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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) in various fields, ranging from languages to engineering or medical sciences. Scholars from different areas have been researching to understand the underlying factors of success and the facilitators and barriers of applying this way of learning in HE. There are, as well, some literature reviews on the topic, (e.g. Subhash and Cudney, 2018), where issues like cultural differences and the impact of different technologies or game elements have been pointed out. However, there are still a lot of knowledge gaps to be filled in and, to our knowledge, there are no studies that duly review and integrate the contributions regarding game-based learning in HE. Our research seeks to fill in this gap, and we perform a systematic literature review on articles and reviews published in Web of Science, more specifically on ISI Current Contents, in the Social & Behavioural Sciences Database, from 1998 to date. We combined different search equations around games, learning, serious games and higher education, with an initial sample of 998 results exported to Endnote 20. These results were manually analysed by three independent researchers who read the abstracts to ensure that the final set of results was related to the topic under study. The final sample undertook two levels of analysis. The first one included a bibliometric analysis showing the key journals related to game-based learning and top authors in the field. A second one included a qualitative analysis performed with NVivo 12 on the results imported from Endnote, which reveals the research questions, the methodologies and the future research directions that may guide scholars that desire to develop the body of knowledge in the future.

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

1. INTRODUCTION

Interactive learning environments present the opportunity to evolve the teaching process by incorporating game elements that have demonstrated to capture student attention, motivate towards goals and promote competition, effective teamwork and communication. Game-based learning systems and gamification aim to bring these benefits to the teaching and learning process (Subhash and Cudney, 2018).

According to Troussas et al. (2020), game-based learning for mobile devices constitutes an important issue in the related scientific literature as it promotes learning in a fun way and stimulates student motivation to increase engagement in the educational process. Therefore, it can enhance the learning process and improve student participation.

In order to fill the identified gap, this research aims to generate 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 methodology chapter, in which we incorporate the relevant aspects for the systematic literature review. The second 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, main journals, results of the content analysis and literature maps with the main schools of thought identified and the main thematic areas of study. In closing, we present the critical discussion and also indicate future research directions.

2. METHODOLOGY

To develop our research, we conducted a systematic literature review (Saur-Amaral et al., 2013) following a three-step approach:

1 - Planning (development of the review protocol);

2 - Research (implementation of the review protocol by three independent researchers);

3 - Reporting (analysis of the results and development of literature maps).

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

After the search, the data were 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 through NVivo 12 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.

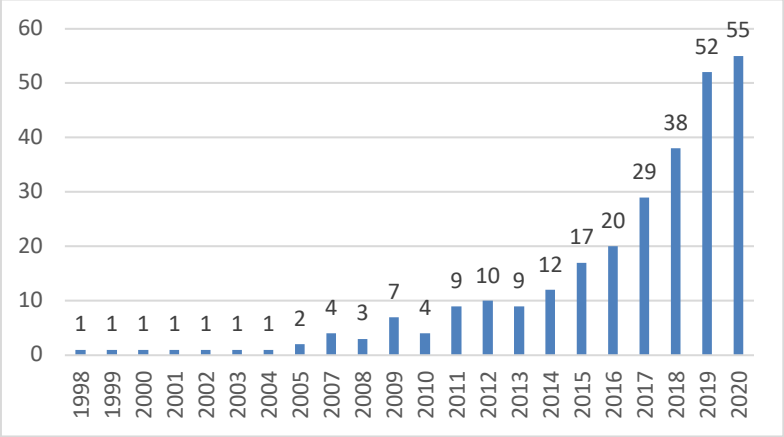

Figure 1 – Number of GBL papers distributed per Publication Year (1998 to 2020)

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.

