Exploring the use of social gamification during and after emergency remote teaching caused by Covid-19

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***Abstract*—The Covid-19 pandemic has impacted the world population in several ways. Schools had to modify their teaching methods, reinventing pedagogical practices and actions to students to continue learning in a new teaching and learning routine. In particular, gameful approaches (*e.g.*, games, gamification, and simulators) were alternatives used to improve the quality of emergency remote teaching. However, the need to use these approaches on an emergency basis meant that institutions could not plan the application or analyze the impacts of these technologies. To fill this gap, we performed a qualitative study, in which four students and a teacher participated. Using thematic analysis, we explored their perception regarding the use of social gamification in emergency remote teaching compared to regular face-to-face teaching. The results indicate that some different gamification elements drew the attention of students during remote and face-to-face teaching. However, no differences were identified between the different teaching modalities. Our study contributes to the fields of educational technologies and gamification through insights into the application of social gamification in education.**

***Index Terms*—gamified education, social gamification, emergency remote teaching, covid-19, thematic analysis**

I. Introduction

As a result of the Covid-19 pandemic and the need for educational institutions to find a teaching-learning model during the pandemic [1], emergency remote teaching emerged as an alternative to maintaining the continuity of activities in educational institutions, as a means of maintaining the interaction between teachers, students, and employees remotely [2]. However, the change in teaching modality meant that teachers needed to adapt educational models [3]. As a result, different agents (*e.g.*, teachers, principals, and researchers) were looking for new solutions so that they could keep teachers and students motivated in this new scenario [4]. One of the widely used options to improve learning environments is gamification (*i.e.*, "the transformation of systems, services, and activities to provide motivational benefits as games often do" [5], [6]) in education [7], [8].

Trabalho de conclusão de curso, sob orientação do professor Wilk Oliveira e Pasqueline Dantas submetido ao Curso de Licenciatura em Ciência da Computação do Centro de Ciências Aplicadas e Educação (CCAE) da Universidade Federal da Paraíba, como parte dos requisitos necessários para obtenção do grau de LICENCIADO EM CIÊNCIA DA COMPUTAÇÃO.

An emerging challenge was finding new solutions to engage and hold students' attention during social isolation [9], [10], to increase social interaction between students and teachers, as well as the interaction between students themselves [11]. Affecting social interaction positively is one of the principles of gamification [12], making this methodology an important and useful tool during emergency remote teaching. Thus, especially social gamification emerges as a possibility to encourage social interaction between students and teachers, possibly making the teaching and learning process more efficient [13].

Therefore, to understand how social gamification is perceived in emergency remote teaching and regular face-to-face teaching, we conducted a qualitative study to explore the following research questions: **RQ1**: How does social gamification is perceived by students during emergency remote teaching? **RQ2**: How does social gamification is perceived by students during face-to-face teaching after the pandemic? **RQ3**? What are the differences between the perception of students and teachers in the use of social gamification during emergency remote teaching and face-to-face teaching after the pandemic?

The main results of the study indicate that *i)* in general, students felt motivated by the gamified system both in remote and face-to-face teaching, *ii)* the ranking generated divergent perceptions among students, and *iii)* in face-to-face teaching, one can see a desire for recognition by being at the top of the ranking. Thus, the study contributes to the areas of educational technologies and gamification through insights into the use of social gamification. These insights in addition can enhance students' performance in remote and face-to-face teaching, as well as engage and motivate the students, reflecting on the teaching and learning experience.

II. Background and Related Works

Social gamification is a type of gamification design that refers to interactions between students presented in the environment, seeking to expose only gamification elements that tend to impact the social interaction of students [14]–[16]. The social gamification design is composed of the following

gamification elements: **Social pressure** which is related to social interactions that exert pressure on the learner. An example of this element is peer pressure or group missions [16]. **Competition**, which is related to challenges where a user faces another user to achieve the same goal. Some examples: leaderboards based on the number of points, emblems, and levels [16]. **Cooperation**, which is also known as teamwork and concerns tasks in that the user must collaborate to achieve a common goal. An example of this design would be tasks where groups interact with each other [16]. **Reputation**, which is related to the titles that the student can earn and accumulate within the environment. Some examples are classification, and status [16].

