Thematic Trends Around Gamification in MOOC: A Bibliometric Analysis

Orfa Nidia Patiño-Toro[1][*], Paula Andrea Rodríguez-Correa[1], Alejandro Valencia-Arias[1], Andrés Camilo Fernández-Toro[2], Alexander Jiménez-Guzmán[3], John Jairo Escorcia-González[4]

[1] Instituto Tecnológico Metropolitano

[2] Fundación Enseñas

[3] Corporación Universitaria Americana

[4] Fundación Universitaria Católica del Norte

*Corresponding Author: orfapatino@itm.edu.co

ARTICLE INFO	ABSTRACT
Received: 02 Sep 2022 Accepted: 15 Oct 2022	Currently, educational systems have assumed a relevant role in developing knowledge and strengthening skills in individuals, an aspect that has become a determining factor for the advancement of society. However, these systems present constant challenges, especially influenced by the advance in information and communication technologies, access to the Internet, and mobile devices, which implies transformations in the new paradigms of teaching and learning methodologies. In this scenario, gamification has been one of the strategies used within virtual learning environments such as MOOCs to increase student motivation in the development of courses. In the last decade, interest in this topic has been evidenced. Therefore, this study aims to identify the main research trends in studies on gamification in MOOCs in the last ten years. For this purpose, a bibliometric analysis was carried out using the Scopus database, from which 265 publications were obtained. The main actors (authors and journals) most cited and thematic trends were identified based on the recurrence of keywords. Among the findings, it was identified that researchers are interested in e-Learning, motivation, online learning, serious games, student engagement, badges and rewards, and the use of the Internet as a tool for learning. **Keywords:** MOOC, online learning, gamification, game-based learning, educational information systems, thematic trends.

INTRODUCTION

In recent years, it has been mentioned that massive open online courses (MOOCs) have generated important and sudden changes in educational systems thanks to the available online learning alternatives (Romero-Rodriguez et al., 2019). Altalhi (2021) points out the possibility of studying and improving skills from anywhere in the world, thanks to its virtual mode, among the various benefits of online training. This is considered a modality that contributes significantly to individual empowerment and allows people to learn about a wide range of subjects, following a predetermined rhythm (Aparicio et al., 2019).

This digital learning modality has presented a significant growth in its applicability due to the abrupt changes that originated in the COVID-19 pandemic, creating the permanent need to design strategies for the motivation and participation of students in their different stages, such as higher education (Rincon-Flores and Santos-Guevara, 2021). Students have expressed the need for this gamification as a means to reinforce the learning extracted through traditional educational practices (Oe et al., 2020), even impacting aspects such as the mental health of the network of actors involved, such as teachers and students (Fontana, 2020).

However, considering aspects that vary according to the context analyzed, there is a low acceptance of MOOCs, which makes it essential to promote their use among students (Altalhi, 2021). For this, it is necessary to understand all their success factors, such as use, user satisfaction, individual performance, and organizational performance (Aparicio et al., 2019). As well

as the attitude and computer self-efficacy, factors that, according to Altalhi (2021), are verified in the literature to exploit to the maximum their qualities of being free, heterogeneous, and multi-thematic (Romero-Rodriguez et al., 2019). Similarly, better organization of the learning process, greater accessibility to higher education, resource efficiency, and academic mobility, among others, are important aspects to consider (Zakharova and Tanasenko, 2019).

Therefore, given the low acceptance by the scientific community, some authors have presented the role of gamification as fundamental for the success of MOOCs (Aparicio et al., 2019; Romero-Rodriguez et al., 2019). Such a role consists of applying game elements and techniques in the educational context (Manzano-León et al., 2021), aiming to increase students' motivation, engagement, and performance (Hallifax et al., 2019; Manzano-León et al., 2021). It is said that gamification will surpass the traditional way of learning to increase the employability of other technologies, such as cloud computing (Hakak et al., 2019).

Despite the important trend of applying gamification methodologies in the educational context, some authors, such as Palomino et al. (2019), mention that studies on the subject are still inconclusive about student engagement. The reason why recent studies try to overcome the main complexities from the analysis of topics, such as the updating of learning modules or scalability (Hakak et al., 2019).

