Revista Brasileira de Informática na Educação – RBIE
Brazilian Journal of Computers in Education
(ISSN online: 2317-6121; print: 1414-5685)
https://sol.sbc.org.br/journals/index.php/rbie

Submission: 10/Mar/2023; 1st round notif.: 09/Aug/2023; New version: 13/Sep/2023; 2nd round notif.: 23/Mar/2024;
Camera ready: 28/Sep/2024; Edition review: 08/Oct/2024; Available online: 08/Oct/2024; Published: 08/Oct/2024;

Brazilian Teachers' concerns towards the use of Gamification in Education: perceived barriers to its adoption

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Abstract

Gamification applied to learning environments is widely accepted as positively impacting students' psychological and cognitive aspects, such as motivation and learning performance. According to the literature on the subject, gamification tends to promote more positive effects on students than negative ones. Meanwhile, the literature lacks a deeper understanding of how education professionals perceive gamification in learning environments and their concerns about implicit issues and ethical issues. Prior research has not examined the relationship between gamification in education, its ethical concerns, and barriers. As a result, we expanded a previous study to identify and delve deep into potential barriers and ethical concerns pertaining to gamification from the perspective of Brazilian teachers. A survey was designed and answered by 61 Brazilian teachers. According to our findings, teachers are not inclined to use gamification for various reasons, such as social factors (e.g., acceptance by teachers and students) and planning and evaluation issues (e.g., lack of knowledge). Our study also found that their ethical concerns pertain to psychological effects, social issues, privacy issues, humanization, and behavioral effects. As part of the contribution of this paper, we list potential barriers and ethical concerns that designers and researchers should keep in mind when designing and implementing gamification and gamification-based personalization in learning environments.

Keywords: *Gamification; Survey; Ethical Challenges; Perceived Bias; Qualitative Study*

Cite as: Toda, A. M., Palomino, P. T., Rodrigues, L., Pereira, F. D., Borges, S., Gasparini, I., Oliveira, E. H. T., Isotani, S. & Cristea, A. I. (2024). Brazilian Teachers' concerns towards the use of Gamification in Education: perceived barriers to its adoption. Revista Brasileira de Informática na Educação, 32, 510-532. https://doi.org/10.5753/rbie.2024.3228.

1 Introduction

Gamification, the use of game-like elements outside of a game Deterding et al. (2011a), has been extensively used in the educational domain due to its leaning positive effects on learners' performance, engagement, and motivation Bai et al. (2020); Rodrigues et al. (2020).

Literature on the subject states that when adequately designed and addressing students' needs, gamification can solve motivational and engagement problems in educational contexts Toda et al. (2018a). However, most recent research is focused on researchers' points of view and experiments with students, aiming to support the gamification design process Klock et al. (2020); Rodrigues et al. (2020). Towards better tailoring, researchers mainly focus on the students' characteristics (e.g., psychological, socio-demographics, or behavioural) as inputs on how to personalise and adapt gamification Klock et al. (2020). At the same time, literature often neglects the practitioner, who needs to design and apply gamification to the learning environment and who is usually a teacher or pedagogue Toda et al. (2018a).

Rather than addressing teachers' workloads and needs, most studies present gamification to them as a solution they still need to request and understand. Since gamification will be used by those professionals, aiming to increase their students' motivation and engagement, it is crucial to understand what are these professionals' perspectives, including ethical considerations, when planning and applying any technology, gamification included, to learning environments Kim and Werbach (2016); Holmes et al. (2021). Hence, addressing their concerns about real or perceived barriers is essential to understand why they would or would not use gamification in education. Tackling this gap is a challenging task since both aspects (i.e., bias and ethical concerns) are too abstract and are influenced by many different aspects, such as context and culture Hyrynsalmi et al. (2017).

Regarding the context, for instance, most literature on gamified education tackles impacts on students' learning and motivational problems while overlooking potential barriers and ethical concerns from practitioners. Furthermore, considering culture, literature has shown that the contextual and cultural differences between developed and developing countries affect the way of teaching and how it impacts students' learning Chaudhury et al. (2006); Cochran-Smith et al. (2020).

From these insights, recent studies emerged, focused on creating tools and mechanisms to support teachers on how to design gamification, often offering conceptual frameworks [Mora et al., 2017], or computational tools Rodrigues et al. (2021). However, most of these tools are often designed without considering how teachers and other educational practitioners perceive gamification impacts Kim and Werbach (2016). In our early study, Toda et al. (2022) presented a summary of a qualitative study focused on identifying and describing possible biases and ethical concerns teachers might have towards gamification; however, the early study did not contain any details on its methods or delve deeply into practical implications these results might have.

Thus, the main objective of this study is to understand how teachers perceive the issues, barriers, and ethical concerns related to gamification in educational environments through exploratory qualitative research. Moreover, we target the following research questions (RQs): (A) "*What are educational practitioners' biases towards gamification in education?*"; and (B) "*What are educational practitioners' main ethical concerns towards the use of gamification in educa-*

tion?". Considering these RQs, we believe that our main contributions to this study are a thematic classification of perceived barriers to using gamification in educational environments, which we can use to propose: (i) a set of themes containing potential barriers that should be considered during gamification design in educational contexts; (ii) a set of Brazilian teachers perceived ethical concerns which must be addressed before and when gamifying a given learning context. Those themes can support the planning and development of gamified learning environments.

To present our findings, this paper is divided as follows: section 2 refers to our Background and Related Work, where we present some similar research and how our research advances the current state of the literature. Section 3 presents the methods alongside the justifications for each one. Section 4 refers to our results followed by our discussions in Section 5. Finally, we present our conclusions and future works in Section 6.

2 Background and Related Work

2.1 Gamification in education

Gamification is mainly defined as using game elements outside of a game [Deterding et al., 2011b]. It is widely used in educational contexts to motivate and engage students [Borges et al., 2014] with an overall positive tendency to improve learning Bai et al. (2020).

However, there is still much to delve into to provide the best gamified experiences to enhance the learning experience Palomino et al. (2020). For example, Rodrigues et al. (2020) present a state-of-the-art on personalized gamification in educational contexts, presenting how personalization influences learning. One of the main problems in educational contexts is the one-size-fits-all (OSFA) approach, which can hinder the positive effects and lead to negative ones, such as indifference or demotivation Toda et al. (2018b). According to the authors, future research must focus on developing strategies that consider the context of the learners and conducting qualitative studies to provide insightful results that match the quantitative data of the studies.

Considering these recommendations, teachers and instructors also play an active role in the gamified learning context since they are the ones that effectively implement gamification Toda et al. (2018a). To develop better gamified strategies, it is essential to understand why these actors want or do not want to implement gamification in their learning environments. By understanding those barriers and how they perceive gamification, we can develop guidelines and approaches matching their needs and their students.

2.2 Related work

To select our related work, we conducted a narrative review Rother (2007) using the terms "gamification", "teachers", and "barriers" in Google Scholar in December/22, aiming to find studies that other researchers cited. We selected the papers based on their relevance (e.g., the number of citations and adherence to the theme of this paper and discussed their inclusion among the researchers involved).

