Assessing Gamification Effects on E-learning Platforms: An Experimental Case

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Abstract. Many educational organizations have implemented E-learning platforms aiming to improve student learning performance. However, due to its self-learning nature, these platforms reveal high dropout rates. The use of gamification is presented as a solution to this problem, through the generation of play environments that provide a high interaction with more motivating ludic experiences, attractive, and creating a positive impact on pedagogical and psychological aspects of E-learning. This paper conducted an empirical analysis using gamification in an online teaching platform used by an experimental group of students. The impact on dropout rates and final grades were examined comparing the historical data with those obtained after implementing the games in the online platform. The results expose the direct positive relationship that gamification has on the efficiency of using online platforms.

Keywords: Gamification · E-learning · Desertion · Learning

1 Introduction

New information and communications technologies have changed the way of transmitting knowledge and learning. Easy access to the information has allowed knowledge to be conceived as universal and open. [1]. Owing to the emergence of E-learning, classes can be imparted virtually, and students can access to their training courses, at any time and from anywhere, providing a solution to overcoming place and time barriers for to learning [2].

E-learning is an electronic learning system based on independent learning, for this reason, its effectiveness largely depends on the creation of an environment that encourages participation, continuous activity, attentiveness, commitment and emotional motivation of students [3, 4]. It is argued that the use of games can have a positive impact on the psychological characteristics of students and their behavior towards learning [5]. Hence, including gamification in E-learning to generate

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interactive dynamics that boost competition, challenges, instant feedback, rewards and recognition, among others, might improve the interaction between students and platforms, and therefore, to promote better learning.

The term "gamification" denotes the use of elements (mechanical, dynamic and aesthetic) of games as a strategy of improvement in different environments or fields. The use of this term has been increasing exponentially during recent years, and its importance has been increasing as well, positioning itself as an innovative technology [6]. Previous studies have focused on demonstrating the positive effects of their application in several fields. However, in the education field, only a few researches include empirical studies, and those who do it focus on assessing the effect on the learner motivation. This study implements some gamification elements in the E-learning platform of a Distance/Virtual Higher Education Institution course, and assess its effects on desertion, average time of platform usage and the final grades of students, with a quantitative data analysis by making use of gamification and historical data.

2 E-learning

E-learning is a teaching and learning system based on the use of information and communication technologies that allows students learning without space and time restriction [7]. Its use has caused a transformation from traditional teaching to virtual teaching and learning environments incorporating self-training aspects related to collaborative learning.

The importance of virtual learning is due in large part to its advantages: (a) efficiency in transferring knowledge, (b) learning environment customization according to specific individual needs and learning styles, (c) adaptability for multiple forms of interactive learning, (d) promotion of dynamic-type capabilities in learning and innovative potential, (e) time flexibility, allowing pauses at specific points and, if necessary, repetition of specific parts, (f) enables autonomy development and eases self-evaluation processes, (g) allows having a greater number of students, without location or space limitations, as in the case of traditional or physical class attendance [7, 8]. For these reasons, many educational institutions and firms have incorporated vitrual platforms in their training processes. Since the success of E-learning on the education field must integrate a joint vision of technical, pedagogical and didactic processes, its use in the university context will include the application of models and methods to generate more effective learning results, this exploration demands more functions, flexibility, and changes in tutor's activity, leading to propose educational models of technological and methodological innovation.

One of the main challenges of the virtual education is to decrease the student dropout rate that reaches higher percentages than those ones in traditional classes. Several studies have been carried out in order to identify what are the variables and main determinants that may affect this phenomenon. According to a study carried out in the Open Learning Institute in British Columbia, the main dropout cause is due to individual motivation, followed by academic level and lastly previous social characteristics. The study concludes that the characteristics of the student such as age and

gender influence 11% in their continuity in virtual courses [9]. Other studies indicate that women have a slightly higher tendency to remain in distance courses [10].