This deficiency in aspects related to user engagement has resulted in low student retention rates and high no-show rates for enrolled courses, making it transcendental to adapt new aspects of gamification to the educational context (Jarnac de Freitas and Mira da Silva, 2020). As a consequence of the above, education professionals are expected to support the learning process of students in a dynamic, flexible, and intuitive way (Dreimane, 2019).

The above added to the fact that there is little research that provides comprehensive visions or notions on the extrapolation of ludic concepts to education (Dreimane, 2019). This opens the door to interesting opportunities for future research based on (Ofosu-Ampong, 2020) what identified. The present study aims to identify the main research trends in studies on gamification in MOOCs in the last ten years.

METHODOLOGY

Bibliometrics is an article identification methodology that can be replicated (Cardona-Montoya, 2022). Bibliometric analyses have been widely used to provide a quantitative analysis of scientific publications on a given topic (Ellegaard and Wallin, 2015). Over time, this technique has evolved and been refined along with the exponential growth of science (Ordoñez et al., 2017). This has led to the fact that currently, the large amount of data and information generated in scientific matters is stored in bibliographic databases from academic journals, books, patents, and conference proceedings, among others (Moral-Muñoz et al., 2020).

In short, bibliometrics uses statistical and quantitative analyses to identify patterns of publications, thus being considered an effective method to evaluate scientific publications (Arias Labrador et al., 2021). Based on the above, this study applies a bibliometric analysis to perform a quantitative analysis of related research on the application of gamification in MOOCs. For this, an analysis of publications by year, most cited researchers and journals, and thematic trends around the topic is performed.

Database Selection

In this study, the Scopus database was used to retrieve the publications on the topic. This database allows tracking, analyzing, and visualizing the research results, making it possible to determine that the search performed is adequate. The database covers three sources: book series, journals, and specialized magazines. In addition, it has been considered the largest multidisciplinary database in the world in terms of the most recent academic literature (Gorraiz and Schloegl, 2008; Moral-Muñoz et al., 2020).

In this sense, the keywords game, gamification, and MOOC are used in the title, abstract, and author keywords fields; additionally, the AND and OR operators are included. Thus, the search equation generated was as follows: TITLE-ABS-KEY-AUTH ((game OR gamification) AND (("MOOC")). From this, a total of 265 related publications were obtained in the period between 2012 and 2022.

RESULTS ANALYSIS

The results are presented around quantity, quality, and structure indicators. The quality indicators reflect the research actors with the highest number of related publications. The quality indicators present those with the highest number of citations received. The structure indicators show the collaboration networks and keyword co-occurrence networks, i.e., the most recurrent keywords that create research clusters and research trends.

Quantity indicators

Most of the documents related to this topic correspond to conference proceedings (51.5%), followed by research articles (23.5%), conference reviews (17.5%), and book chapters (5.6%). The reason that most of the publications are conference proceedings can be explained by the fact that the topic has been a trend in several conferences, congresses, and research meetings. The above allows the collection of academic papers, usually in books, and research results that, compared to journals, are published more quickly.

On the other hand, there is a tendency to publish in computer sciences with a percentage of 38.1%, followed by social sciences with 22.6%, engineering with 13.2%, and mathematics with 10.6%. This is largely because these areas cover the theoretical bases of information and computation and their application to social interactions, as in the case of education.

First, the publications are analyzed by year. This covers from 2012 to 2022. **Figure 1** shows the distribution of publications. In
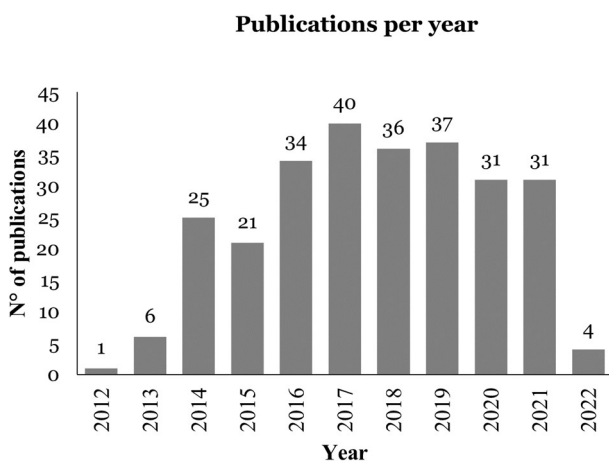
the last decade, research on this topic has been developed, which means that the subject is still very new. Also, it can be evidenced that the growth of publications has been continuous, except for the years 2015, 2018, and 2020 when publications have decreased from the immediately previous year. Important peaks of publications are evidenced in 2014, 2016, and 2017, the latter being the year with the highest number of records. In addition, 2019 also records a significant number of publications. In the last two years, publications have decreased and are at an average of 31 publications.

