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ORIGINAL RESEARCH

A Wide View on Gamification

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Abstract
This paper presents an overview of gamification research. It introduces a panoramic research map that comprises a research map and keyword maps for each year of publication of research on gamification. The panoramic research map resulted in a detailed view of gamification research: covered areas, types of published papers, gaps, and most researched themes. The main area of research on gamification is related to the education and training domain, showing a strong connection to the use of game design elements and game experience to improve educational scenarios among students. Knowing the panoramic research map aids the development of future research on gamification, helping in the identification of important papers, gaps in the knowledge, and relevant papers for future research. As an additional outcome, the panoramic research map might also be used to understand other fields of research or specific themes besides gamification.

Keywords Gamification · Method · Panoramic research map · Research map · Keyword map · Literature review

1 Introduction

It took just a couple of years for gamification to get popular as a research subject. The use of game elements in non-entertainment contexts, though, is not a novelty. The first known approach of gamification occurred in Lenin's Soviet Union, where competitions were used to motivate workers to increase production rates (Nelson 2012). Many years later, in the 1980s, game elements were used to improve user interfaces and evaluate computer systems (Malone 1982). Around 1990, gamification was then used to make work environments more enjoyable (Nelson 2012). The concept of gamification, however, was only coined

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in 2008 and became popular after 2010 (Deterding et al. 2011). There was a significant increase in published papers about gamification in recent years, which might be related to the close relationship between gamification and motivation.

One of the most-used definitions describes gamification as "the use of game design elements in non-game contexts" (Deterding et al. 2011, p. 10). Another definition frames gamification as "a process of enhancing a service with affordances for gameful experiences in order to support users' overall value creation" (Huotari and Hamari 2012, p. 19). Walz and Deterding (2015, p. 7) complete the understanding by showing gamification on a conceptual mapping of the gameful world and providing a definition "'ludic elements or qualities', or non-game objects and experiences that use design elements from games and/or are designed to afford gameful experiences." Thus, we understand gamification as a process of adding game design elements and creating gameful experiences, relying on particular game elements or experiences, instead of in the development of a game.

A gameful experience should be developed by focusing on the user experience, instead of a focus on the need to use a system (Jensen 2012). The shift from user experience to player experience encompasses the development of five planes of game experience: motivation, meaningful choices, balance, usability, and aesthetics (Ferrara 2012), each of them having their own approaches and leading to the use of specific game elements. Besides reaching a certain plane of experience, the same approach for a gameful experience might not be effective for everyone, as Bartle (1996) argues that people are divided among four player types: conqueror, explorer, socializer, and killer. Each player type has a desired kind of activity to have a gameful experience: conqueror players want to gain levels and badges, explorer players reach for exploring all possibilities from the game, socializers want to interact with other people, and killer players want to make trouble for others (Bartle 1996).

A common factor guides every type of well-developed gameful experience: flow. When someone performs an activity, this activity has a complexity level that requires a certain skill level to be performed. If there is equilibrium between complexity and ability, one can achieve the flow, getting motivated, and with great concentration on the activity (Czikszentmihalyi 1990). If the complexity or the ability is too low or too high and equilibrium is not reachable, the flow will not be achieved.

Motivation exists on a continuum that starts with complete demotivation and ends with intrinsic motivation (Ryan and Deci 2000). Gamification uses individual intrinsic motivation to engage people; "when intrinsically motivated a person is moved to act for the fun or challenge entailed rather than because of external prods, pressures, or rewards" (RYAN; DECI 2000, p. 56). Many game elements are used to motivate, including badges, points, leaderboards, competitions, and avatars. According to Hamari et al. (2014), the most-used game elements sited in empirical gamification studies are points, leaderboards, and badges. Points are numerical values that indicate progress (Seaborn and Fels 2015) and provide feedback (Sailer et al. 2017). A leaderboard is a way to visualize rankings (Seaborn and Fels 2015) and is "an effective approach to gamify task performance" (Landers et al. 2015). A badge is a type of medal that includes a description, achievement criteria, and the award (Hamari and Eranti 2011). Domains such as education, healthcare, environment, business, engineering, and others provide examples where those elements promote and improve gamification, resulting in spreading the knowledge on gamification through many areas of research.

