

Use of Gamification as Collaborative Learning Resources in Teacher Training

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Abstract:- Gamification in combination with mobile devices is one of the learning tools that is used most frequently today and that is gaining great relevance in the area of education. With the implementation and use of gamification as a collaborative resource, the use of mobile devices is necessary, given the easy access to the platform for users, as well as the motivation to the learning process of the subject of arithmetic and geometry.

This article aims to present the results obtained from the research study on gamification in a virtual learning environment as a collaborative resource for mobile devices. The main objective of this study was to check whether the gamification methodology in combination with mobile devices helps to improve the academic performance of students at the Salome Ureña Instituted. This article presents the results obtained from the interventions with students in the academic periods September - December 2019, January - April 2020.

Keywords:- Gamification, Collaborative Learning, Educational Resources, Technological Tools. Videogame.

I. INTRODUCTION

The use of mobile devices in education is a reality to access available technological resources, virtual learning campus, databases, social networks. With the implementation of these technological tools (Moodle as virtual learning campus) it was evidenced that the students enrolled in the Arithmetic and Geometry subject in the face-to-face study modality of the education career at the Salome Ureña Higher Teacher Training Institute, it was verified which is beneficial for increasing academic performance, if merged with mobile devices.

The changes that the field of technology is undergoing in mobile devices in Latin America, places it as the most developed means of communication in society, this is located in the context of learning based on Mobile Learning or Mobile Learning. This technology is one of the most developed in the educational field because it facilitates rapid access to information and has transformed it into one of the learning methods most used by students in the teaching-learning process. This tool is essential to create learning micro-content that facilitates the rapid visualization of content in a virtual environment using Gamification in combination with mobile devices. There is no doubt that students who are in contact with technology benefit in many ways, which allows them to advance in their development as

user in training. This requires that the selection, use and organization of the information be of quality so that the student gradually develops as a mature citizen of the information society. (Salinas, 2004).

Research Context

Given the low marks reflected in the subject Arithmetic and Geometry at the Instituto Superior de Formación Salomé Ureña in previous years, an investigation is carried out on this context and this subject is used for intervention in the academic records of two (2) sections of classes that comprise the academic periods 2017, 2018 and 2019. The results obtained show that students have difficulties due to the low grades obtained during the mentioned academic periods. A large number of students did not obtain sufficient grades to be able to pass the course. In the academic records reviewed, it can be observed that a large number of students, approximately 30%, have problems in each of the semesters. This problem is causing concern to the authorities of the Academic Directorate of the Higher Institute of Teacher Training Salome Ureña (ISFODOSU), since it can be evidenced that students have greater difficulty in the modules of plane geometry, angles, polygons, area and perimeter and geometric bodies. The grades obtained in the practices, the tasks and in the exams are below the goals set by the institution; if we compare them with the results obtained in the modules of the numbering system, the set of natural numbers and the set of rational numbers. With the review of these documents, it has been possible to identify the presence of a problem faced by students in the class program of the subject Arithmetic and Geometry.

Theoretical fundament

This section of the research study presents the main learning theories that are related to the use of information and communication technology. The most relevant resources that can be used to support education, mobile devices, electronic devices that are used for interconnection to the available technological platform. All tools related to the educational environment are also analyzed, such as the materials that are used together with mobile devices, tablets, desktop computers, and laptops. "Digital literacy, as an educational action, acquires a crucial role in the appropriate use of technologies within higher education institutions" (Gamboa, 2016, p.2), virtual learning environments are also studied, describing the characteristics of a Gamification environment using the Moodle platform in a virtual learning field, as a collaborative tool, which can be used as a support resource for the teaching and learning process, in the training of new teachers ... "teachers they feel that

Gamification is contributing positively to the learning process of their students "(Alabbasi, 2018, p. 39). Gamification is being used as an alternative to improve education so that students can have access to the virtual campus from anywhere using mobile devices.

Mobile Learning

Mobile devices and tablets are the electronic means of communication most used by students (Sanjaya, Eva, Soekesi, Posmaria, & Sitohang, 2015, p.3) these are the most common means among young people in the classroom, these are more easily incorporated into the educational context of Mobile Learning. Students use this tool because of the ease it provides to connect to the Moodle platform and educational video games, when using these Mobile Learning devices or mobile learning, according to this author (Cient, Profesional, & Pedagog, 2017, p.12) "With the use of ICT, access to the resources provided from the classroom is guaranteed", with the incorporation of mobile devices as a necessary learning tool to facilitate access from anywhere to the platform to review educational content . This model of education has become a trend for the students of the Salome Ureña Higher Teacher Training Institute.