The acceptance degree and success level of an E-learning, to a large extent, is due to the student's continuity, that depends on two general factors: the characteristics of the course (the Web, platform or specific technology employed, the content and methodology of the course) and, on the other hand, personal impressions or sensations from the student such as the will to do, the enjoyment, which are variables that influence individual motivation [11–13].

With the purpose of increasing student's individual motivations in virtual courses and the success of this learning modality, gamification is employed.

3 Gamification in E-learning

Gamification is defined as the application of game elements in not game related contexts [14] with the purpose of generating a greater commitment and ownership in tasks execution. Several studies have shown that gamification has a positive impact on personal motivation [15–19]. By using the dynamics, mechanics, and aesthetics of games, the students feel motivated, allowing them to increase their responsibility for distance learning, and strengthen their link with the content and the tasks proposed.

In overall terms, gamification in the education field has been used to foster desired learning behaviors and to encourage participation, interest, and commitment of students in the learning activities by allowing a greater immersion in the learning environment. The former is derived from the self-determination theory (SDT) proposed by Deci and Ryan [20], which exposes the way in which videogames, games and therefore gamification satisfy the psychological needs of players or participants. This theory distinguishes two types of motivation: intrinsic (where people continue to participate because they have fun, satisfaction, and taste) and extrinsic (external rewards) [20].

Games are intrinsically motivating, the gamified environments must address three psychological needs: autonomy (providing freedom of choice), competition (providing challenges, once achieved them make players feel recognition, competence, and efficiency) and finally the collaboration and relationship with others to promote social connections, hence, gamification in education motivate students by creating a better learning experience [20].

In E-learning, the general game designs are based on three areas: (1) the cognitive area: make complex systems where the student gradually progresses in obtaining achievements based on established rules; (2) Emotional area: elements that create appropriation and positive emotions; (3) Social area: generates mechanisms of interaction and competence [21]. Moreover, gamification impacts four aspects of motivation, boosting interest and stimulating the student: the cognitive, which improves attention, reaction time, and permanence; the social, which leads to transfer the acquired knowledge; and the emotional that regulates positive emotions and behaviors [22]. This study implements these game elements. Thus, an virtual course is gamified to measure its impact on the dropout rates, the average time on the platform and the final results of the course (Grading), inferring variables such as age and gender of the group of students who made use of the new gamified platform.

4 Description of the Study

This study was developed in a Distance/Virtual Higher Education Institutions in Colombia. Several gamification strategies were implemented in the course titled 'Foundations for Integral Management' due to (1) it belongs to one of the academic programs with the highest dropout rates, and (2) it reports a low academic performance. This course belongs to the administration and economic area, and has developed a methodology based on tasks and theoretical content.

The first semester is the period where the curriculum assigns the course, and it has a value of 3 academic credits. The course content includes 3 units and evaluates from 0.0 to 5.0; being the minimum and maximum score respectively, 6 tasks or products. Students must reach a grade equal to or greater than 3.0 to approve the course.

During one academic semester gamification was implemented on the E-learning platform. The course was taught to a total of 236 students with ages between 19 and 35 years old, and around (72%) of the students were males.

4.1 Gamification Implemented in the E-learning Platform

Moodle 2.7 (Modular Object-Oriented Dynamic Learning Environment) is the platform used by the research course, currently, the module has linear access to content, forums, and students can create their own profile, upload their profile picture, personal data such as age and a brief description of themselves.

The content of the training material in the course remains the same, i.e. the videos made by the tutor, assignments, exams, documents and forums were not modified, only six gamification components were added to the platform (See Table 1).

Table 1. Gamification strategies implemented in the course

Gamification element	Need to satisfy
Custom account	Sense of identity, personality, own style
Progress bar	Progress sensation in the achievement of goals
Levels (Titles) - scores	Competence, achievement, recognition, status
Score table	Recognition, social environment, competition
Instant feedback	To be informed about self-performance, Recognition
Battles	Competence

1. Custom Account

At the beginning of the course, the platform allows each student to design their own avatar, creating a unique and personal representation that generates identity [7]. In this case the avatar is improved according to the level obtained by the student, this level is reached based on the scores accumulated. The avatar goes together with the corresponding title of the level reached.

