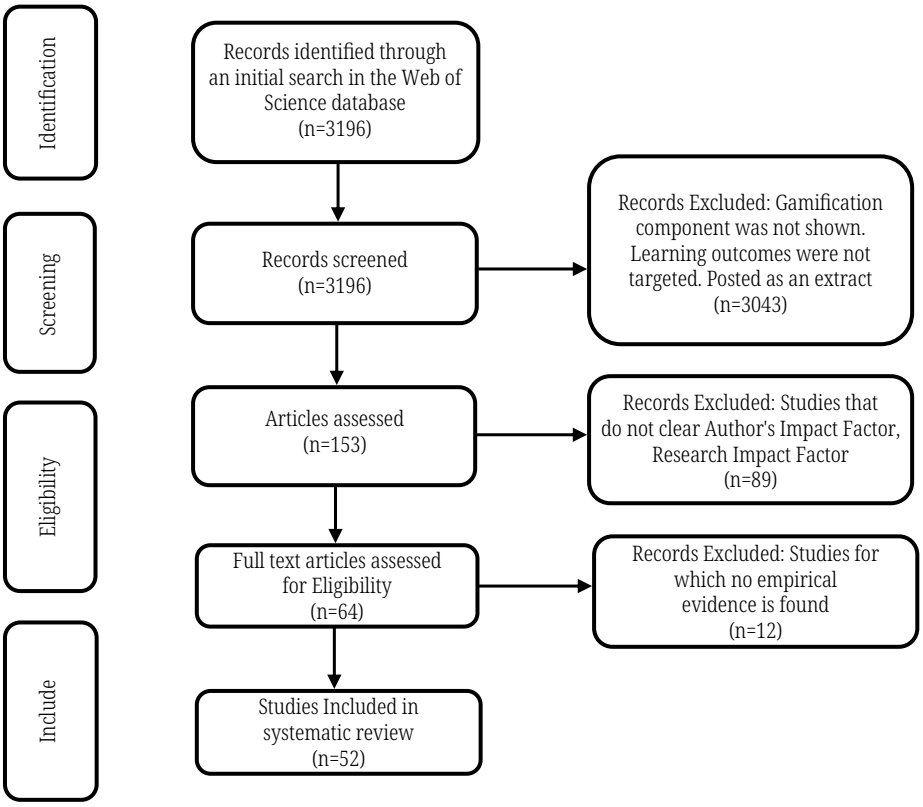

Fig. 2. The PRISMA review process

The coding model was applied to the 52 studies included in the systematic review and for data extraction and analysis [6–8], [17], [56–103]

4 RESULTS

4.1 Addressing inquiries about bibliometric analysis's findings

What have been the most popular words in gamification for the past 10 years?