The evolution of mobile devices in recent years has contributed to the development of multiple technologies such as: web 2.0 (blogs, wikis, social networks, social bookmarks), open digital content, augmented reality, portable video game consoles, devices multifunctional mobiles, STEAM computing, among other technological advances. The use of these tools has been fostered in all areas, including education, these advances have achieved that not only science and mathematics benefit but also contributing to the personal construction of students (Olabe, 2017)

Mobile or mobile learning proposes a new pedagogical model that aims to exploit all the didactic potential of these devices and promote their use as an effective tool to facilitate teaching and learning in the educational context.

On the other hand, he affirms (Castaño, 2009) that micro-contents are produced, managed, put into circulation, enriched with semantic metadata, processed, remixed and used and / or consumed, it is a published information of a short, whose length and size is a function of sticking to a single main and relevant topic, and due to the physical and technical limitations of the software and hardware that we use to manage digital content.

The pedagogical use of this type of digital content has educational potential to be transmitted through mobile devices such as: smart phones or Smartphone, tablets, personal digital assistants (or its acronym in English PDA), multimedia playback consoles, games and Gamification etc.). Referring to educational micro-content, (Marcia Isabel Fugisawa Souza, 2011) points out:

"The micro-content is studied from the perspective of an object or element of learning with mobility. It is admitted that such a conception of microcontent favors the

construction of new knowledge and the emergence of new interrelationships between concepts, with the possibility of broadening the range of students' understanding of the subject dealt with by the teacher". (p.1203).

(MARISCAL, 2010) indicate that mobile telephony has become the ICT with the highest penetration in the world. At the end of 2009, there were more than 4.6 billion active mobile phones, a base more than four times larger than that of fixed telephony. In Latin America, as of March 2015, the number exceeded 550 million, equivalent to a penetration of more than 91% [...]. Mobile technology has reached segments of the population that no other ICT has reached (p.2, 3).

Students are increasingly immersed in the world of technology, specifically in the use of mobile devices as educational resources, video games and social networks, these tools are used as learning resources, due to the situation they are experiencing the world with the covid19 pandemic. The Salome Ureña Higher Teacher Training Institute (ISFODOSU) has managed to implement this learning methodology, to continue teaching its students virtually.

The Gamification methodology used as a tool in combination with mobile devices has contributed to improving the academic performance of the students who participated in the experiment, in the first experiment of the intervention, September - December 2019 it was found that 74.59% of the students improved their academic performance in the second intervention of the experiment, in the academic period January, April 2021, the results obtained average 75.25%.

II. METHODOLOGY

For this intervention, two groups were created with the selected students, the first group was chosen as experimental, this group was applied two tests, pretest and post test at the beginning of the semester and at the end, after the first test was applied to measure the degree of knowledge proceeded with the experiment. This was carried out from the beginning of the semester to the end that consists of a treatment, implementing Moodle 3.8 as a collaborative tool in a virtual learning environment using the Gamification methodology in combination with mobile devices, in the academic period September - December 2019, January - April 2020. At the end of this experience with the students, the second test that It consists of a post test to measure the degree of academic performance and thus check if the method used is beneficial for the students.

The second group of the experiment that was selected as a control group, the pretest test was applied at the beginning of the semester and the second post-test test at the end of the semester. This group of students was chosen as a control group and teaching continued with the traditional method, until the second month of the subject, after the second month the intervention was carried out with the students, applying the treatment until the end of the

semester. This intervention consists of an experiment implementing Moodle 3.8 as a collaborative tool in a virtual learning environment applying the Gamification methodology in combination with mobile devices in the academic period September - December 2019, January - April 2020.

During the experiment, the researcher was accompanied by the teacher of the Arithmetic and Geometry subject to follow up with the students and thus comply with the research requirements so that the results were not altered. This intervention was carried out with a population of students from the education program of the Higher Institute of Teacher Training Salomé Ureña ISFODOSU.