2. Progress Bar

The platform displayed the progress bar with the respective avatar at the bottom left-hand side of the screen. Hence, the student was able to know what was the path he took during the content of the course, the different tasks performed, and what remained to complete the goal. This tool is important due to allowing the player to feel an autonomous improvement [8].

3. Titles - Levels

Titles and levels evidenced the acquisition of skills and the mastery of knowledge within the classroom. The levels are also indicators of the degree of progress. In this case there were 4 levels of experience according to the number of points accumulated by the students (See Table 2).

Table 2. The Game levels

Student level	Acumulated score
Expert	>300
Advanced	201–300
Intermediate	101–200
Beginner	0–100

Scores are numerical values that are achieved in gamified systems after carrying out one or a set of actions. Each action that a player makes is associated with a reward, in this case, a certain amount of known points. Points are an important attraction, the mechanism used both to gain them and to preserve them can increase the motivation of the students [9].

Scores were obtained according to the fulfillment and the quality of the tasks and activities presented. The scores criteria were (a) having the highest score in a task, (b) delivering the activities on time, (c) participating in the forums, (d) winning battles with other participants, (e) When students upgraded their level (from first to intermediate, from intermediate to advanced and from advanced to expert).

4. The Score Table

Classification tables were used to display the position of each student in comparison with Others, at the bottom left-hand side of the screen always appeared the podium (the three first places). Therefore, students could track the complete list of positions occupied by each of them. A tab named “Ranking” was installed in the menu, there were three rankings to consult: Weekly Ranking (the students with the best scores of the week), Ranking by unit (the students with better scores in each unit) and the cumulative ranking (the students with the highest score accumulated during the course).

5. Instant Feedback

Feedback can be used to encourage or discourage certain behaviors, causing that the student becomes more involved in the learning process. Students like to be informed about how their performance is, and above all of that, to feel recognized when they are doing well, this generates an intrinsic motivation [8]. In this case, every time a student participated in a forum, performed the tasks in the established time, upgraded the ranking position, won a battle, and so forth, the system displayed motivational phrases to keep improving.

6. Battles

The course previously contained a series of playful activities such as crossword puzzles, and alphabet soups. Once gamification elements were implemented, the platform allowed students to perform these activities in the form of "battles" by challenging another student. The battles had a time restriction and the winner was the player with more triumphs. At the end, the platform assigned the respective score. Battles are usually used to satisfy the feeling of overcoming or recognition and encouraging competition.

5 Results

The course presents an average historical dropout of 42%. Each semester, the total students enrolled remains the same (236). During the experimental semester, 65 students abandoned the course, representing a dropout rate of 27.5% (See Fig. 1), this shows a significant decrease, evidencing that the implementation of the gamification has a considerable positive impact on student's continuity. This decrease in the dropout rate had a greater tendency among male students (26%), whilst the variation in the dropout among female students is negligible (1%) (See Fig. 2). The greatest decrease in dropout compared to the previous semester occurred in students with ages between 23 and 26 (See Fig. 3).

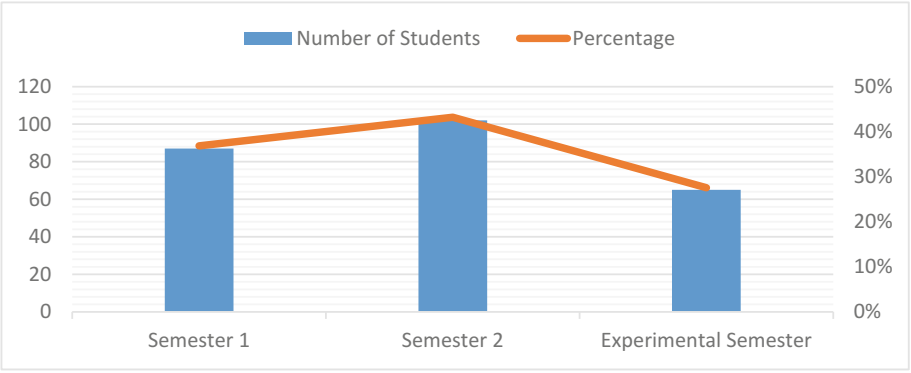

Fig. 1. Dropout percentage of the course

Figure 1 displays a decrease in the dropout percentage 14.5% (37 less students) with respect to the previous semester.