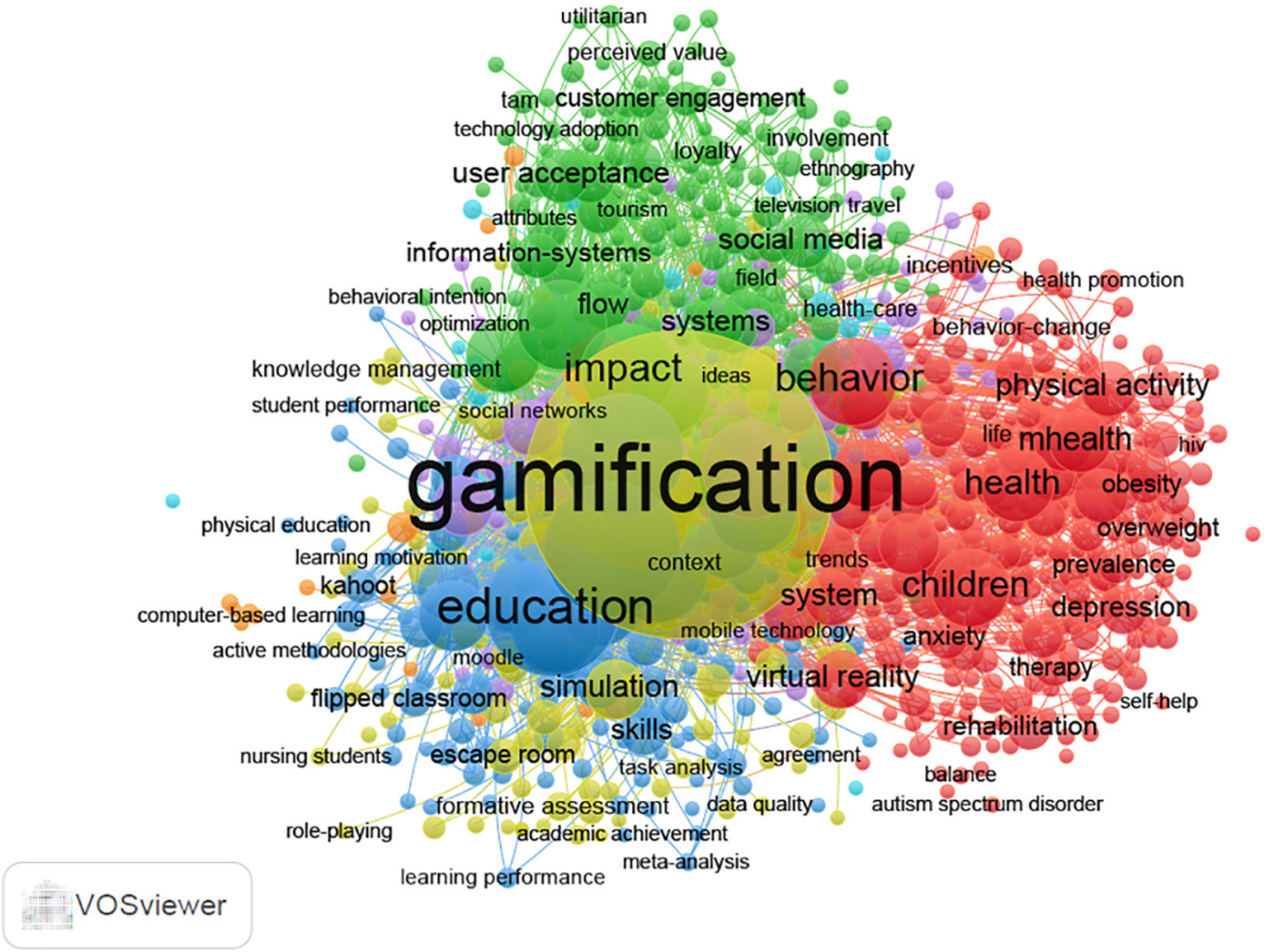

Fig. 3. Bibliometric maps for the most common words in GBL

In Figure 3, the study displays the most common words in the field of GBL. The relative frequency of keywords is represented by their respective font sizes, and the co-occurrence of keywords is represented by complete lines. Among the most popular keywords are gamification, motivation, engagement, education, games, serious games, and GBL. Virtual reality and certain digital platforms, such as Moodle, Kahoot, and various social media platforms, have also been interconnected. It is worth noting that each keyword is indicated by a circle. The diameter of the circle expresses the repetition of the keyword. The larger the circle, the more frequently the keyword appears. The distance between the circles represents the association of two keywords.

Which countries have made the largest contributions to GBL over the past ten years?

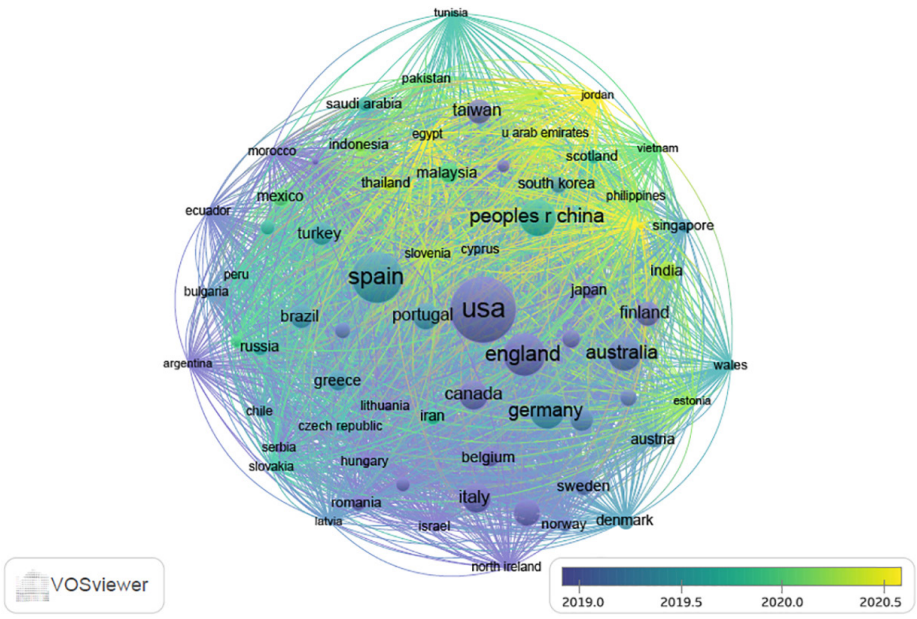

Fig. 4. Bibliometric maps of the countries that have made the largest contributions to GBL