The first group consisted of 77 students, divided into two academic periods; The first period of the experiment ran from September to December 2019, consisting of an enrollment of 42 students and a second academic period that corresponds from January - April 2020, which had an enrollment of 35 students.

The second group consisted of an enrollment of 80 students divided into two academic periods, the first intervention was carried out in the second month of the semester in the academic period September - December 2019, this group consisted of 43 students and the second intervention was carried out in the academic period January - April 2020, made up of 37 students, enrolled in the subject Arithmetic and Geometry of the first semester of the education career.

In this research, a mixed deepening method was implemented, that is, a combination of a quantitative approach and a qualitative approach was used, according to what this author says: "The quantitative approach uses data collection to test hypotheses with based on numerical measurement and statistical analysis, in order to establish behavioral guidelines and test theories "(Hernández, Fernández, & Baptista, 2014, p. 4); Usually the qualitative approach "uses data collection and analysis to refine research questions or reveal new questions in the interpretation process" (Hernández, Fernández, & Baptista, 2014, p. 7).

The experimental design is characterized by the evaluation of the effect that arise from one or more interventions, to comply with the objectives and hypotheses raised and thus provide an answer to the research questions. This design has the characteristic of intentional manipulation of the variable and its possible results can then be analyzed (Hernández, Fernández, & Baptista, 2014).

Table 1 - Experimental design with two groups

Two Group Experimental Designs 2019 AND 2020			
01	X	01 experimental	Pretest, Post Test, Satisfaction Survey, Focus Groups
02	--	02 control	Pretest, Post Test.

III. RESULTS

2.-1 Instruments

In this section, the information collection instruments are detailed first, such as: the pre-test and post-test questionnaires applied to the two groups of students (experimental and control). The results obtained from the academic attitude satisfaction survey are also presented. These tests were applied with the aim of measuring academic performance with the use of a new Gamification methodology in combination with mobile devices to improve academic performance in the teaching and learning process of the subject of arithmetic and geometry using a new methodology. designed from a quasi-experimental case study implementation.

1. Questionnaire to check the academic performance at the beginning of the subject of arithmetic and geometry to the students of the first semester of the Félix Evaristo university campus (pre-test)
2. Questionnaire to check the academic performance at the beginning of the subject of arithmetic and geometry to the students of the first semester of the Juan Vicente Moscosos university campus (pre-test)
3. Questionnaire to check the academic performance at the end of the subject of arithmetic and geometry to the students of the Félix Evaristo Mejía University Campus in Santo Domingo (post-test)
4. Qualifications obtained by the students of the Juan Vicente Moscos, San Pedro de Macorís and Félix Evaristo Mejía University Campus of the city of Santo Domingo in the tests carried out at the beginning of the intervention.
5. Qualifications obtained by the students of the Juan Vicente Moscoso University Campus in San Pedro de Macorís at the end of the course using the new teaching methodology proposed at the end of the semester.
6. Qualifications obtained by the students of the Félix Evaristo Mejía University School in Santo Domingo at the end of the course, using the Gamification methodology in a virtual learning environment, designed from a synchronous implementation and structure.
7. Satisfaction survey at the end to assess the level of confidence regarding the use of mobile devices, used as learning resources in combination with the new Gamification methodology

2.2.- Gamification Methodology

The training of teachers required by the educational system of the Dominican Republic in the area of education is under the responsibility of the Higher Institute of Teacher Training Salomé Ureña (ISFODOSU) and all the universities of the Dominican Republic, supervised by the Ministry of Education Higher Science and Technology. (MESCYT). Most of the applicants for teachers of schools and colleges are acquired mainly from all the ISFODOSU campuses. This institute is the patrimony of the Dominican state, the premises under study are located in the city of Santo Domingo and in the city of San Pedro de Macorís respectively. These university campuses exclusively dictate the face-to-face modality for the teaching of their subjects, with a total of approximately 1,100 students enrolled in each semester of the different teaching courses they offer.

Teachers are not willing to structure the teaching of arithmetic and geometry subjects virtually; However, for this research work a learning environment was implemented using Gamification in combination with mobile devices as learning resources, for this project a quasi-experimental design was used, this was the only subject taught in virtual mode under a methodology of Gamification. For the researcher to achieve the objectives of this study, he trained the teachers who teach the subject Arithmetic and Geometry in the virtual platform Moodle 3.8. The first teachers who received training in Moodle correspond to the teachers of the Félix Evaristo Mejía university campus. For the reason that the group of students in this campus was selected as an experimental group, they were provided with a computer lab permanently, as long as these students did not have the facility to use a computer or some electronic means to access to virtual classes from their homes.