Men shows a greater decrease in the percentage of dropout, going from 68 students in the previous semester to 41 students in the experimental semester (decrease of 39.7%); while women present a decrease of 29.4% with the implementation of gamification (See Fig. 2).

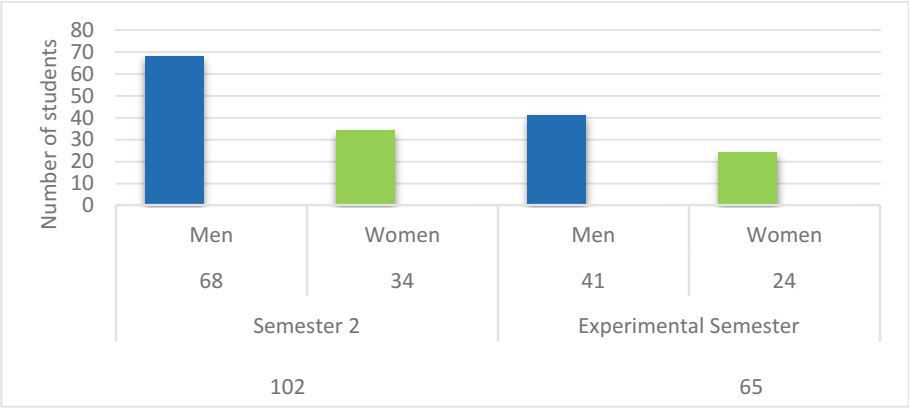

Fig. 2. Number of students deserting by gender

Students between 23 and 26 years old showed a lower dropout rate than students within the same age range in the preceding semester, although in the experimental semester there was a greater number of students in this age range taking the course (See Fig. 3).

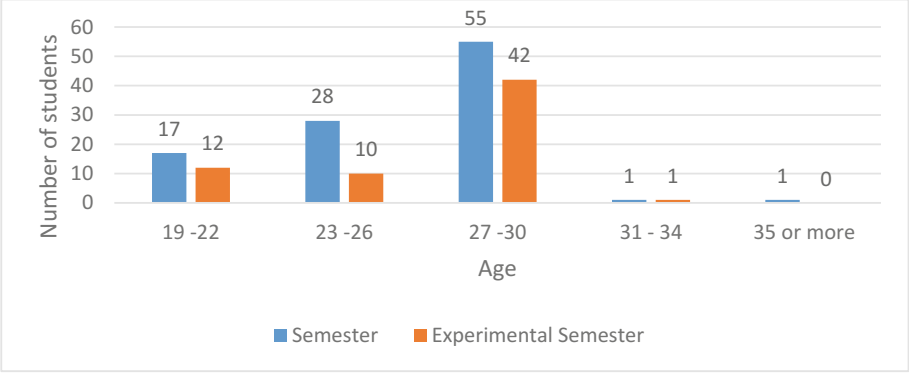

Fig. 3. Number of students deserting by age

The average time of the platform use increased more than three times, from 0:42 h to 1:48 daily hours. The average number of weekly entrances to the course per student also increased 55.5%, from 9 to 14. This findings indicate a greater interest, commitment and motivation of the students that leads them to invest more time in the learning process and, in general, in the platform of the course (See Figs. 4 and 5).

