Gaming in Action

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Gamification and game-based learning: strategies to promote positive competitiveness in the teaching and learning processes

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Introduction

Gamification and game-based learning have attracted the attention of academics, professionals and education professionals. Despite extensive commentary on its merits, little empirical work has sought to validate gamification and game-based learning as meaningful concepts and provide evidence of its effectiveness in motivating and engaging students in non-entertainment contexts.

The use of gamification and game-based learning in education, and its relationship with motivation and positive competitiveness, has deserved increasing attention due to their potential to direct behaviours (Dicheva, Dichev, Agre, Angelova, Salem, Salem, & Carolina, 2015). On the other hand, it also has the merit of allowing a deeper understanding of the concepts, personal appropriation and mastery of complexity, features defended by authors such as James Paul Gee (2008). Good games create

good learning that uses problem-solving to produce deep student engagement and satisfaction (Gee, 2008) and, at the same time, teach students to work for goals, make choices and face the consequences (Trybus, 2014).

This chapter presents a study carried out within the Supervised Teaching Practice of the Masters' Degree in Informatics Teaching at the University of Minho. It seeks to identify the reason for the integration of games and gamification to promote positive competitiveness of vocational training students. To address this goal, we have designed six challenges that seek to focus the student on the learning process and respond to the following research question: *Are gamification and game-based learning the right strategies to promote positive competitiveness in teaching and learning processes?*

In this chapter, we will briefly present the related concepts, the methodology followed in the empirical study, and the results obtained from the data analysis.

Background

Gamification

Although gamification has recently gained academics and educators' notice, gamification is not a new concept, having roots in marketing endeavours, such as points cards and rewards memberships, educational structures, most notably scholastic levels, grades, and degrees, and workplace productivity (Seaborn & Fels (2014). The re-emergence of gamification is thought to have been brought about by many converging factors, including cheaper technology, personal data tracking, eminent successes, and the game medium's prevalence (Deterding, 2012).

Gamification is a term firstly used by Nick Pelling in 2002 to refer to the use of game elements in non-game situations (Domínguez, Saenz-de-Navarrete, de-Marcos, Fernández-Sanz, Pagés, & Martínez-Herráiz, 2013).

These game elements should only be those that play a significant role in the gameplay, such as rewards, difficulty levels, scoring points, time limits, resource limits, clear objectives (Deterding, Dixon, Khaled, &

Nacke, 2011) and a narrative that contextualises those objectives. However, the use of these game elements does not imply the use of games (Deterding, Sicart, Nacke, O'Hara & Dixon, 2011).

Why gamification? Gamification provides an effective way to keep students active, engaged and motivated for otherwise tedious activities (Fuchs et al., 2014). Gamification can use social competition to encourage collaboration and motivation to foster learning (Hanus & Fox, 2014).

Raftopoulos (2014) states that commitment and motivation are essential gamification factors, and the teacher needs to move away from an approach based on content and use a method that seduces the student in his search for knowledge. According to the author, the most effective use of gamification in education is creating a context and a narrative and selecting the most appropriate elements of the game to create an immersive experience. Seaborn e Fels (2014) summarise the game elements linked to gamification:

Table 1 - Legend of game element terminology (Seaborn & Fels, 2014)

Term	Definition	Alternatives
Points	Numerical units indicating progress.	Experience points; score.
Badges	Visual icons signifying achievements.	Trophies.
Leaderboards	Display of ranks for comparison.	Rankings, scoreboard.
Progression	Milestones indicating progress.	Levelling, level up.
Status	Textual monikers indicating progress.	Title, ranks.
Levels	Increasingly difficult environments.	Stage, area, world.
Rewards	Tangible, desirable items.	Incentives, prizes, gifts.
Roles	Role-playing elements of character.	Class, character.

Kapp (2014) states that users engage in games because they have challenging, fun and socialising elements and that these same elements promote learning when used, for example, through the use of challenges.

Game-based learning

The use of games in learning can be an excellent way to use constructivist pedagogies through an active and participatory approach to learning (Whitton, 2012). Many games use learning techniques through problem-solving, providing a contextualised experience that energises learning through practice, error, reflection and repetition, promoting collaboration because players often need to work together towards common goals.

Games also use a wide variety of techniques to ensure engagement and keep players immersed in the activity, which can also be used in learning scenarios. Techniques such as good narrative, clear goals and challenges with different levels of difficulty, rules and rewards, such as getting a higher rank on the leaderboards, or gaining a new skill.