Some recent studies have used different gamification designs in teaching. Rincon-Flores and Santos Guevara [17], used reward-based gamification aiming to generate motivation and engagement in students. In this study, a flow was maintained to have a better result, focusing beyond the grades, such as answering questions, obtaining an improvement in the grade in the second test concerning the first, or through participation in synchronous classes. 57 students participated in the study, from February to June 2020. In another study, Rincon-Flores *et al*. [18] decided to use mixed-method research, implementing qualitative and quantitative perspectives, with a focus on determining the impact of gamification based on reward mechanics in an academically confined environment by comparing two higher-level courses.

In a study implementing qualitative and quantitative data, Alhalafawy and Zaki [19] decided to use mixed method research, implementing both qualitative and quantitative perspectives, with a focus on achieving a better understanding of cross-platform gamification in the educational context during the Covid-19 pandemic. The quantitative analysis was based on a quasi-experimental method. The qualitative approach used the phenomenological approach. 60 students participated in the study in the quantitative phase and 8 in the qualitative phase during the first semester, which took place from March 2020 to July 2020.

Despite the advances represented by these studies, as far as we know, **our study is the only one to explore the difference in the use of social gamification in the teaching and learning process during emergency remote teaching and regular face-to-face teaching**.

III. Study Design

In this study, we aimed to compare the students' experience using social gamification during emergency remote teaching and post-pandemic face-to-face teaching. To achieve the objective, we conducted a qualitative study (based on thematic analysis [20]).

A. Materials and methods

To carry out the study, we used the platform Eagle-edu[1], a gamified educational system that allows teachers to create classes and apply activities (gamified or non-gamified). In addition, the system also allows gamification to be personalized based on the dimensions proposed by Toda *et al*. [16]. The platform was selected because it allows personalizing the system's gamification design, using social gamification, for example. The platform was personalized to be used with social gamification (*i.e.*, with the following gamification elements: *i)* social pressure, *ii)* competition, *iii)* cooperation, and *iv)* reputation). The platform was provided free of charge for research purposes in the study.

To identify the profile of study participants (*i.e.*, students' user types), we used the Hexad scale composed of 24 questions, proposed by Tondello *et al*. [21]. As this is a study carried out with Portuguese speakers (from Brazil), the Brazilian-Portuguese version of the Hexad scale was used, which had its psychometric properties investigated by Santos *et al*. [22]. To avoid responses from students who were not paying due attention when answering the scale, following the suggestion of Kung *et al*. [23], an "attention check" statement has been included (*i.e.*, that is an attention-check statement! If you read this question, check option 3"). One student was excluded from the study for not having answered the question asked in the statement.

For data analysis, the software ATLAS.ti[2] was used. The software enables encoding and uniting such codes in different categories. In addition, the software enables the use of various types of research and the application of systematic and complex analysis strategies, making data generation more flexible. Also, ATLAS.ti allows the discovery of complex phenomena, which would probably not be detectable in a personal analysis [24].

The study was structured and carried out in three steps: *i)* **planning**, in which the number of weeks that the subject would be remote and face-to-face was aligned with the professor who would be in charge of the discipline, *ii)* **execution**, with data collection through the Eagle-edu platform, in addition to two interviews, one carried out during the remote period and the other when returning to the face-to-face period, and *iii)* **analysis**, in which the data were analyzed to answer the RQ.

