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Gamification as a Methodological Strategy and Its Impact on the Academic Performance of University Students

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Abstract. Higher Education is going through profound structural changes, from the methodological orientation in its learning processes to the transformation in the applicable components inside and outside the classroom, where the teacher-student relationship went from being merely a delivery of information and reception of it to becoming a set of knowledge that merges and allows interaction between both participants in a much more lively way, with powerful tools that expand understanding through technological innovation and the joint application of strategies, and skills developed in the different branches of knowledge; therefore, the present work aimed to review existing academic literature and describe the technical power of gamification as a strategy to improve the development of learning in teachers. It was also analyzed through surveys (with the help of the QuestionPro tool) the perspectives that teachers and students have about gamification as a tool for academic activities; In addition, traditional evaluations and gamified tests were carried out, resulting in the fact that 78% of teachers consider the implementation of gamified strategies to be suitable, 92% of students assure that their performance and use have improved under this modality, going from 83% to 94% in their academic evaluations.

Keywords: Gamification · Transversality · Educational methods · Higher education

1 Introduction

The social and economic changes over time have gone hand in hand with the updates and changes in the educational design of the different developed countries and even more so with the imperative obligation of the developing or emerging nations, as in the case of many Latin American countries, where the lack of resources and government investment have been decisive factors for educational backwardness. However, since the exponential arrival of the Covid-19 Pandemic, world education has been involved in the need to redesign the tools that had been used effectively in face-to-face classes until now, taking as the main variable, the new modality of virtual education and the challenging changes that it established in the academic communities of different levels.

2   The Importance of Gamification as a Methodological Competence

On an educational level, these processes are very similar to the aforementioned business context. In fact, from the configuration that strengthens the higher education system, it must be considered indispensably that students are not the products, that the true product is education, and that its quality is subject to innovative and investigative technological growth, which allows strengthening the qualification in their students [1] since they must maintain the same dynamics and must find in their role a challenge to achieve the goals set by each of the teachers, knowing how to invest their time and energies according to each stage of the established academic process.

According to the studies [5], educational institutions face gigantic challenges that involve two essential aspects to achieving quality learning, such as lack of motivation and commitment. However, this is an effect of the poor teaching methodology in terms of strategies that have the student highly motivated and committed to the systematic progress of their academic challenges, being, in effect, a more aggravating factor from virtual education, as described [11], when referring that education in the 21st century must adapt to technological developments, it is not about abandoning face-to-face learning, but rather, using blended learning, in where students can compete and overcome academic challenges, experiencing together with digital literacy a more enriching educational development.

During the implementation of gamification, personal qualities are developed that involve concepts such as persistence, creativity, and resilience, as well as a vital improvement in commitment and motivation, as stated [2], when referring that teaching trends must be much more effective, adapting personalized learning modules according to the level of skills required, implementing gamification and the educational experience based on games (puzzles, crosswords, riddles, knowledge exchange, among others).

According to [5], gamification positively affects three crucial areas: a) cognitive: The first observation of the challenges posed, as well as the different levels of complexity of the task, allow this attribute to be fully exploited favorably; b) Emotional: From the perspective of the game, there is an awakening of very marked emotions where success and failure are elementary pieces to reaffirm knowledge achieved from the perspective of challenge and challenge; c) social: the roles from this area allow to situate the performance of each actor assuming different roles, managing the adaptability to different scenarios and situations.

The contributions of [12], establish a clear perspective of the relationship that exists between active learning whose purpose is that students can be protagonists in each systematic stage of knowledge and learning. One of the ways to be able to link this transformative conception of teaching methodology is precisely gamification.

3   Gamification and University Evaluation

Traditional evaluation has been another of many factors that have had a negative influence on student learning and at multiple times has affected the good work that can be achieved in the development of the course. Based on the contributions of [12] the principles of gamification can be favorably integrated from evaluations that promote the generation of

challenges and challenges from the virtual game. In this context, the student is one more player, who projects his motivation to compete, share and win. From this connotation, a harmonious and antagonistic climate is generated about the common evaluation, the same one that at certain times has lacked effectiveness when evidencing the objective learning of the students at all levels, without ever forgetting that this type of learning methodology integrated by gamification must necessarily be correctly balanced between two closely related factors: education and culture, allowing a holistic academic development that integrates knowledge, science, character, creativity, habits, values and innovation in a single unit [4].