But, despite using the same motivating elements, game-based learning is not the same as gamification (Davis, 2014). When we talk about game-based learning, we are talking about learning through real games and not strategies that use the game elements.

Referring to the educational system, Schell (2008) states that it is, in itself, a game. Students (players) are given work objectives (game missions) that will have to be delivered (completed) by specific dates (time limits); also grades (scores) are attributed as feedback on the work developed (challenges), repeatedly, with increasing difficulty, until the final exam (boss) in which they will only be approved (defeat) if they have developed the skills of the course (game). Students who have a good performance can be part of an honour roll (leaderboard).

However, the author concludes that games can be excellent in education if used as tools and not as a substitute for educational systems.

Motivation and positive competitiveness

The role of motivation in the learning process is of the utmost importance. It is the motivation that makes a student define his goals and use cognition (e.g., planning, monitoring) and behaviours (e.g., persistence, effort) to achieve them (Schunk, 2012). In the learning process, ideas are built about the contents and the didactics itself, which can be stimulating and challenging or tedious and devoid of interest. Associated with these are also the representations that each person builds around themselves (Salé, 1997) and that influences motivation.

One way to stimulate motivation is through competition (Shindler, 2009). Referring to the competition, Plowman (2013) highlights the positive competitiveness as the one desired to exist in workgroups and organizations. Positive competitiveness is a way for individuals to compete to improve their position in the group, in a cooperative manner with mutual respect, and through interactions that do not harm other group members. Additionally, Shindler (2009) refers to the fact that the pressure of competition can potentially increase students' response capacities, keep them motivated to be successful and raise levels of fun in school activities.

We can also add that teachers who teach in competitive environments tend to be better prepared because they also organise the sessions better, always seeking new strategies and teaching methods.

However, says the author, the competition must be exercised with prudence in the classroom, because in the presence of a competitive situation there may be a tendency to increase interest in the processes necessary for victory, to the detriment of learning itself.

Method

Following Kapp, Blair and Mesch (2012), we imagined a narrative of six different challenges that served the purposes of clear learning objectives, a sense of progress and interconnected learning, instant feedback, transparency, challenge and status. In addition to “time”, other game elements were used in our narrative, such as points, leaderboards and

rewards. Implicit in all challenges was self-discovery and new knowledge or the regeneration of previously acquired knowledge.

To facilitate comparison and encourage positive competitiveness, the results of the challenges were published on an online platform, allowing students to analyse and comment on these results.

We developed the pedagogical intervention in a 10th-grade class of a Vocational Training Course named 'Computer Systems Management and Programming Technician' in the subject 'Computer Architecture'.

We choose the contents syllabus 'Assembly and Computers Configuration' and 'Error Detection', whose objectives were (Rodrigues, 2005, p.9):

1. to provide students with knowledge/skills suitable for assembling and configuring computers and their peripherals, and
2. to provide students with the knowledge to solve minor problems in terms of software and/or hardware.

Since this is a subject "with a formative and professional purpose" (Rodrigues, 2005, p.2), it is recommended that the teacher "adopt strategies that motivate the student to learn and to allow him to develop his autonomy and initiative" (Rodrigues, 2005, p.3).

Methods and techniques for collecting data

Direct observation - It serves for the elaboration of a diary where the significant occurrences in the sessions are registered. In our work, these occurrences contribute to (re)defining the strategy from one session to another.

Focus group interviews (Courage & Baxter, 2005) Interviewing students is a way to validate the planned strategy. In our case, we used an audio recorder and a tablet for notes. We asked everyone for permission to record the interview on audio, remembering the anonymity associated with the activity. After the sessions were over, we transcribed the recordings and performed a content analysis (Bardin, 1979). To maintain students' confidentiality, we agreed to refer to their participation in the

focus group with "S", which means student, followed by a number that refered to the order in which they intervened, followed by FG (focus group)", for example, S14FG.

Participants

Twenty-three students (organised in two separate groups), with twenty-one boys and two girls, aged between 15 and 19 years old. As for favourite activities in the classroom, the students almost unanimously elected group work and research practices.

Results

First challenge

The first challenge was to use the multi-choice game called "Quem quer saber? [Who wants to know?]" (*cf.* Barradas & Lencastre, 2015).