The second group of teachers who received the training correspond to the Juan Vicente Moscoso university campus, these teachers were trained to use the Moodle platform, to accompany the students of the control group at the end of the semester.

To apply the pre-test and post-test instruments, to measure the academic knowledge and the progress of the students when using the virtual environment Gamified in Moodle, an instrument was built, which consists of an exam-type academic attitude test with practical exercise , closed questions where students have to give the correct answer, for each of the questions, for this instrument a scale was developed that goes from one (1) to two (2) points, according to the following scale:

Pre-test and post-test assessment scale	
1	Correct
2	Incorrect

Table 2 - Pre-test and post-test rating scale.

3.3 Pre-test tests

This instrument was applied in the semester September - December 2019, at the Juan Vicente Moscoso and Félix Evaristo Mejía University Campus, to a total of 85 students enrolled in the first semester, in the subject of arithmetic and geometry of the education career. These were divided into two groups: 43 students correspond to the Juan Vicente Moscoso University Campus, and 42 students to the Félix Evaristo Mejía University Campus, the objective of this test is to measure the level of knowledge in the subjects of Arithmetic and Geometry, before starting the intervention with the students selected to apply the experiment of the

Gamification methodology in a virtual learning environment. Likewise, for the four-month period of January - April 2020, the experiment was carried out on a total of 72 students from both campuses, stratified into: 37 students from the Juan Vicente Moscoso Campus and 35 students from the Félix Evaristo Mejía Campus.

Table 3 - representing the students, the experimental and control group who participated in the experiment.

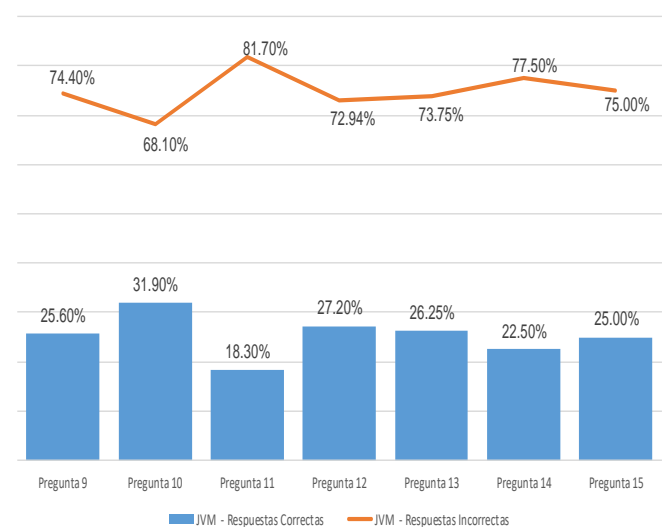
University Campus	Year	Total students enrolled in the semester September-December
Juan Vicente Moscoso	2019	43
Felix Evaristo Mejía	2019	42
Total		85

Table 4 - representing the students, the experimental and control group who participated in the experiment.

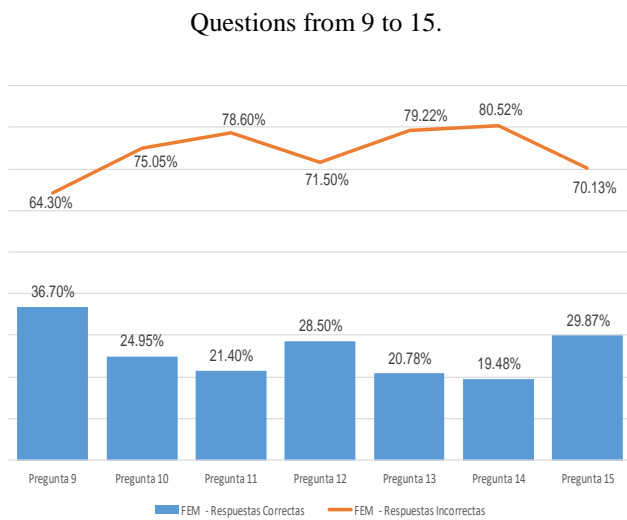
University Campus	Año	Total students enrolled in the January-April semester
Juan Vicente Moscoso	2020	37
Félix Evaristo Mejía	2020	35
Total		72