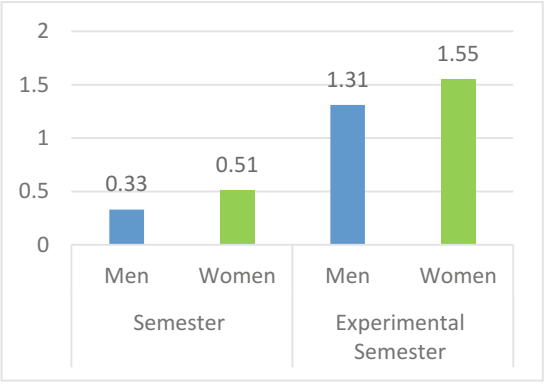

Fig. 4. The average time of daily use by gender

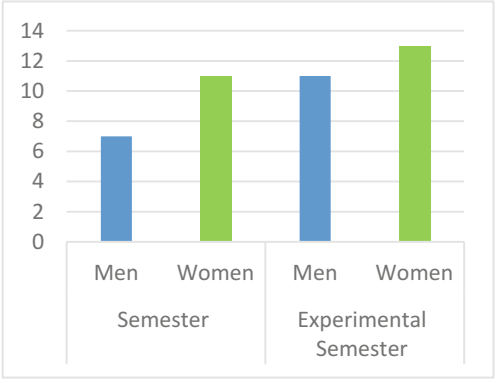

Fig. 5. Average number of weekly entrances by gender.

The average time of daily use in the platform increases 68% for women and 75% for men. The average weekly entrances increase 37% in men and 26% for women when gamification was implemented. There is evidence of a greater increase in men with respect to immersion in the platform and the content of the course when gamification is applied. However, women continue to have a higher average time of use and a higher number of weekly entrances than men.

It is important to mention that from the gamification activities implemented in the platform those that present the greatest number of visits or participation are the battles and the scoring tables respectively. Therefore, according to the theory it can be concluded that the profile of the student has a greater inclination towards competition, and these activities motivate students, as a consequence, there is a greater use of these gamification elements in the platform. It should be noted that women had a greater number of participation in the forums (See Table 3).

Table 3. Average weekly visits by gender to the implemented gamification elements in the course

Gamification element	No. of students	
	Man	Women
Battles	25	12
Score table	18	13
Forums	9	15
Avatar	3	3
Progress bar	3	5

On average 21% of the students failed the course, that is to say, they obtained a final grade lower than 3.0. The average grade is 3.36. The average of final grades when making use of gamification increased to 3.62 and the percentage of failed students decreases to 14%. The number of students who failed in the previous semester and in the experimental semester is similar. However, the percentage varies since the dropout was greater in the semester in which the platform has not been gamified, therefore, the number of students that ends the semester and gets final grade is lower.

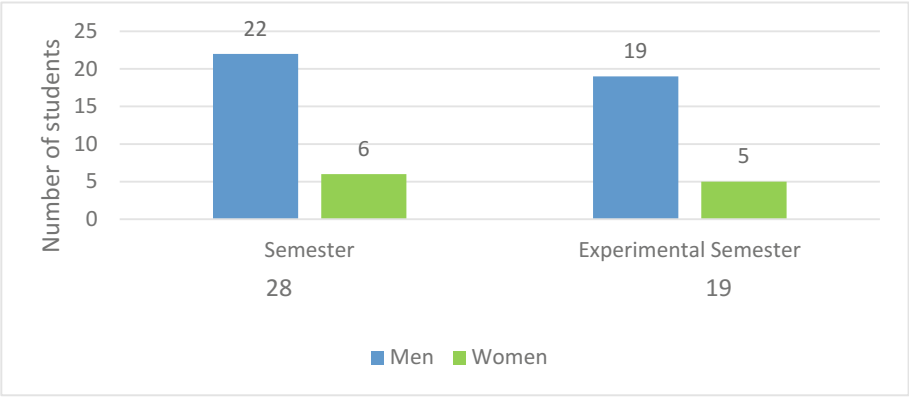

Fig. 6. Number of students failed the course by gender

Figure 6 shows that men had a greater decrease of failing the course with respect to women when implementing gamification. Regarding the improvement in the average of final grades, there is a greater increase in the average obtained by the ages of 19 to 22 years followed by the age range between 23 and 26, increasing 0.7 and 0.3 respectively (See Fig. 7).