Furthermore, the step of **execution** was organized into five sub-steps: *i)* at the beginning of the 2021.2 academic semester (which took place in the first semester of 2022, where at the Federal University of Paraíba students had classes in the emergency remote teaching format for 1 month, and after that, they returned to the face-to-face format), the students answered the Hexad questionnaire so their profiles could be analyzed; *ii)* **first two weeks**, the study started remotely, using the Eagle-edu platform enabled with elements of social gamification, then *iii)* **first semi-structured interview** which aimed to obtain impressions about the use of the platform during remote teaching, *iv)* **the following two weeks**, with face-to-face teaching, Eagle-edu continued to be used with elements of social gamification, *v)* **second semi-structured interview**,

[1]https://eagle-edu.com.br/

[2]https://atlasti.com/pt

which was intended to verify impressions about the platform during face-to-face teaching, *vi* **semi-structured interview with professor**, to obtain the professor's impressions about the platform and the performance of students. Figure 1 summarize the study method.

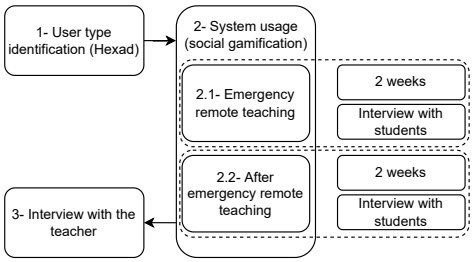

Fig. 1. Study method

B. Participants and data analysis

19 undergraduate students attended classes, including one self-declared female and 18 self-declared males. Four students agreed to participate in the interviews, and those who signed a consent form had no prior knowledge of gamification. The class selection was made in agreement with the class professor, the participating students were those enrolled in the discipline of Applied Research to Computing.

The data collected in the semi-structured interviews were analyzed following thematic analysis [20]. The analysis was organized following the guidelines proposed by Braun and Clarke [20]: **1. Familiarization with the data** which consists of transcribing the data, reading and rereading the data, and finally, writing down the initial ideas. **2. Code generation** which consists of systematically coding exciting features across the data set, grouping relevant data for each code. **3. Theme search** which comprises grouping the codes into potential themes. **4. Theme review** which investigates whether the themes work concerning the coded extracts, thus generating a thematic "map" of the analysis. At this stage, we also conducted a review by an external analyst, verifying the codes' coherence. **5. Define and name themes** that is part of the continuous analysis to refine the specifics of each theme, generating clear definitions and names for each theme. **6. Production of a report** which is the last opportunity for analysis.

For data collection, two semi-structured interviews were carried out to ascertain students' impressions about the platform: *i)* What is your general opinion about the Eagle-edu platform? *ii)* Please mention positive and negative points about the platform; *iii)* Did you notice any game elements on the platform?; *iv)* What is your opinion about the elements you noticed?; and *v)* Would you suggest any new game elements for the platform? And with the professor responsible for the discipline to obtain impressions during the interaction process with the students, as well as their opinion about it: *i)* Did you notice any difference between student performance while using the platform face-to-face and remote teaching?; *ii)* Did you receive some feedback from students regarding the platform in the face-to-face and remote periods?; *iii)* How did you structure the class to work during the face-to-face and remote periods?; *iv)* What is your general opinion regarding the Eagle-edu platform; *v)* Mention the positives and negatives of the platform. Both interviews were defined based on a discussion between the responsible researchers following the definitions of the thematic analysis technique.

IV. Results

Initially, to explore the experience of each participant with their Hexad type, in the Table I, we present the data referring to the Hexad user types. All had only one dominant profile (*i.e.*, Hexad profile, which scores from 4 to 24, with the highest score), but also had profiles that were only one point away from the dominant profile. Table II summarizes the results of the thematic analysis in both interviews.

TABLE I
HEXAD USER TYPES

Id	A	D	T	P	R	S
1	25	17	20	25	25	26
2	26	19	22	16	27	15
3	25	11	24	28	25	27
4	26	11	25	24	21	18

Key: Id - participants identification; A - Achiever; D - Disruptor; T - Free Spirit; P - Philanthropist; R - Player; S - Socialiser.

