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Abstract.

Reading in an adequate way evolves the process to understand the message, to have a comprehensible reading and acquire new knowledge. In recent times, students at the secondary level have reading problems and comprehension and these affect the academic development and learning. That is the reason why a study was carried out on the elements of gamification and reading comprehension to find out their influence on reading comprehension. A total of 165 students considering half of the population as an experimental group and the other half as a control group were the subject. The research work was experimental, and a pre-test was applied to determine the level ofreading comprehension prior to the study. The gamified activities were applied focused on four gamification elements to develop reading comprehension. Finally, a post testwas applied to verify the effectiveness of the gamification elements used and their activities. It is clear thee result of post test with 30,14% reading comprehension in the experimental group, versus 17,81% in the control group with a statistically significant difference, which represents 25% more than the conventional teaching. The results obtained during the research were positive since it has been possible to demonstrate that there is an influence of the elements of gamification within the reading comprehensionof the students.

Keywords: Gamification, elements of gamification, reading comprehension.

1 Introduction

Learning is a process that involves some skills necessary to acquire it and reading is an important one, people read every day and all the time.

While gamification are elements that teacher uses in the design of a learning activity by introducing game elements into his thinking in order to enrich that learning experience, direct and/or modify the behavior of students in the classroom. Nowadays, this process is an important transition. Most of the time it is not easy to understand the informant received. Also, for students is challenging to read because they find it boring or are not interested at all.

Reading skill helps to develop other skills like speaking and writing, but also, it helps to improve grammar and get more vocabulary. This is one of the reasons for paying special attention to involve students in reading, particularly in these times when they find so many stimuli around that takes them away from this purpose. The educational institutions and teachers have the responsibility to find the best way to motivate and promote reading comprehension.

The current research project has the main objective, to determine the influence of the gamification elements on the reading comprehension. The quasi-experimental method was applied for the development of the research and the design of the study was a pre- test and a post- test. Quantitative research allowed to collect accurate data on the current reading levels of students and those obtained thanks to the insertion of gamification elements. It allowed testing the hypothesis, the use of the elements of gamification challenge, competition, cooperation, reward, and incentive produce an effect on the comprehensive reading level on students, and establishing causal relationships in the presentation of the research variables. The instrument was a questionnaire related to reading comprehension.

2 Methodology

The research was qualitative-quantitative, evaluating comprehensive reading ability quantifying it through written tests and comparing numerical values with statistical tools. The method used was inductive, since from the data of the evaluations it inferred the effect that the ap-

plication of the gamification elements had on the comprehensive reading capacity of the experimental group.

The research level project was descriptive, after applying four elements of gamification, the effect on comprehensive reading is determined. The degree project is experimental, working on two groups, experimental and control, applying elements and evaluating the effect through inferentialstatistics.

All students were considered for the research, a total of 165 students considering half of the population as an experimental group and the other half as a control group. To determine the sample size of the experimental group the formula for finite populations was applied, obtaining a value of minimum 69 students for the experimental group. (Asesoría Económica y Marketing, 2019)

Considering the difficulties in splitting between the students of a parallel, it was decided to separate by rooms, so that two rooms (A and C) became the control group, and the rooms (B and D) became the experimental group. This does not affect the reliability of the results, since they were chosen randomly, and the minimum sample size was respected.

2.1 Data collection

Comprehensive reading assessment, in the pre and post experiment stage, was carried out using an adapted test based on the KET assessment as instruments. The pre-test was carried out with two purposes, on the one hand to determine the level that the students present in comprehensive reading, and on the other, to elucidate if there is any difference -at a statistical level- between the reading levels of the experimental and control groups in which case it would be necessary to apply a correction to the results.

During the development of the classes with gamification (experimental group) the gamification elements were applied using specific teaching resources for each type of element, which are listed here, but detailed and discussed in the results section.

At the end of the application of each gamification element, short quizzes were applied to both groups to consolidate the contents and obtain an overview of the individual effect of each element. The quizzes were weighted on a scale between 0 and 10 points.

Once the experimental process was completed, a standardized post-test was applied, in a similar way at the beginning, based on an adapted format of the KET test model for reading comprehension, and validated, like the pre-test, by 3 professors of the Master's program in Pedagogy of National and Foreign Languages, English Mention, from the Technical University of Ambato-Ecuador. Pre and post test evaluations were conducted with a 20 questions quiz and quantified using a rating scale between 0 and 10 points.