Selected	Country	Documents	Citations	Total link strength
☑	usa	660	13260	526806
☑	spain	408	5842	477108
☑	england	276	5007	268694
☑	peoples r china	207	2882	282962
☑	germany	196	3430	294492
☑	australia	177	2325	179499
☑	italy	135	1781	152236
☑	canada	135	3452	149227
☑	netherlands	113	2059	125403
☑	portugal	109	1379	153384
☑	finland	94	4729	186908
☑	taiwan	94	1723	131530
☑	brazil	85	587	93733
☑	switzerland	84	1608	121594
☑	turkey	81	974	137406
☑	greece	67	637	61746
☑	malaysia	61	396	59113
☑	belgium	58	1038	87882
☑	india	57	370	76720
☑	sweden	55	842	56906
☑	france	53	783	81357
☑	mexico	49	324	68261

Fig. 5. Ranking of countries that have made the greatest contributions to GBL

Figure 5 shows the countries that made the largest contributions in the field of gamification-based learning, with the largest share of research coming from the USA with 660 research papers. Spain ranked second with 408 papers, while Britain ranked third with 276 papers. China ranked fourth with 207 research papers. It is followed by Germany, Australia, Italy, and Canada, respectively. Furthermore, when comparing the colors in the timeline of Figure 4, it appears that in recent years, some

countries such as Jordan, Egypt, and Thailand have started showing interest in and exploring game-based learning.

What are the leading journals in the field GBL in the past 10 years?

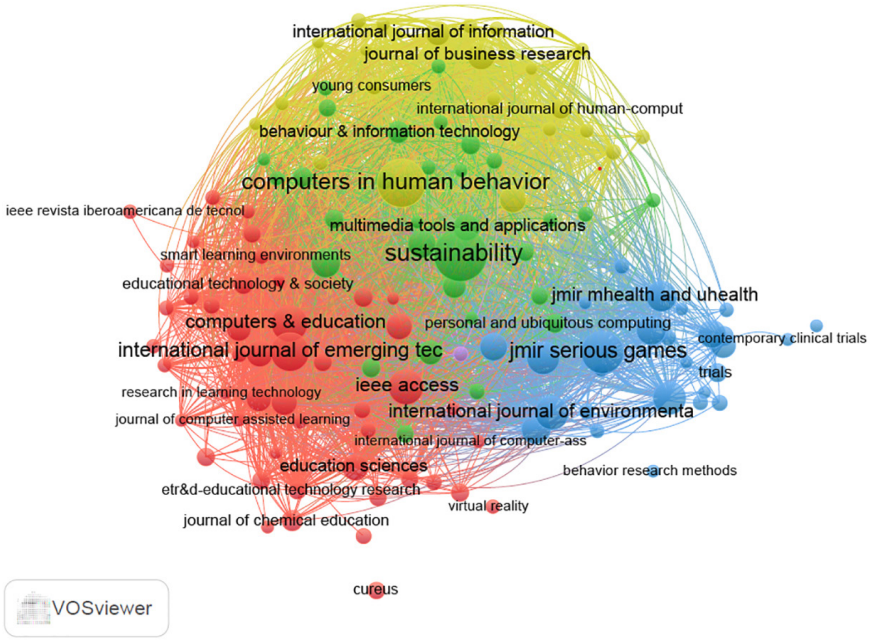

Fig. 6. Bibliometric maps of journals that have made the greatest contributions to the field of GBL

Selected	Source	Documents	Citations	Total link strength
☑	computers in human behavior	73	5048	75462
☑	computers & education	41	3824	51699
☑	sustainability	88	641	47782
☑	international journal of human–co...	23	1398	39303
☑	journal of business research	25	738	36148
☑	international journal of informatio...	19	753	28734
☑	jmir serious games	56	628	26576
☑	ieee access	39	356	26130
☑	international journal of emerging ...	47	329	22651
☑	education and information techno...	22	173	21516
☑	international journal of engineerin...	26	213	17705
☑	interactive learning environments	20	563	17635
☑	simulation & gaming	21	356	17580
☑	international journal of human–co...	13	151	16460
☑	frontiers in psychology	33	286	16098
☑	international journal of serious ga...	24	169	15744
☑	computer applications in enginee...	23	201	15594
☑	behaviour & information technology	15	94	15130
☑	information	24	92	14226
☑	international journal of environme...	35	273	14095
☑	young consumers	9	54	13607
☑	jmir mhealth and uhealth	30	627	12760

Fig. 7. Ranking of journals that made the greatest contributions to GBL

According to Figures 6 and 7, the most influential journal in the field of gamification is *Computers in Human Behavior*, with a total correlation strength of 75,462, while the number of citations was 5048. *Computers and Education* ranked second

with a total correlation strength of 51,699. The number of citations was 3,824. This is followed by a group of journals in descending order of link strength and citations.