Concerning the first interview with the students, 10 subthemes were obtained, which are organized into three main themes: "Gamification Elements", "Feeling" and "About the gamified system". The "gamification elements", instigated students, either with prizes, rankings, or competition. The "Feeling" theme, lists four codes, which are divided into positive feelings, such as relaxation towards discipline, motivation when receiving feedback, and encouragement to make more effort and stay at the top of the ranking. However, also had a negative feeling about the ranking, the student was concerned about how it would be affecting the other docents if it would be generating some discouragement for being at the bottom of the table. Then, in "About Eagle-edu", only one code was obtained, which mentions encouraging students to try to carry out the activities correctly.

Subsequently, the interview was conducted after the end of the emergency remote teaching, which identified four codes, "Competition", "Recognition elements", "Negative feeling about the ranking" and "Positive feeling about the ranking", divided into two categories "Gamification Elements" and "Feeling". In the "Gamification Elements" theme, it can be perceived that students remain motivated not to be at the bottom of the ranking and to receive a reward, be it a trophy or knowledge. In the theme "Feeling", the same opinions are maintained concerning the ranking, the negative feeling about the concern with the other students being discouraged by being at the end of it, the positive being perceived with good eyes when placed as a game element. In the interview with the

TABLE II
THEMATIC ANALYSIS

Theme	Sub-theme	Summary/example	Frequency
Remote teaching			
Gamification Elements	Competition	Indicate citations to the element Competition (*e.g.*, "[...] competing is always good, see who is not last")	2
		Element as positive points in education	3
		Economy element	2
		Dots element	2
		Recognition element	1
Feeling	Relaxation	It demonstrates the feeling of relaxation when doing activities on the platform (*e.g.*, "[...] stressful, when I'm doing this I get very overloaded, so things like that are relaxing, I think it's great.")	4
		Motivation	1
	Negative feelings about ranking	Demonstrate negative feelings about the ranking (*e.g.*, "[...] that ranking of best and worst, which I don't know if it's good or bad, like, the people who are in last place in the ranking, will it be will they feel unmotivated? And my concern.")	
	Positive feeling about ranking	They demonstrate positive feelings about the ranking (*e.g.*, "I think it's cool if you get a question wrong, you already know that you won't be the first because there are people who got more right, then it motivates you not to make a mistake.")	1
About Eagle-edu	Approval	Student opinion about the Eagle-edu platform (*e.g.*, "I liked it, it forces the student to look for the right answers.")	1
Face-to-face teaching			
Gamification Elements	Competition	They indicate citations to the Competition element (*e.g.*, "[...] competing is always good, seeing that you are not last.")	7
	Recognition elements	Indicate citations to the Recognition element (*e.g.*, "[...] whether or not it will generate a reward.")	3
	Negative feelings about ranking	Demonstrate negative feelings about ranking (*e.g.*, "Ranking, as it might demotivate students.")	1
	Positive feeling about ranking	They demonstrate positive feelings about the ranking (*e.g.*, "[...] ranking that if you place yourself having a vision of the game, it would be a positive point.")	1
Professor's opinion			
Equality	Equality between face-to-face and remote	Teacher's view comparing the completeness of activities during emergency remote teaching and during face-to-face teaching (*e.g.*, "[...] Whenever I created a mission, I looked to see if more students had completed it or not, in terms of completeness it's the same thing.")	1

professor, it can be observed that only one code was identified, which shows that there was no perception of the distinction between remote emergency teaching and face-to-face teaching.

In summary, regarding RQ1, most students had positive feelings, feeling motivated and encouraged. Finally, in the second round of interviews, the competition was the most cited code, in addition to recognition elements. Regarding RQ2, students continue to have the same opinions about the ranking, however, the desire for recognition for being at the top of it was added. Regarding RQ3, the teacher did not notice any difference between student performance during and after emergency remote teaching. Something to be highlighted is the position of each participant in the ranking, the ID 1 student was in 1st of the 19 participants, the ID 2 was in 18th, the ID 3 in 8th, and the ID 4 in 14th. It is noteworthy that all 19 students, except the one excluded due to attention issues, were considered in the ranking.