Previously, Marti-Parreño, Seguí-Mas, and Seguí-Mas Martí-Parreño et al. (2016) con-

ducted a qualitative study to identify teachers' attitudes towards gamification. They designed a survey and collected data from 98 lecturers of European higher education institutions. They also analysed how teachers' demographics might influence their attitudes toward gamification. According to their results, lecturers had a strongly positive attitude towards using gamification. The authors also showed that in their sample, gender, age, and type of institution (private or public) presented no significant differences in their attitudes. However, they also found that only a minority of the teachers used gamification actively in their courses (11.3%).

In another study, Sánchez-Mena and Marti-Parreño [Sánchez-Mena and Martí-Parreno, 2016] conducted a qualitative analysis in which they interviewed 26 higher education lecturers (from Europe) to understand their drivers and barriers regarding the use of gamification in educational contexts. Their results suggest four drivers: attention-motivation, entertainment, interactivity, and ease of learning. These drivers are associated with the positive use of gamification in courses. They also identified barriers that make teachers avoid gamification, such as lack of resources, students' lack of interest, subject and classroom dynamics, and time.

Similarly, de Paula and Fávero Paula and da Pena Fávero (2016) conducted an exploratory study with mixed methods of analysis (quantitative and qualitative) with 51 researchers on gamification in education in Brazil to understand their perceptions towards using gamification in educational practices. According to their results, teachers still confused gamification with the use of games/serious games in educational contexts, and teachers who knew the difference between games and gamification often stated that gamification might be complex due to the abstraction of game design concepts. In their study, the authors identified elements those researchers consider necessary (e.g., immersion, gamefulness, and quick feedback), undesirable (e.g., leaderboards and loops), and elements to focus on in future experiments (e.g., achievements, gamefulness, and immersion) for gamified environments. They also identified barriers to why gamification is 'bad' in these participants' perceptions. According to the authors, the interviewees considered that gamification based on competition might induce traditional teaching methods that are not efficient, as well as pointed out potential pitfalls: gamification as a buzz, the lack of knowledge to apply it correctly, and students' loss of interest and motivation. These points are similar to the ones found in the study of Sánchez-Mena and Marti-Parreño Sánchez-Mena and Martí-Parreño (2016).

From a theoretical perspective, Kim and Werbach Kim and Werbach (2016) present a rich discussion about the ethics of gamification in a general context. The authors elicit some themes that should be considered before practitioners consider designing and applying gamification in a given context. In their work, they advocate that gamification should not be used when it: (i) takes unfair advantage of workers; (ii) infringes on workers' or users' autonomy; (iii) intentionally or unintentionally harm users or other parties involved in the gamified practice; and (iv) has a negative impact on the moral character of any involved parties.

Finally, a recent quantitative study by Toda et al. Toda et al. (2020) used data-driven methods to identify general users' profiles of gamified systems based on their intentions to use gamification in education. They used a survey to collect 1692 answers and provided empirical evidence that the (positive and negative) intention to use gamification is affected by contextual variables and participants' demographics (e.g., age group). According to their results, the authors suggested that teachers and designers should not gamify learning environments when the students do not know the concept, do not have the habit of playing games, and have not used any gamified environment before. The studies can be summarized in Table 1.

Table 1: Summary of related work

Authors	Type of study	Methods	Population	Outcomes
Marti-Parreño, Seguí-Mas and Seguí-Mas (2016)	Qualitative	Survey	98	Lecturers' demographics do not influence their adoption of gamification. Overall, these lecturers have a strong positive attitude towards using gamification in education.
Sánchez-Mena and Marti-Parreño (2016)	Qualitative	Interview	26	Identification of drivers and barriers that the educational practitioners have towards gamification in education.
de Paula and Fávero (2016)	Mixed (quantitative and qualitative)	Survey	51	Insights on researchers' perceptions towards the use of gamification in education, and perceived barriers.
Kim and Werbach (2016)	Theoretical	-	-	Guidelines to gamification practitioners to not violate any ethical aspects of the targeted users.
Toda et al (2020)	Quantitative	Survey	1692	Evidence that the intentions of using gamification might be influenced by users' demographic and contextual variables.
Ours	Qualitative	Survey	61	Identification of Brazilians' teachers perceived bias and ethical concerns towards the use of gamification in education.

In summary, our related research deals with education practitioners' (e.g., teachers and lecturers) and general users' perceptions towards gamification in education (Table 1). While some studies explored positive perceived aspects of gamification Sánchez-Mena and Martí-Parreño (2016); Toda et al. (2020), others explored barriers and perceived adverse outcomes [Kim and Werbach, 2016; Martí-Parreno et al., 2016]. In our work, we aim to explore barriers to the overall design of gamification in education and ethical concerns that teachers and other education practitioners may have towards the concept. Unlike previous studies, our study uses thematic analysis Boyatzis (1998) to understand and extract the topics pertinent to answering our research questions. Furthermore, we also analyse this under the umbrella of the Brazilian education scene, which was only explored through the study of de Paula and Fávero Paula and da Pena Fávero (2016).

3 Survey

This section presents the steps taken to design and apply the survey that was used to collect the data that was analysed.

3.1 Goals

Aiming to answer our RQs, and considering our main objective, we conduct a qualitative study Lazar et al. (2017). We used the survey method to gather the data due to its reach and low cost (due to its dissemination capacity) Goodman (1961); Lazar et al. (2017). Thus, we created an online survey and shared it with educational practitioners through social media groups (in Brazil) and asked these practitioners to spread the link (convenience sampling Lazar et al. (2017)).

3.2 Materials and Methods

The form (in Brazilian-Portuguese) can be accessed at the following link: https://forms.gle/TjhmHr2Y38YcBdhX9. The survey consists of 41 questions that were divided into two groups of questions. The first group (with 22 questions) consists of gathering demographic and socioeconomic data (e.g., age group, gender, degree, teaching degree, higher academic degree, current and previous job(s) on education, experience in teaching, etc.), while the second group (with 19 questions) addressing the gamification themes covered in our research. Participants were not rewarded for participating in the research (to avoid participation bias) and were asked to agree via a consent form before answering the survey. Thus, their participation was ensured to be voluntary and fully informed. It is important to note that the data gathered was anonymised of information that could identify participants. The leading researcher who had access to the main form removed emails (that were collected to assure that we collected only one answer from each participant), the time that the form was answered, and any other contact information that was provided by the participant, before submitting it to the other authors for analyses. The data used for the analysis of this work is stored in a Google Drive folder, which can be accessed through the link: https://shorturl.at/sMhXF.

