

## STEAM Educational Approach in Collaborative Learning, Faculty of Pedagogy and Physical Culture – UNE

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### Abstract

*The research STEAM educational approach in collaborative learning, Faculty of Pedagogy and Physical Culture – UNE, quantitative approach study, type of applied research, quasi-experimental design, hypothetical deductive method, population in this research the population will be made up of 78. The instrument for the dependent variable collaborative learning which was validated by expert judgment obtained an Applicable declaration, and Cronbach's Alpha reliability, with 0.702 being high reliability. Their results in the pretest that the mean found in the EG = 57.76 regular collaborative learning; CG average = 70.14 good level. In the posttest, the average of the EG = 100.88, a very good collaborative learning, the average of the CG = 72.20, a regular collaborative learning. Conclusion: STEAM educational approach significantly influences collaborative learning, Faculty of Pedagogy and Physical Culture - UNE. (In the posttest  $z = -6.074$ ,  $p < 0.05$ , values where the EG is favored by its average rank that is equal to (38), being evident that it is greater than the CG that obtained (13) as a result. In the posttest after the proposal, according to the Mann Whitney U statistic).*

**Keywords:** Focus, STEAM, Learning, Collaborative, Interdependence, Skills, Exchange.

## INTRODUCTION

In recent decades, changes have occurred in various areas of education, such as our students, education professionals, schools and teaching methodologies. The need also arose for the introduction of digital technologies, assuming a prominent place in the practices of teachers who seek innovations in pedagogical practices.

It is in this new school scenario where the active teaching methodologies studied and defended by several authors emerge. In active methodologies, the student assumes the role of protagonist, being led to interact with the study content, in this way, managing to build knowledge. The role of the teacher in this learning process is that of facilitator, guide, encourager and who allows the student to assume this active posture. In the active methodology, students “become understood as historical subjects and, therefore, assume an active role in learning, since their experiences, knowledge and opinions are valued as a starting point for the construction of knowledge” (Diesel et al., 2017, p.271).

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The methods used in active methodologies are diverse. Almeida (2018) cites, for example, problematization, project-based learning, hybrid teaching, games and STEAM. Since these methods provide students with autonomy and prominence in the learning process.

Our interest focuses on STEAM, which has an integrative approach to science, technology, engineering, arts and mathematics. This pedagogical approach favors creative and active learning, giving the student the power to make decisions, to evaluate the results through interdisciplinary projects with everyday problems.

The most well-known proposals in Brazilian schools that are in some way related to STEAM. Expressions such as “do it yourself”, which enable the creation of objects or products, are very present in maker culture, with the arts being the main trigger to activate these creative processes. Thus, students and/or teams can discuss their ideas and/or projects and now have the opportunity to put into practice, make reality, knowledge that was previously limited to the use of pencil and paper. For Pugliese (2019) “this pedagogical practice has become a profitable strategy for institutions, which is why it has been restricted to private establishments and some NGOs, which have a training course for STEAM teachers, but practically without government initiatives” (p. 78).

In this context, of preparing young people for the world of work, whether in continuing studies or in the labor market, immersed in the digital world, we question the contribution that the STEAM approach can promote in the teaching and learning process of the students. in basic education, particularly in secondary education due to the ongoing curricular reform. Thus, the objective of this work is to analyze the evolution of the STEAM approach in its articulation with the current reform of secondary education.

In order to verify the contribution of the STEAM approach in pedagogical practices, on a new language. proposal for the teaching and learning process of students practicing culture, who have a lot of contact with the digital world, in terms of overcoming uncertainties and enriching reading.

The aforementioned gave meaning to this research work, seeing that the students, teachers in the Alternative Basic Education Specialty of the Faculty of Pedagogy and Physical Culture -UNE, are aware of the implementation of virtual tools in their classes, therefore Therefore, it is imperative to train in the use of virtual tools, as well as in their implementation of the STEAM educational approach, in the curriculum, to improve learning and competencies that improve the quality of meaningful learning of future teachers.