According to the organization of the Ministry of People's Power for Education, educational evaluation has a major impact on the development of learning, so it is important to be able to understand it and adopt mechanisms that generate a positive impact, as can be seen in what they propose [10] when referring that introducing higher order thinking skills (HOT) allows evaluation practices that include teacher and student assessment to determine their academic performance while solving problems of daily life from the curricular context by applying gamification.

3.1 The Potential of Gamification as an Evaluative Resource

Competition as a gamification mechanic in the classroom is an enriching vision that leads to the analysis of problem-based learning and cooperative learning as its main gears, this, in turn, allows generating awareness of the meaning of what healthy competition is. The studies of Cantador citing by [8] reflect that gamification from competition generates high motivation in students, obtaining 75% utility and effectiveness in the application of this resource.

4   Model of Development by Competencies and Gamification

Competences are the conceptual construct that is attributed to the accumulation of skills and abilities that people manage to acquire according to a rigorous process of academic learning, where not only skills linked to disciplinary knowledge are learned, but also a series of tools complementary that help the student to face reality; and this one, being familiar with the challenges and challenges that professional praxis entails, can face the challenges in a more effective and timely manner.

4.1 Specific Skills as a Transversal Axis in Gamified Strategies

Specific skills contribute exponentially to the comprehensive development of the student, which is why they constitute one of the ultimate goals of university education in a global context, where the construction of knowledge associated with their professional field does not guarantee the future success of university students. For this reason, it is necessary a teaching methodology well aligned to extend its field of action towards the improvement of generic skills, thus achieving comprehensive learning, but above all skillful in problem-solving, decision-making, and efficiency in the critical analysis of real situations according to their professional field, therefore, it is a high priority that

there is significant work motivation in teachers, creating structures based on institutional success in Higher Education centers, in where, components such as socialization, strategy, information, leadership, environment and ICT domain are combined to strengthen the organizational culture aimed at achieving the visions and missions of academic institutions and, generate a friendly environment of high value and educational performance, both for teachers and students [9].

5 Materials and Methods

5.1 Methods

The methodological development of this research presented a study of the non-experimental correlational design of the Transectional type (also called cross-sectional) supported by deductive reasoning, under a mixed approach. [3] describe that the correlational study aims to measure the relationship or "association that exists between two or more concepts, categories or variables, compare each of them and then quantifies and analyzes its connection", allowing Transectional information to be collected (the representative sample was studied at a given time) achieving, under deductive reasoning, "organizing the premises into syllogisms that indicate new relationships as it goes from the general to the specific" [7] where the mixed approach allowed "collecting, analyzing and mixing (integrating and connecting) qualitative and quantitative data in a single study for its pertinent inquiry" [3].

The research presented a field research modality, given that information was collected from students from five universities in the city of Guayaquil from the first cycle of 2022, studying the last semester of 3 different careers to receive the perception they have regarding the use of gamification within the classroom by their teachers, and based on this, determine the academic performance of students, under the use of gamification. Descriptive statistics were used to collect, store, order, make tables, graphs, and calculate basic parameters on the collected data set.

5.2 Population and Sample

Population. For [6], "a population is a set of all the elements that we are studying, about which we try to conclude", where the elements that are part of it can be determined in a finite population (when the number of individuals is known) and infinite (when the number of individuals that comprise it is unknown), in the specific case of this investigation the set of units to be observed are 1,360 students from five universities in the city of Guayaquil (due to professional ethics, the name of each of them was not described) belonging to three Faculties: Education Sciences, Economics and Psychology (for each University) that completed the last semester of their careers in the first cycle of 2022, for Consequently, the population as known was described as a finite population.

Sample. Knowing the study population and optimizing time and results, the information collection work will take a representative sample of all the students described, applying a simple random probabilistic sample, in such a way that each of the units to be observed will have the possibility of being chosen.