Thus, it fully complies with the local General Data Protection Regulations (GDPR), approved by the ethical committee CAAE:42598620.0.0000.5464. Besides, any participant could

email the leading researcher and remove their answers anytime after answering our survey. Considering the second part of the survey, we asked the participants:

(i) know what gamification is by asking directly through a Yes/No/Maybe question;

(ii) understanding of the gamification concept, by presenting them three different concepts of gamification: the correct one defined by Deterding et al (2011) Deterding et al. (2011b), the use of games in educational contexts (partially wrong), and the making of games (erroneous);

(iii) previous gamification usage, by asking if they had used gamification in their practices before;

(iv) reasons to use gamification, by asking the reasons why they used gamification;

(v) perceptions towards the planning/design of gamification, by asking the difficulty they had while designing gamification (using a scale from 1 to 10 where 1 was not difficult and 10 were too difficult);

(vi) perceptions towards the application of gamification, by asking the difficulty they had in implementing gamification in their practices (using a scale from 1 to 10 where 1 was not difficult and 10 were too difficult);

(vii) perceptions towards the evaluation of gamification, by asking the difficulties they had to evaluate (using a scale from 1 to 10 where 1 was not difficult and 10 were too difficult);

(viii) perceived concerns towards gamification that might affect its adoption by other practitioners, by asking what was considered a problem towards using gamification in education (here, they were presented a list based on the related work, where they could check as many choices as they want);

(ix) perceptions towards how gamification might impact on students' autonomy, by asking if they had a positive attitude towards using gamification and why;

(x) biases and ethical concerns, by presenting two open fields where they could discuss about their main barriers and ethical concerns towards the use and adoption of gamification in educational practices.

All these points were divided among the 19 questions. For the context of this work, biases are considered barriers perceived by practitioners that might hinder the adoption of gamification (e.g., the lack of resources). As for the ethical concerns, we considered situations where a moral conflict might arise (e.g., equality and equity and perceptions of right or wrong).

3.3 Procedure and Data Analysis

After collecting and processing the data, we noticed that certain variables had only one response or required greater relevance to the analysis conducted in this research (e.g., which city the practitioner lived or worked in). Of the 41 questions, only 29 contained data relevant to this research. The anonymised and processed data used in this work can be found in the following link: https://shorturl.at/sMhXF.

To analyse our data, we used thematic analysis in qualitative research to summarise and analyse possible topics from a given data to understand an event Lazar et al. (2017). A thematic analysis consists of three steps: pre-analysis, exploration of the content, and interpretation Boyatzis (1998). In the pre-analysis, the leading researcher is responsible for organising the material that will be analysed, defining which fields are pertinent to answer the research questions, which tools will be used, what are the units of registry (elements that are obtained through the decomposition of a message), context (which context the message is a part of), and categories. In the scope of our study, we defined the units of registry as the data related to the perceived barriers and ethical concerns in the context of education. Six gamification specialists defined the categories through a brainstorming session. In the step related to content exploration, experts were invited to analyse the survey fields that contained the data regarding barriers and ethical concerns and infer possible categories. These experts were recruited through convenience sampling Lazar et al. (2017) and required at least three years of experience with gamification and education. We assigned two experts to a group of teachers' comments from biases and ethical concerns and used Google Forms to collect their answers about the inferred categories. In this form, the expert needed to insert a quote containing the part of the teachers' comment that was used to infer the category. Next, the experts were invited to a group meeting, where they discussed and standardised the categories that would be analysed. Finally, in the interpretation phase, we analysed the categories defined in the previous phases and used descriptive statistics, to help us understand and answer our research questions.

3.4 Participants

The participants were recruited through convenience sampling Lazar et al. (2017) by sending emails to different social media (WhatsApp and Facebook) and higher education institutions. Our sample is composed of 61 teachers from Brazil. When considering part one (sociodemographic variables) of the survey, we can observe that a majority of these practitioners are over 40 years old (N = 21; 43.3%), followed by teachers ranging from 26 to 30 years (N = 18; 29.5%), 31 to 35 years (N = 10; 16.4%), 36 to 40 years (N = 6; 9.8%), 21 to 25 years (N = 5; 8.2%), and one person of an age between 18 to 20 years.

From this population, 45.9% identified as male (N = 28) and 54.1% as female (N = 33). From this sample, 44 (72.2%) worked directly with education (as a teacher or pedagogue), while the remaining 17 (27.8%) worked with education to some degree. From the teachers' side (N = 35; 57.4%), 20 (57.1%) teach STEAM-related subjects, and 15, Humanities (42.9%).

Considering their higher academic degrees, most of the participants have an MSc or a specialisation (N = 21 for both; 34.4%), 9 (14.8%) have a Ph.D., and 10 (16.4%) do not have an academic degree.

When asked about their jobs, the majority of the participants reported working as teachers in primary education (N = 30; 49.2%), followed by teaching assistant (N = 15; 24.6%), higher education teaching (N = 13; 21.3%), with two participants reporting to work with other jobs related to education and one participant, with informal education.

Considering their experience in teaching, the average was 11.2 years (minimum = 0; max = 35; SD = 9.6), but the majority (N = 20; 32.8%) worked up to 5 years in the field of education, followed by 6 to 10 years (N = 17; 27.9%), more than 20 years (N = 10; 16.4%) and between 11

to 20 years (N = 14; 23%). In this population, 32.8% had more than one job (N = 20), whereas at least 19.7% (12 from these 20) worked with private classes.

Regarding their workload, most (N = 50; 82%) worked up to 40 hours per week, while a minority worked more than 40 hours per week (N = 11; 18%). Also, from our sample, at least 20 practitioners (32.8%) have more than one job in teaching, and at least 17 (27.9%) work in a different town they reside in. Considering their educational institutes, 50 participants (82%) reported that their institution has a computer lab, and 55 (90.2%) reported that their institution has Internet access. Also, from this group, a majority have access to a personal computer (N = 60; 98.4%), and all of them have internet access (N = 61; 100%).

3.5 Pilot study

It is important to note that an early pilot study was conducted to check the consistency of the answers; however, this study was conducted with only 5 participants (who did not participate in the final version of the survey). The pilot participants were recruited through convenience sampling (since they were easy to access and could answer the survey within a week); only two had previous contact with gamification, while the others did not. They stated minor corrections towards typos that were found and analysed the survey qualitatively (e.g., if the questions were too specific, if the vocabulary was appropriate, and if they managed to understand the questions that were asked). None of the 5 participants commented on any of these topics.

4 Results

This section presents the results of our research. As stated in the Materials and Methods subsection, we followed the order of the questions in the second part of the survey.

4.1 Know what gamification is

When analysing part two (gamification-related variables), we can observe that 85.2% (N = 52) of the participants said that they know of gamification, while 13.1% (N = 8) think they might know what gamification is, and one participant stated they do not know what gamification is (Figure 1).