## **MATERIALS AND METHODS**

The approach is quantitative, this is supported by the contribution of the methodological author Bernal (2010) who says that this presupposes the quantification of events to subject them to classification, measurement and analysis, its objective is to propose an explanation of the set of data collected from of a conceptualization of perceived or observed reality.

Applied research, to support it, consults the meanings collected from the methodological author Carrasco (2009) where he says that "it seeks to obtain new technical knowledge with immediate application to a given problem, part of basic research, which in turn It is subject to a social need to be resolved, both practices cannot be separated" (p. 44).

The design is quasi-experimental, for Sánchez and Reyes (2015), this research was based on a quantitative - quasi-experimental nature, with the manipulation and control of a variable, therefore, I investigated the phenomenon under study by testing hypotheses and relationships between variables) .

The method used was the Hypothetical-deductive, Bernal (2006) states that it is a method that seeks a solution, through attempts (conjectures, hypotheses, theories) and elimination of errors. This method can also be called the “trial and error removal method.”

The population in this research was made up of 78 students from the Faculty of Pedagogy and Physical Culture-UNE, during the period 2023. The Sample was 50 students divided into two equivalent groups.

The sampling used in this research was non-probabilistic, because, as it is a quasi-experimental research, the groups are already formed previously, and the groups are taken intact.

The technique was the survey, according to Hernández et al. (2018), we have the possibility of reaching a large number of people, since it can be sent by postal mail or email; It has fewer expenses, since it does not require training of researchers; guarantees the anonymity of the people who answer it.

The designated instrument was the questionnaire, its technical sheet is: Technical sheet.

**Variable Collaborative Learning**

Name: PEAU (Collaborative Learning Evaluation Test) Objective: Collect information

Author: Gerardo Quilli Pinto

Adaptation: No

Administration: Individual Duration: Approximately 30 minutes

Unit of analysis: Tenth cycle students of a public university Scope of application: A public university

Technique: Survey

Significance: Evaluates collaborative learning

**RESULTS**

**Table 1**Results in measures of central tendency of collaborative learning in the pretest of both groups.

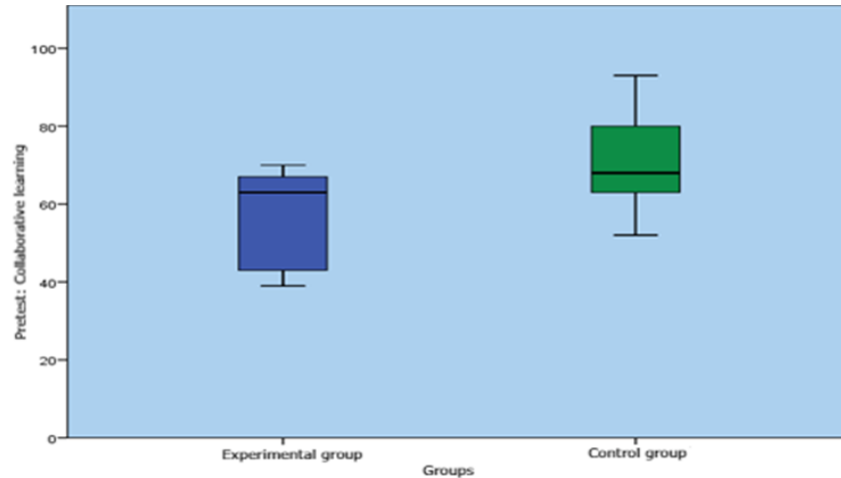
Indicator	Group	
	Experimental (n = 25)	Control (n = 25)
Middle	57,76	70,12
Median	63,00	68,00
Moda	42	63
Standar deviation	11,723	10,477
Minimum	39	52
Maximum	70	93

Note: Results divided into mean, median, mode, among others, representatives of the central tendency measures based on the collaborative learning dimension.

In table 15, the result of the EG in terms of its highest value shows a result = 70 similar to the CG where it obtained a maximum score = 93; The difference in the mean is also different, finding that the GE has a value = 57.76. This value is an indicator to deduce that the evaluated students achieve their learning at a regular level; The average found for the CG expresses a result = 70.12, a result that indicates that the respondents are at a good level. The values presented express a distance between the GE and GC.