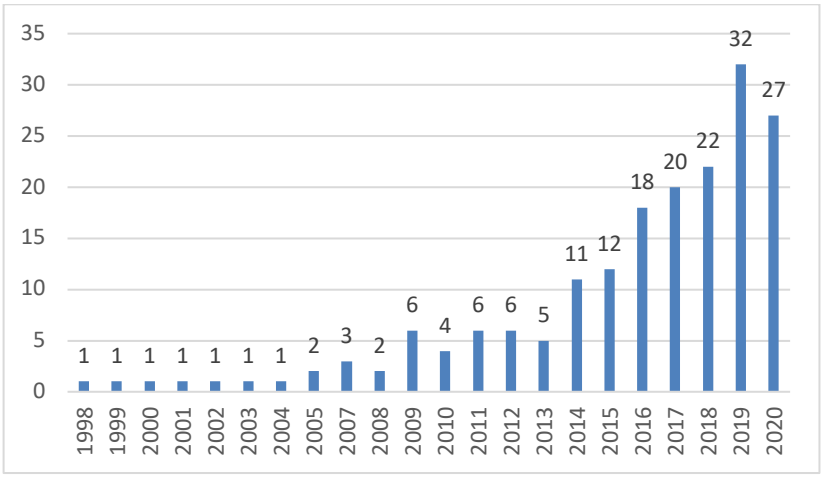

Figure 2 – Number of Journals that published GBL papers per Publication Year (1998 to 2020)

Concerning 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 a pretty encompassing editorial policy, we may conclude there is a predominance of education technology-oriented journals.

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%

The distribution of papers per year shown in Figure 1 indicates that 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.

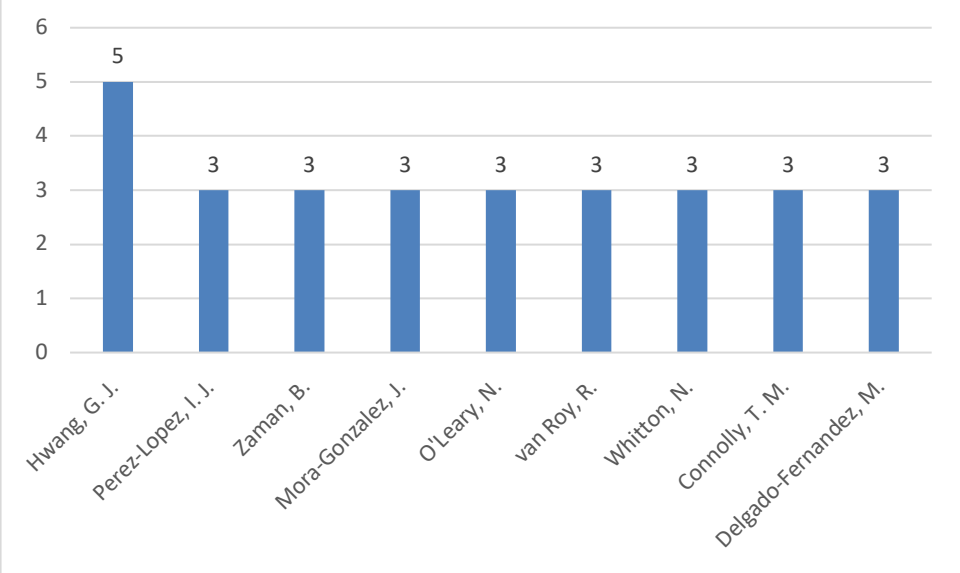

Figure 3 – Top authors that published GBL papers (1998 to 2020)

Regarding top authors, considering the period covered by our search (1998-2020) we may conclude that there is no dominant author. The author that published most GBL papers is Hwang (5 papers), followed by Perez-Lopez, Zaman, Mora-Gonzalez, O'Leary, van Roy, Whitton, Connolly and Delgado-Fernandez (each with 3 papers).

To sum up, the bibliometric analysis reveals an increasing interest of the academic community in studying game-based learning and there are specific journals that publish more GBL papers as part of their editorial policy (emphasis on Computers & Education). However, there are still no dominant authors and there seems to be space for groups of researchers to focus on this topic as a medium-long term research strategy.

4. CONTENT ANALYSIS

The qualitative analysis was performed in NVivo 12, based on the content analysis of the abstracts of the sample. As it may be observed in Figure 4, the most frequent words were linked to gaming, learning, students and educators, and it is interesting to observe that learning, students and teachers (educators) all appear related in the overall analysis of the GBL sample.

Figure 4 – Word Frequency Query in NVivo - GBL papers (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.