When identifying the population of finite type, the representative sample of the present investigation is determined by means of the following formula:

$$n = \frac{N * Z^2 * p * q}{e^2 * (N - 1) + Z^2 * p * q} \tag{1}$$

where (Table 1):

Table 1. Parameters stipulated in the formula, definition and the values established.

Parameter	Definition	Value
n	Sample size to find	–
N	Population size	1.360
Z	Confidence level	95% = 1.96
p	Probability of the studied event occurring (success)	50% = 0.50
q	1 − p = Probability that the studied event will not occur	1–0.5 = 0.50
e	Maximum accepted estimation error	5% = 0,05

Once the parameters defined in the formula and the value that has been considered to be used have been determined, the corresponding calculations are carried out:

$$n = \frac{1.360 * 1.96^2 * 0.50 * 0.50}{0.05^2 * (1.360 - 1) + 1.96^2 * 0.50 * 0.50} \tag{2}$$

When performing the respective calculations, the following value was obtained:

$$n = 299, 72 = 300 \tag{3}$$

The result that was obtained to carry out the information collection was 300 samples that were applied to the students of the chosen Universities. Therefore, 20 students per Faculty were chosen (it was mentioned that each University collaborated with three Faculties), giving a total of 60 samples per university center, that is, 300 samples from the five Universities.

Information was also collected on some subjects with their respective grades, where grades were compared under the traditional educational system and with gamified strategies.

It is also emphasized that there was the help of a teacher for each collaborating Faculty (three teachers per university), since there were five Universities, 15 teachers (between 25 and 50 years old) participated to carry out the information gathering.

5.3 Materials

The material that was used to collect the information was the survey, which through the QuestionPro application, using the Likert rating scale, allowed to quantify and manage

the answers offered by teachers and students. Where it was possible to evaluate the scale of frequency, importance, and the degree of satisfaction presented by university students concerning the application of gamification by their teachers as a methodological strategy inside and outside the classroom. In the same way, the degree of importance, difficulty, and value that gamification represents for teachers was investigated, while it was collected if gamification is valid to improve the performance of university students and if it is feasible that in all universities and careers, gamified strategies are fully applied in the subjects taught. A comparative evaluation was also carried out between the qualifications under traditional and gamified education.

6   Results

The results obtained from the surveys carried out made it possible to measure the perception that teachers and students have regarding the implementation of gamification as a learning method in university academic activities. The data collected is presented below:

6.1   Survey of University Teachers About Their Perception of Gamified Tools as Methodological Strategies in Academic Subjects to Improve the Performance of University Students
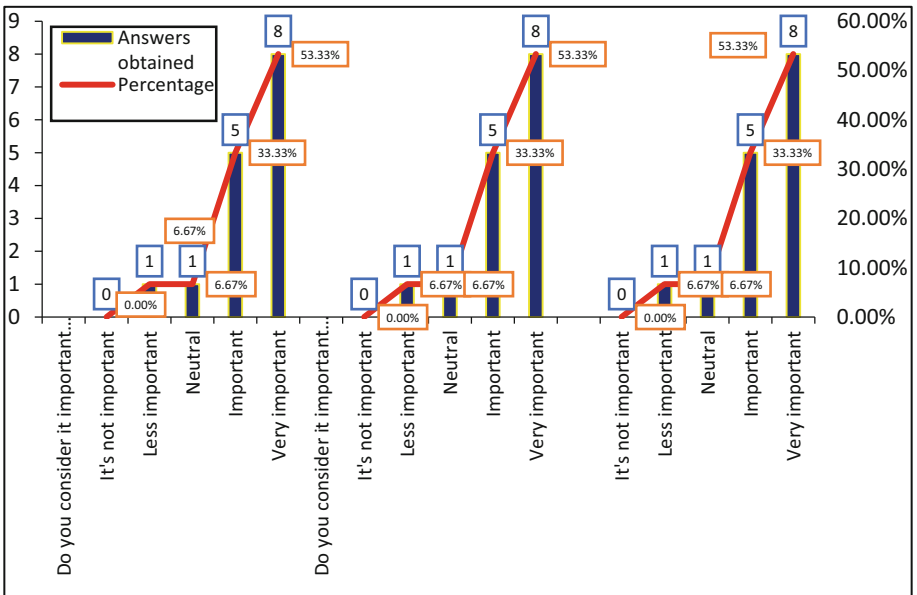
Fig. 1. Unified of the 3 questions asked to teachers about the degree of importance that gamification has in academic activities.