There are still many opportunities for improvement and understanding gamification research, as listed by previous surveys. Hamari et al. (2014) have analyzed empirical papers to investigate if gamification works, finding positive results regarding its use and identifying the most-used motivational affordances, although the authors suggested different player

types could experience game elements in various ways. Seaborn and Fels (2015) have presented a review of applied human participant research involving computer-based gamification systems. Among their findings, the researchers call for exploring and diversifying application domains and elements used in gamification. Two years later, Nacke and Deterding (2017) suggest a gain of maturity in gamification research, as well as evidence that it is becoming a cross-disciplinary field of research.

This paper is an attempt to answer some of the questions posed by previous researchers by discovering how gamification research has evolved over the years. We aim to explore (1) which domains are approached through gamification; and (2) which game elements are used to employ gamification. Besides trying to answer these queries, this paper aims to help future researchers visualize gamification research quickly and easily.

2 Methods

We have developed a new method to help visualize and analyze gamification: the panoramic research map. The method allows a quick global visualization of the field of investigation. It includes two types of maps: a research map that presents a classification of papers based on year of publication, domain, and the main outcome of the publication; and summary maps that provide an overview of the research.

The research map allows quick understanding of how the subject evolved as a field of research: from the first publications to the most common areas of actual research. It also presents changes in the types of publication over time: some fields of research start with empirical papers focused on applying gamification and lead to theoretical and practical studies, while in other areas of research the order might be reversed. The summary map enhances understanding of the domain by showing the most relevant themes of research according to the words used by authors in the abstract. The panoramic research map might be utilized both as a complement to a systematic literature review to visualize the review outcomes, or alone as a single method. It differs from other common methods by focusing on a global visualization of the theme, rather than on a detailed view of the works themselves, which allows a quick review of numerous papers. This approach is useful to identify the characteristics of the research field and to locate key papers within it.

The development of a panoramic research map includes three main phases: review, classification, and development, as shown in Fig. 1. The review starts with the definition of the search terms that will be used to identify papers to be examined, followed by the selection of relevant databases to conduct the search, and ends with the listing of papers included in the classification. In the classification phase papers are filtered according to inclusion and exclusion criteria and classified per type of research, area, year of publication, and authors' keywords. During the development phase, three maps are developed: the research, the summary, and the evolution map. The research map is a pie chart that combines concentric circles with a historical overview, slices of research areas, and icons of research types. This map presents a wide panorama of the field of investigation, allowing the identification of previous studies, gaps in the knowledge on specific areas, and other papers that could benefit future research. The summary map shows the group of the most-used keywords in abstracts, grouping them and showing their frequency, easing the process of understanding the structure of a research domain. An evolution map shows the most-used keywords on a temporal line, allowing an understanding of their interest during the time of publication. While the research map presents the extent of the field, the summary map shows its

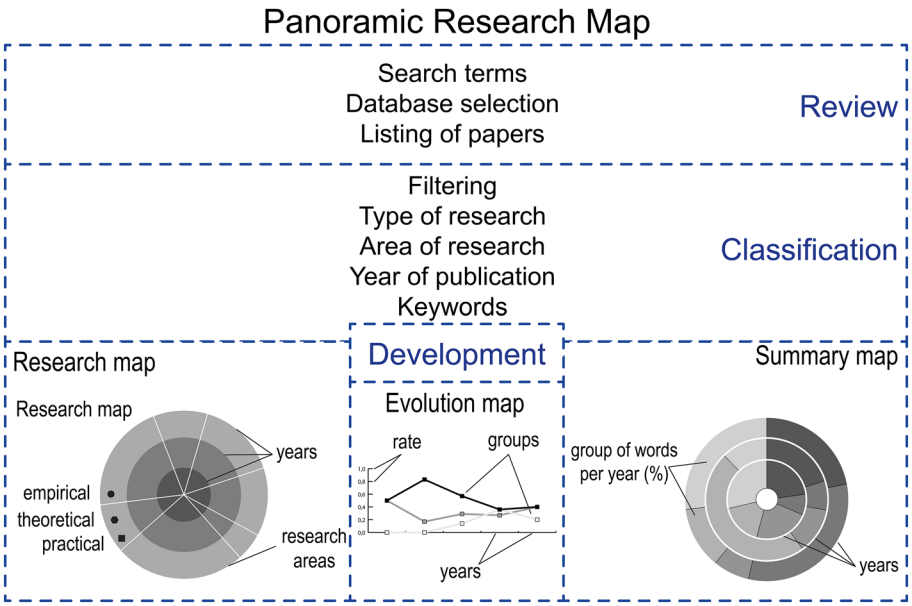

Fig. 1 Method to develop a panoramic research map

details, and the evolution map shows its progression over time. A combined view of the maps results in the panoramic research map.