Likewise, the dispersion obtained in the EG is = 11.723, a value that represents a high

concentration of the data, due to the low dispersion index obtained with reference to the mean; while the dispersion value of the GC is = 10.477, a value that represents a high concentration of the data, due to the low dispersion index obtained with reference to the mean.



**Figure 1** Collaborative learning in the pretest

Note: The previous figure is the schematic representation of a box and whiskers where the results of the EG and CG can be seen with reference to the collaborative learning dimension, it is highlighted that both medians are close.

Then apply the STEAM educational approach tests, the learning of collaborative learning is observed in the post-test on the observation scale to evaluate learning, the descriptive results found as the measures of central tendency are presented as follows:

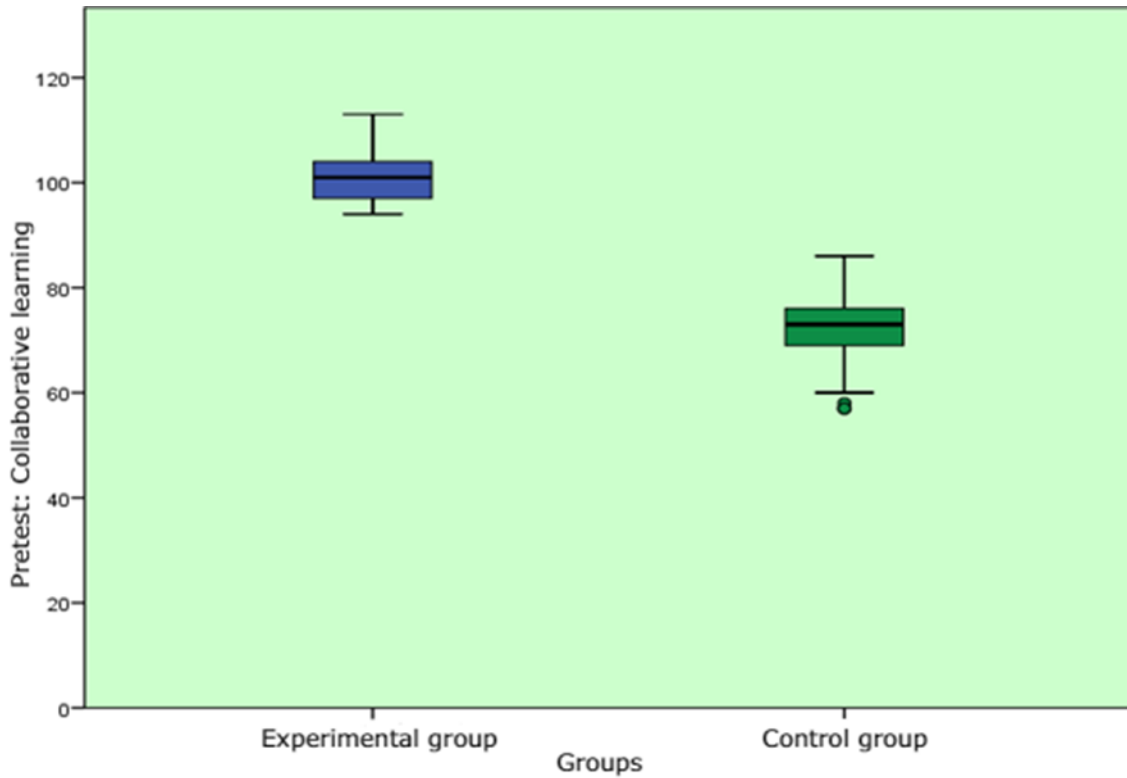
**Table 2** Results in measures of central tendency of collaborative learning in the posttest of both groups

Indicator	Group	
	Experimental (n = 25)	Control (n = 25)
Medium	100,88	72,20
Median	101,00	73,00
Mode	104	73
Standard deviation	4,986	8,317
Minimum	94	57
Maximum	113	86

Note: Results divided into mean, median, mode, among others, representatives of the central tendency measures based on the collaborative learning dimension.