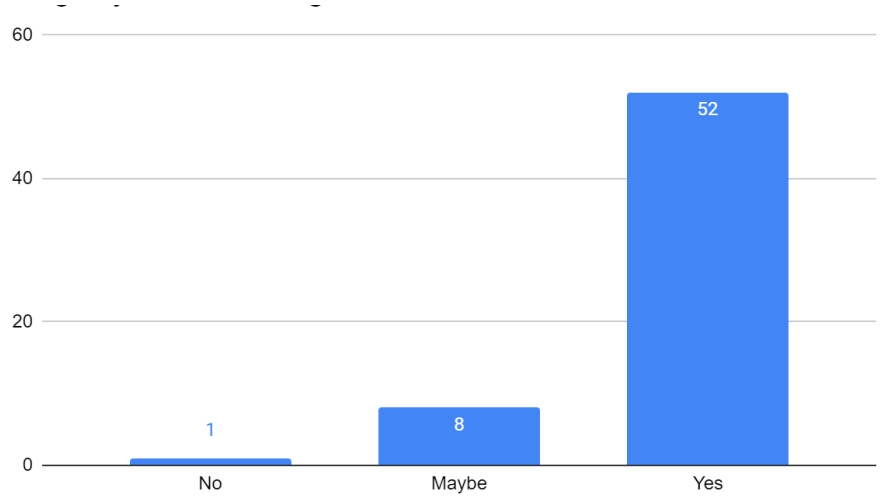


Figure 1: Participants who allegedly know what gamification is

4.2 Understand the concept of gamification

Considering the concept, 85.2% (N = 52) of the participants know (Figure 2) that gamification is the use of game elements outside of a game Deterding et al. (2011b), while 13.1% think, erroneously, that gamification is the use of games in education. One person believes (also erroneously) that gamification is the process of making games. Of these 52 respondents who know what gamification is, 27 (51.9%) are female, and 25 (48,1%) are male.

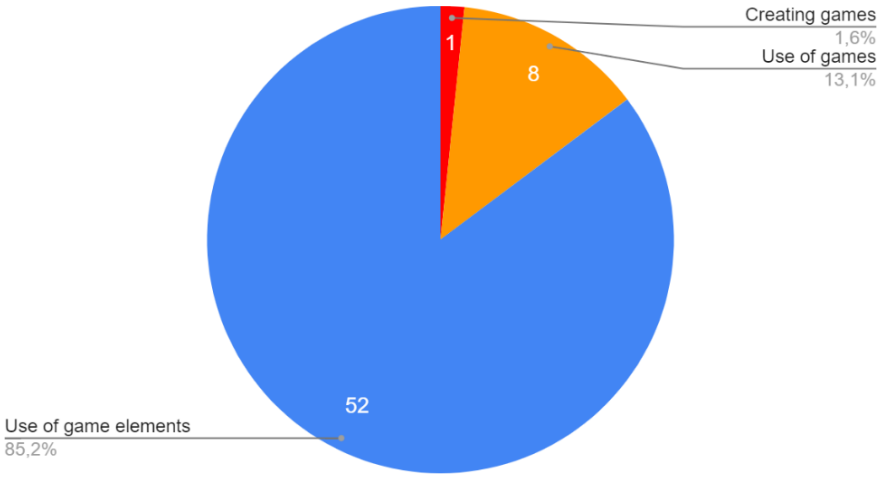


Figure 2: Participants' answer to the concept of gamification (blue is the correct answer)

4.3 Previous usage of gamification

Concerning previous usage of gamification in education, 73.8% (N = 43) of the participants stated that they had used it before, 18% (N = 11) stated they had not used gamification before, and five participants did not know if they had used it. Some tools that were used by these practitioners

are Kahoot![1], Quizizz[2], Edpuzzle[3], and Scratch[4]. It is important to note that the authors of this work do not make any judgments about the tools the teachers reportedly used. It is debatable in the literature whether some tools are, in fact, gamified or not. Since this is not the scope of this work, we only reported the tools that the teachers stated.

4.4 Reasons to use gamification

When asked about the reasons they used gamification for (this question was a multiple-choice question with the "select all that apply" option, which totalised 99 answers as seen in the data that was made available), 38.3% (N = 38 out of the 99 answers) said they use gamification to improve students' motivation, 31.3% (N = 31) said they used it to improve their classes and/or teaching processes, 25.3% (N = 25) stated they use it because they wanted to try different pedagogical strategies, and 5.1% (N = 5) participants stated they use for other reasons. It is worth noticing that there is a significant overlap (N = 21 similar answers; 21.1%) between practitioners saying they wanted to improve students' motivation, improve their teaching processes, and try different pedagogical strategies (Figure 3).

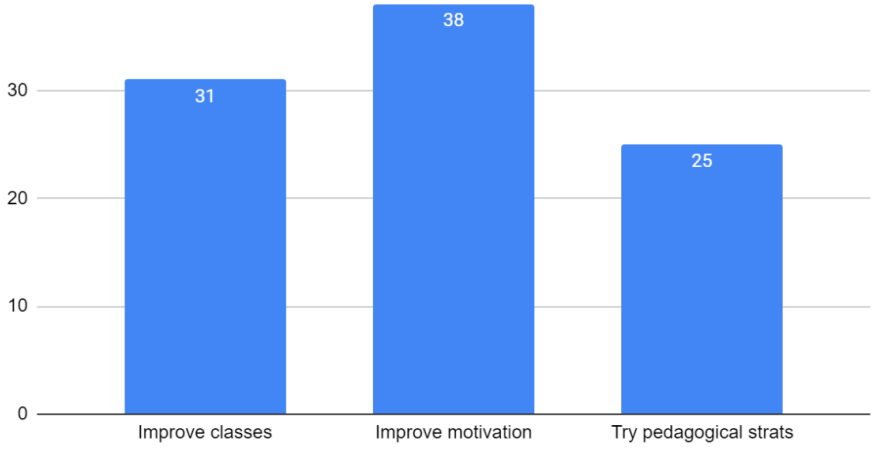
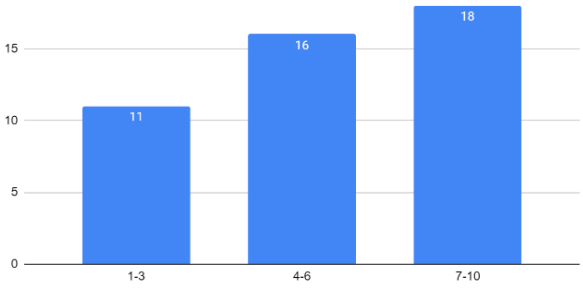


Figure 3: Reasons practitioners state they use gamification

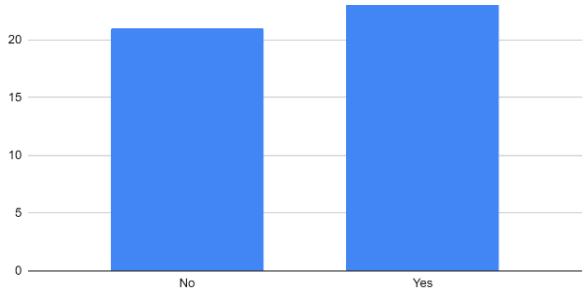
4.5 Perceptions towards planning/design of gamification

Considering their perceptions of the difficulty of planning gamification, 40% (N = 18 out of 45 who answered this question) stated that they think gamification is challenging to plan, followed by 35.6% (N = 16) thinking it is moderately difficult to plan, and 24.4% (N = 11) think that gamification is not that difficult to plan (Figure 4a). When asked if gamification can be easily planned considering their contexts, 53.3% (N = 24) participants stated that gamification can be easily planned, while 46.7% (N = 21) stated it cannot be easily planned (Figure 4b).

