

Boosting the Engagement of Undergraduate Students in the Class Activities through Gamification

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ABSTRACT

Not all of the courses that are part of the compulsory curriculum for undergraduate education arouse the interest of students. The lack of emotional involvement with the content of the course eventually distances the students from that subject. However, professors may propose some stimuli to encourage student engagement in the proposed activities in the class. One of these stimuli, the gamification contributes to increased interest in the content of the lessons through competition. In this work, we discuss the concept of gamification and present some results of the application of this concept in the Operating Systems (first and second semesters in 2016) and Computer Organization and Architecture (first semester in 2017) courses. The results show that students' engagement in solving the proposed exercises correlates with the performance of the class in the courses.

Keywords: Gamification, engaging, undergraduate.

INTRODUCTION

Several factors can arouse students' interest in attending an undergraduate course. Curiosity about the content of the class and need to use that knowledge to achieve personal or professional goals are among these factors. However, not all the classes that belong to the undergraduate curriculum that attracts the interest of all students indistinctly. After all, within a single undergraduate course, there are diverse interests and motivations for each class.

Therefore, it is necessary to have other strategies that act as stimuli to motivate students' engagement in the class even if, at first, they are not interested in it. In that case, it appeals to a more fundamental motivation: the challenge. Associated with the challenge, we must add the recognition, that is, the evidence that the individual has accepted and won that proposed challenge with merit.

These ingredients – challenge and recognition – can increase the level of interest in the class, since the content addressed becomes an indispensable tool to achieve the goal that the professor proposed. These same ingredients are present in any game, whether in sports, board games such as chess or even in electronic games, which are currently quite common in any age group.

However, it is necessary to differentiate the idea of a game from the concept of gamification. In this text, we did not create or use games for stimulating students but instead propose challenges and digital recognition – the so-called digital badging – that are part of the gamification concept. The goal was to increase students' engagement in the class and improve their academic performance.

TEXT STRUCTURE

This text will discuss, in the next section, the definition of gamification, in addition to some concepts inherent to the theme. In Section 3, we present the

methodology of this work, including some details for replication of this work in other classes. Section 4 states the results obtained with the application of gamification concepts. Section 5 discusses the results presented and, finally, Section 6 gives the conclusions about the use of gamification in the selected classes. In the end, we list the bibliographic references.

GAMIFICATION

The term “gamification” is not new and came about around the year 2004. At that time, a game designer named Nick Pelling attempted to use game concepts to make program interfaces more user-friendly. The idea was to use the interface as if it were a game and thus make the user experience with the program more interesting (RUGHINIS, 2013). However, only in 2010, the concept of gamification gained more power, and more work on the subject appeared latter. (DICHEV; DICHEV, 2017)

Sánchez-Martín, Cañada-Cañada e Dávila-Acedo (2017) gave the most general definition of gamification, which defines this concept as the use of game elements and techniques for game projects in diverse contexts (not directly linked to games) to engage people in solving problems. The game elements to which the authors refer are distinct, but some of them are common in literature. Among them, the following stand out:

- Challenge: a narrative element that presents a situation to the user overcome.
- Strategy or Action: a set of decisions or actions that a player needs to take to achieve a partial or final goal.
- Reward, a sign of progress or mastery: objects or symbols that the player defeated a particular stage in the course of the game or that the player has gained new skills.

Although there are other elements for creating exciting games for different purposes, in the case of educational games these elements are the most relevant. By the way, the concept of gamification gains some nuances when applied to the learning process. Thus, Dichev and Dichev (2017) define gamification in Education as an approach to encourage and engage students in the process of knowledge acquisition, using some principles of game design in the learning environment. Therefore, the significant importance of gamification is in the process of achieving the goal rather than the reward. One should notice that the concepts of games and gamification are not synonymous. Educational games, in particular, present challenges to the players overcome and, in this path, one must use strategies to reach the goal. The games have a whole mechanic, that is, actions the players should take at every moment to implement a plan and achieve a goal. (AZMI; IAHAD; AHMAD, 2016)

In gamification, in turn, only a small subset of objects are familiar to games. Especially those elements that bring the extrinsic and intrinsic motivations. Among the objects in this subset are:

- Digital badges: small icons, representing a conquered ability;
- Classification tables: a list of participants and their achievements, classified by some pre-established criteria;
- The scoring system: a method for calculating points.

These three elements are sufficient to implement the gamification concept and evaluate its impacts. Some more modern Virtual Learning Environments (VLE) have the possibility of using these elements for the courses offered. When we use these environments, it is simpler to implement and evaluate the gamification strategies.

METHODOLOGY

Considering the possibility of improving students' engagement in some subjects of the undergraduate course in Informatics of FT, we decided to apply the concept of gamification in some classes in this course. Thus, to evaluate the impact of the utilization of gamification for stimulating undergraduate students, we applied the concept in the following classes: the Operating Systems, offered in the first and second semesters of 2016, and the Computer Organization and Architecture, offered in the second semester of 2016, as the cases for study. Both classes used the Moodle software as VLE, made available by the Ensino Aberto of UNICAMP, which has in itself the elements necessary to implement gamification.

In Moodle, we made available three digital badges as shown in Figure 1. We build three blocks of questions that together cover the whole content of a class. Figure 1 (a) shows the badge for those students who completed the first block of questions. Figure 1 (b) presents the badge for those who finished both the first and second blocks of questions. Finally, Figure 1 (c) shows the badge for those who completed the three blocks of questions.