As can be seen in the following graph (Graph 1) of the pre-test data collection instrument, where the last 7 arithmetic questions have been evaluated in the intervention of the experiment in the implementation of the Gamification methodology in a virtual environment of learning, using mobile devices as a learning resource for the students of the Felix Evaristo Mejía university campus as an experimental group and the Juan Vicente Moscoso university campus as a control group, in the semesters from September - December 2019 and January - April 2020, where The final results obtained from questions 9 to 15 are presented, for the Juan Vicente Moscoso university campus and later on the Félix Evaristo Mejía university campus (Graph 2).

Graph 1 - Results of the Juan Vicente Moscoso University Campus Questions from 9 to 15



Graph 2 - Results of the Félix Evaristo Mejía University Campus.



Subject, but they do not have the awareness of obtaining optimal results in a subject that later allows the student to enter the career of their choice. However, the results obtained in the first pre-test of the intervention of the experiment show that the students graduate from university education with poor knowledge strength since the skills to interpret, analyze, explain and compare results have not been developed. at the height of the needs it deserves.

3.4 Post-test tests

This instrument was applied at the end of the semester once the intervention with the selected students had ended, which corresponds to the Félix Evaristo Mejía University Campus, this group was chosen as experimental, this intervention was carried out in the semesters between September - December 2019 and January - April 2020, with a total of 42 and 35.

The students of the Juan Vicente Moscoso University Campus were selected as a control group, the intervention with this group was carried out at the end of each semester, to improve academic performance in the teaching of the subject Arithmetic and Geometry, this intervention was carried out in the semesters between September - December 2019 and January - April 2020, with a total of 42 and 35 students respectively.

Table 5 - representing the students of the experimental group who participated in the experiment.

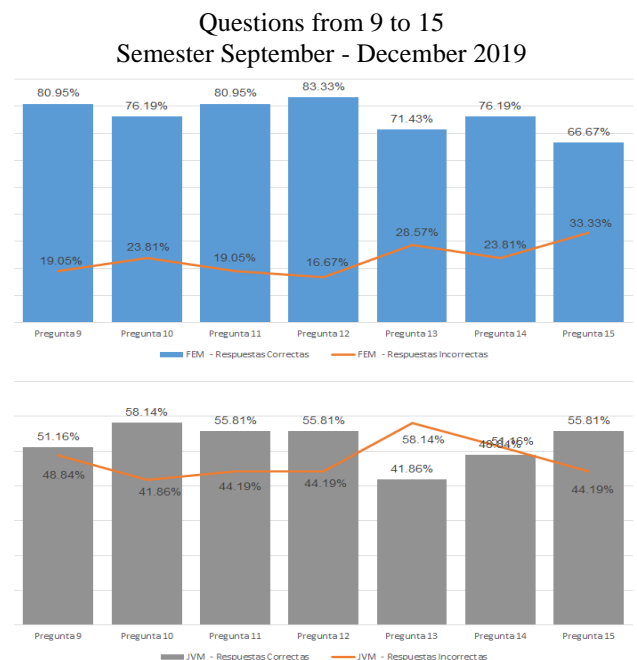
Campus	Año	Total of students Enrolled
Félix Evaristo Mejía	2019	42
	2020	35
Total		77

Table 6 - representing the students, from the control group who participated in the experiment

Campus	Año	Total of students Enrolled
Juan Vicente Moscoso	2019	43
	2020	37
Total		80

In the graphs of the post-test test, it shows the results of the evaluations of these last arithmetic operations that have been presented in tables 3 and 4, both of the correct and incorrect answers for the semesters of September - December 2019 and January - April 2020, as well as, the control and experimental university campuses. It is about visualizing in a general way, questions from 9 to 15 of this post-test that were presented previously, where with these results an idea of the skills that students obtained in the methodology of Gamification of the Felix university campus can be offered Evaristo Mejía and his comparison with the combination of the traditional and virtual method that was staged on the Juan Vicente Moscoso campus. Regarding the result of the arithmetic operations in the post-test, the Félix Evaristo Mejía university campus in both semesters of the experiment, obtained a percentage above the average of 81.70% of correct answers, unlike the university campus Juan Vicente Moscoso. Above 30 percentage points is the difference that divides both methods presented, which indicates that the use of the Gamification methodology in combination with mobile devices, and using Moodle as a support tool favors academic performance, and increases results. of the students.