The first publication on this topic in 2012 was made by Baker et al. (2012). They investigated new educational approaches using virtual platforms, defining the development of online courses as MOOCs, the future university. Subsequently, the topics of game integration in MOOCs were included. Furthermore, the latest publications for the year 2021 and those of 2022 have focused on evaluating the application of gamification resources in these courses to identify opportunities for improvement (Rodríguez et al., 2022).
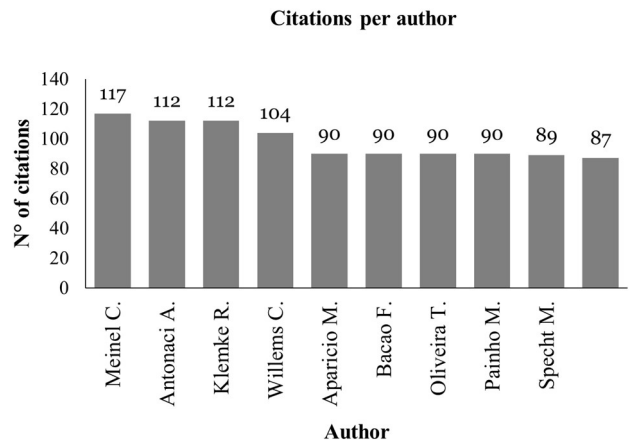
Quality indicators

These indicators are usually associated with the number of citations that publications receive and, therefore, their authors and journals in which the respective publication was made (Ho, 2014). In this sense, the indicator is based on the method that, as explained by Rodríguez Sabiote and Úbeda Sánchez (2019), is the most widely used to measure the impact of journals provided by the Journal Citation Reports (JCR) based on the number of citations received during two years preceding the current year.

As can be seen in **Figure 2**, the authors with the highest number of citations received are listed. In first place is author C. Meinel, who has eight publications on the subject and about 117 citations. His publications have been based on MOOC design to support multiple learning styles, including social learning from gamification (Grünewald et al., 2013; Meinel and Schweiger, 2016; Staubitz et al., 2017).


Figure 2. Most cited authors

Next are authors A. Antonaci, and R. Klemke, who have ten publications and a total of 112 citations recorded on the topics of the effects of gamification in online learning environments to enhance user goal achievement and learning analytics (Antonaci et al., 2019, 2017; Klemke et al., 2018). The author F. Grünewald, also appears in the list and shares co-authorship with C. Meinel. It is worth noting that these authors are also listed among the most productive authors by having the largest number of publications on the subject, so these authors are the most important referents.

Next are the authors M. Aparicio, TT. Oliveira, F. Bacao, and M. Painho, have collaborated in a work in which they define gamification as a key determinant of the success of MOOCs (Aparicio et al., 2019). At the bottom of the list is author M. Specht, with six publications on the topic and about 90 citations.


Figure 1. Publications per year
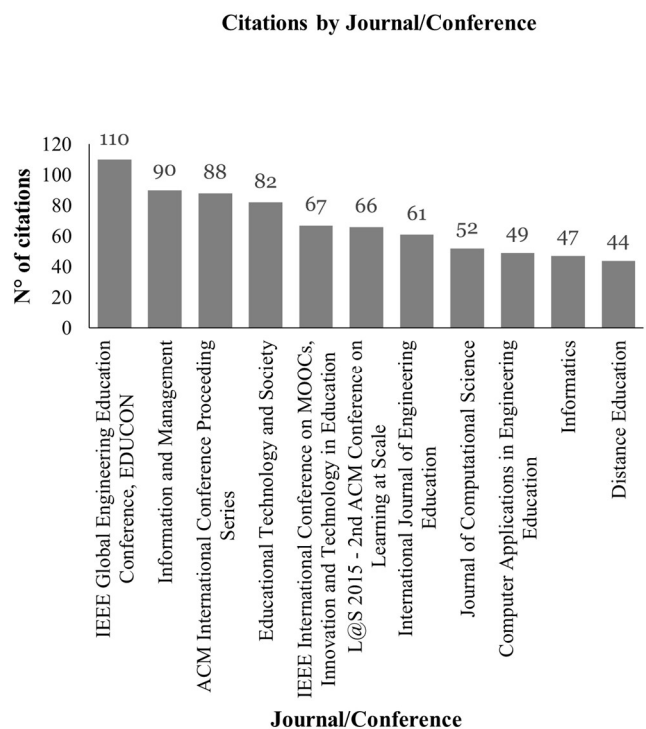
Figure 3. Most cited journals and conferences