A. Discussion

At the end of December 2019, an outbreak of Covid-19 spread across the world. Devastatingly, it had a considerable impact on the world's population and led to changes in teaching methods. To address student motivation, we explored the use of social gamification during and after emergency remote teaching. Results showed both positive and negative impacts.

Student ID 1 expressed concern about the ranking, which he expressed in his first interview "*that ranking of best and worst, which I don't know if it's good or bad, like, the people who are in last place in the ranking, will it be will they feel unmotivated? And my concern*". In the second interview, he said "*Ranking, perhaps discouraging students*". This student has higher traits of Socialiser, Player, Philanthropist, and Achiever, who has as one of the elements of the suggested designs, social competition [25].

However, this student was the only one who was concerned about the ranking and motivation of the rest of his colleagues, which turns attention to the rest of his gamification designs, Achiever, Philanthropist, and Player, thus being able to associate such concern with the Philanthropist profile [26]. Or else in another speech in which he says that "*It would be interesting to be able to change the eagle's clothes*", being one of the suggested design elements of the Player profile.

The code with the highest frequency was "Competition" which was cited nine times, three times by student ID 2, who has Player and Achiever as the most salient traits, having cited twice in the face-to-face and once in the remote, with speeches such as "*[...] competing is always good, seeing that you are not at the bottom*". As a suggested profile design, interest in leaderboards, which matches their most salient traits [25], [26]. The other student who cited this code, was ID 3, six times, twice in the remote and four times in the face-to-face period, having the same case cited above, in which the most salient trait, Philanthropist, does not match the suggested design [26], however, with a point of difference for the Socialiser, profile stands out, having social competition as one of its suggested designs, mainly being emphasized during the face-to-face period. The speeches of the ID 4 student did not make sense for the study, for this reason, it was not cited.

Another point to be highlighted is that the ID 1 student who was first in the ranking was the one who was most concerned with the motivation of the other students, even though Socialiser was the dominant profile, while the others were ranked 8th to low, which reminds us that the dominant profile is not enough to understand the profile of people since we have a little of each profile, and therefore we need to consider all profiles [27].

B. Limitations

Only four students consented to participate in the interviews. To mitigate this limitation, we chose to conduct a qualitative analysis using a robust data analysis technique (*i.e.*, thematic analysis), which is considered adequate to identify reliable results even with small samples. Even so, we did not reach a sufficient sample to saturate the codes [28]. Another limitation was the lack of female participants, which be able to create an

imbalance in the analysis of the data obtained. In addition, the time of two weeks may have been short, and certain nuances of the experience of students and teachers may not have been identified. Therefore, our results may not be generalizable.

C. Lessons learned and recommendations for future studies

Initially, in this study, we explored the experiences of users, therefore, **we recommend that future work focuses on student performance**. In the study, social gamification was used, but there are other types of gamification design. So, **we recommend that future studies analyze other gamification designs**. Finally, we conducted the study with a small sample size (*i.e.*, four teachers and one professor) in a specific course/discipline. Thus, **we recommend that the study be replicated in other disciplines, with a larger sample, with comparisons between classes and different types of data analysis, being carried out in traditional teaching or in online disciplines**.

V. Concluding Remarks

This paper discussed an experience of using social gamification, applied through a gamified educational platform, during the Covid-19 quarantine period and when returning to face-to-face activities, in which the student's learning experience concerning social gamification was analyzed. The main results demonstrate that the application of social gamification can be beneficial to the teaching process, leading students to diversified standard classroom activity, thus renewing their interest in learning. On the other hand, contrary experiences about a gamification element were noticed. Finally, no differences were identified between the use of social gamification during and after emergency remote teaching. We aim as future studies, to compare the use of new different gamification designs in remote and face-to-face teaching with a lager sample size.

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