> Sort groups of 2 or 3 students, randomly. We will provide students with generic information about different computer component malfunctions and website addresses to search for their resolution. Through Internet searches, one gets the full details on computer errors, their detection and solution. Each group will have 30 minutes to perform this challenge. After 30 minutes, one needs to answer questions on that topic using a game platform: 'Quem quer saber?'. Given the game's eliminatory nature, each group can play up to 3 games, with a maximum of 5 minutes. The sum of the scores obtained is considered for scoring purposes. The group that wins the highest score/minute ratio wins the challenge. The groups grant the points obtained in the sum of the games. The group that is in the last place will receive only 2/3 of the points earned. Individually, each player has the same score as their group.

Figure 1 - Students playing the multi-choice game "Quem quer saber?"

Challenge 1 went quite well, and the students had no difficulty playing the multi-choice game "Quem quer saber?". However, due to the game's eliminatory nature and play limit, students could not obtain results as high as expected. This observation led to the idealization of a new challenge, using the same game but with different rules, to be carried out later.

To facilitate comparison and instigate positive competitiveness, we published the results on the score board.

Reflecting on the students' reactions to the results, it was possible to verify the differences between the two groups regarding sensitivity to competitiveness. Despite being curious about the results, the students in one group did not give much importance to the scoreboard and did not note the results until the next face-to-face class. On the other hand, all students in the other group consulted the scoreboard, even making comments. This difference in sensitivity to the competitive element did not affect the levels of interest in the activity or their active commitment to it, which had remained high in both groups.

Second challenge

The second challenge begins with the scoreboard presentation, allowing the students to discuss and ask questions about it. Like the previous

challenge, this second challenge's design includes the applause for the winners and the positive reinforcement for those who were in the last place, this being another way to instigate the competitiveness motivation.

> Sort groups of 2 or 3 students, randomly. Students must use the knowledge obtained in the previous challenge about a computer's errors to create, in 50 minutes, a summary presentation of hypotheses of error, organised by symptoms. Malfunction symptoms considered for this challenge are:
>
> - The computer will not turn on;
> - The computer turns on, but there is no picture;
> - The computer turns on, but freezes;
> - The computer is continuously restarting;
> - The computer works normally except for some components.
>
> For each of these symptoms, students should highlight the possibilities of malfunctions and solutions. A group wins the challenge when creating a complete presentation, considering (1) the number of malfunctions/solutions highlighted, (2) the organization, and (3) the presentation's graphic quality.
>
> Groups will be rating from 0 to 20 points: 11 points for the contents; 1 point for creativity; 2 points for the presentation's technical aspect; 3 points for multimedia elements; 3 points for the attitude/collaborative work, noted in the teacher's diary.
>
> Individually, a student who eventually repeats first place in the classification will have a bonus of 1 point. Individually, a student who repeats the last place will have a penalty of 1 point in the overall classification.

In this challenge it is expected that students reflect on the effect that the *time* element has on their behaviour. Although this challenge is similar to the tasks that students do throughout the school year, the expectation is that the explicit rules, with a time limit for solving tasks, will lead to a

completely different approach to tasks. In reality, collaboration should be the answer for working in a group and the decisive element in victory.

In the second challenge, the influence the *time* element has on students' behaviour was noticeable. This challenge was very similar to what the students have done since the beginning of the school year. However, the fact that there are explicit rules with time limits for solving tasks made the students' approach completely different. Collaboration within the working groups was one of the main factors for winning the challenge. We quickly realised that the best marks were for the most committed students, with a sense of organization, responsibility, and autonomy. Despite all groups' excellent performance in their quest for the best positions in the scoreboard, the students' later comments concluded that this was the challenge they liked least since it deals with tasks similar to those they perform in other subjects.

Third challenge

To consolidate learning about assembling computer components, we designed the following challenge:

> Sort groups of 2 or 3 students, randomly. In 45 minutes, students must use the knowledge obtained in the previous tasks to create a computer configuration with a maximum budget of €1000, using online computer stores for that purpose. Then, each group will have 2 minutes to highlight the strengths of their configuration. The group that presents the best computer at the lowest price wins the challenge, taking into account the characteristics of the computer shown and the justifications given for the choice of components. The benchmarks of processor, motherboard, memory and graphics card will be considered for the analysis. In the case of a tie, the computer with the lowest price wins. The winning group will earn 10 points, then there will be 6 points granted for 2nd place, 4 points for 3rd place and 3 points for 4th place.