Figure 3 lists the journals and conferences with the highest number of citations recorded. In first place is the IEEE Global Engineering Education Conference, EDUCON. This is a research and industrial conference on global engineering education. It has nine related publications and a total of 110 citations. In second place is the journal Information and Management, with 90 citations. This journal focuses mainly on papers related to information systems (Elsevier, 2022). The ACM International Conference Proceeding Series has 17 publications and 88 citations in third place. This proceedings series publishes content from high-quality conferences, technical symposia, and workshops largely on technology-related topics (ACM, 2022).

Trend Analysis

The trend analysis is performed with the support of Python software to identify the most used keywords within the field of this research and VOSviewer software to map the author's keyword co-occurrence networks and their evolution over time. In the first instance, as shown in **Figure 4**, the most recurrent keywords are listed in two-time windows: up to 2019 and the period from 2020 to 2022.
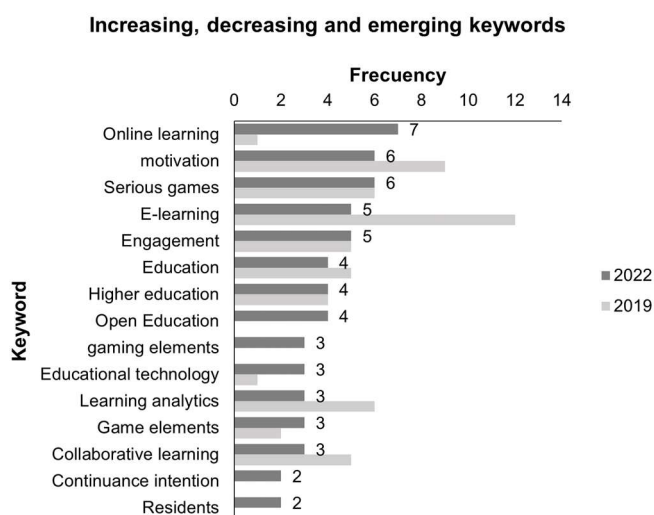
Figure 4. Keywords analysis

For the year 2019, a great interest in e-Learning was presented. Said keyword was included in 38% of the publications. E-Learning is intrinsically linked to the MOOC concept, as it is mass communication, knowledge sharing, and openness (Aparicio et al., 2019). It is for this reason that e-Learning has been so present within the keywords of this type of study.

Originally, the definition of MOOC was derived from the combination of several concepts, including e-Learning. This concept has evolved from a distance education approach focused on time and space, so the MOOC concept shares ideas with e-Learning (Aparicio et al., 2019). Therefore, an open environment through digital communication artifacts requires innovative learning tools. To promote participation through e-Learning systems, some authors have recommended

gamification as an important tool in learning processes. In this sense, the incorporation of a social dimension (such as gamification) to this type of learning is fundamental to integrating it into MOOCs as a potential in the learning process (Gené et al., 2014; Martínez-Núñez et al., 2015).

Subsequently, a significant interest is reflected in the keywords for aspects associated with motivation. In this sense, motivation is considered to be related to gamification due to the possibility of stimulating real-time interaction with learning resources, the development or strengthening of skills, being a fun way for the absorption of knowledge and obtaining rewards for achievements in specific activities during the learning process (Antonaci et al., 2019). Ortega-Arranz et al. (2019) explain that gamification is a technique used to increase student motivation and engagement in MOOCs.

Considering the above and taking into account the high dropout rate of MOOC-type courses, institutions are considering the need to find new training scenarios in which student motivation is a fundamental factor to generate greater efficiency in these interactions (Cruz-Benito et al., 2017). Students' learning becomes more enjoyable and interactive to the extent that they can immerse themselves in it and participate more actively in the ongoing activities. Therefore, an integration of MOOCs with game-based learning is recommended in the literature (Hung et al., 2019), in which students can obtain rewards to achieve a higher level of engagement in online courses and, at the same time, increase retention (Ortega-Arranz et al., 2019).