The answers received from the 15 teachers of the five universities under study regarding the degree of importance of applying gamified tools as a methodological strategy to work on academic learning and the improvement of the performance of university students concerning their subjects revealed that the weighted analysis of all the questions registered that 53.3% consider that it is very important to apply gamified tools for the positive development of their students, while 33.3% affirmed that if it is important, 6.7% remain neutral and believes that it is of little importance for these methodological strategies based on gamification. An average of 4.33 was obtained from all the collected data, presenting a standard deviation of 0.90 to the average, which implies that there is a uniform dispersion in the responses reached (Figs. 1 and 2).
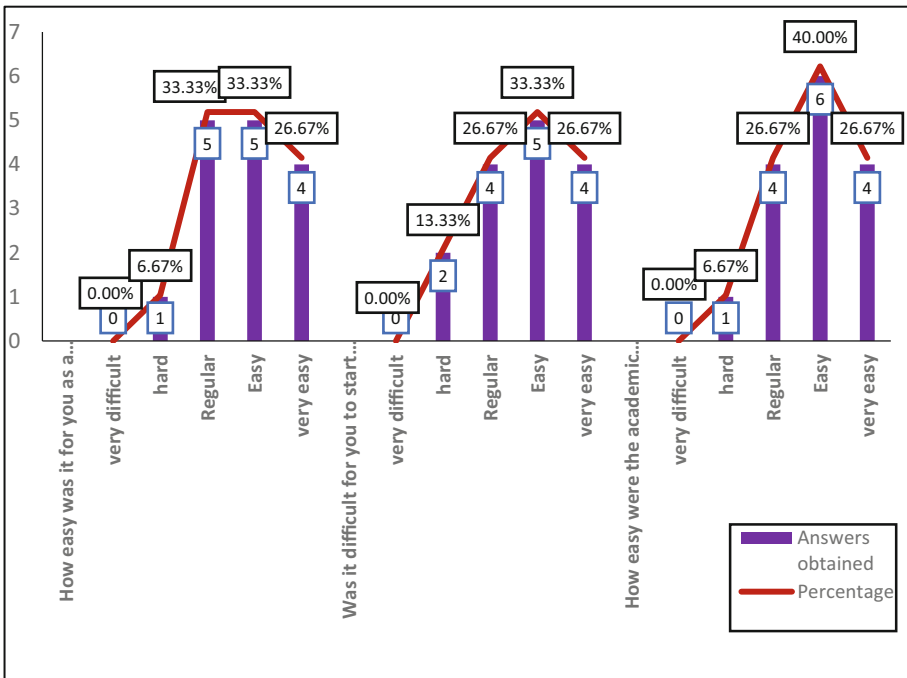
Fig. 2. Unified of the three questions asked to teachers regarding the degree of difficulty that occurs when implementing gamification to their academic activities.

The answers offered by the 15 teachers from the five universities under study regarding the **degree of difficulty** they have in mastering and evaluating university students using gamified tools as a methodological strategy to work on academic learning, where the weighting of all the questions revealed that 35.6% consider that it is easy to master gamified tools for the positive development of their students, while 28.9% indicated that it was regular for them to master gamified techniques, 26.7% affirmed that it is very easy to master this type of gamified tools, 8.9% answered that it is difficult to master gamified techniques, for none of them it was very difficult 0%. An Average of 3.8 was obtained