Graph 3 - Final Results of the Post-Test University Campuses



Graph 4 - Final Results of the Post-Test University Campuses
Questions from 9 to 15
Semester January - April 2020

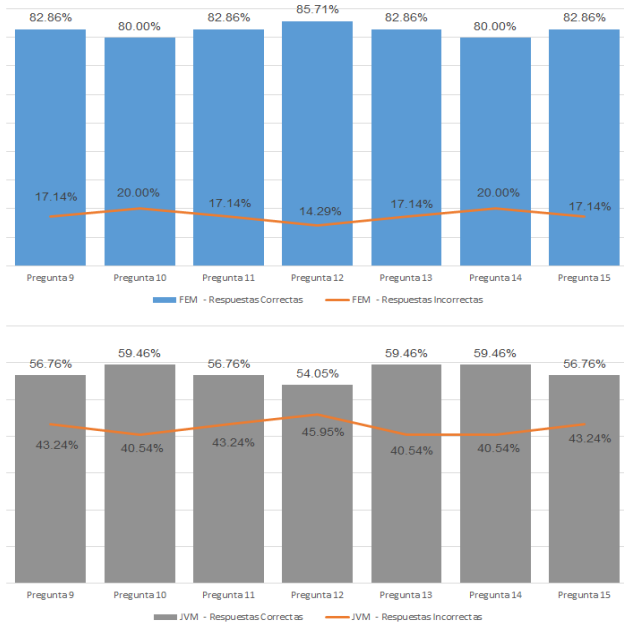
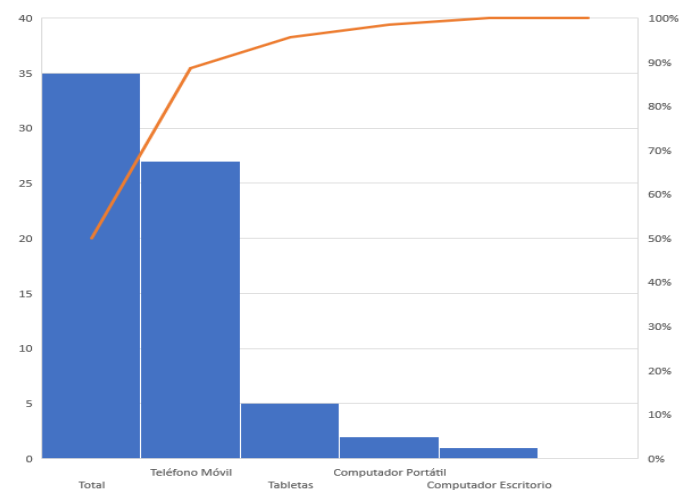


Table 7 4– Electronic devices used to learn arithmetic and geometry
Félix Evaristo Mejía University Campus
Semester January - April 2020.

	Frequency	Percentage	Valid percentage	Cumulative percentage
Mobile phone	27	77.14	77.14	77.14
Tablets	5	14.29	14.29	91.43
Laptop	2	5.71	5.71	97.14
Desktop Computer	1	2.86	2.86	100.00
Total	35	100.00	100.00	

However, when asked if they were satisfied when they received classes through the Internet, with the virtual or blended modality, 51.43% are very satisfied and a percentage of 48.57% not so satisfied (table 73). At this point, it should be emphasized that many of the students do not have an electronic device at home that is easily accessible to them, so they used their mobile phones more to access virtual classes. The following question shows which electronic devices they used to learn arithmetic and geometry (table 74), where 77.14% of the students used their mobile phones and the rest, tablets (14.29%), laptop (5.71%) or computer of desktop (2.86%).



Satisfaction survey results

This instrument was applied at the Félix Evaristo Mejía university campus in Santo Domingo with an enrollment of 35 students of the subject of arithmetic and geometry for the semester of January - April 2020 and that after the gamification methodology for the virtual teaching of this subject and Regardless of their final grade, they answered the 21 questions of this instrument. Of the students, 68.57% correspond to female participants who finished the course and 31.42% to male participants who finished the course in the same way (table 68).