By 2022 the focus will shift to online learning. The focus of online learning and MOOCs, as explained by (Antonaci et al., 2019), has several points in common such as taking advantage of the Internet and advanced technologies. Up to a point, MOOCs can be distinguished as a subcategory of online learning. MOOCs, unlike online learning, provide advantages in terms of open learning, offering a collective learning opportunity with people from all over the world. The gamification technique has been applied in different educational environments to these elements (online learning and MOOCs). In this way, games become an example of highly engaging, scalable, and personalized user experiences, which can be an option to find those elements that can be transferred to online learning (Freire et al., 2014).

For this reason, in documented cases, it has been shown that serious games, i.e., those designed for educational purposes, have been effective in increasing both content retention and student engagement, significantly influencing the acceptance of online learning systems. These types of games attempt to take advantage of the huge motivation aroused by online games to improve the learning process (Freire et al., 2014; Gordillo et al., 2021).

Figure 5 visualizes how trends have changed over time. In the first instance, researchers were inclined toward topics such as social networks, serious gaming, and learning from mobile devices. Subsequently, the topics they leaned towards were: game-based learning, collaborative learning, learning analytics, e-learning, motivation, collaboration, and gamification. Finally, there was evidence of interest in online learning, engagement, badges, rewards, and game elements.
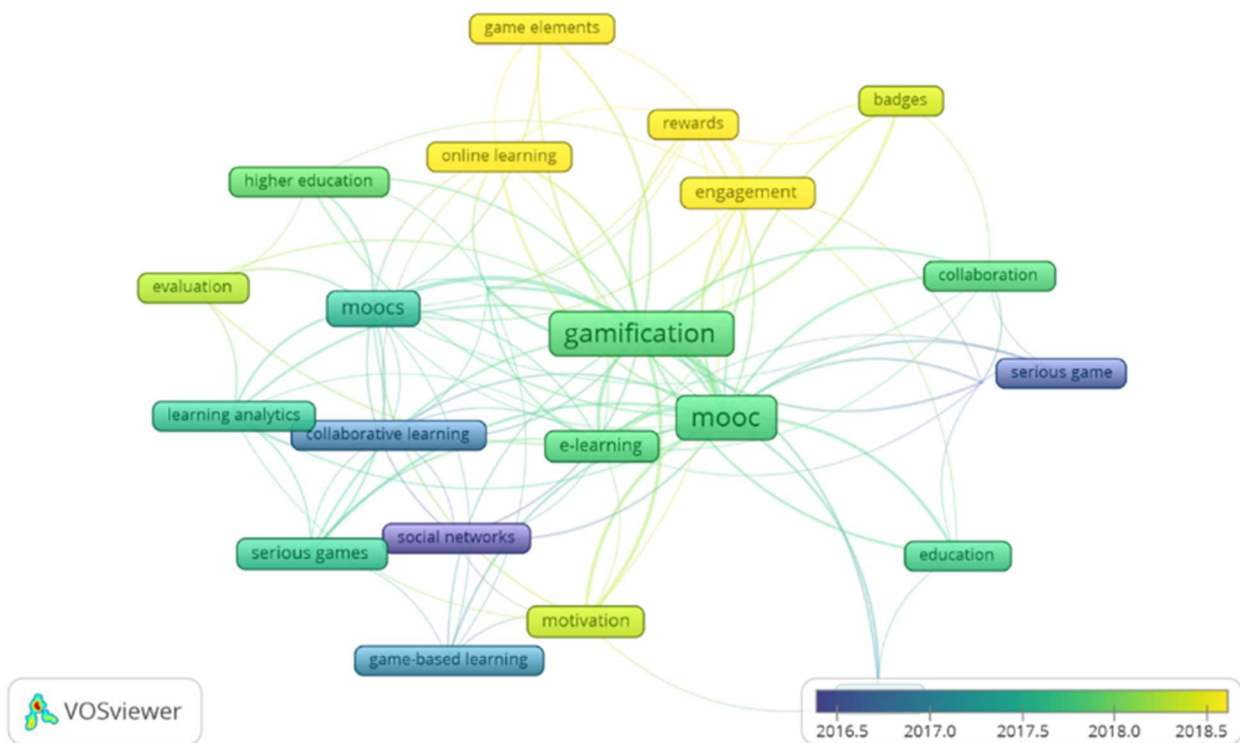
Figure 5. Thematic trends over time