from all the selected data, presenting a Standard Deviation of 0.96 to the average, which implies that there is a uniform dispersion in the responses obtained (Fig. 3).
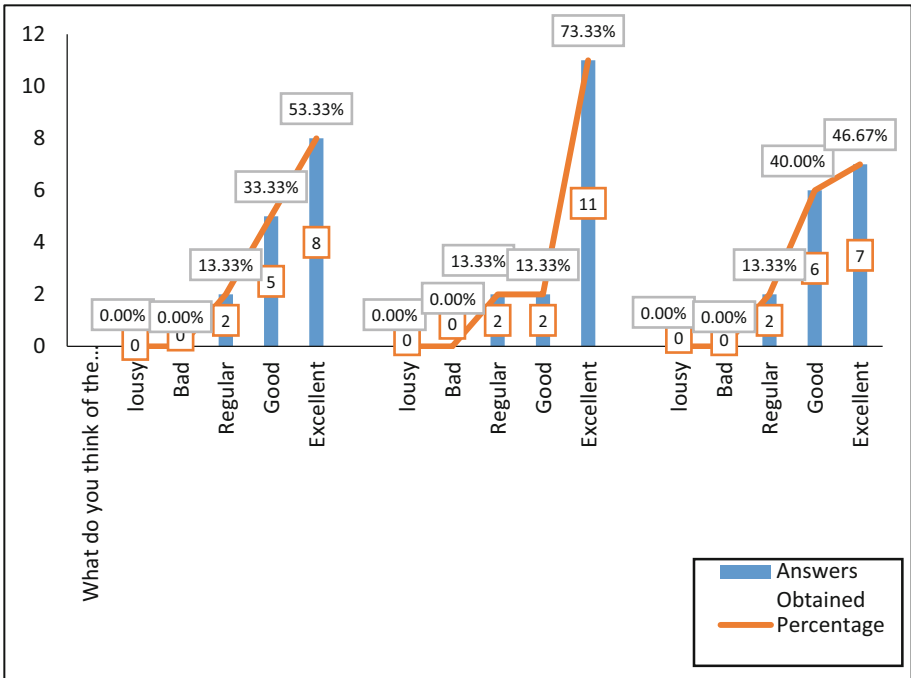
Fig. 3. Unified of the three questions asked to the teachers regarding the degree of value that the experience of using gamification has, being adapted in all the signatures for the improvement of the performance and use of university students.

The 15 teachers from the five universities under study answered the questions regarding the **degree of value** of the experience of using gamification in teaching work in all subjects to enhance the performance and achievement of university students. That have been weighted in their results to identify what, 57.8% consider that the teaching experience is excellent, the idea of applying gamification in all subjects and the results obtained, while 28.9% consider it to be good, 13.3% confessed that everything obtained from gamification is regular (0% of the teachers think the idea is terrible), the average obtained from the collected data was 4.4, presenting a standard deviation of 0.73 to the mean, which implies that there is a uniform dispersion in the data obtained from the questions posed.

6.2 Survey of University Students Regarding the Use of Gamification as a Methodological Strategy by Their Teachers

The answers obtained from the questions regarding the degree of the frequency with which teachers use methodological strategies, gamified tools, and assign tasks applying
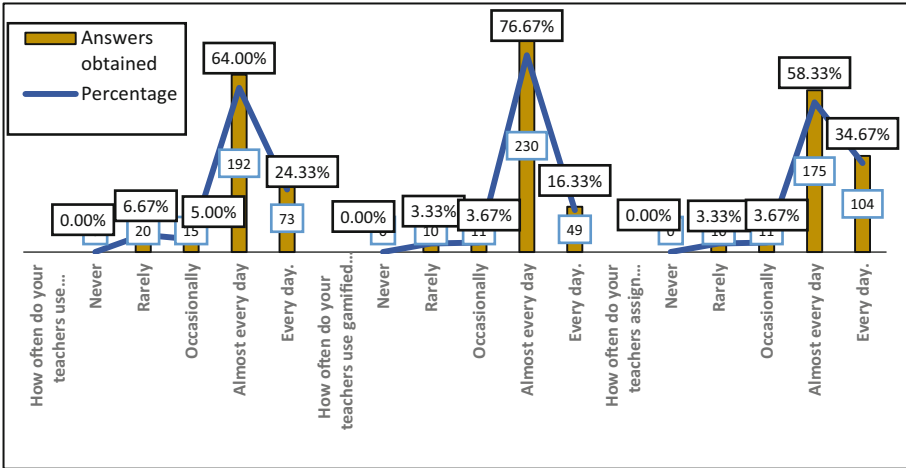
Fig. 4. Unified of the answers obtained in relation to the degree of frequency with the teachers they carry out certain gamified activities.