Table 68 - Gender Students
Felix Evaristo Mejía University School
Semester January - April 2020

	Frequency	Percentage	Valid percentage	Cumulative percentage
Male	11	31.42	31.42	31.42
Feminine	24	68.57	68.57	100.0
Total	35	100.00	100.00	

Table 73 - Motivated or satisfied when receiving classes through the Internet
Felix Evaristo Mejía University School
Semester January - April 2020

	Frequency	Percentage	Valid percentage	Cumulative percentage
Very little	2	5.71	5.71	5.71
Little	1	2.86	2.86	8.57
Regular	1	2.86	2.86	11.43
Pretty	13	37.14	37.14	48.57
Much	18	51.43	51.43	100.00
Total	35	100.00	100.00	

IV. CONCLUSIONS

As evidenced in the data obtained from the pre-test and post-test instruments, there is a close relationship of the student with the ICT tools and with visualization-oriented teaching to transmit knowledge, as long as this relationship exists, it is still promoted plus motivation, excitement, and asynchronous learning; It is sustained in the way in which the human being today learns, assimilates and knows about what is around him and in this same way he structures knowledge. When these components are intermixed to express knowledge, it guarantees a sustainable improvement in student learning.

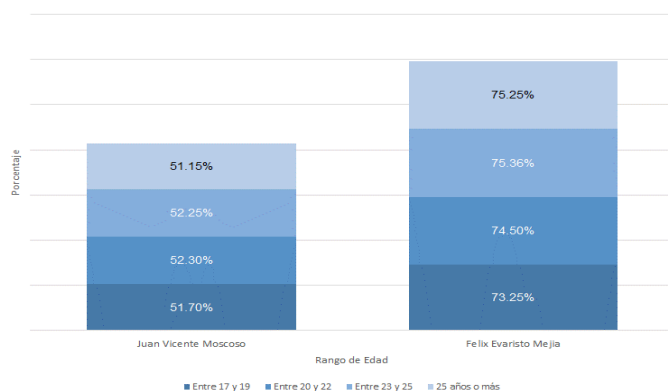
In the instruments presented in this experiment, students aged between 17 to 19 years old, 20 to 22 years old and 23 to 25 years old are seen as even though their

knowledge in Arithmetic and Geometry was below expectations and Their interest in learning was more to finish their studies in the subject, rather than knowing and ensuring their professional growth, they received virtual teaching using the Gamification methodology in combination with mobile devices. With the use of this learning tool, they significantly increased their level of knowledge, their interest in the subject was better valued and they strengthened a bond of emotion that allowed them to achieve throughout this experiment a weighted average of 74.59% in correct answers using the Gamification methodology, when traditionally this percentage was 51.85%. If this percentage presented by the semesters of this experiment is divided, in the semester of September - December 2019, the students aged 17 to 19 from both university campuses of the experiment, were those who in their initial test (pre-test), received the lowest grade for 28.05% of correct answers, however, upon finishing their studies of arithmetic and geometry in the semester, the correct answers increased by 70.35%. Likewise, for the semester of January - April 2020, these students aged 17 to 19, presented a score of 25.30% of correct answers in their pre-test test and 73.45% of correct answers in the post-test tests, when traditionally, this percentage was close to only 52.00%.

For students aged 20 to 22 years, the percentage of correct answers in the initial test (pre-test) was 29.50% in the semester of September - December 2019, however, in their final test (post-test). test) reached 72.00% of correct answers, similar percentages were presented by students aged between 23 to 25 years, where their percentage of correct answers in the pre-test was 30.50% and a significant increase of 75.36% in their test post-test. Not to mention the students with an age range over 25 years, where in their pre-test they presented 29.60% of correct answers and 75.25% in the post-test.

For the semester of January - April 2020, these students aged between 20 to 22 years old, presented a grade of 28.50% in the pre-test and increased in the post-test a 74.50% of correct answers, being 51.85% the percentage that is traditionally maintained throughout this intervention (graph 5).

Graph 5 - Comparison of Age Range in University Campus Semester September - December 2019 and January - April 2020



What we do observe is the need to continue improving the quality of the content. However, with this experiment carried out, it can be reaffirmed that the use of Gamification is an excellent methodology for teaching the subject of Arithmetic and Geometry and another subject that can be integrated into the class program.

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