2.1 Review

We have performed a systematic literature review to identify the area and type of research on gamification (Boell and Cecez-Kecmanovic 2015). We have searched for the string gamif* to cover gamification related words such as gamified, gamifying, and others. As gamification is applied to diverse domains, we have selected three multidisciplinary databases to conduct the research, performed on July 14th, 2017: EBSCOHost, ScienceDirect, and Scopus. No filters regarding the year of publication have been chosen, while we filtered document type to show only the following types of works: articles, book chapters, books, editorials, and reviews. As the last filter, we narrowed the search to show papers that had the word "gamification" as a keyword. This way we could both focus on the main related gamification studies and pass over most of the briefly related research. After searching the databases using the stated filters, we have found 815 papers, including duplicates, as shown below in Table 1.

2.2 Classification

Studies were classified according to their research type, research domain, year of publication, and listed keywords. Three types of research were identified: empirical, theoretical, and practical. Empirical, or application, papers present ways gamification is used. Theoretical papers include literature reviews, definitions, and other discussions mainly based on theoretical aspects. Practical papers present surveys, models, frameworks, and related

Table 1 Number of papers from each database that were reviewed

Database	Number of papers
EBSCOHost	296
ScienceDirect	17
Scopus	502

contributions that help in developing, applying, evaluating, or understanding gamification. Some papers have characteristics of more than one group, and we have included them in a single group according to the major outcome of the research. In example, Lopez and Tucker (2017) present a method to evaluate the complexity of implementing a game feature and its impact on increasing motivation. The paper was classified as a practical research, as its main outcome is the method that was developed. A case study is also presented, but the research was not included as an empirical paper, as gamification was only applied on a case study to evaluate the use of the method. Titles, abstracts, highlights, and keywords were used to classify the papers. The same method of classification presented above was used to classify all the researches. We have faced a problem described by Seaborn and Fels (2015): a large number of false positives, where the term "gamification" is used to describe other domains besides gamification. As Seaborn and Fels (2015) noted, we understand that gamification does not comprehend a fully developed game—the focus is on its elements. Thus, we have excluded papers where the authors stated that a game was developed. Besides the mentioned focus, exclusion criteria have also been included: papers that had a weak relation to gamification (for example: gamification is presented as a future research opportunity and just briefly discussed); papers we were unable to access; and those that do not provide enough or clear information in the abstract to classify the research paper. After eliminating papers using the described criteria, the classification phase ended with a list of 365 individual records (Table 2). The complete list of all papers can be seen in an appendix of the ESM provided as a complementary material. Papers were classified in domain groups according to the areas they are related to. Domain groups with at least 10 studies were nominated, while those with less than 10 papers were clustered into a single group.

2.3 Development

The research map was created using the year of publication as concentric circles: from the oldest publication in the center of the chart (2012) to the newest in the border (2017). Domains were represented as the slices of the pie chart, ordered by their frequency. Each paper is represented by a single number, a specific shape, and color. The number is the paper identification number, as seen in the table in Appendix 1 of the ESM. Both the shape and the color are used to identify the type of paper, easing the identification of the kind of

Table 2 Number of papers from each database that were included in the panoramic research map

Database	Number of papers
EBSCOHost	108
ScienceDirect	9
Scopus	325

research: a yellow circle represents an empirical (application) paper, a green hexagon for a theoretical paper, and a blue square accounts for a practical paper.

Summary maps were created by identifying the most common words used by authors to describe the research in the abstracts. Words were normalized to allow frequency analysis. Variant words were considered as a single one: as an example, the variant words "gamification", "gamify", and "gamified" became "gamification". We have eliminated words that could not add to the analysis, such as "no", "the", and "we", as well as terms such as "provide" and "paper", that were meaningless terms as single words. Normalized words were classified into five groups: domain, activity, process, outcome, and player. The domain group includes words related to the area where gamification was applied or studied. Activity words include actions and activities performed during gamification or to gamify. Process words comprise those words related to tools and elements used to gamify. Outcome words are focused on the desired results of the gamification process. Words from the player group include those concerning people who will use or benefit from gamification. The top 150 most-used words were analyzed and combined into the summary map. The map illustrates concentric circles representing years, and pieces (pie slices) representing groups.