> For this challenge, students consider the configuration of a computer for gamers, with all components (processor, motherboard, graphics card, memories, etc.), monitor, keyboard and mouse.

This was the most demanding challenge for the teacher since the diversity of configurations made instant feedback impossible. Only after class was it possible to present the ratings on the scoreboard.

The students liked and engaged well with this third challenge. After the teacher posted the results on the scoreboard, some students even asked how he had evaluated the configurations, since some were very similar. However, all students were satisfied with the teacher's explanation. Once again, the curiosity to know the leaderboards showed that we were dealing with two completely different groups regarding sensitivity to competition. Until that moment, despite the student having different grade levels, the teacher's diary notes led to a direct relationship between positive competitiveness and the teaching / learning processes. This statement is because all the doubts raised showed curiosity and a desire to improve colleagues' results, which was happening. The level of learning and the degree of student commitment were the highest since the beginning of the school year.

Fourth challenge

For this challenge – more hands-on than the previous ones – we developed the following situation:

> Sort two groups of 4 students and a group of 3 students randomly. During 45 minutes, using the knowledge obtained in the previous challenges and using a set of hardware, students must assemble a computer. That computer should be impeccable while only taking one piece at a time from the warehouse then use it in the assembly before taking another. The group that presents the best-assembled computer wins the challenge. In case of an equal number of failures, the

> group that performs the challenge in the shortest time wins. The judges are the members of the other groups, having 10 minutes for the evaluation. The teacher needs to validate the possible failures found. The score attributed to each group's members will be 20 points, subtracting points for the number of errors in their own computer, and adding points for the number of errors the group find in the other groups' computers.

Challenge Four would be considered by students as the best one and the most appreciated. It required two weeks of preparation. It was necessary to find similar computer components to guarantee the same level of difficulty for each group. Also, the game rules had to be carefully prepared so that no one was harmed.

Figure 2 – "Warehouse" for challenge 4

Class started, as usual, with the presentation of the scoreboard, with students examining the positions. With the same goal in mind – to stimulate competitiveness – the teacher identified the students who were in first places, and those in last. Then, we described the challenge as to what was already expected as everything was prepared for the activity when the students arrived in the classroom. As in the previous challenges, the groups were randomly formed, allowing them to balance the

individual performances, which was not well undestood by the students in the initial challenges. In this challenge, the students assumed this fact naturally.

Then, because it was manual work with parts, screws, screwdrivers and plates, attention was drawn to the safety precautions to be taken during the activity.

To assess the acquisition of knowledge, there were some incompatible components (memory modules) deliberately supplied to understand whether students would choose them, causing situations that would prevent the computer from working. During the challenge, students could use the Internet to answer any difficulties. Also, we provided the component manuals because, when in doubt, it is convenient to consult the literature to avoid mistakes.

Not forgetting that the rules need to be fulfilled, the group that finished before the time limit made a point of remembering that in case of a tie the group that finished earlier wins.

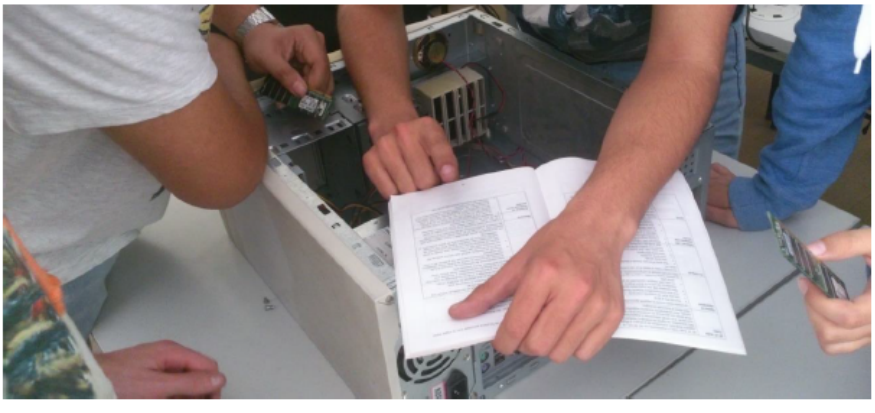

Figure 3 - Building knowledge with the help of the manual

We designed the challenge to minimise the chance of uncontrolled assessments. The groups' rotation was thought in advance so that some would evaluate the work of the others. However, as the students were in competition with one another, there would be a possibility of result manipulation. Thus, we decided to keep an element of the group under

assessment together with the verification team, to prevent one group from interfering with another's work after the challenge is over. Concerning this rule, we noted with curiosity that the most competitive group spoke on this subject before the teacher presented this rule. Also, in that group, one student deliberately ignored the rules and tried to hide some hardware pieces from other groups to harm them. However, as this was noticed rapidly, the other groups were not harmed. The student was warned, and the challenge continued. All the mistakes made were used to reflect on the given subject.