2.2 Statistical analysis

To test the hypothesis, the t-Student test was applied, which allows comparing means of two samples or of a sample with a value considered true or of reference. An advantage of this test is its applicability to data sets with a data number around thirty. (Livingston, 2004)

There are two approaches to performing the Student's test: calculating the experimental "t" statistic or obtaining the p-value. Of these, the most widely used is the determination of the p-value supported by statistical software. In this research, Minitab®, version 19, was used and the analysis was carried out considering a confidence level of 95%.

The interpretation of the p-value and its relation to hypothesis testing is as follows:

- If the p-value ≥ 0.05, the null hypothesis is accepted (both means are statistically similar)
- If the p-value < 0.05, the null hypothesis is rejected, accepting the alternative hypothesis. (both means are statistically different)

To compare the individual effect of each gamification element, a comparison of the averages of scores of the tests carried out after the application of each element was used. The comparison criterion used was the same as for the general study, that is, the Student's t-test with a

confidence level of 95% with an interpretation of the p-value>
0.05 as the absence of difference and the p-value <0.05 as the statistically significant difference.

Finally, to quantify the variation between the results of the experimental group versus the control group, in all cases where the difference in means is statistically significant, it was chosen to express in terms of relative difference, calculated as.

$$variation = \frac{\bar{x}_e - \bar{x}_c}{\bar{x}_c} \cdot 100 \quad (1)$$

Being xe the mean scores of the experimental group and xc the mean scores of the control group. The relative difference is expressed as a percentage.

3 Results and discussion

3.1. Gamification elements

For the identification and subsequent selection of the gamification elements to be applied, those compiled in the bibliographic review by Carlos Luis Sánchez were taken as a reference (Sánchez Pacheco, 2019) as well as the elements listed by Virginia Gaitán in the Educativa blog (Gaitán, 2013).

Table 1. Gamification elements

Gamification Element and alternative name	*Description*

Competition, acumulation, accumulation of point, score, classifications Scaling, Level scaling, leadersboard, Digital markers.	It is the competitors points received for completing a task or getting the objective. It is the visual representationfor the competitors that allows them to keep track of their progress.
Rewards & incentive, obtaining prizes, gifts, goodies, Badges, digital badges.	A prize received for an overcome challenge.
Challenges	It is the designed activity for the competitor to get engage in the activity until it is achieved.
Collaboration,	This is the element that helps attract the players through a friendly competition in which each participant from the group must contribute.
Missions, Goals	The missions are the guidelines for the players to understand what they need to reach and is helpful to have the engage in the activity.
Feedback, Immediate feedback	It provides the players (students) with some understanding of their progress and what they are achieving.

Note: This table was adapted from Sánchez Pacheco, C. L. (2019). Elementos de la gamificación y sus impactos en la enseñanza y el aprendizaje. Identidad bolivariana, 51-62 and compile by the author.

From the list of elements, it was decided to work with <challenge>, <competition>, <collaboration> and <reward & incentive>, as they were the most objective applicability. There was not included <feedback> because this element is used even in non-gamified activities and its effect is not exclusive to a playful environment.

<Goals>were not used either, because, on the one hand, the research design considered activities shorter than those related to achieving a goal, and because, its effect could be comparable to that of competition by generating both sense of achievement and hierarchy.

3.2. Application of gamification elements

For the application of the gamification elements, a review was made of the most widely used ICT tools for education, comparing their characteristics with those of the challenge, competition, cooperation, and reward & incentive elements. Finally, the following tools were chosen and assigned. See the table below.

Table 2. Application of gamification elements

Gamification element	*Tool*	*Description*	*Place where the element is placed*
Challenge	Educaplay	Platform that allows teachers to create different types of multimedia educational activities, through different scenarios or activities such as crosswords, word search, riddles, dictations, among others	The generation of activities that test students' abilities to solve problems and reach the objective.
Competition	Kahoot	This is a tool that allows the creation of tests or questionnaires.	The generation of a ranking and the recognition of the best scored stimulates the competition.

Cooperation	Wordwall	This is a tool that allows the creation of interactive activities such as questionnaires, true and false, ordering of words, missing words, matching, anagrams, maze, crosswords, word search puzzle, among others.	The generation of activities that made students work in a collaborative way to complete them.
Reward & Incentive	Class Dojo	This is a platform that helps to manage the classroom based on scores and badges based on the student's behavior and work.	There were created two classes in the platform where students got enrolled. They received extra points and badges for their participation, teamwork, persistence, working hard, and helpingothers.