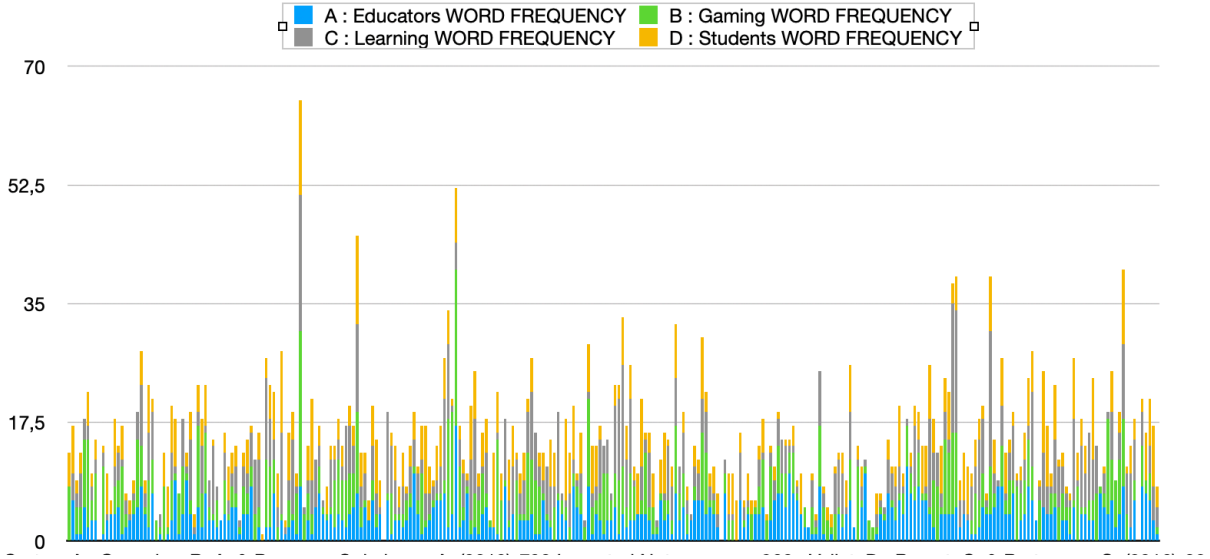

Figure 5 – Presence of most frequent words in the sample (own elaboration)

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)

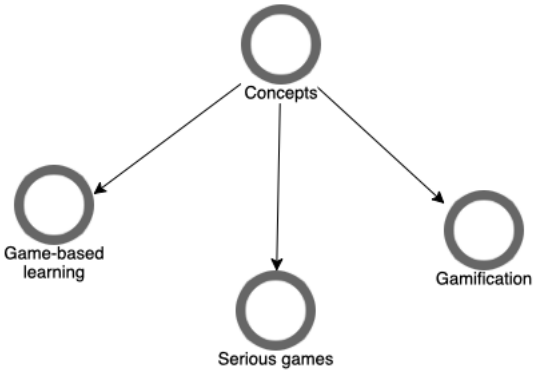

Figure 6 – Concepts (NVivo Map view – own elaboration)

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.

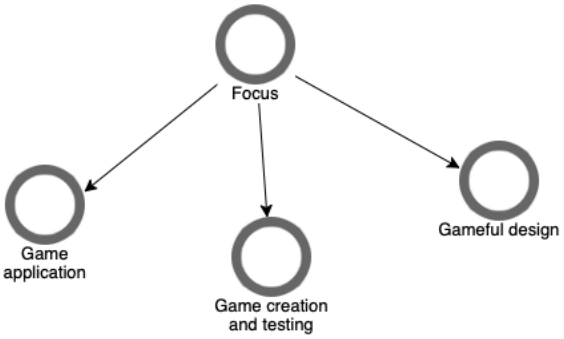

Figure 7 – GBL focus (NVivo Map view – own elaboration)

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).

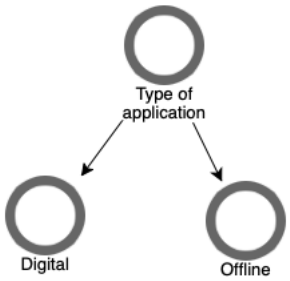

Figure 8 – Type of application medium (NVivo Map view – own elaboration)

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).