[1]https://kahoot.com/
[2]https://quizizz.com/
[3]https://edpuzzle.com/
[4]https://scratch.mit.edu/



(a) Difficulty to plan gamification (in scale)

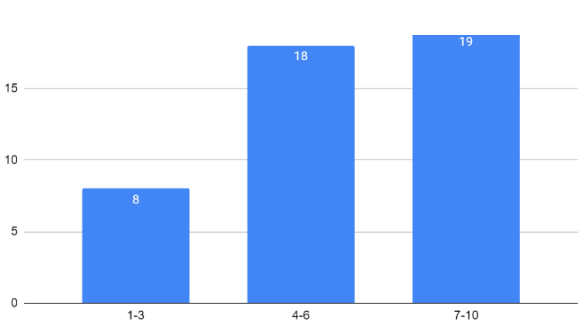


(b) Practitioners that believe gamification can be easily planned

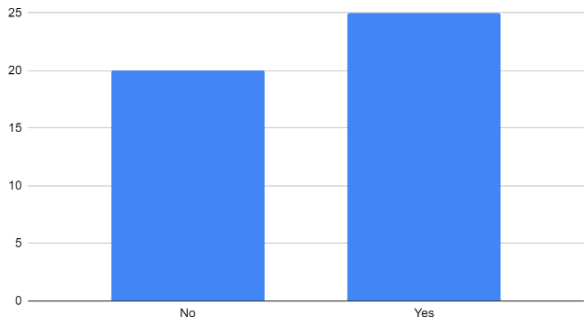
Figure 4: Perspectives on planning gamification

4.6 Perceptions towards applying gamification

When asked about the difficulty of applying (or implementing) gamification in their educational contexts, a majority of 42.2% (N = 19 out of 45 who answered) think it is difficult to apply it, while 40% think it is not difficult nor easy, and 17.8% (N = 8) think it is not difficult (Figure 5a). Among these participants, 55.6% (N = 25) stated they used a tool to apply the gamification and gave a list of tools that could be used for both planning and application, such as Google Docs (Figure 5b).



(a) Difficulty to apply gamification (selected from a scale)

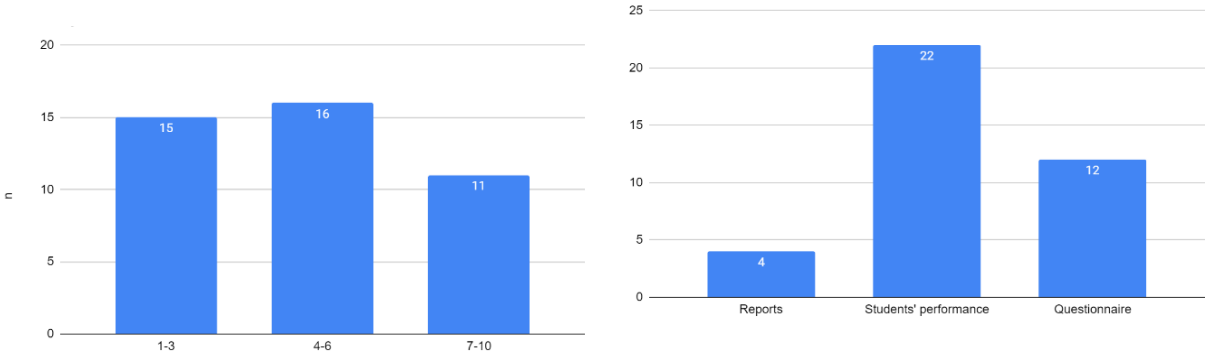


(b) Practitioners that used a tool to support the application

Figure 5: Perspectives on applying gamification

4.7 Perceptions towards evaluating gamification

Considering the difficulty of evaluating gamification, a majority of the participants (N = 16; 38.1%) do not find it easy nor difficult to evaluate, while 35.7% find it easy, and 26.2% (N = 11) think it is difficult to evaluate (Figure 6a). When asked how they evaluate gamification, 57.9% of participants (N = 22 out of 38 who answered they evaluated) evaluate the effectiveness of gamification through students' academic performance, while 31.6% (N = 12) evaluate through a questionnaire, and 10.5% (N = 4) evaluate through reports (Figure 6b).



(a) Difficulty to evaluate gamification (in scale)

(b) How practitioners (that evaluated) conducted the evaluation

Figure 6: Perspectives on evaluating gamification

4.8 Perceived concerns towards adoption by other practitioners

When asked about what they consider a significant problem that impacts the adoption of gamification (multiple choice), the majority of answers (N = 46 out of 236 answers, 19.5%) state that the lack of time of practitioners is their primary concern, which is a valid thought, considering that practitioners often work up to 40 hours per week and may not have time to plan gamification properly. Following, 17.8% (N = 42) believe that teachers' formation impacts why gamification is not widely adopted, which is also a valid argument, considering that most undergraduate teaching and pedagogy courses do not consider games or other game-based technologies as part of their syllabus. In third place, 17.4% (N = 41) believe that the practitioners' lack of knowledge about gamification is a concern, which again is aligned with the practitioners' formation and lack of time since these practitioners are not exposed to these concepts during their formation, nor have the time to study about it, after graduating. Other concerns on why gamification is not widely adopted that were pointed out were: lack of infrastructure (N = 38; 16.1%); lack of computational resources (N = 32; 13.6%); lack of material resources (N = 31; 13.1%). Six answers (2.5%) were related to other factors, such as planning of gamification (Figure 7).