Who are the most influential authors in the field of GBL over the past 10 years?

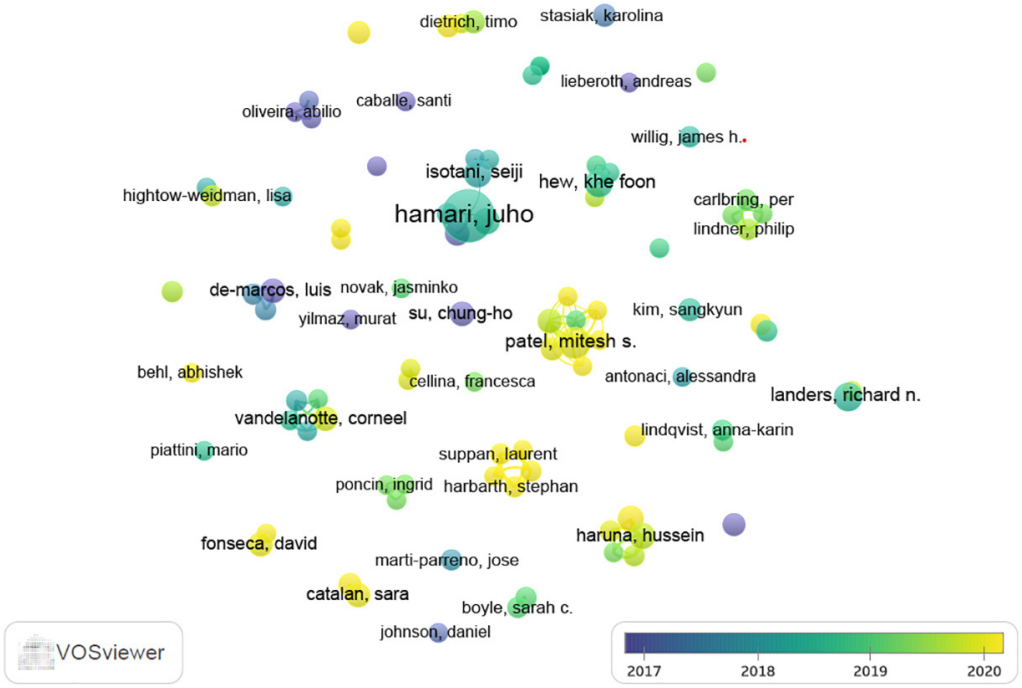

Fig. 8. Bibliometric maps of the most influential authors in the field of GBL

Selected	Author	Documents	Citations	Total link strength
☑	hamari, juho	37	3966	15
☑	patel, mitesh s.	13	274	35
☑	landers, richard n.	11	483	1
☑	hew, khe foon	10	451	7
☑	isotani, seiji	10	145	7
☑	haruna, hussein	9	153	22
☑	zainuddin, zamzami	9	190	16
☑	rapp, amon	9	203	1
☑	small, dylan s.	8	224	31
☑	vandelanotte, corneel	8	131	17
☑	de-marcos, luis	8	1256	12
☑	catalan, sara	8	120	7
☑	koivisto, jonna	8	1125	7
☑	fonseca, david	8	56	5
☑	su, chung-ho	8	126	0
☑	rareshide, charles a. l.	7	117	29
☑	buil, isabel	7	98	7
☑	russell-bennett, rebekah	7	132	4
☑	dietrich, timo	7	82	1
☑	kim, sangkyun	7	30	0
☑	segura-robles, adrian	7	110	0
☑	stasiak, karolina	7	244	0

Fig. 9. Ranking of authors most influential in GBL

Figures 8 and 9 lists notable authors in the field of GBL. The author, Juho Hamari, had the highest number of publications, with 37 articles, and received 3,966 citations.

Patel, Mitesh S., came in second with 13 publications and 274 citations. In third place was the author Richard N. Landers, with 11 publications and 483 citations. It is noted that some authors have fewer than eight publications, yet their total number of citations has exceeded 1000.

How much growth has been in the GBL studies over the past 10 years?