gamification revealed a weighted percentage of 66.31% that almost every day teachers use gamification in their classes, 25.11% stated that their teachers use gamification every day, 4.11% occasionally, and 4.44% indicated that they rarely use gamification (Figs. 4 and 5).
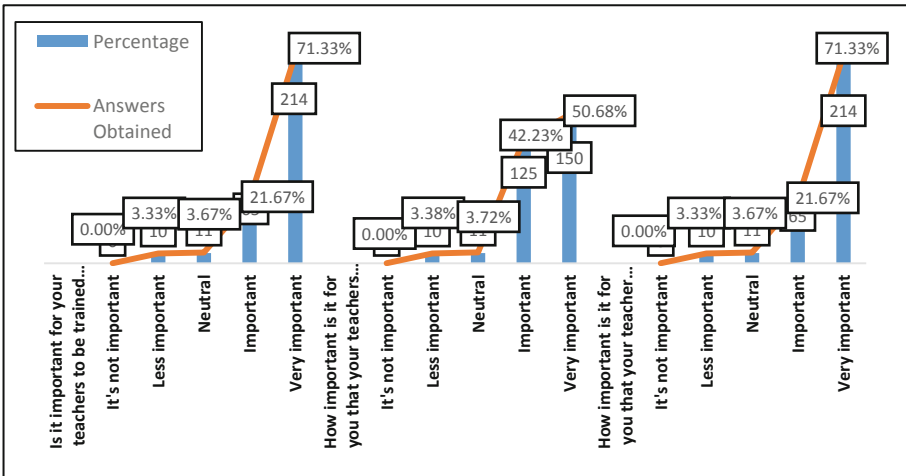
Fig. 5. Unified of the answers obtained regarding the degree of importance that they find as students that their teachers manage, use and evaluate their performance through gamified tools.

The results that were obtained about the degree of importance that the university students surveyed have on the level of training, the development of dynamics and the

evaluation through gamified strategies in academic activities revealed a weighted percentage of the three questions, where, 64.45% believe that it is very important, 28.52% that it is important, those who maintain a neutral response 3.68%, while 3.35% consider that it is not important (Fig. 6).
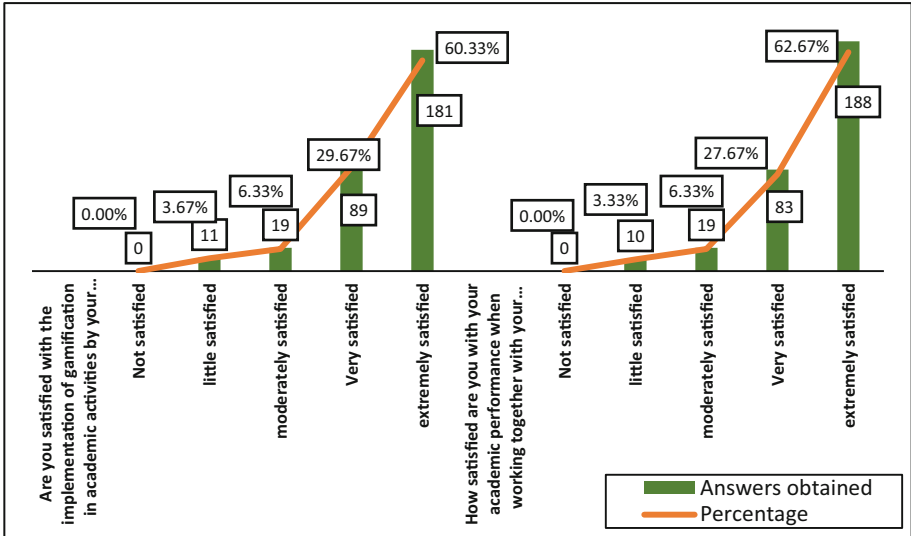
Fig. 6. Unified of the answers obtained in relation to the degree of satisfaction that students feel when working on gamified academic activities with their teachers.

Regarding the degree of satisfaction that university students have regarding the use of gamification in academic activities and that thanks to them their performance and use present an improvement, it was found that the weighted responses to the three questions indicated that 61.5% of the students are extremely satisfied, 28.7% are very satisfied, 6.3% are moderately satisfied, 3.5% are not very satisfied, while none stated not satisfied (0%).