In table 16, the result of the EG in terms of its highest value shows a result = 113, evidently different from the CG in which the maximum value found was = 86; The difference in the mean is also different, finding that the GE has a value = 100.88. This value is an indicator to deduce that the evaluated students achieve very good

collaborative learning; The average found for the CG expresses a result = 72.20, a result that indicates that the respondents have regular collaborative learning. The values presented express a distance between the GE and GC. Likewise, the dispersion obtained in the EG is = 4.986, a value that represents a high concentration of the data, due to the low dispersion index obtained with reference to the mean; while the dispersion value of the GC is = 8.317, a value that represents a high concentration of the data, due to the low dispersion index obtained with reference to the mean.



**Figure 2** Collaborative learning in the pretest

Note: The previous figure is the schematic representation of a box and whiskers where the results of the EG and CG can be seen with reference to the collaborative learning dimension, it is highlighted that both medians are close.

The descriptive analysis of collaborative learning before and after the application of the STEAM educational approach shows clear differences, with better scores on the post-test of the experimental group.

### Hypothesis

General hypothesis: The STEAM educational approach significantly influences collaborative learning, UNE 2021.

### Statistical Hypotheses

H<sub>0</sub>: There is no sufficient and significant evidence on the results of GE and GC students in collaborative learning before and after the STEAM educational approach.

H<sub>1</sub>: There is sufficient and significant evidence on the results of GE and GC students in collaborative learning before and after the STEAM educational approach.

H<sub>0</sub> is accepted if  $p > 0.05$  and H<sub>0</sub> is rejected if  $p < 0.05$

**Table 3.**Data resulting from the EG and CG in terms of their average rank and the sum of their ranks based on collaborative learning in the pretest and posttest

	Groups	N	Average range	Sum of ranks
Pretest: Collaborative learning	Experimental group	25	19,20	480,00
	Control group	25	31,80	795,00
	Total	50		
Postest: Collaborative learning	Experimental group	25	38,00	950,00
	Control group	25	13,00	325,00
	Total	50		

Note: Values adopted according to average ranges and sum of ranges, based on the pretest and posttest of the EG and CG in reference to collaborative learning in the pretest and posttest of both the EG and CG.

**Table 4. Mann-Whitney U hypothesis testing statistic for collaborative learning in the pretest and posttest**

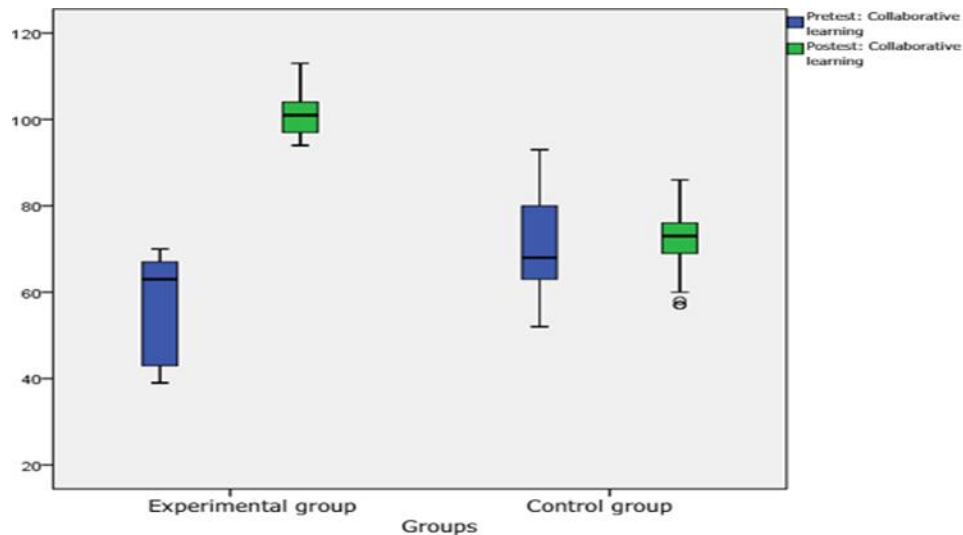
	Pretest: Collaborative Learning	Posttest: Collaborative learning
Mann-Whitney U	155,000	,000
Z	-1,063	-6,074
Sig. asymptotics (bilateral)	,062	,000
a. Grouping variable: Groups		

Note: The data in the previous table denotes the test statistic of collaborative learning in the pretest and posttest between the GE and CG groups.