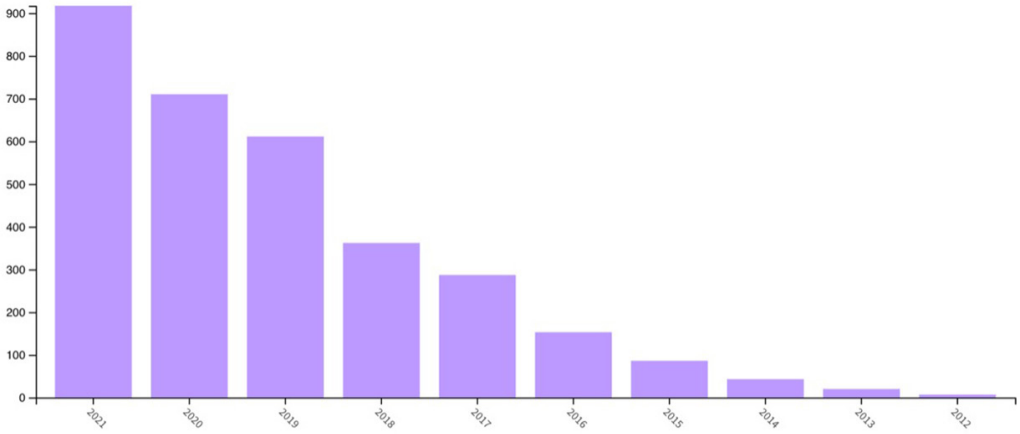

Fig. 10. The amount of growth GBL studies

Select All	Field: Publication Years	Record Count	% of 3,196
☐	2021	917	28.692%
☐	2020	710	22.215%
☐	2019	611	19.118%
☐	2018	362	11.327%
☐	2017	287	8.980%
☐	2016	153	4.787%
☐	2015	86	2.691%
☐	2014	43	1.345%
☐	2013	20	0.626%
☐	2012	7	0.219%

Analyze Data Table

Fig. 11. Number and percentages of GBL studies

Figures 10 and 11 illustrates the growth in gamification studies over the past decade. It shows the increasing growth of this field. In 2012, there were seven studies. After that, the growth continued steadily, but in simple proportions. In 2016, the number of studies began to increase significantly, reaching 153. Studies continued to grow until 2021, when they reached 917.

4.2 Addressing inquiries about systematic review's findings

Learning stages. Based on the data collected from the selected studies as presented in Figure 12, the most common learning stages in gamification-based learning are shown. Most of the undergraduate studies included 35 studies. The studies that focused on the secondary stage were fewer, with only five studies, while one study was conducted in a middle school, and 14 studies were conducted in primary schools.

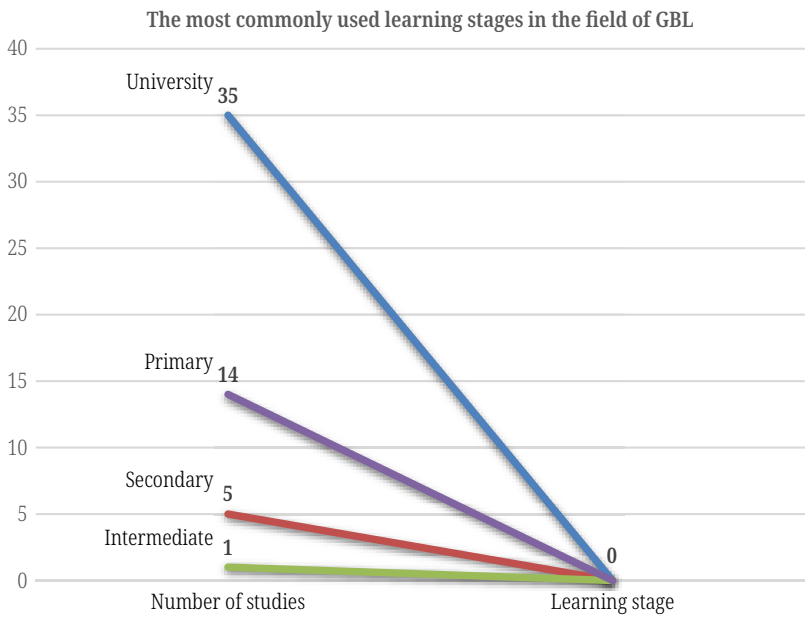

Fig. 12. Learning stages

Game elements. A review of game elements used in previous literature is extremely important [104]. According to Figure 13, the game elements that were employed in the previous studies included 22 points, badges, a leaderboard, a virtual character, rewards, tasks, gifts, money, a personal account, levels, challenges, achievements, stars, pawns, narration, selection, experience points, goals, background music, time, a progress bar, and forums. It is also noted that there is a discrepancy in the number of digital stimuli used by previous studies to stimulate the educational process. Some studies utilized more than two stimuli, such as points, badges, leaderboards, and others. In contrast, some studies only employed two motivators, such as narration and selection, while others were content with a single motivator, such as levels. We found that the most commonly used game elements are points, leaderboards, and badges.