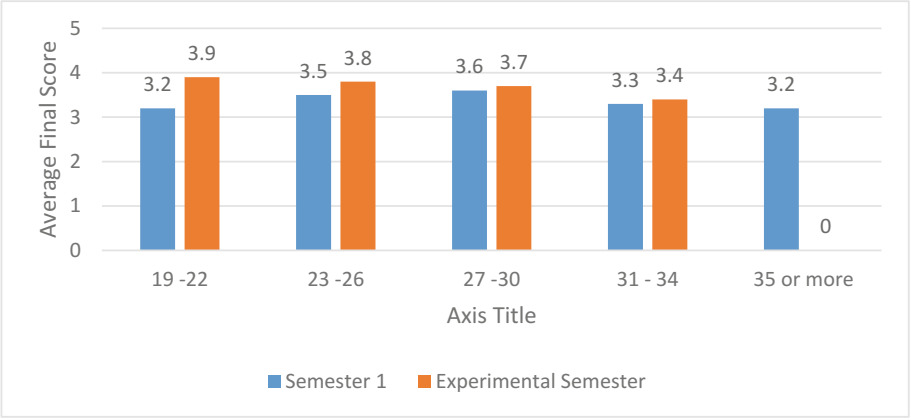

Fig. 7. Number of students failed the course by gender

6 Conclusions

According to the results, the implementation of gamification in the virtual course improved the educational effectiveness, causing a greater interest in the student learning process, which leads to a greater immersion in the contents of the course. Consequently, an increase of the average time of use and weekly number of entrance to the platform were observed. This interest also affected the continuity of students in the course, impacting and significantly decreasing the dropout rate. Moreover, an increase in the average final grade and the percentage of students that approved the course indicated a greater capture of the concepts and content of the course.

The study also showed that the participation frequency analysis in the gamification activities included in the platform could provide orientations towards the student's preferences, contributing in the definition of the player's profile who had a greater tendency of competition. This information provides guidelines for the improvement of gamification. Not all students got good results. One possible explanation is owed to personality, which directly affects the efficiency of gamification, due to the activities that motivate a certain group of students does not necessarily motivate the general group. Hence, a greater diversification of the elements can cause a greater effectiveness in the obtained results, as well as the use of surveys and tests could provide an early student's profile.

Lastly, the study showed that men between 23 and 26 years of age significantly improved their performance. A tentative interpretation might be that there was a greater affiliation among young people to the use and adaptation of technologies. The study showed that men had a greater motivation towards competition, while women showed greater participation in collaborative and social activities such as forums.

7 Discussion

The main empiric results from this study shows that gamification learning methods outperforms the conventional/non – gamification learning method in terms of: permanence of the students (continuity of the course), learner skills and immersion.

Another important result shows that the response from the user to the design prototype of the gamified course was positive, thus, in general terms the students accepted the new model.

In addition, the results of this study provided evidence that female college students were highly interested in playing computer games as male students. However, male generate a greater percentage improvement in each of the statistics evaluated as well as the group of students (male and female) between 23–26 years old. In this study case, the battles and rankings are among the gamification elements that have a major impact on enhancing students' inner motivation, this vary according to the player rol, who in this case had a greater inclination towards the competition. Therefore, it is crucial in this model that a feedback system includes challenges and positive reinforcement. Other than that, cooperation between students can be achieved by providing them with an interactive medium as the social fórum, enhancing social communications among learners, leading to a strong motivation and contribution of individuals in the social ambit.

The decreasing rate of students engagement while using virtual courses has been seen as an opportunity to explore gamification fields and using it to elaborate the online learning platform. Gamification will be serve as a motivation for all parties to participare actively in any virtual courses (educators and students).

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