At the end of the evaluation and validation of the errors found, one student had a minor complaint about being evaluated by another group that he considered "a strong group", which in theory could have undermined his score. However, after showing the student that his computer assembling had even more errors than his colleagues detected, the results were accepted. Although they refer to it as an additional pressure factor, a constant clock counting down is tolerated well by the group and allows tasks to be carried out within the expected time.

Fifth challenge

For the fifth challenge, we use again the multi-choice game platform "Quem quer saber? [Who wants to know?]", this time individually. In this challenge, we opted for the following structure:

> The students play individually the "Quem quer saber?" game. They have 45 minutes to obtain the maximum score, without being allowed to consult external aids. The total score obtained in the game will be converted into points.

Reflecting on this challenge, it was possible to realise that individual gaming is more suited to the subject's objectives than the multi-choice game platform's previous use. The students learned by 'trial-and-error', and played incessantly in search of the highest score. Gee (2013) states that this helps the student take risks, as failing a game has minor

consequences compared to real life. This allows the students to gain confidence, enabling them to take additional calculated risks.

Competitiveness increased in the classroom because every time a student achieved a high score, they referred to it out loud to inform colleagues of the new limit to be reached. However, the teacher realised that one of the students was (de)complying, announcing higher scores than those he had achieved, to destabilise the colleagues.

Figure 4 - Figura 8 - Utilização individual do game-based learning

With this challenging structure, the students could learn and memorise the wrong answers to try and answer correctly later. Gee (2013) states that this way, competence occurs through a game's action, reversing the usual model in which students are forced to learn before acting.

Sixth challenge

We designed Challenge Six to encourage the students with the lowest scores. For this purpose, we created the following situation:

> Students with the bottom three positions will compete with each other. For 45 minutes, using the knowledge obtained in the previous challenges and using a set of hardware pieces, students must assemble a computer and consider that only one piece at a time can be removed from the warehouse for application in the assembly. The student who presents the

> best-assembled computer wins the challenge. In case of an equal number of errors, the student who performs the assembly in the shortest time wins. The evaluation takes 10 minutes and is the responsibility of the students' colleagues. The errors found must be validated by the teacher. The score assigned individually will be 10 points, subtracting points for the number of mistakes they make. The winner of this individual challenge receives five bonus points. The remaining students can bet 20% of their points on the student they believe will win the challenge, thus increasing their points by the amount of the bet. Regarding losses, only the number of points wagered will be considered lost.

The last challenge was designed to stimulate the recovery of students with the lowest scores. To this end, taking advantage of the challenge they liked the most, despite being in the bottom positions on the scoreboard, a new situation was designed. This challenge also aimed to involve the whole class. The betting system created and the fact that this challenge was communicated to students three days in advance allowed students to teach their three colleagues and improve the performance of the one they wanted to bet on, consequently increasing their own points. On this day, the classroom atmosphere was a little less ordered than usual, as the whole class was present and excited.

We started the challenge by reminding the students about the safety rules and receiving the bets on closed paper. The activities went satisfactorily, taking into account that they were students with the lowest scores. However, they have already seen the explanations made in Challenge 4. Also, their colleagues have tried to explain the assembly techniques to them in the previous days. Once again, the teacher used the mistakes made to inspire learning of the subject. the other colleagues in groups established at the time made the evaluation, but always with the teacher's validation.

Inflated by the fact that the students were all together, there was notorious solidarity with the colleagues who were taking the challenge,

even helping (not allowed, but tolerated) those they had not voted for but they perceived to be in trouble. Only one student who bet lost points once the challenge was finished. There was an accumulation of bets on the same element (curiously, the student in the bottom place), which leads us to think that, regardless of the results, the students know each other well and can differentiate by themselves, using their knowledge of each other.

