

## Game-based Learning in Higher Education: Where Do We Stand?

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### Abstract

In the last decade, game-based learning has been increasingly used in higher education (HE) across various disciplines, from language studies to engineering and medical fields. Scholars have examined key success factors, facilitators, and challenges of game-based learning integration (GBL) in higher education. While some literature reviews exist, they primarily address issues like cultural differences or technological impact without offering a comprehensive synthesis. This study addresses this gap through a systematic literature review of articles from the ISI Web of Science Current Contents database, spanning from 1998 to 2020. The study's final sample of 288 articles underwent two levels of analysis: a bibliometric analysis to highlight significant publications and authors, followed by a content analysis to identify primary research questions, methodologies, and suggested future directions for advancing game-based learning research. Our findings provide an integrated overview of game-based learning's role in higher education, offering a framework for future studies to build on existing insights and address ongoing challenges in applying game-based learning effectively in various educational settings.

**Keywords:** Game-based Learning; serious games; gamification; higher education

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## 1. Introduction

The prevalence of digital technologies has driven the development of innovative teaching strategies aimed at engaging and motivating students in higher education. Interactive learning environments allow the incorporation of game elements that have demonstrated to capture student attention, motivate towards goals and promote competition, effective teamwork and communication. Game-based learning (GBL) systems and gamification incorporate game mechanics, e.g., points, competition, and collaboration—into educational frameworks to stimulate engagement, enhance student motivation, and foster teamwork and communication skills (Subhash and Cudney, 2018).

Their application spans various fields, ranging from language acquisition to technical disciplines like engineering, healthcare, and business, making them versatile instruments for diverse educational contexts, as they increase student engagement and support diverse learning styles. Also, incorporating game mechanics can enhance learning outcomes by facilitating goal-oriented behaviors and promoting an enjoyable, competitive learning environment. Additionally, mobile-based GBL strategies have gained prominence for providing flexibility and convenience, enabling learning outside traditional classroom settings and adapting to the habits of digital-native students (Subhash and Cudney, 2018; Troussas et al., 2020).

Key studies have highlighted distinct concepts within GBL, including gamification, serious games, and game-based learning, each offering unique applications and outcomes. Gamification integrates game-like elements within non-game contexts, as illustrated by Brady and Andersen (2019), while serious games focus on educational content delivered through a gaming interface. The potential of these approaches is vast, yet there is a notable absence of a unified theoretical framework that consolidates the findings across different contexts and methodologies, leading to inconsistent outcomes and interpretations.

To fill the identified gap, this research generates knowledge through the integration of published research in journals, Web of Science, more specifically in ISI Current Contents, in the Social & Behavioral Sciences Database between 1998 and 2020.

The paper is organised into three sections. The first one is the current introduction. The second one is the methodology chapter, in which we incorporate the relevant aspects for the systematic literature review. The third section presents the results obtained from the systematic literature review, namely descriptive statistics on the relevant sample, as well as the main authors, years of publication and main journals, in section 3.1., and the results of the content analysis and literature maps with the main schools of thought identified and the main thematic areas of study, in section 3.2. In the fourth and last section, we present the critical discussion and also indicate future research directions.

## 2. Methodology

A systematic review is a comprehensive research methodology that involves both quantitative, bibliographic analysis and qualitative, thematic analysis (Saur-Amaral, Reis Soares, & Proenca, 2018). To develop our research, we followed a three-step approach (Saur-Amaral et al., 2013): a) *Planning*: development of the review protocol; b) *Research*: implementation of the review protocol by three independent researchers; c) *Reporting*: analysis of the results and development of literature maps.

In our study, we have followed established conventions by concentrating solely on peer-reviewed academic journal articles in English. This selective approach serves to uphold the quality of the literature considered while also ensuring that our sample remains manageable for in-depth analysis.

We searched for “gamification”, “game-based learning” and “serious games” combined with “higher education” in Topic, in three separate searches on ISI Current Contents, Social & Behavioral Sciences Database, using as filter the period between 1998 and 2020.

After the search, the data was exported to Endnote 20, and a first selection of valid results was obtained (998 articles). Then, all results were read and all papers that did not relate with the topic of the systematic search were eliminated.

A total of 288 results remained after this step. Next, a qualitative analysis was developed using NVivo on the results imported from Endnote.

## 3. Results

We present our results as follows. First, we present the bibliometric analysis, where the yearly distribution of papers, as well as top authors and journals are shown. Second and last, we present the results of the content analysis, which reveals key topics studied by the authors.

### 3.1. Bibliometric analysis

Regarding paper distribution per year (see Figure 1), there has been a flat tendency between 1998 and 2004, with only one publication per year and a slow increase of publications between 2005 and 2014. An ascendant trend in the number of publications happened from 2015 onwards. This reveals an increasing interest in the topic.