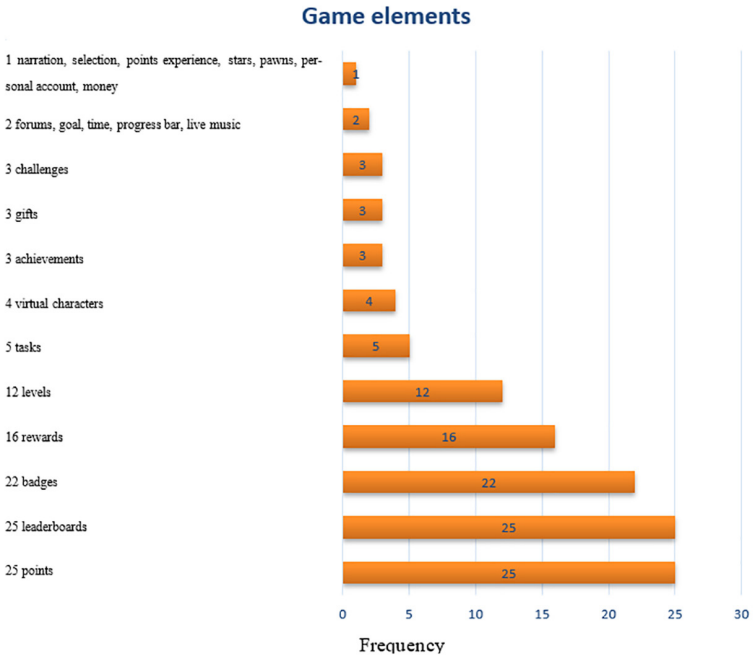

Fig. 13. Game elements used in studies

Measured learning outcomes. As shown in Figure 14, the GBL was used to examine its impact on learning outcomes. The discussed educational outcomes amounted to 15 educational outcomes. Educational achievement was the most covered (24 articles), followed by performance (16 articles), engagement (14 articles), motivation (10 articles), satisfaction (6 articles), attitudes and competence (5 articles), stimulation and awareness (4 articles), unity (2 articles), and finally, readiness, psychological well-being, decision-making, cognitive load, and independence with one article.

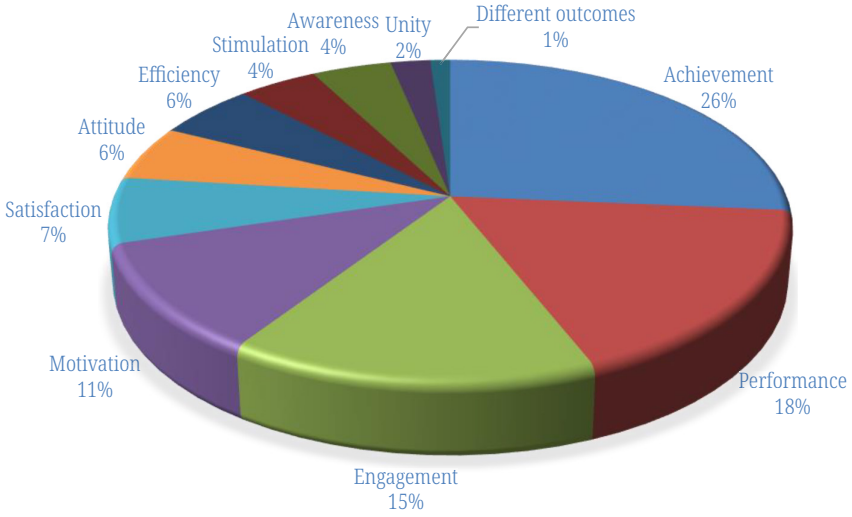

Fig. 14. Educational outcomes

5 DISCUSSION

5.1 A discussion to the findings of bibliometric analysis

A bibliometric analysis was conducted to offer an overview and a systematic review, providing insights into the research literature on gamification. The study from the first question to the fifth was related to the bibliometric approach, as it was based on data retrieved from the Web of Science database. Using the VOS viewer, a bibliometric mapping tool, helped answer those five questions.

Discussing the findings of the first question. Regarding the first question, the most frequently used words are gamification and related gaming terms, serious gaming, and game-based learning. Additionally, some commonly used words include virtual reality, digital platforms such as Moodle and Kahoot, social media platforms, students, education, e-learning, and teaching. In addition, it was found that there are some words closely related to gamification, such as technology, motivation, engagement, teaching, learning, and learning systems.