The resolution of the blocks of questions was not mandatory and answering the questions had no implications on the grade of the student in the class. However, at the beginning of each class, we mentioned that the students responsible for assigning the badge to the extent that the student complied with the blocks of questions correctly.



Figure 1. Digital Badges.

For each lesson, there were a set of questions (between 2 and 4 questions) regarding the content of that lesson. The questions were always objective, that is, the type in which the student could choose the right options from a set of options. We choose this sort of question due to the possibility of automatic correction, that is, by creating the question, we already informed of the correct options to the VLE. In this way, the student would have the answers immediately after finishing the question, as well as the number of questions answered correctly. One should notice that there was no possibility of a new attempt to resolve the question. Besides, each student has randomized alternatives to each question, so there was no pre-defined answer template.

The classes teaching assistants elaborated the questions and later discussed with the professor who, in turn, suggested modifications or updates, if needed. After proposed and revised, the professor put the questions in the question bank. In the following section, we discuss the results obtained in the subjects and their correlation with the students' performance.

RESULTS

Table 1 presents the results obtained when applying gamification in the classes of Operating Systems offered in the first and second semesters of 2016 and Computer Organization and Architecture offered in the first semester of 2017.

Level of expertise	1st Sem. 2016	2nd Sem. 2016	1st Sem. 2017
Beginner	11 (26.83%)	11 (20.75%)	41 (71.93%)
Advanced	10 (24.39%)	1 (1.89%)	27 (47.37%)
Expert	8 (19.51%)	0	15 (26.32%)
Number of students enrolled	41	53	57
Percentage of approved students without final exam	63.41%	56.60%	82.46%

Table 1. The result of Gamification in the classes

In Table 1, the first column is the level of expertise reached by students (Beginner, Advanced, and Expert). In the second, third and fourth columns are the data of the Operating Systems classes, offered in the first and second semesters of 2016, and Organization and Architecture of Computers class offered in the first semester of 2017, respectively. Besides, in the penultimate row is the number of students enrolled in the course and the last line the percentage of students approved without a final exam, i.e., with the students that obtained a grade higher than or equal to six.

It is important to highlight that the students who reached the Expert level also won the Beginner and Advanced badges. As well as the students who achieved the Advanced level, they also won the Beginner badge. Therefore, the students who answered all the questions correctly conquered all the badges.

DISCUSSION

Table 1 shows that there is a correlation between the number of participants and the percentage of students approved in the classes. Besides, in the Computer Organization and Architecture class, offered in the first semester of 2017, more students reached the Expert level, and the percentage of students approved without the final exam was higher than the other classes.

On the other hand, in the class in which students engagements were low, the number of students approved without a final exam was low as well. This observation makes it clear that there is a correlation between student participation in the class and the performance of the class as a whole.

However, in this work the volume of data from this survey is small. Therefore, it is not possible to infer with absolute certainty that the inclusion of the gamification strategy will bring incontestable results in any situation or any class. Researchers may run more studies to increase the level of certainty.

However, in this experiment, considering spontaneous reports made by some students, the experience with gamification was positive. The students felt that they have their effort rewarded, not only with better grades in the class but also with the feeling that they overcome a challenge.

Besides, some students who have conquered badges in previous classes have asked if there would be more badges to conquer in the current class. It indicates that regardless of the contents taught, the will to overcome challenges remains. Therefore, there are indications that the use of the gamification strategy may promote more student engagement in classes.

CONCLUSIONS

The results indicated that the promotion of student engagement in complementary activities of the subjects is possible without a grade associated with these practices. This stimulus to the students, motivated by the gamification, arouses the interest of the class through the challenges they overcame.

Besides, recognition of the student effort by the professor in charge of the class, as well as by his peers, is a motivating factor for the students' good performance in the classes. However, we need more qualitative studies to understand if the challenge motivates the students or if the interest is due to the contents of the class.

REFERENCES

- AZMI, Shahdatunnaim; IAHAD, Noorminshah A.; AHMAD, Norasnita. Attracting students' engagement in programming courses with gamification. In: IEEE CONFERENCE ON E-LEARNING, E-MANAGEMENT AND E-SERVICES (IC3E), 1., 2016, Langkawi. Proceedings... . Langkawi: IEEE, 2016. p. 112 - 115.
- DICHEV, Christo; DICHEV, Darina. Gamifying education: what is known, what is believed and what remains uncertain: a critical review. *International Journal of Educational Technology in Higher Education*. Barcelona, v. 14, n. 1, p. 2-36. Fev. 2017.
- RUGHINIS, Razvan. Gamification for productive interaction: Reading and working with the gamification debate in education. In: IBERIAN CONFERENCE ON INFORMATION SYSTEMS AND TECHNOLOGIES (CISTI), 9, 2013, Lisbon. Proceedings... Lisbon: IEEE, 2013. p. 1 - 5.
- SÁNCHEZ-MARTÍN, Jesús; CAÑADA-CAÑADA, Florentina; DÁVILA-ACEDO, María Antonia. Just a game? Gamifying a general science class at university. *Thinking Skills and Creativity*. Amsterdam, v. 26, p. 51-59. Dec. 2017.