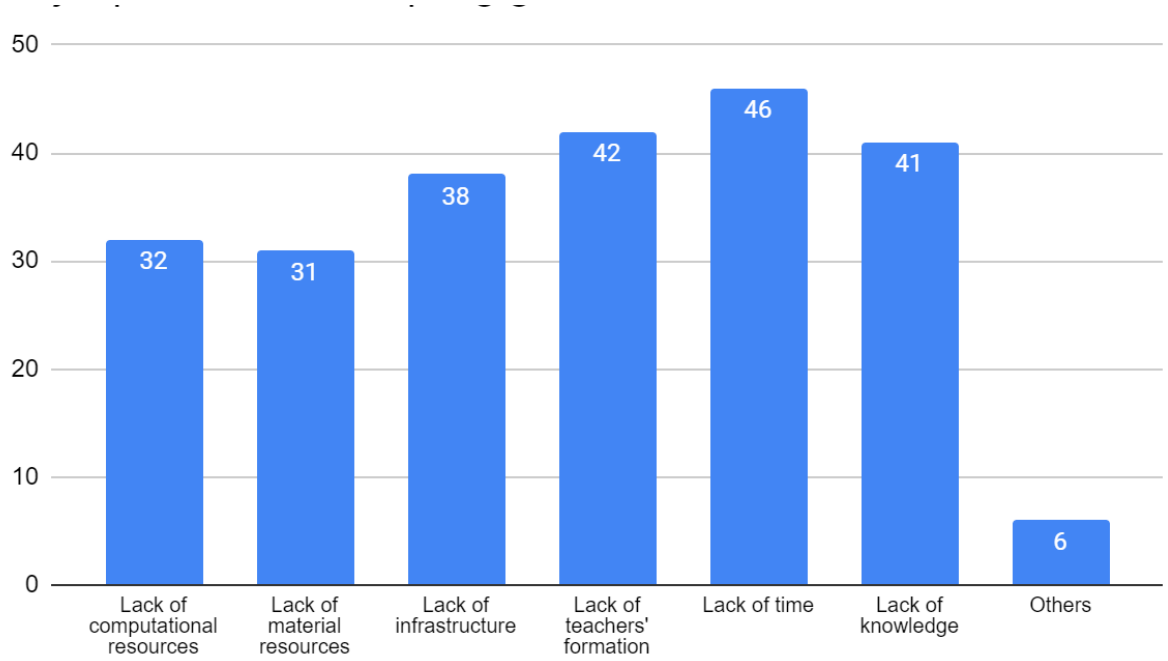


Figure 7: Major problems stopping practitioners from adopting gamification

4.9 Perceptions towards the impact gamification might have on learners' autonomy

Finally, when asked if gamification could impact students' autonomy, 65.6% (N = 40 out of 61) answered that gamification has a positive impact, while 24.6% (N = 15) stated that gamification has both a positive and a negative impact on students' autonomy. Others, 9.9%, believed it depends on several factors (N = 2) or does not affect students' autonomy (N = 4). This leads us to infer that, in general, educational practitioners believe that gamification is an overall positive tool for pedagogical practices.

4.10 Perceived barriers and ethical concerns

Regarding the perceived barriers, we received 61 comments from practitioners, where at least two experts extracted possible themes (as discussed in section 3). After extracting the possible themes for all the comments on biases, we identified 64 barriers. After the brainstorming session amongst the six experts that extracted the themes, these 64 themes were reduced to 11, divided into four categories (Summary can be seen in Figure 8).

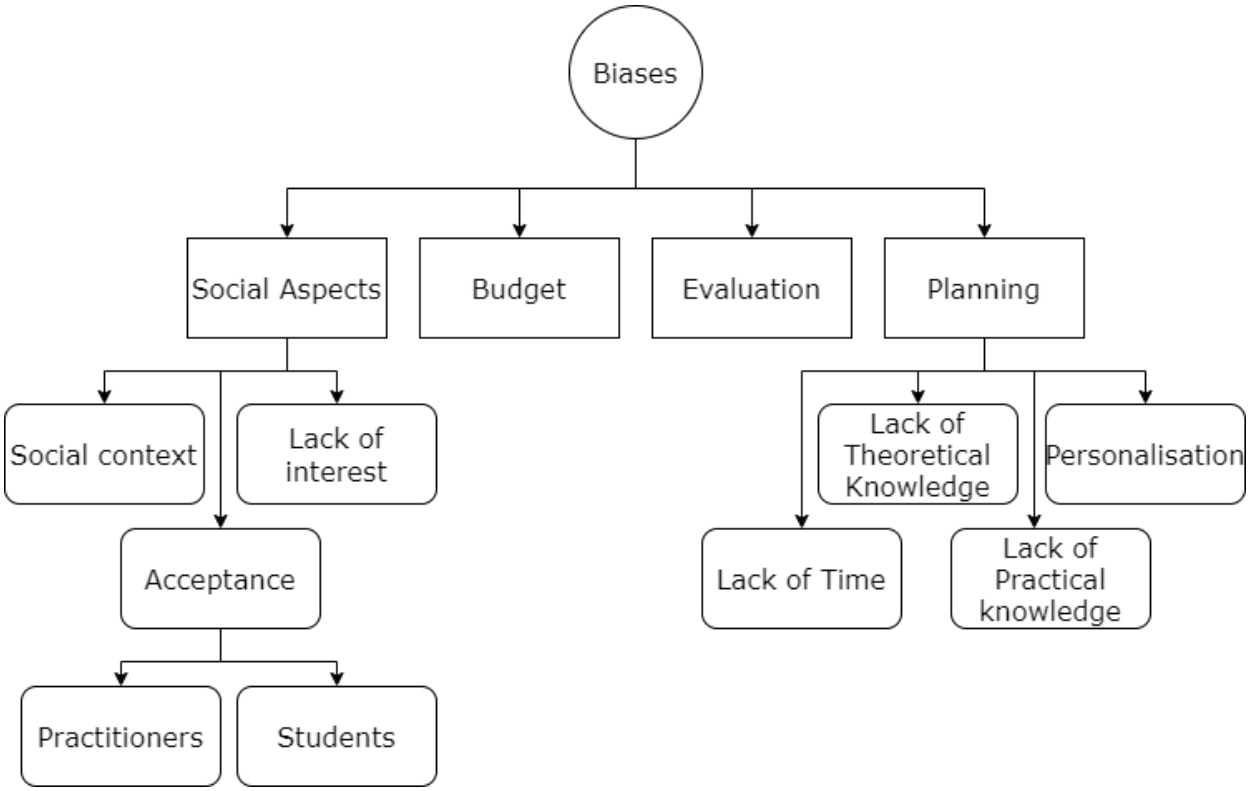


Figure 8: Summary of the perceived barriers according to our thematic analysis

As can be observed in Figure 8, we pruned similar themes and grouped the ones that were identified as semantically similar (e.g., "Teacher formation" and "Incentives on teacher formation" were considered to be the same theme). Finally, we created four categories to group those 11 themes for a more straightforward overview. Each theme is followed by some sample comments that were made by the practitioners using the nomenclature T#, where # is the number attributed to the practitioner in our mapping (available in [link removed due blind review]):

- Social Aspects: This category includes issues related to barriers and perceptions of gamification in educational settings, such as concerns about student social context, resistance from teachers and other practitioners, lack of consideration for student characteristics, and lack of interest. Negative acceptance refers to a dislike or rejection of gamified interventions, while lack of interest may indicate a lack of engagement or a latent interest;

Regarding the social aspects, sample statements from teachers in our open comments field are: "*There is a belief that gamification is a panacea that will solve problem students*" (T20: Acceptance by teachers), another teacher (T33) also states "*. . . Lack of familiarity and acceptance of students to materials/methods based on gamification. . . .*" (Acceptance by students). In addition, T54 adds, "Most students today are extremely unmotivated and uninterested." (Lack of interest). Finally, T30 noted, "*The previous analysis of the social and educational context of the students.*" (Social Context).