Evolution maps use the same list of normalized words from the summary maps. This map allows the identification of the most-used keywords on a temporal line, enabling a comparison between words across years.

3 Results and Discussion

Six years of formal research on gamification led to eight main domains of research, as listed: education, training, and academia (44.38%, $n=162$); business, marketing, enterprise, and services (15.34%, $n=56$); general (11.23%, $n=41$); health and lifestyle (8.77%, $n=32$); urban, transportation, social, and political (4.93%, $n=18$); information science, communication, computation, and internet (4.38%, $n=16$); engineering, development, and technology (2.74%, $n=10$); and research methods (2.74%, $n=10$). Figure 2 shows the research map created with all papers classified.

The first reviewed papers were published in 2012. Cafazzo et al. (2012) have developed a gamified health and lifestyle application that led to a greater frequency of blood glucose tests on type 1 adolescent diabetics, while Rai and Beck (2012) have gamified a math tutor to help math learning. The studies are the earliest from the group of application papers on gamification, a group that encompasses most of the gamification research (45.21%, $n=165$).

Figure 3 shows the evolution map of each area, presenting types of studies published per year. Application studies are the most common among research type studies (90%, $n=9$), urban, transportation, social, and political (77.78%, $n=14$), education, training, and academics (59.88%, $n=97$), and health and lifestyle (53.13%, $n=17$). The general group, instead, has no application study, as the group encompasses knowledge that could be applied to various studies on gamification. For example, the group includes theoretical papers that allow understanding of common factors of gamification, such as the review from Seaborn and Fels (2015) and practical papers that might help in gamification development, such as the study of Ferro et al. (2014), who developed a method of paper prototyping to be used during the design of gamification approaches.

Excluding the general and the business, marketing, enterprise, and service groups, application papers are predominant in almost every year of gamification research for the