In the collaborative learning pretest, the Mann Whitney U statistic was used, from which the following result is extracted ( $z = -1.063, p > 0.05$ ). This does not show significant differences, in addition to the average range that was obtained for the CG (31.80) which is not related to the GE (19.20). The statistical data obtained by the EG and CG in the pretest do not show any significant difference in collaborative learning, therefore, both groups have the same conditions before the educational approach.

STEAM. In this sense, in the pretest it is accepted that there is not sufficient and significant evidence on the results of GE and GC students in collaborative learning before and after the STEAM educational approach.

In the post-test after the proposal, according to the Mann Whitney U statistic, highly significant differences can already be seen, with the result ( $z = -6.074, p < 0.05$ ) being values where the EG is favored by its average range, which is equal to (38) being evident that it is greater than the GC obtained as a result (13). Based on this hypothesis testing, it is acceptable to reject  $H_0$  and accept  $H_1$ , because the data obtained in the EG posttest are better than the CG. In this sense, it is accepted that there is sufficient and significant evidence on the results of GE and GC students in collaborative learning before and after the STEAM educational approach



**Figure 3: Comparative box diagram of collaborative learning between the EG and CG in the pretest y posttest**

Note: The previous figure is the schematic representation of a box and whiskers where the results of the GE and GC can be seen with reference to collaborative learning in the pretest and posttest.

Given the contrast, the statistically demonstrated conclusion is provided for the general hypothesis where we confirm that it is accepted that the STEAM educational approach significantly influences collaborative learning, UNE 2021.

## DISCUSSION

It was found that the application of the STEAM educational approach significantly influences collaborative learning in EBA students - Faculty of Pedagogy and Physical Culture -UNE, 2023. (In the posttest  $z = -6.074$ ,  $p < 0.05$ , values where the EG is favored due to its average range that is equal to (38), being evident that it is greater than the CG that was obtained as a result (13). In the post-test after the proposal, according to the Mann Whitney U statistic, highly significant differences can already be seen, being the result), there are similar results in the study by Santa María (2022), in the results regarding variable 2 that, 100% of the students present a beginning level in competencies of the science and technology course, in terms of their dimensions, 65% of the sixth cycle students present a developing level in using the scientific method, 24% present a beginning level and 11% an expected level, on the other hand, for the seventh cycle students the 49 % present a level at the beginning, the other 49% present a level in development, 1% an expected level and the other 1% a notable level. Furthermore, it can be seen that 33.3% of the teachers do not apply the STEAM methodology, 33.3% on certain occasions and the other 33.33% almost frequently. For all this, the researcher concluded that the level of competencies of the course studied for the research is at a beginning and development level, so it is necessary to apply the STEAM method in order to improve their knowledge and learning.

For its part, Incarroca (2022), in the results obtained for the critical thinking variable, 100% of the experimental group and 100% of the control group present a level at the beginning, later when carrying out the intervention it was evident that 100% The control group maintained its level at the beginning, while 50% of the experimental group presented a level in development and the other 50% a level in beginning. For the concept dimension, 78.9% of the experimental group obtained a developing level and 67.9% obtained a developing level; subsequently, 57.1% of the experimental group obtained an optimal level and 82.1% of the control group obtained a level in development. For all this, the researcher concluded that the use of the STEAM approach methodology does help in reinforcing critical thinking in students. Likewise, Ruiz (2022), in his results obtained from the questionnaire regarding the cooperative work carried out in the laboratory, the total score is 4 points of which, 25% of the group's grade went to the achievement of objectives, the 15% of the grade was for participation and collaboration, 25% of the grade was for the effective distribution of responsibilities, 15% of the grade was for interaction and 20% of the note was for the fulfillment of the activities.