Discussing the findings of the second question. Regarding the second question, the United States of America leads in the number of publications in the field of gamification-based learning. While the U.S. spearheads the research in this field, countries such as Spain, Britain, and China also make significant contributions to the interest in widespread adoption of gamification-based learning. This promising field is not monopolized by one country or group of countries; rather, there is significant interest in it and its practical applications in many countries around the world.

Discussing the findings of the third question. In the third question, the *Journal of Computers in Human Behavior* and the *Journal of Computers and Education* are the two journals that focus on gamification-based learning. They have managed to attract a large number of publications in this field. This provides guidance for future researchers in identifying the suitable venue for publishing their research and reaching the intended audience.

Discussing the findings of the fourth question. Looking at the fourth question, Professor Juho Hamari is considered the foremost authority on gamification, producing the most gamification-based learning publications. This scientist leads a research group called the Gamification Group within the Faculty of Information Technology and Communication Sciences at the University of Tampere in Canada. Research related to this author indicates a focus on gamification since 2011, studying the field from various perspectives.

Discussing the findings of the fifth question. In the fifth question, the field of gamification-based learning has become a vital and rapidly developing research area. Over the past decade, there has been a noticeable increase in the number of publications annually, reflecting a growing global interest in researching, studying, and exploring this field. This may indicate the impact of gamification on the educational process and its significant contribution to enhancing the performance and motivation of learners. It creates an engaging and stimulating environment that fosters learners' active participation in the learning process.

5.2 A discussion to the findings of the systematic review

Regarding the systematic review approach, the study questions related to this approach, from question six to question eight, were interconnected. The data retrieved from the Web of Science database was utilized, and the PRISMA process was followed based on specific and strict criteria to address these three questions.

Discussing the findings of the sixth question. In the sixth question, the literature review revealed that the most commonly utilized educational stages for gamification are at the university and primary levels, while the secondary and intermediate stages were significantly less utilized compared to the former two stages. This is in line with previous studies by [3, 27, 52, 82, 105], which indicated that the university and primary education stages are the most common. This can be explained by the fact that primary education plays a crucial role in meeting a child's urgent need to learn in a fun and engaging manner through purposeful play [38]. It also brings joy and pleasure to the child's heart and mind, fostering interaction and enhancing integration [7]. A gamification environment can stimulate curiosity and reinforce the association with learning [21]. This is the reason why gamification is so important and often used in primary education. At the university level, the prevalence of gamification is evident in the utilization of various digital platforms in the educational process [23]. It caters to learners' needs, taps into their competitive tendencies, and enhances participation by applying basic game principles and fostering application-oriented learning [106]. Gamification at this stage is a dynamic educational experience aimed at enhancing learners' skills. It offers the best opportunity to help them overcome various academic and social challenges by supporting independent and efficient learning. Additionally, it fosters connections among members of the academic community by promoting collaboration and healthy competition [42].

Discussing the findings of the seventh question. As for the seventh question, the analysis provided us with an accurate insight into the game elements utilized in

the learning environment. We discovered that the most commonly used game elements include points, leaderboards, badges, rewards, and levels. This is consistent with the study by [6, 7], which indicated that the most common and widely used game elements are points, leaderboards, and badges. This is confirmed by the study of Alhalafawy and Zaki [12], who found that points, leaderboards, and badges are among the most prominent elements of motivation used across educational platforms and applications. In the same vein, the study by [104] revealed that points, leaderboards, and badges are crucial tools and key elements in gamification systems, particularly prevalent in digital educational settings. This result can be explained by the rich environment of interactions, challenges, and competition that these elements provide, as well as their compatibility with many educational theories. It is possible to apply goal-based theory through points, leaderboards, and badges, allowing learners to measure their progress in relation to their goals. They can rely on the points and badges they have earned or monitor their rank on the leaderboard. As a result, the learner realizes how much they need to adjust their methods to better achieve their goals. Also, the points, the leaderboard, and the badges contribute to stimulating self-efficacy by measuring the progress of the learner and providing immediate feedback related to his performance, enhancing his sense of efficiency. This is consistent with the theory of self-efficacy. In the same context, the total points the learner obtained from the points collected or ranked on the leaderboard, or the badges earned, assist in social comparisons. This, in turn, enhances the learner's engagement in the learning process, as suggested by the social comparison theory. When we consider the continuous or random provision of point stimuli, the leaderboard, and badges as types of positive reinforcement used for each correct response or achievement of a particular task to reinforce the desired behavior and interest in the learner's activity, we achieve the theory of operant conditioning.