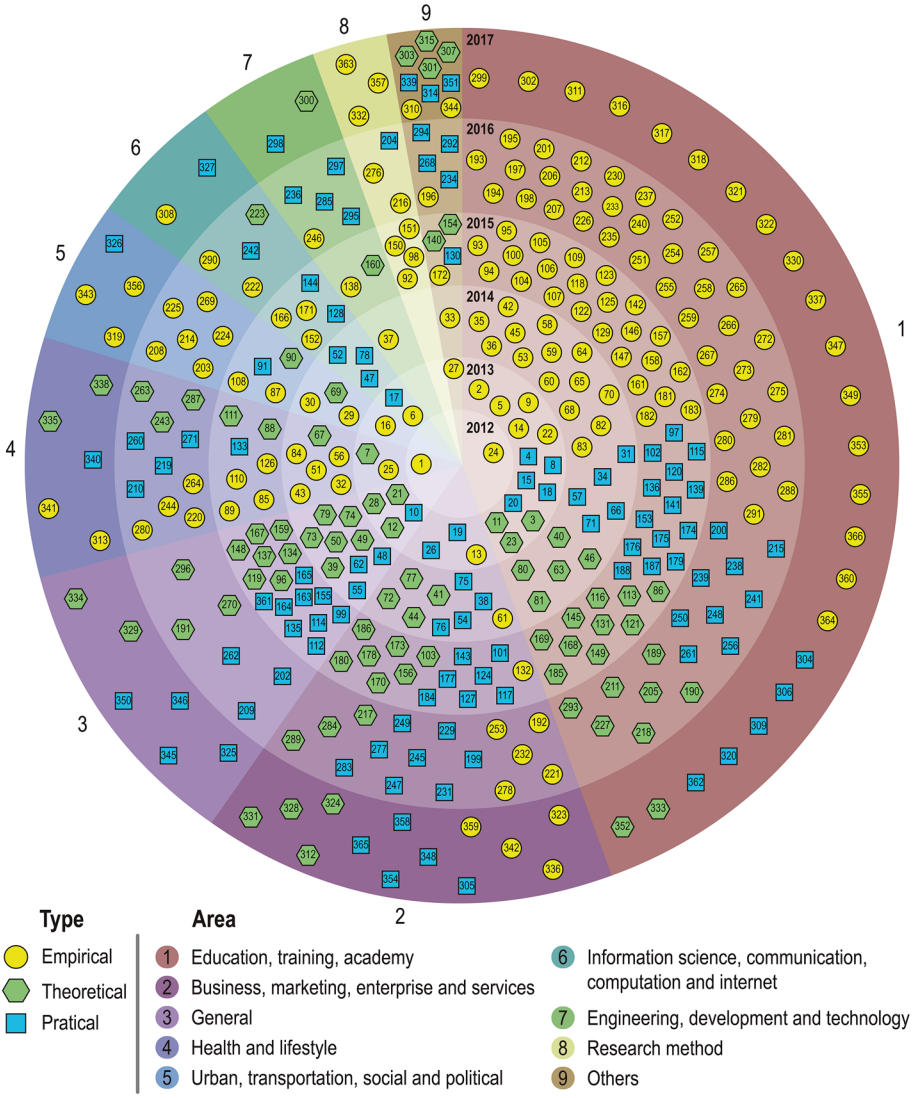

Fig. 2 Research map on gamification

other groups. Practical papers come in second place, amounting to 31.23% ($n=114$) of all papers, followed by theoretical papers, with 23.56% ($n=86$) of the studies. The year of 2013 has the highest rate of practical papers, with 34.62% ($n=9$), while the following year has the lowest rate, excluding 2012 (26.79%, $n=114$). Unlike for practical papers, 2014 was the year with the highest rate of theoretical papers (30.36%, $n=17$), while 2016 has the lowest rate (15.74%, $n=17$). For application research, 2016 was the year with the highest rate of research (52.78%, $n=57$), while 2013 and 2015 both had the lowest rate (38.46%, $n=10$ in 2013, $n=40$ in 2015). In short, in all years application research prevails, but after the early start of gamification research, 2013 has begun with a sharing research

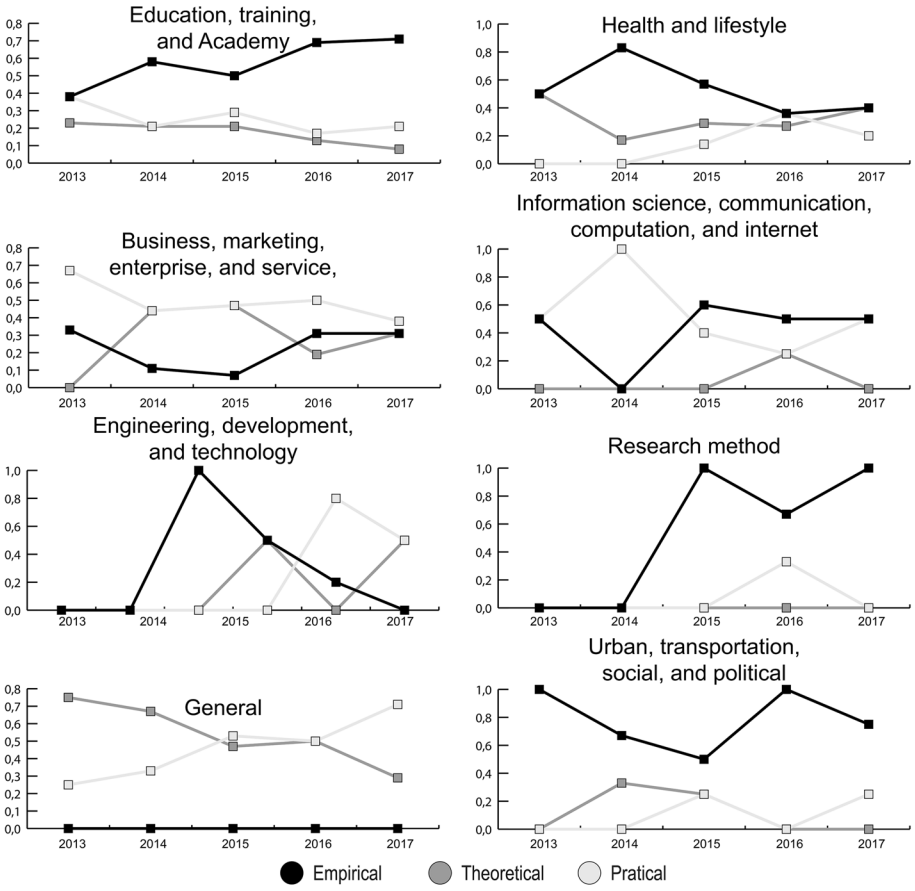

Fig. 3 Evolution map of the type of research per area

effort in application, theoretical, and practical studies. The next year—2014—had a higher rate of application studies. In 2015, practical studies became more popular, showing the need for developing tools to help apply gamification. The result of this effort was the great number of application research studies in 2016 and again in 2017. Theoretical papers have shown an improvement in the rate of research in 2017, suggesting the beginning of a new cycle of gamification research: theoretical studies, followed by practical advancements, and resulting in new and more basic applications. This finding agrees with what Nacke and Deterding (2017) said about the maturity of current gamification research, indicating that gamification is still a growing research interest.