- Planning: This category includes themes related to gamification design, such as lack of

theoretical or practical knowledge, lack of time, and concerns about personalisation. Practitioners may struggle with applying gamification effectively due to a lack of knowledge or experience or constraints on their availability to study and apply concepts related to gamification, and may also have concerns about how to personalize the gamification approach to suit the characteristics of individual students;

Considering the planning, many teachers commented how difficult it was to plan and deploy, considering their workload. T7 states, "*The huge need for planning, which leads to having more than one person helping so that it has an interesting flow.*" (Lack of theoretical knowledge), followed by T22, which states "*Time and creativity to plan activities that are interesting*" (Lack of time). In addition, T19 also said, "*Lack of disclosure, so more people know what it's like to do*" (Lack of practical knowledge). Finally, T30, again, states that the previous analyses of students' backgrounds are important to understand and prepare gamification properly, "*... If this is not the case, neither gamification nor any practice will be fruitful.*" (Personalisation)

- Evaluation: This is considered a main category since many teachers stated that evaluating the effectiveness of gamification might not be so doable in real learning environments, making it difficult to accept in practice. This theme overlaps with the Planning themes since not knowing how to evaluate might be a lack of practical knowledge as well, but different from that theme, this main category is focused on the different ways to evaluate gamification since it is not common knowledge in the literature due to many external factors (e.g., What to evaluate? How to evaluate? Rodrigues et al. (2020); Klock et al. (2020));

As for the evaluation of gamification, T55 stated, "*There is a lack of research to assess the effectiveness of the process.*" Followed by T58, who stated, "*Training for application, motivation, and evaluation.*".

- Budget: This theme covers the lack of resources (e.g., when the institution does not provide infrastructure or financial resources), which poses a significant barrier for our sample and also overlaps with other themes from the previous topics, as the lack of time from Planning, or lack of interest from Social aspects, however in the case of this main category, it is directly related to financial and structural incentives.

Finally, many teachers also considered the budget to be a huge issue. According to T17, "*Technology is lacking in schools. Computers, tablets, whiteboards, among others.*" Followed by T24's "*Difficulty in having access to the necessary resources for both a more physical and a digital application.*".

Covering the ethical concerns (Summary seen in Figure 9), we identified 70 topics that our experts grouped into nine themes. These nine themes were classified into five categories. We also removed similar concerns and grouped others that had similar semantics (e.g., "Undesired Behaviour" and "Concerns towards Competition").

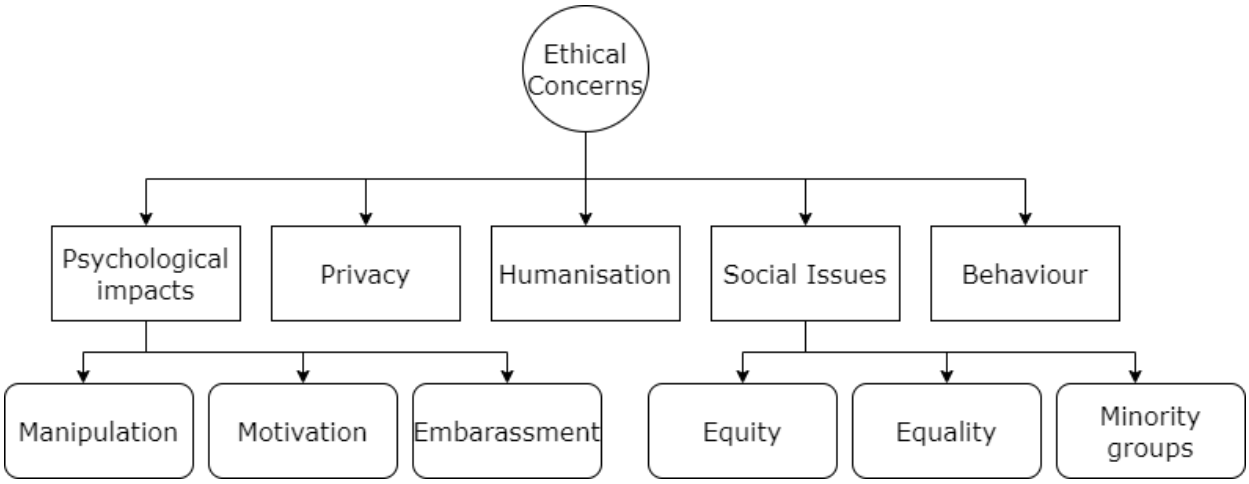


Figure 9: Summary of the ethical concerns according to our thematic analysis

Similar to what we did in Figure 8, in Figure 9 we pruned the themes and grouped some sub themes based on what was discussed in the discussion between the coauthors in the thematic analysis (e.g., in the Psychological Impacts ethical concerns, we identified themes related to Manipulation, Motivation, and Embarrassment based on the practitioners' comments).

- Psychological impacts: Practitioners were concerned about gamification's effects on students' motivation. They also stated a primary concern about gamification not being used as a tool to manipulate students and cause embarrassment;

Regarding the psychological impacts, T4 noted, "*Beware of the psychological damage that gamification can cause if poorly planned (. . .)*" (Motivation), followed by T16, "I believe that elements that provoke direct competition between students (rankings, etc.) can be harmful and demotivating for some of them." (Manipulation). Finally, T10 states that cyberbullying might be an ethical concern that can occur (Embarrassment).

- Social issues: In this topic, practitioners were worried about the equality and equitable experiences that gamification could promote so no student feels excluded;

In the social issues, T21 commented, "*I think it's important to take into account whether, when using gamification, the content will be passed on in a democratic way. (. . .)*" (Equality), followed by T32 who was concerned with "*(. . .) social, ethical aspects (race, gender, religion, sexual orientation, etc.).*" (Minority groups). Finally, T11 states, "*I always try to be fair (. . .)*" (Equity).

- Privacy: Practitioners were also worried and expressed their concerns about students' data and how it would be gathered, addressed, and organised in gamified environments;

Privacy (primarily digital) was also a theme that some practitioners commented on T24 stated, "*If it's digital, LGPD. In all cases, avoid the use of unethical or controversial items. Follow the type of game(play) vs. the age of users.*", T32 also stated "*Avoid exposing negative results.*"

- Humanisation: Practitioners believe that gamification should be used as a tool to improve students' creativity and promote respectful and proactive behaviours in the students' routine;

Regarding the humanisation thematic, T48 recommended "*empathy and respect for students' knowledge and cultural aspects*"; similarly, T41 emphasised "*respect for diversity, honesty with oneself and with peers.*"

- Behaviour: Some practitioners were concerned that gamification could lead to negative behaviours that could directly impact many students' psychological aspects (e.g., students losing motivation because of competition in a given gamified task).

Finally, worried with students' behaviour, some practitioners, such as T43, note "*Check if there are students who do not adapt to the Gamification strategy, as a low position in the Ranking can create a contrary effect to what was expected (. . .)*", and T16 "*I believe that elements that provoke direct competition between students (rankings, etc.) can be harmful and demotivating for some of them.*".

5 Discussions

This research aims to identify teachers' perceptions of barriers and ethical concerns in gamification applied to education. Considering previous work, we can further contextualise the findings on why educational practitioners do not use or avoid using gamification.