A similar tendency is observed when coming to the number of journals that published papers on GBL over the years (see Figure 2). In 2020, the number of journals that published papers on GBL was 27.

Regarding scientific journals that were most representative in terms of the number of publications in the analysed period (see Table 1), we find Computers & Education, Sustainability, British Journal of Educational Technology, Educational Technology & Society and Computers in Human Behavior. Considering that Sustainability is an eclectic journal with an encompassing editorial policy, we may conclude there is a predominance of education technology-oriented journals.

In the first years analyzed, there was no specialization in the papers published. Only from 2015, the GBL started to appear more in the technology and education-oriented journals. The Top 5 journals represent 37% of all publications.

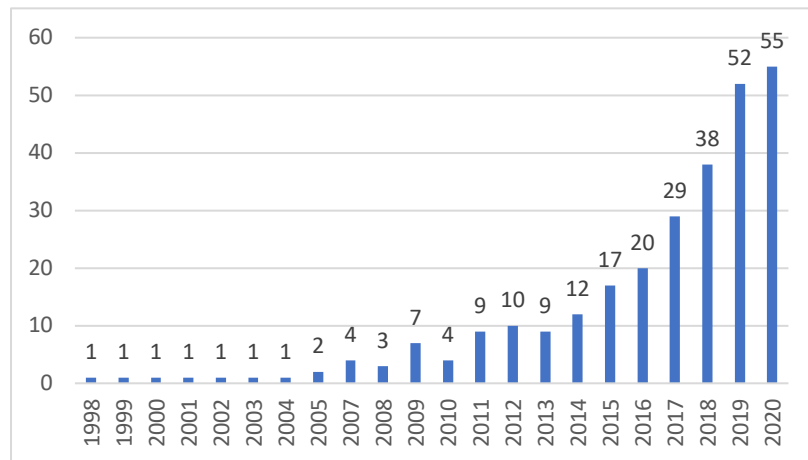


Figure 1 - Number of GBL papers distributed per Publication Year (1998 to 2020)

Source: Own elaboration

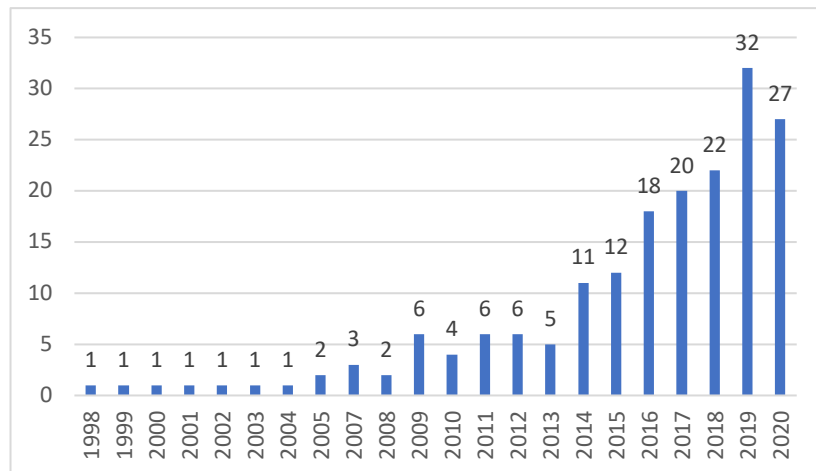


Figure 2 - Number of Journals that published GBL papers per Publication Year (1998 to 2020)

Source: Own elaboration

Table 1 – Top five journals per number of GBL papers published (1998 to 2020)

Journal	Percentage of total papers published
Computers & Education	14%
Sustainability	9%
British Journal of Educational Technology	5%
Educational Technology & Society	4%
Computers in Human Behavior	4%



Source: Own elaboration

Gaming appears in most of the papers, as it would be expected due to the search equations used to obtain the sample, but the remaining three words are also very frequent in the papers, as illustrated in Figure 5.