Note: the gamification elements, the description and the placement were compiled by the author.

It should be noted that, although there are platforms fully focused on gamification -like Centrical, uLearn Play, ClassCraft- these would imply prior training in its use and the introduction of the new variable (learning to use the platform) that would reduce the reliability of the results. That is why it was preferred to use previously known tools and in which, due to that previous use, they are no longer a variable to be considered, but are able to use in una gamification way.

3.3. Pretest results

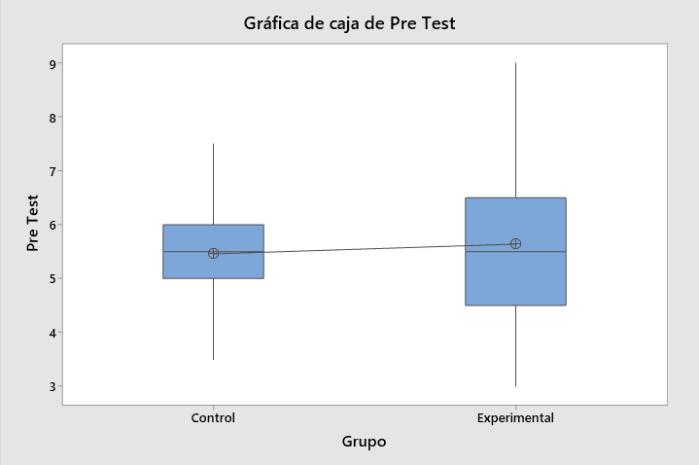
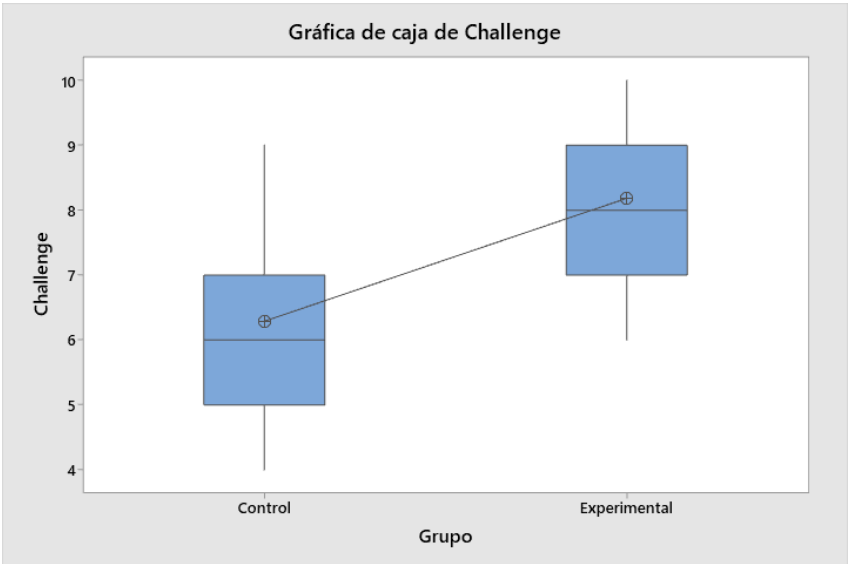


Fig. 1. Shows the results obtained after the pre-test between the control and experimental groups.

The result of the p-value confirms the null hypothesis, which indicates that both groups in the initial stage are statistically similar in their comprehension reading level. This similarity is due to the fact that both groups share similar teaching environments. Additionally, this indicated that it was not necessary to make bias corrections to the results of the following stages.

3.4. Challenge



3.5. Fig. 2. This graphic shows the result obtained with the application of the challenge element.

The p-value of zero indicates that the null hypothesis (similarity) should be rejected and the alternative (difference) accepted. By accepting that the difference is statistically significant, the relative variation formula was applied, giving a value of 30,05%

$$VarChallenge = \frac{8{,}18 - 6{,}29}{6{,}29} \cdot 100 = 30{,}05\% \quad (2)$$

The application of the "challenge" element has a positive impact on the performance of the students in the experimental group, obtaining an average score 30% higher than the average score of the control group. This may be due to a perceived challenge, students devote more attention and concentration to the reading activity, which facilitates comprehension. The foregoing would be in accordance with what was mentioned in the Sánchez-Pacheco review, where it indicates that the challenge consolidates the learning results through the effects of motivation and satisfaction. (Sánchez Pacheco, 2019)