Gamification develops from the transfer of game design elements to a non-game scenario. Regarding those game elements, the literature has identified the most relevant effect of gamification in virtual learning environments: badges/rewards, leaderboards, ranking/scoring, feedback, and challenges. Such elements contribute to the field of designing appropriate gamification. Thus, performance (directly related to badges) is the most important element, followed by motivation, learner engagement, attitude towards gamification, collaboration, and social awareness (Antonaci et al., 2019).

Engagement is also one of the most recent research's most recurrent keywords. Researchers have worked on the topic of engagement due to the high dropout rate of MOOCs. Therefore, they constantly recommend including innovative teaching strategies that promote participant engagement. In this way, engagement is quite related to gamification elements, given the fun, interactive, and meaningful experiences that participants can get from using gamification (Romero-Rodriguez et al., 2019).

Rewards are also part of the research interests around gamification in MOOCs. These are part of the most important game elements used as a strategy for the motivation and permanence of students in online learning courses. A reward system allows learners to accumulate points and digital badges. Learners can earn rewards when they complete an assignment, which can be a primary course objective related to the knowledge objectives of the course. Given these benefits, the well-known MOOC platforms Udacity, edX, and Coursera have started implementing gamification strategies in which reward systems are included (Abu Bakar et al., 2018). It is in this way that the preference of researchers in this topic is evidenced.

In addition to the above, about the analysis of the behavior of keywords in studies on MOOCs and gamification, the following Cartesian plane of **Figure 6** is designed, by means of which, for the horizontal axis or X axis, the frequency of the keywords is established, that is, the number of times that these have been repeated in scientific studies. In contrast, for the vertical axis or Y axis, each word's average year of use is positioned, thus locating the main 30 keywords evidenced in the subject matter.

In this sense, we have Quadrant IV or Quadrant 4, which relates those words that, although they are among the most frequent in the field, their average year of use is earlier, which indicates that they are decreasing concepts in the literature. Thus, they are concepts that were protagonists of the previous literature. In this quadrant, we have the concepts of "Serious games," which were integrated into the dynamics of MOOCs by pretending to overcome the basic methodologies based on text materials, video lectures, and forum-based interactions (Romero and Usart, 2013). "E-learning" which was identified by Pilcher (2013) between the envisioned horizon for education and the horizon at the beginning of the previous decade, and "Motivation", which is positioned among the main problems of virtual education, so several authors have studied the motivational factors that can provide better learning experiences (Morales et al., 2016).
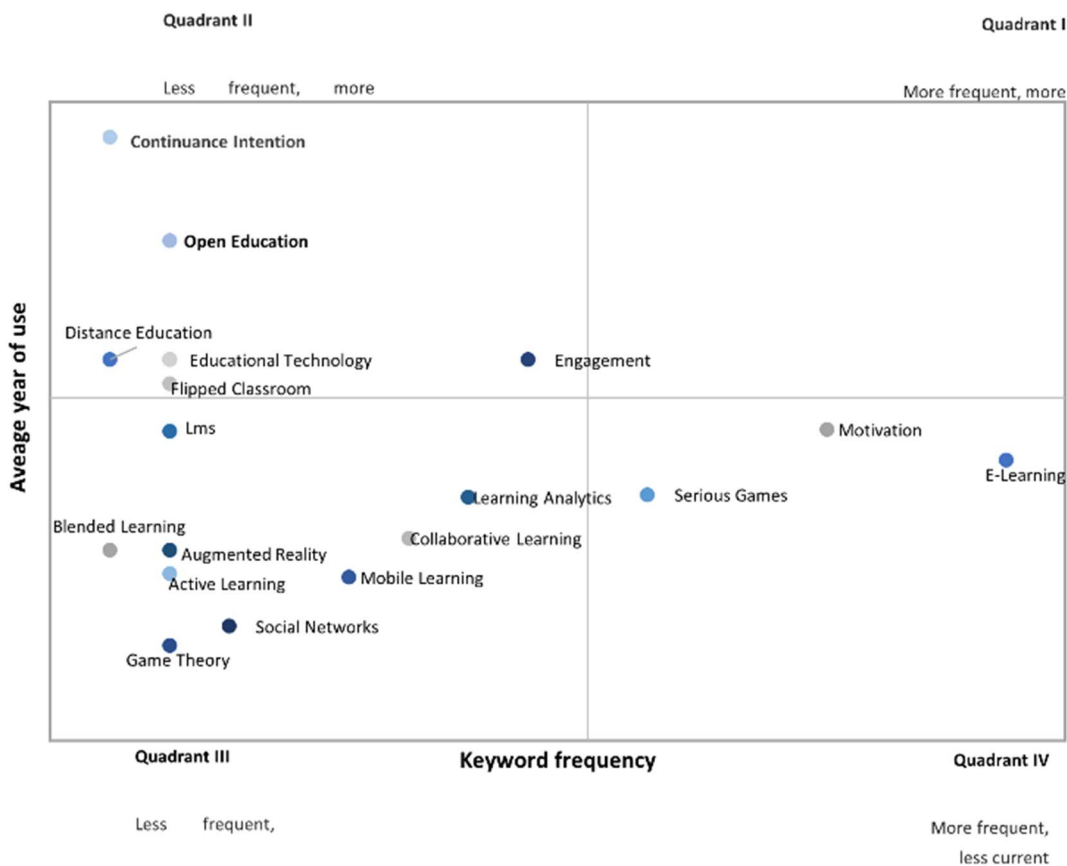
Figure 6. Validity and frequency of keywords