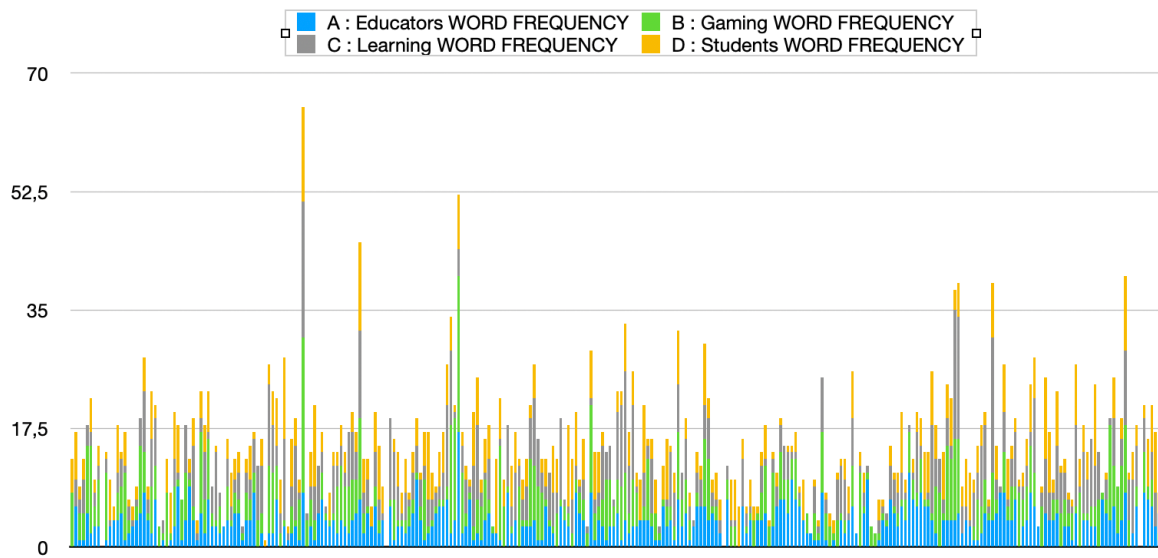


Figure 5 - Presence of most frequent words in the abstracts - GBL papers (1998 to 2020)

Source: Own elaboration

In terms of concepts, three major approaches are used by the scholars: gamification, game-based learning and serious games. Gamification, defined as “one type of active learning approach that incentivizes student participation by incorporating gaming elements into the learning experience” (Brady and Andersen, 2019) is the most frequently used approach (see Figure 6).

Authors focus on GBL using three different perspectives. They use existing games and apply them in HE context, at different levels (undergraduates, postgraduates or executive training), they create games and test them in HE context or they use the concept of gameful design (See Figure 7). Applying existing games is the most used focus.

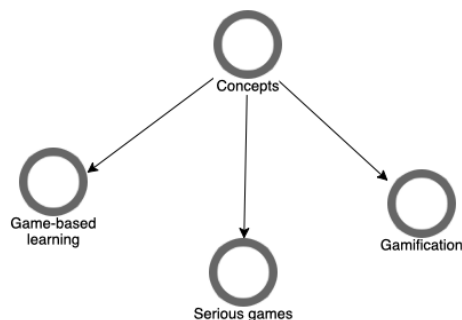


Figure 6 - Concepts (NVivo Map view)

Source: Own elaboration

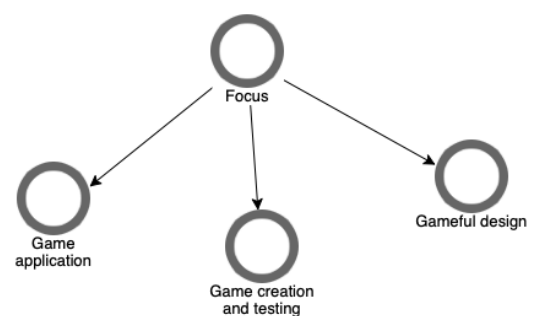


Figure 7 - GBL focus (NVivo Map view)

Source: Own elaboration

In terms of choice of application medium, most authors choose digital games, frequently associated to students “digital native” generation. A common used tool is Kahoot!, one of “the most popular game-based learning platforms, with 70 million monthly active unique users” (Wang and Tahir, 2020).

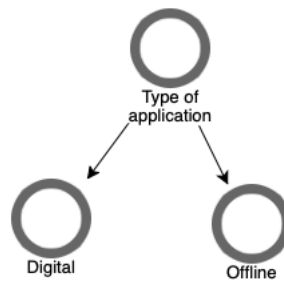


Figure 8 - Type of application medium (NVivo Map view)

Source: Own elaboration

Regarding the geographical context, authors study GBL in different countries. United Kingdom is the most frequently chosen context, followed by United States, Netherlands, Italy, Spain and France (see Figure 9). In some papers, combined studies are performed, e.g. (Capatina et al., 2018) where simulation tool called Simbound is tested at three European universities in Grenoble (France), Milan (Italy) and Galati (Romania).

Some areas of study in HE are more frequently used as object of studying GBL, as seen in Figure 10. Management / Business is the most used in the sample, both for “soft-skills” (e.g. conflict management in (Bruno et al., 2018)) and for more technical endeavors (e.g. project portfolio in (Barbosa and Rodrigues, 2020) or operations management in (Brandon-Jones et al., 2012)). In medicine and nursing, GBL was used for diagnosis (e.g. (Agudelo-Londono et al., 2019) or capacity to work under pressure (e.g. (Gomez-Urquiza et al., 2019)). Engineering, computer science and maths were other frequently used areas.