6.3   Academic Performance of University Students

The results obtained from the qualifications achieved by university students under the two modalities worked by teachers: traditional modality and gamified strategies modality (the qualifications of 45 students from the three university faculties (Science of Education, Economics and Psychology) of the five universities, as well as the selection of five common core subjects observed in the study, presented the following information:

Table 2. Achievement of university students

# estudents	Faculty	Course	Ratings without gamified tools	Ratings with gamified tools
Use of university students without gamified strategies and with gamified strategies				
1	Sciences of Education	Philosophical Anthropology	8	9,5
2	Sciences of Education	Philosophical Anthropology	7,2	9
3	Sciences of Education	Philosophical Anthropology	8,4	8,9
4	Sciences of Education	Educational Policy	6,9	9
5	Sciences of Education	Educational Policy	7,1	8,5
6	Sciences of Education	Educational Policy	9	9
7	Sciences of Education	Sociology of Education	8,3	8,9
8	Sciences of Education	Sociology of Education	7,9	9
9	Sciences of Education	Sociology of Education	9,2	10
10	Sciences of Education	Educational technology	7,4	9,5
11	Sciences of Education	Educational technology	8,6	9,3
12	Sciences of Education	Educational technology	6,7	10
13	Sciences of Education	Managerial skills	7,8	9,4
14	Sciences of Education	Managerial skills	9,2	9,3

(*continued*)

Table 2. (*continued*)

| # estudents	Faculty	Course	Ratings without gamified tools	Ratings with gamified tools
15	Sciences of Education	Managerial skills	8,6	9,9
16	Economic Sciences	Public finances	6,8	8,9
17	Economic Sciences	Public finances	8,8	10
18	Economic Sciences	Public finances	9	10
19	Economic Sciences	Local development	8,3	9,6
20	Economic Sciences	Local development	9,5	10
21	Economic Sciences	Local development	10	10
22	Economic Sciences	Project Evaluation	7,4	10
23	Economic Sciences	Project Evaluation	7,6	9,1
24	Economic Sciences	Project Evaluation	6,9	8,7
25	Economic Sciences	International Economics	8,1	9,7
26	Economic Sciences	International Economics	6,8	7,9
27	Economic Sciences	International Economics	8,3	9,2
28	Economic Sciences	Strategic planning	9,3	10
29	Economic Sciences	Strategic planning	8,7	9,8
30	Economic Sciences	Strategic planning	7,9	8,6
31	Bachelor of Psychology	Professional Psychology and Ethics	9,1	10

Table 2. (*continued*)

Use of university students without gamified strategies and with gamified strategies

# estudents	Faculty	Course	Ratings without gamified tools	Ratings with gamified tools
32	Bachelor of Psychology	Professional Psychology and Ethics	8,3	9,5
33	Bachelor of Psychology	Professional Psychology and Ethics	7,6	8,7
34	Bachelor of Psychology	Vocational and Occupational Guidance	10	10
35	Bachelor of Psychology	Vocational and Occupational Guidance	9,2	10
36	Bachelor of Psychology	Vocational and Occupational Guidance	7,9	9,2
37	Bachelor of Psychology	Clinical Psychology and Psychotherapy II	8,1	8,9
38	Bachelor of Psychology	Clinical Psychology and Psychotherapy II	10	10
39	Bachelor of Psychology	Clinical Psychology and Psychotherapy II	9,7	10
40	Bachelor of Psychology	Forensic psychology	8,5	9,9
41	Bachelor of Psychology	Forensic psychology	9,7	10
42	Bachelor of Psychology	Forensic psychology	10	10
43	Bachelor of Psychology	Clinical and Psychopharmacology	8,5	9,3
44	Bachelor of Psychology	Clinical and Psychopharmacology	7,1	8,7
45	Bachelor of Psychology	Clinical and Psychopharmacology	6,9	8,9