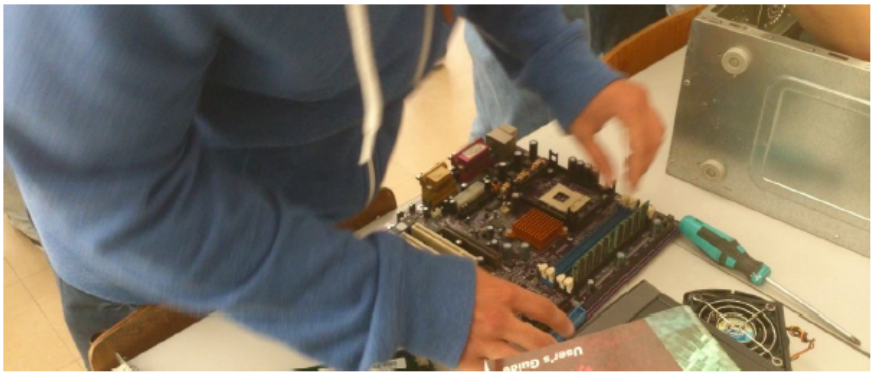

Figure 5 – A student assembling memory modules

After counting the gains and losses, the final results were posted on the scoreboard. The students commented on the scores, particularly by those in the first places, trying to understand where they gained or lost points.

At the end of the challenge and after the disclosure of the final classifications, the first seven ones (1/3 of the class) were awarded with a mouse pad, which was much appreciated by the students, not for their value but for their meaning. Deliberately, to minimise external motivation factors, it is only on this day that the students realise that they would receive that award.

Discussion

We promote two focus groups to evaluate better this pedagogical strategy of gamification and game-based learning and its effects on students. Each focus group lasted about 40 minutes, with twelve and eleven students

respectively. We asked the participants to give their opinion on what they thought of the pedagogical strategy used.

The data collected allowed us to verify the satisfaction with which the students embraced the strategies used, with "motivation" and "fun" being two of the most mentioned words. Even being in the bottom places did not take away the motivation for some of them. They consider game-based learning (through the multi-choice game platform "Quem quer saber?") as an excellent way to learn. Difference and innovation are adjectives that characterised gamification that everyone, except one, liked and would like to repeat. As for positive competitiveness, some of them think it could have been even more visible.

Regarding the fulfilment of the objectives of the subject, particularly:

(i) to develop skills in the assembly of computers and their peripherals,

we concluded that these competencies were acquired in a very satisfactory way by analysing the class registration grids with results that indicate:

1. 86.9% have strong interest and commitment,
2. 77.6% demonstrate correct working methods,
3. 78.5% gain a sense of responsibility and autonomy,
4. 72.0% carried out the work challenges successfully.

To develop personal skills, it was necessary to use strategies

(ii) to promote collaboration among students.

Using group work as a class strategy, students could develop cooperation and collaboration through content selection and evaluation activities. Additionally, we assessed the group work through students' presentations to the class. The need for students to plan the work and tasks in a group contributed to collaboration. The students found this strategy useful, one stating: "we could be in a group (…) we can help each other (…) we can get to know more about things" (S14, FG). We realised that this objective of collaboration was fulfilled by analysing the class results in conjunction with the group's reflections at the end.

More related to the gamification strategy, there was the objective:

> *(iii) to develop competencies through playfulness in the classroom, stimulating positive competitiveness through a system of rewards and scoreboards.*

The use of a scoreboard was something that students enjoyed, with evidence from statements like "the scores gave motivation to involve ourselves" (S18, FG), and "we guided ourselves well, with the points" (S6, FG).

This guidance increased the competitiveness, turned on the comparison between students, and positively affected students in striving to succeed. This fact is mentioned when students say that "they were competing, researching to try to be the best" (S22, FG). Shindler (2009) talks about the motivation to be successful and raising the level of fun in the schooling activities and, according to students, "the points always gives more motivation to continue" (S17, FG). We noticed, however, through observation and the focus group analysis, that one group of students was not as sensitive to criticism as the others. One of the students stating that for him, "the scoreboard meant nothing" (S13, FG). However, when asked if the motivation to work seriously was the same without the scores, they stated that "if there were no scores, no one was here competing and running for pieces [computer components] during the challenge" (S18, FG). One student, later, in an individual interview, said that his concern was "not to be last" (S13, FG) due to the negative connotation that has.

Some adverse factors also occurred in the presence of competition in the classroom. Shindler (2009) referred to the possibility that a competitive situation could be conducive to an intensified interest in victory to the detriment of the learning itself. In group work, this happened: in the words of one student, in some cases, “the one who knows more tries to work harder to improve the grades for him and for his colleagues” (S7, FG), a fact not considered worrying by the student. In his words, although the colleagues may not understand the content, they “earn more points” (S7, FG). Despite this reference, the results are in line with Cantador and Conde (2010) because the students, despite the competition, managed to focus on the learning objectives.