3.6. Competition

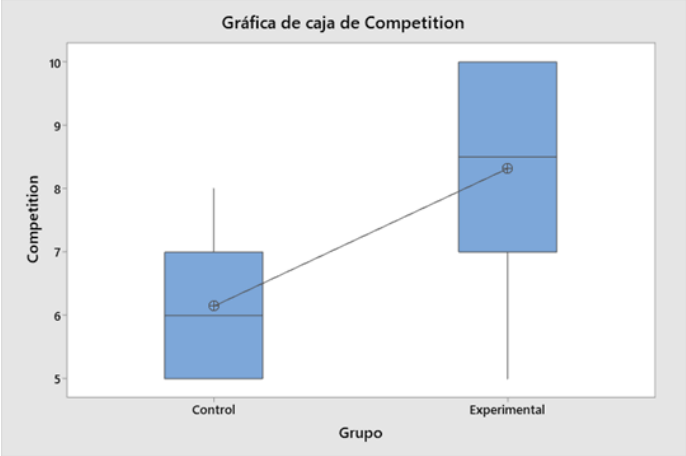


Fig. 3. This graphic shows the result obtained with the application of the competition element.

In the case of the "competition" element, the p-value of zero indicates that the null hypothesis (similarity) should be rejected and the alternative (difference) accepted. By verifying that the difference is statistically significant, the relative variation formula was applied, giving a value of +30,05%

$$Var_{Challenge} = \frac{8{,}32 - 6{,}145}{6{,}145} \cdot 100 = 35{,}39\% \quad (3)$$

Competition, as a preponderant element in games, particularly those on the Internet, would seem to function as a driver, making the student seek to capture the greatest amount of information, which would give him a greater chance of beating his so-called opponents. This would explain why the experimental group achieves an average score 35.39% higher than that of the control group. The Sánchez-Pacheco review shows that most authors consider a motivational effect related to the results-achievement approach and commitment to the activity (Sánchez Pacheco, 2019)

3.7. Cooperation

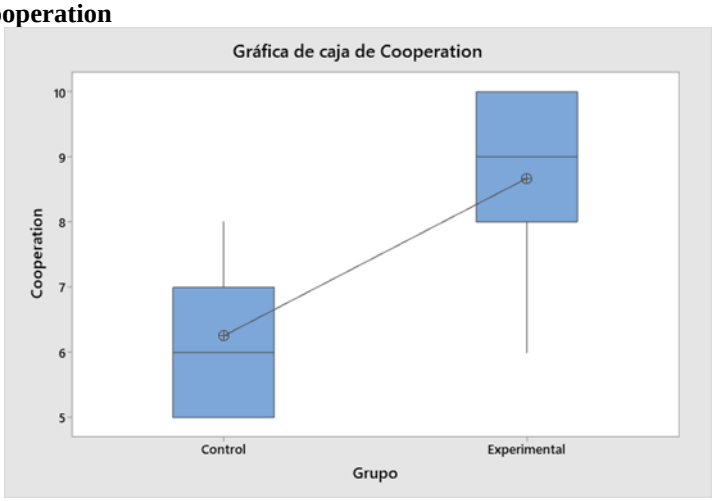


Fig. 4. This graphic shows the result obtained with the application of the cooperation element.

In the case of the "competition" element, the p-value of zero indicates that the null hypothesis (similarity) should be rejected and the alternative (difference) accepted. By verifying that the difference is statistically significant, the relative variation formula was applied, giving a value of +30,05%

The difference between mean, the biggest within the gamification elements, can be seen in the box-and-whisker plot above.

$$VarChallenge = \frac{8{,}67 - 6{,}253}{6{,}253} \cdot 100 = 38{,}65\% \quad (4)$$

Cooperation as an element of gamification has achieved the highest incidence. This could be due to the fact that it involves a dynamic similar to that of so-called network games, where part of the attraction is the interaction with other players seeking common goals. In a similar analysis, Pechenkina et al. and Cózar-Guitiérrez et al., cited by Sánchez-

Pacheco, link this element with an effect of commitment and involvement with the learning object (Sánchez Pacheco, 2019). This, in addition to individual cognitive components, implies social factors and synergistic effects, which would explain that the use of this element is the one that achieves the most significant improvement, around 38.65%

3.8. Post Test and Final Results

In the final stage of the study, to obtain a general comparison of the incidence of the use of the elements, a standardized comprehensive reading assessment was applied again, the results of which were analyzed using the Student's t test, obtaining the following results.