Note: Information compiled from the grades obtained from university students

The average or weighted balance point of the set of qualifications obtained from the traditional methodological strategies of education was 8.3, with a standard deviation of 0.99 with respect to the average, while the weighted of the qualifications obtained of the students under the gamified education strategies had a result of 9.4 and a standard deviation of 0.55 with respect to the average (Fig. 7).
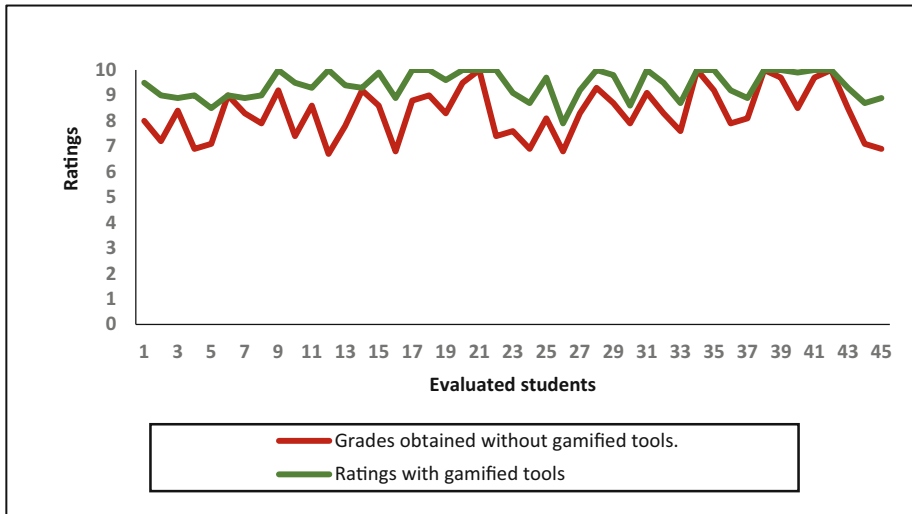
Fig. 7. Trends presented by the scores of the 45 students evaluated between traditional educational strategies and gamified methodological strategies. Information adapted from the ratings in Table 2.

7   Discussion and Conclusions

The results obtained in the present study that refers to gamification as a methodological strategy and its impact on the performance of university students showed that of 100% of the teachers surveyed where the degree of importance, difficulty, and value was measured, 79% considers that it is extremely important, significant and despite any difficulty that arises in the implementation of gamified tools, the daily application of these tools in various academic activities allows them to enhance the achievement of their students, as revealed in the evaluations carried out in different subjects, where the 83% average that the students had obtained from traditional educational activities went to 94% performance by changing the traditional methodology to the gamified one.

It should be noted that, according to the results obtained from the teachers concerning the degree of difficulty, importance and value, it was shown that 19% of teachers have had setbacks to engage with this new gamified education modality, having a neutral response and fair compared to the expectations generated by gamification with a methodological strategy, while 2% view gamification negatively. The surveyed students provided an interesting perspective about the gamified strategies developed in their university academic activities, where of the 100% studied in which they were measured with a scale of frequency, degree of importance, and degree of satisfaction, 92% assure that teachers carry out gamified activities periodically and it is extremely important for them to develop academic activities under this type of methodological strategies since their level of satisfaction with the improvement in their performance as students is more significant about other types of activities educational strategies.

Correlating the results obtained from teachers and students, it can be indicated that the higher the level of implementation of a gamified methodology within university academic activities, the better results can be obtained in student performance and achievement.

The difficulties that arose during the collection of the information were:

1. Survey all the universities in Guayaquil to detect how many of them gamified tools are applied in their academic curricula because there is a teaching population over 55 years of age that is a little reluctant to work with this type of educational modalities frequently with their students.
2. Taking the surveys could be carried out thanks to the collaboration of the teachers participating in this study and their interest in revealing the importance of gamification in university studies.

The results presented in this study will make it possible to more efficiently measure the existing perspectives of both teachers and students on the application of gamification in the various subjects of the academic curriculum, and based on this, continue to strengthen the comprehensive implementation of gamified strategies in all the universities of the country. In conclusion, it can be indicated that it is extremely significant and positive that teachers acquire new skills and educational techniques for their professional performance since this fosters a new educational environment, where both teachers and learners can enhance their skills and competencies, which will allow them to function in the professional and labor field in a much more efficient way.

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