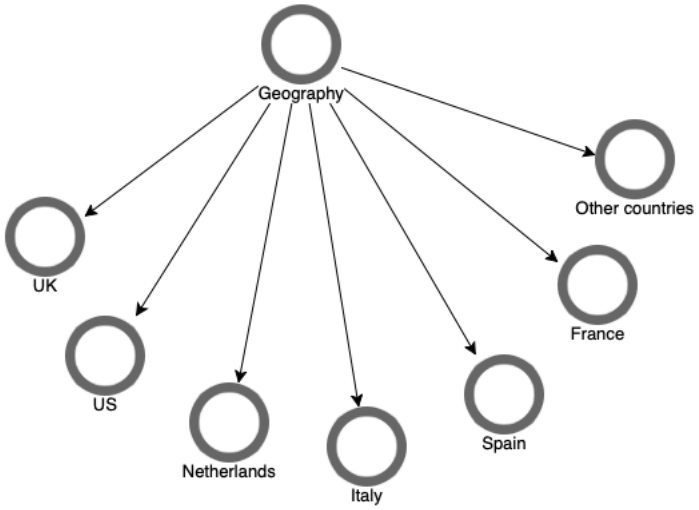

Figure 9 – Geographical context (NVivo Map view – own elaboration)

Some areas of study in HE are more frequenly 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 porfolio 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.

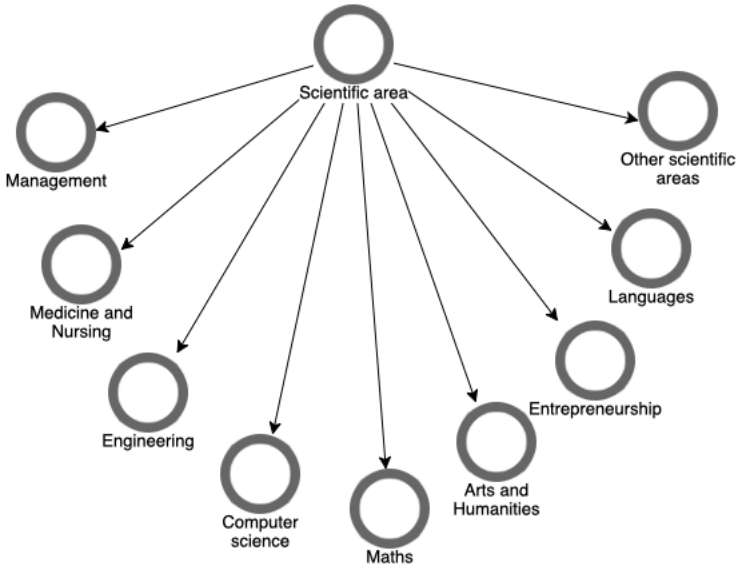

Figure 10 – Scientific areas (NVivo Map view – own elaboration)

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.

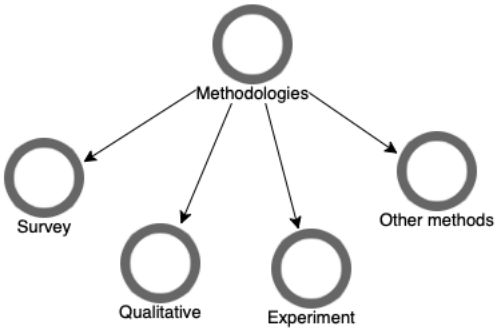

Figure 11 – Methodologies (NVivo Map view – own elaboration)

The results from the papers do 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.

There are no consolidated authors in the field, which means that there is space for researchers to invest in this topic.

GBL is associated to different levels of study in HE and a set of different contexts, but essentially focuses on digital game application. While there is space to create new games and test them, it seems that the application of existing games and the identification of success factors and facilitators of learning is an increasing area of study.

Different methodologies may be used by scholars who wish to research GBL, knowing that surveys and experiments are the most frequent, 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.

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APPENDIX - LIST OF REFERENCES USED FOR THE ANALYSIS

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