The p-value, being less than 0.05, indicates that the null hypothesis (similarity) should be rejected and the alternative hypothesis accepted, which postulates the statistical difference between the scores obtained in the standardized test. On the other hand, it should be noted that the relative variation is less than those calculated for each individual element.

$$Var_{Challenge} = \frac{8{,}073 - 6{,}43}{6{,}43} \cdot 100 = 25{,}55\% \quad (5)$$

The box-and-whisker plot (see above) visually shows that the difference, but that difference is less intense than showed up in the individual elements.

The general result of the post-test confirms what was previously observed in the element tests, that is, that the experimental group obtained a higher grade average than the control group. It should be noted, however, that the difference is less than in the cases of individual elements, this could be due to the existence of a "novelty factor" at the time of applying each element that, supported by short-term memory, helps in the evaluation at the end of class. However, the post-test requires great-

er use of cognitive skills, reasoning and long-term memory, so the improvement, although it exists, is of lesser magnitude, around 25.55%.

Using the two extreme values, it could be said that the application of gamification elements can influence an improvement of the grades between 25% and 38%.

3.9. Overall results

Summarizing the results of the research, and to obtain an overview of the effect of the use of gamification elements, the following table and graph are presented. In them that confront the results obtained by the study groups throughout the different steps of investigation

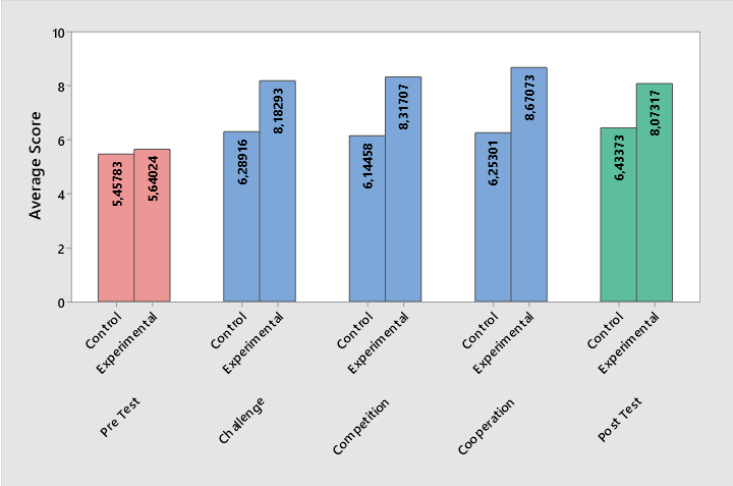


Fig. 5. Overall results

It can be seen that, prior to the application of the gamification elements (pre-test, pink bars), there is no significant difference between the groups, visually confirming what was determined and analyzed in section 4.3.

As soon as the gamification elements begin to be applied (blue bars), a separation of results is observed. There, the scores in the test group being higher than those in

the control group; confirming what was determined statistically in numerals 4.4, 4.5 and 4.6.

Finally, when comparing the overall performance of the two groups against a reading comprehension test, the results of the test group exceed those of the control group by 25.51%.

In all cases of application of gamification elements, there is a beneficial effect regarding the development of comprehensive reading skills, with the improvement in qualifications being between 29 and 38%. The result of the post-test evaluation of reading comprehension shows a difference of 25.51% in favor of the experimental group, which received the class with the implementation of gamification elements.

4. Conclusions

The students present an average reading comprehension of 5.64/10 in the experimental group and 5.46/10 in the control group, values that are statistically similar.

Based on a bibliographic review, six types of gamification elements were identified, of which, based on their compatibility with integration with online educational tools, four were chosen: challenge, competition, cooperation and reward-incentive.

The application of gamification elements produced increases in the score obtained; thus, the use of "challenge" increased the grades by 29.84%; "competition" increased by 35.50%; and the use of "cooperation" increased ratings by 38.72%. In all cases the differences are statistically significant.

The global effect of the use of the selected gamification elements on the reading comprehension of the students in the experimental group produced an improvement in the reading comprehension test of 25.51% compared to the control group; which, according to the t-studet test, is a significant difference.

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