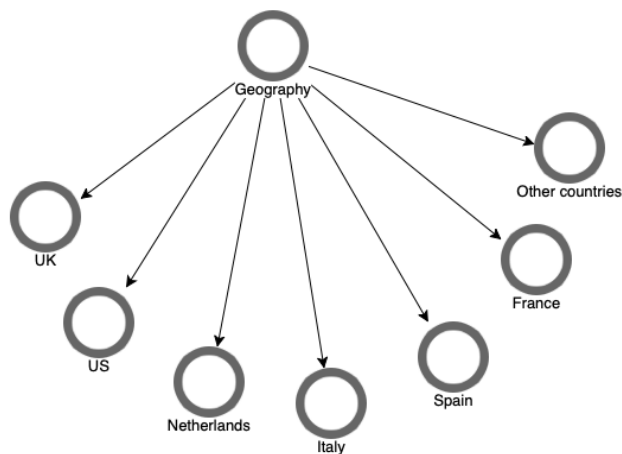


Figure 9 - Geographical context (NVivo Map view)

Source: Own elaboration

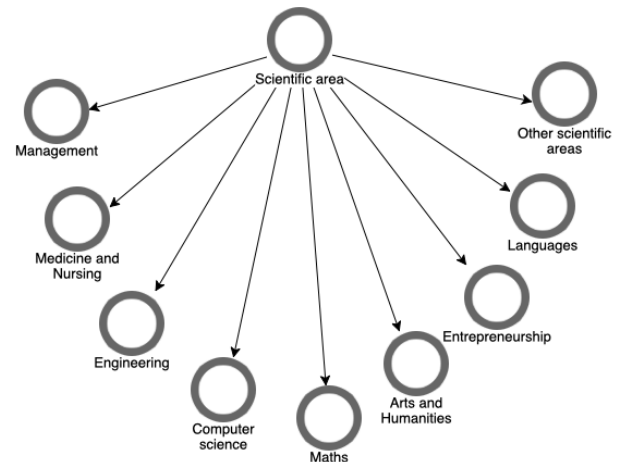


Figure 10 - Scientific areas (NVivo Map view)

Source: Own elaboration

Finally, regarding methodologies (see Figure 11), authors used as the most frequent method the survey, either alone, or in combination with experiments. Qualitative studies were also frequent and used to understand the reaction of the students to newly created or existing games.

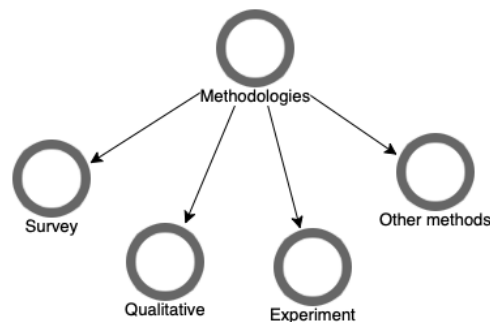


Figure 11 - Methodologies (NVivo Map view)

Source: Own elaboration

The results from the papers vary, and it is possible to identify papers focusing on different student profiles and different teacher profiles, as well, as well as a set of motivational factors for students and teachers to engage in GBL and a set of facilitating factors to promote the success of GBL implementation in HE.

## 5. Conclusions

Our paper was focused on a systematic literature review aiming to review and integrate the contributions regarding game-based learning in HE. Our results indicate that there has been an increasing interest in the topic in the last years, and that there are already some journals publishing an important number of papers related to GBL. Emphasis falls on Computer & Education, who published 14% of all papers from our sample. However, no author or research group has emerged as a prominent leader, indicating that GBL remains a relatively open field for new contributions and collaborative research initiatives.

Our analysis highlights several takeaways. GBL applications are mainly focused on digital and interactive platforms, leveraging students' familiarity with digital tools and their affinity for technology-driven experiences. This aligns with studies emphasizing the importance of digital natives' adaptability to mobile and web-based learning platforms. However, most studies concentrate on evaluating existing games and identifying success factors and facilitators of learning, rather than developing new games tailored to specific educational objectives.

Different methodologies have been employed in GBL research, involving surveys and experimental designs that aim to capture immediate learning outcomes or motivational shifts, indicating a possible tendency to start the consolidation of this field. Future research directions may focus on the application of existing games and the usage of quantitative methods to further allow the development of GBL academic knowledge considering different cultural and disciplinary contexts.

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