5.1 Perceived Barriers - RQ(A)

In the work of Sánchez-Mena and Martí-Parreño (2016); Martí-Parreño et al. (2016), the authors identified that teachers' lack of time, knowledge, and resources are among the main reasons for not using gamification. In our work, we identified that the lack of knowledge could either be theoretical (e.g., not knowing how to plan, manage, and evaluate, or even knowing the difference between games and gamification, also stated by Paula and da Pena Fávero (2016)) or practical (e.g., not having guidelines to support them or experience), supporting existing literature.

Besides, according to their comments, the practitioners found that applying gamification might be more complex than planning, which is also related to the lack of resources. This lack of resources results from the lack of incentives given by institutions (e.g., courses on how to gamify classes or investment in hiring gamified learning environments) or even financial incentives since most teachers are not paid for extra hours to improve their classes (which also falls under the lack of time, due to the high workload of teachers) Martí-Parreño et al. (2016). In addition, we can infer through the answers of our population that most of these problems are related to their formation since they were not taught about these types of technologies during their undergraduate degrees, which makes these technologies even more challenging to adopt.

One possible long-term solution would be to invest in restructuring teaching formation courses to cover gameful (or game-based) technologies so that these teachers and practitioners

can also have contact and become familiar with this approach before working in real learning environments (physical and virtual). This is important since, according to previous research from Toda et al. (2020) Toda et al. (2020), people (this includes teachers) with prior knowledge of gamification are more susceptible to accepting it in educational environments. According to the literature, understanding gamification design and the best strategies to plan it can positively influence learners' performance and motivation Bai et al. (2020).

Another possible solution related to ongoing research is to create personalised gamification, where studies try to tailor the gamification to match the students' needs Klock et al. (2020); Rodrigues et al. (2021). With a well-planned design, gamified systems can adapt their gamified strategies to the students, consequently supporting teachers by minimising their workload Palomino (2022). Other computational resources, such as Artificial Intelligence or Computational Models (e.g., ontologies), can also help automate the process of providing "ready-to-use" gamified strategies, so teachers do not need to spend their time delivering doing so Rodrigues et al. (2022). In summary, solutions should be designed around providing approaches that can facilitate the practitioner's use of gamification while not requiring too much of their time. This, however, also needs to be aligned with the possible ethical concerns that result.

5.2 Ethical concerns - RQ(B)

As for the ethical concerns, we also found similar discussions in the study of Kim and Werbach (2016) Kim and Werbach (2016), where teachers are also worried about gamification being used to manipulate students or harm them in some way, as well as felt it might incite questionable moral values (e.g., undesirable behaviour that might emerge from bad design). In addition, teachers were also worried about students' privacy in gamified systems since they might store sensible data about students and raised questions about which of their actions were being held. These same teachers also thought that gamification should be used to promote humanising behaviours, such as respect for others and cooperation, and being accessible to anyone who wants to use it (equity and equality).

Practitioners also considered it essential to be transparent by allowing the students control over what kind of information they would provide and demand transparency to students on how this data would be used (privacy). Some participants consider gamification as a humanising technology; up to now, almost no study has discussed the concept as a humanising technology. However, since studies such as Palomino et al. (2020), researchers have been trying to find ways to create meaningful gamification so that it can improve students' personal and learning experiences and not just be offered as a checklist, stated in a given gamified plan. Since, up to now, no study has provided a clear answer to some of these implicit questions, it is essential to understand:

(a) How can personalising gamification support educational practitioners?

(b) How can personalised gamification minimise these practitioners' workload?

(c) How to design fair and transparent personalised gamified strategies that might attend to each student's and practitioners' needs?

Furthermore, ten years after the concept was defined by Deterding et al. (2011b), there still needs to be studies that try to address possible ethical issues regarding gamification. It is important

to tackle those issues to promote meaningful and ethical gamification to students. One of the many possible ways to approach this is to consider students' autonomy on whether they want to participate or not in gamified systems since most of these systems do not offer any agreement option to the user (if they want to use a gamified version or not). Studies on gamification should focus on developing ways to approach these concerns:

(a) How to tackle equality and equity from the point of view of education and how does this influence the use of gamification?

(b) How can we create gamification that promotes autonomous humanising behaviours, without exploiting students' autonomy?

(c) How can we provide clear statements on which and how data is being processed for the students?

(d) How can we design an ethical gamification strategy considering both students' privacy and their needs?

(e) How can gamification be used to promote autonomy and critical thinking?

These and other questions can be used as reference for future studies in the field of gamification in education.

5.3 Limitations

Concerning the limitations of our work, surveys are not reliable in providing strong evidence of cause and effect, and snowball sampling might not be reliable in creating a generalisable sample. However, due to the exploratory characteristics of our study, both are still suitable as methods to explore the field Lazar et al. (2017). In addition, our survey was designed by researchers to understand practitioners' knowledge and practice in gamification. We created the survey since we found nothing similar in the literature. Regarding format, we used similar questions presented in previous studies conducted Martí-Parreño et al. (2016); Paula and da Pena Fávero (2016); Sánchez-Mena and Martí-Parreño (2016).

Since we aimed our survey at education professionals, groups, and institutions through social media, we believe we have collected data regarding only those types of professionals. We understand that teaching assistants and informal educators were considered and might not be considered teachers, but these people also provided and had valid teaching experiences, so we kept their responses. We also understand that the data presented in this study could be used to triangulate possible relations between practitioners' characteristics and their responses. However, this study did not focus on generalising this type of relation due to the sample size obtained. We, however, made the dataset available so other studies could conduct any analyses that the researchers might find helpful or were not contemplated by the aim of this study.

It is also worth noting that our sample is entirely from one country (Brazil). Still, a prior study shows that teachers from Brazil seem to have similar tendencies toward some aspects of gamification as that of teachers from Europe Sánchez-Mena and Martí-Parreño (2016). Nevertheless, it is essential to replicate those kinds of studies in different contexts and for different countries

to understand which of these barriers and ethical concerns are similar and which are not. Also, further replications of this study focusing on different regions from Brazil might provide some regional insights and concerns about the use of gamification and other active methodologies.

6 Conclusions

This work explored practitioners' perceptions of gamification biases and ethical concerns. The main contribution of this study is a thematic classification of perceived barriers to using gamification in educational environments. By mapping these aspects, we believe that this study can guide future practitioners and that the themes addressed in this paper should be considered in guidelines when planning gamification in educational environments. It is also important to explore each of these aspects further to understand other possible concerns that might be related to them.

It is also important to understand how teachers perceive gamification ethical concerns to build more equitable and equal gamified environments and comprehend these teachers' expectations when they intend to gamify something related to their teaching practices.

In future works, we aim to collect more answers from different countries and work with international collaborations to understand if those concerns are similar in different parts of the world. These themes can also aid designers and researchers when gamifying teaching practices and learning environments, providing an understanding of what teachers are concerned about and what aspects gamification should promote.

Acknowledgements

This work was partially supported by the European Union's Horizon 2020research and innovation programme under the Marie Sklodowska-Curie (Grant No. 101029543, GamInclusive), CNPq grants 302959/2023-8 and (303443/2023-5), and FAPESC Edital nº 48/2022 TO n°2023TR000245.

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