On the other hand, we have Quadrant III or Quadrant 3, where the less frequent and current terms are located among the selected concepts. This analysis is important to analyze the prominence given in future research agendas critically. In this quadrant, we have concepts such as "Blended learning," a learning modality in which face-to-face training is combined with online learning activities, which is useful, especially in the context of the pandemic due to the outbreak of the Covid-19 virus (Giannatelli and Tomasini, 2021). "Augmented reality" also emerges as an innovative strategy to provide a more engaging experience to learners for student retention in MOOCs (Chauhan et al., 2015). "Collaborative learning" and "Social networks" as participants learn and participate in cooperative environments that promote learning communities within external hypermedia environments, such as social networks (Cruz-Benito et al., 2017). "Learning analytics" to collect and analyze MOOC data for improvement (Khalil et al., 2017). And "Game theory," among others.

Finally, we have Quadrant II or Quadrant 2, which, although it positions terms among the least frequent, are also among the most current in the research field, so they are considered emerging keywords or those that have emerged in the scientific literature on MOOCs and gamification in recent years, emerging as protagonists for future research agendas. In this quadrant, there are concepts such as "Flipped classroom" that, according to (Hung et al., 2019), have positive effects on engagement and learning outcomes in students, "Engagement"

that has been one of the main challenges in terms of virtual education, which has been wanted to impact directly from the gamification part (Rincon-Flores and Santos-Guevara, 2021). "Educational technology" that has modified methodologies, curricula, content, and learning needs (Goksu et al., 2021), "Distance Education", "Open education" as two of the contexts most impacted by virtual and digital learning methodologies (Mystakidis, 2021) and "Continuance intention" (Continuance intention in MOOCs) that is mediated, according to Cheng (2022) by latent variables such as cognitive participation, fluid experience and social presence.

CONCLUSION

In the decade analyzed, publications on gamification in MOOCs have increased, with some years marking a decrease; however, interest in the topic has been evident. Among the most important actors, we found authors whose production and impact have been outstanding since it has been found that the authors who publish the most are those who, at the same time, have registered the highest number of citations. In addition, influential journals and conferences on the subject were found, in which the focus of interest was on the most recent technologies.

Following the trends, it was found that the most recurrent

topic is e-Learning. In recent years there has been evidence of a growing interest in online learning, especially in courses of an accessible nature such as MOOCs that have provided numerous facilities to students in terms of providing free and quality education offered by multiple higher education institutions and commercial industries. This is how numerous strategies are implemented to motivate students to continue in these online courses, such as gamification, aiming to improve and dynamize the processes of knowledge absorption and strengthening skills in students.

There has also been a research trend towards serious games based on traditional video games' commercial and motivational success. Based on this theme, trends have become evident in the study of rewards, badges, engagement, and other game elements that are important in designing and developing these games within virtual learning environments. These issues, therefore, mark the interest of future research on gamification in MOOCs.

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