Ultimately, the goal was

> *(iv) to identify the pedagogical strategy's impact on the students' learning process.*

Overall, the students considered that their learning process "was different from other classes" (S14, FG). "Different and better" (S17, FG). The innovation associated with gamification was considered fundamental for some students' success because "if the classes were normal, we would not be so interested in the subject" (S7 and S9, GF). There would be "people who had no chance of having positive grades on this subject" (S7, GF).

According to the students, "they were all motivated, wanting to get ahead of each other" (S4, FG), including the student, who was always in the bottom place and says that "I stayed last but always wanted to work" (S2, FG). So where does this motivation come from? Much of the motivation is associated with fun. "I enjoyed the activities. They were "fun" (S20, FG), "animated" (S17, FG), "very crazy" (S14, FG) and "captivating" (S4, FG) were some of the expressions used to characterise gamification in the classroom. The students' willingness to be in class and be involved in the challenges was notorious: one of them said he "wanted to come to these classes, and not to the other subject classes" (S6, FG).

It should be noted that, although there were students who did not agree with some rules (negotiated and accepted), they considered their ratings fair because "they were the rules of the game ... We had to play with them" (S6, FG). The time control was one of the rules that had to be met in all challenges. This time control proved effective in raising the students' sense of responsibility since all challenges were completed on time, with no request for postponement of deadlines, contrary to what usually happened in this class.

The game-based learning strategy, implemented using the game platform "Quem quer saber?" was also very much appreciated. Evaluated by the 23 students in terms of satisfaction through a SUS questionnaire - System Usability Scale (Brooke, 1996) - the game obtained an average score of 86.5 points in 100. According to Bangor, Staff, Kortum and

Miller (2009, p.121), it corresponds to a classification of 'Excellent'. Additionally, the content analysis of the focus group also made it possible to assess the use of game-based learning since students consider that "the game the teacher made was brilliant" (S14, FG), saying that it is an exciting way to learn because "we don't want to miss the next one" (S6, FG) and "[with these activities], we are able to recall: even when we fail, that [failure] stays in our mind so we do not fail again."(S17, FG).

However, the pedagogical strategies did not please all students, as one expressed that being lower than he expected in the scoreboard discouraged him a little. Although he liked the challenges, he thinks they undermined them in the assessment. In a subsequent individual interview, this student said that it is easier "to memorise things and take the tests". Although it was only one student to mention this fact, it still makes us reflect.

Conclusions

The experience of converting the classroom into a playground with challenges was enriching for the students; it allowed them to make mistakes in environments where there are no real consequences and still actively learn, keeping them involved in the process, which facilitates the learning for real-life (Gee, 2013; Trybus, 2014). Also, feeling the desire to participate in classroom activities, be involved, help others and learn was rewarding.

Reflecting on the research question - *Are gamification and game-based learning valuable strategies to promote positive competitiveness in teaching and learning processes?* - our answer is YES.

An analysis of the class grids' indicators, the content analysis made of the focus groups (in which there were 13 positive references to competitiveness and 28 to motivation) point to this. Thus, reinforced by the automatic data from the software logging to the platform: students played until the time limit of the challenges, searching for the maximum score, with no apparent signs of disinterest.

However, as Kapp (2012) stated, these strategies must be used sparingly and are not perfect for all learning circumstances. One student mentioned that they don't like to do the same thing all the time. This leads us to think that using these strategies for a long time can lead to different results, possibly more similar to the studies of Hanus and Fox (2014) in which students showed lighter levels of satisfaction and motivation. The best solutions do not always work the same way with different audiences. In this case, it was possible to verify that not all students showed the same sensitivity to competition, although they liked it. As to teaching in competitive environments, it is neither necessary nor appropriate for students to feel that they have to be the best in everything. As teachers, we must be sure that students understand this.

From the teacher's point of view, these strategies are not easy to design and implement. They require imagination and knowledge of the game elements and their applicability to each situation. Also, the strategies need a reinvention of the teacher's role. Suppose teachers accept their new role of creating opportunities and pleasant environments that promote learning collaboratively and use a pedagogy that sets students' responsibility for learning. In that case, you can become a better educator.

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