Discussing the findings of the eighth question. Regarding the eighth question, the educational outcomes most addressed in previous studies were educational achievement, performance, engagement, and motivation through GBL, which have received great attention from researchers in the past 10 years. This result is consistent with the educational literature, which confirms the association of gamification with a variety of educational outcomes, such as achievement, performance, engagement, and motivation [48, 107–110]. This result can be attributed to the advantages of GBL that enhance learner engagement in educational activities and tasks. This increased engagement leads to improvements in their cognitive abilities, consequently positively impacting their cognitive achievement [111]. The system that the game elements rely on allows for reviewing the learners' levels and progress bars, providing feedback on each completed task. This contributes to increasing the learners' motivation and engagement in the educational process. Also, the stimulus element environment that is designed in a way that helps to identify attractive factors capable of positively changing learners' behaviors and attitudes towards learning contributes to making the learner more active and interactive in his or her learning [112]. Moreover, achievement and performance are major goals for any educational structure or system. That is why many studies target achievement and performance as a foundation for advancing the effectiveness of game elements. Engagement and motivation are crucial outcomes of previous studies. Promoting engagement can directly and indirectly influence other learning outcomes. Therefore, many previous studies have focused on studying it. This is consistent with the flow theory, which suggests that focused engagement and active participation driven by motivation lead to enhanced motivation for achievement and engagement in learning [113–123].

The findings of this study suggest that practitioners may utilize the results of this research in various ways. The first route pertains to the bibliometric analysis procedures conducted, whereby significant indicators related to the investigation of gamification were identified within the Web of Science database. The present research established criteria for defining key concepts in gamification, identified the nations with the highest adoption and implementation of gamification, and identified the scientific publications focused on the study of gamification. Furthermore, the pace of expansion in research specifically targeting gamification is noteworthy. The second pathway is associated with methodological reference procedures and was accomplished by precisely identifying the key educational phases that underwent experimentation with the use of gamification in educational settings. As well as the most significant features of gamification that can be relied upon to enhance the educational environment. Ultimately, the critical learning outcomes that were assessed were influenced by the implementation of gamification, potentially opening the door for further investigations into learning outcomes that were previously overlooked.

6 CONCLUSION

According to bibliometric analysis, the research revealed the most popular word combinations, the countries with the most contributions, the leading journals, the most influential authors, and the amount of growth in GBL. The systematic review was conducted to offer comprehensive and in-depth information to investigate the levels at which. GBL was used to explore the most common game elements in education. Furthermore, the educational outcomes measured in GBL are highlighted.

Although the results of the present research are significant, they are associated with significant limitations, such as the inability to assess or include studies conducted in languages other than English. Moreover, the primary focus of the current study, especially the works analyzed in the methodological assessment, is centered on research conducted using the quasi-experimental approach.

According to the results obtained, it is recommended to incorporate game elements (such as points, leaderboards, and badges) into course systems and digital platforms. These stimuli have shown the greatest potential to impact learning outcomes. It is also necessary to move towards developing guidelines related to how to enhance achievement, engagement, and motivation through digital educational systems by effectively incorporating game elements. In addition, training plans should be developed for faculty members to ensure they are aligned with the functional mechanisms of gamification to enhance learning outcomes. Finally, educational institutions should consider expanding the utilization of motivational platforms that incorporate points, badges, and leaderboards. These platforms have the potential to significantly impact learning outcomes, both quantitatively and qualitatively. Researchers in the field of gamification need to utilize the findings of the current study's bibliometric analysis to access research on gamification. This involves understanding gamification terminology, identifying the most influential researchers in the field, and analyzing other indicators discovered in bibliometric analysis.

Moreover, the research findings highlight several issues that require careful consideration in future studies. These include the growing interest in exploring the relationship between the most frequently used gamification patterns and learning outcomes, conducting a qualitative analysis of teachers' and learners' perspectives on the use of gamification in educational settings, and utilizing mixed methods to

assess the quantitative and qualitative effects of gamification on various psychological variables. It is also necessary to conduct more studies in the areas of content representation in certain courses, such as science education, computer science, mathematics, and other scientific fields. Additionally, incorporating additional retrieval databases such as SCOPUS and IEEE, as well as increasing the volume of literature for analysis, is essential. In conclusion, this research is believed to make a significant contribution to determining the current status of GBL and its various online applications. It also aims to reveal useful topics that can be explored for the advancement of this field. It also provides valuable insights for researchers who plan to delve into this field, serving as a solid reference for future research endeavors.

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