Figure 4 shows the summary map of gamification research. Excluding the early 2012 year, there is almost a constant rate of the group of words used to summarize gamification research in the top 150 most-used words. Activity group accounts for 25.72% of them, including activities such as study, development, and learning. Domain group sums 22.96% of the words, including terms such as gamification, game, and education. Process group follows with 22.01% of the terms, presenting words like design, application, and system. Next, the outcome group comprises 21.85% of the words, including the terms

Fig. 4 Summary map of gamification research

motivation, increasing, and engagement. Finally, the player group is the only one that presents a very different value, representing only 7.46% of the most-used words, including the terms student, user, and group.

Based on the classification of game elements used on gamification proposed by Seaborn and Fels (2015) and the summary map of game elements, the most cited game element, according to our findings, is the point (29%), followed by level, rewards, and progress (13%) (Fig. 5). The less used of the game elements listed by the authors is the status. We believe that the predominance of points is related to their use to allow other game design elements. Points provide feedback by themselves, but also enable the creation of leaderboards and of scores that can be used to reach specific badges. Points are the basis of many of the game design elements. Frequency of game elements has a greater variance than frequency of groups of words from the summary map of gamification research. The biggest variance was in the use of points, showing a difference of 17% between 2014 (23%) and 2017 (40%). The lower variance was in the use of badges, that showed a difference of only 5% between 2015 (12%) and 2016 (7%). We cannot identify a pattern of greater or lesser usage of game elements based on the summary map, although we can suggest the most

Fig. 5 Summary map of gamification research

relevant game elements used while describing gamification research. For further studies of game elements, we recommend the paper from Sailer et al. (2017), and the study from Khaleel et al. (2016), if oriented to a learning environment.

4 Conclusions and Future Research

This paper has focused on exploring gamification research, in order to identify the main areas gamification is related to and the main game design elements used. We have identified that education, training, and academia is the domain that concentrates most of the studies on gamification. It might be possible that gamification is more socially acceptable for students that already have a connection to games, while in other domains there is a fear that the game experience would not be welcome, which could partially explain the rate of studies belonging to this group.

Most of the papers on gamification research present ways gamification is applied, and we found evidence that there is a cycle of gamification research. This cycle starts with a

greater effort on practical and theoretical studies, leading to increasing studies of where gamification is applied. This seems to be the way gamification evolves as a research field. If this finding is correct, we should soon see a significant expansion of the application of gamification, adding original elements and theories, on an even more multidisciplinary research. We suggest applying the panoramic research map again after some years to confirm or reject the hypothesis of a cycle on gamification research.

Our study has also suggested that the point is the most discussed game element, as it provides a basis for the use of other game elements. This finding might lead to a deeper study of points on gamification design. One of the possible questions of this future research is how a point—or any other game design element—might reflect on different game experiences while being shown in a novel way. Findings from this future research could lead to better-developed game experiences in gamification usage.

Regarding the novel methodology that was used, future research could also provide electronic and interactive content to offer an expanded view of the maps, including papers, and connecting the maps. We believe that this solution could ease the identification of relevant papers for readers, improving the current research map that was presented.

Lastly, we encourage accessing the spreadsheet in Appendix 1 of the ESM with the complete list of references used to develop the panoramic research map.

5 Limitations

We have used an embracing string to search for the papers, and we have performed the search in multidisciplinary databases. The approach has increased the range of the research. Even so, our conclusions are limited to the papers we found during the study and might not reflect the whole field of gamification research. The focus of this survey was especially on papers from journals, presenting consolidated studies while excluding new and still incipient studies that might be still too nascent to be published in journals. Although having a rigorous methodological process and having established criteria to exclude, include, and classify papers, the review process is partially subjective, which could lead to slightly different results. This method allows a quick analysis and understanding of a research domain. If a more detailed analysis is needed, we suggest starting with the panoramic research map to visualize the global research domain and identify papers, following the use of a methodological approach that deepens the understanding of each study, such as PRISMA (Liberati et al. 2009), which was not the focus of this research or methodological approach.

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