Regarding activity B, which was based on a cooperative activity in the mathematics classroom, it was evident that the total score is 4, of which 30% of the grade was for the achievement of objectives, 35% of the grade was for participation and collaboration and 35% of the grade was for interaction. Likewise, it was observed that 70% of the students responded positively about mathematics, 24% did not give any response and 6% responded negatively. For all this, the researcher concluded that the research has contributed to investigating and evaluating aspects and situations in education.

It was also found that the application of the STEAM educational approach significantly influences positive interdependence in EBA students - Faculty of Pedagogy and Physical Culture -UNE, 2023 (In the posttest  $z = -4.791$ ,  $p < 0.05$ , values where the EG is favored by Its average range is equal to (35.34), being evident that it is greater than the CG obtained as a result (15.66). In the post-test after the proposal, according to the Mann Whitney U statistic, highly significant differences can already be seen being the result), there are similar results in the study by Ordoño and Velarde (2022), where it is evident in the results obtained regarding to the variable level of mathematics learning that, when taking the entrance test, 77% of the students had a level at the beginning, 23% had a level in development and no student had an optimal or notable level, later, when taking In the exit test, 54% of the students present an optimal level, 42% present a remarkable level and 4% present a developing level. Regarding the quantity problem solving dimension, in the entry test 92% presented a beginning level and 8% a developing level, subsequently, in the exit test 69% presented an optimal level, 27 % presented a notable level and 4% a developing level. For all this, the researchers

concluded that it was possible to establish that the STEAM methodology significantly strengthened the learning of the mathematics course in secondary level students.

For its part, Angulo (2021), in the results that, 67% of the teachers stated that they did not have any knowledge about the STEM method and 33% stated that they did, likewise, 38.1% stated that they did not know that stands for the acronym STEM, 21.4% stated that it means Science, technology, engineering and mathematics, however, 31% stated that it means Society, Technology, Energy and Movement. Regarding the tendency of teachers to use technological instruments to grade their students, it is evident that 52.4% have an intermediate level, the 38.1% have a high level and 9.5% have a poor level. Regarding ICT training, 55% of teachers have an intermediate level, 36% have a high level and 10% have a poor level.

For all this, the researcher concluded that it is feasible to propose STEAM education as a method of reinforcing professional academic training, since it allows us to consolidate the professional figure.

Likewise, it was found that the application of the STEAM educational approach significantly influences social skills in EBA students - Faculty of Pedagogy and Physical Culture -UNE, 2023 (In the posttest  $z = -5.655$ ,  $p < 0.05$ , values where the EG is favored due to its average range that is equal to (37.12), being evident that it is greater than the CG that was obtained as a result (13.88). In the post-test after the proposal, according to the Mann Whitney U statistic, differences can already be seen highly significant being the result), there are similar results in the study by Lam (2023), where it can be seen in the discussion of the results obtained that the STEAM project involves applying all the components of the course competencies, which is why This means that the methodology must be applied in each area individually, because each course has its own objectives and competencies. In addition, this methodology will contribute to strengthening learning regarding solving problems according to the context. Likewise, it strengthens the capacity for critical thinking, considerably improves creativity and better develops skills with respect to the course studied. The application of the STEAM method is also important to observe the evolution of students. For all this, the researcher concluded that it was possible to study that the STEAM methodology does contribute to strengthening the students' ability to solve quantity problems in the different courses.

For their part, Chaverra and Chaverra (2022), in the results of the questionnaire focused on determining the ashes about the mathematics course, 37% of the students do not have good knowledge about the distance between two points, 35% do have good knowledge, 24% have doubts and 4% have greater knowledge. Regarding the understanding of the pattern unit, 48% of the students are in doubt about their knowledge, 33% have no knowledge, 15% have no knowledge and only 4% have a more precise concept. Regarding locating a coordinate in the Cartesian plane, 26% managed to locate it accurately, 22% found the coordinates with more difficulty, 33% had difficulties and 21% were unable to locate it. For all this, the researchers concluded that it was possible to show that the

Students present an intermediate level in knowledge about mathematics, so it is clear to affirm that the STAM methodology would significantly improve learning.

Finally, it was found that the application of the STEAM educational approach significantly influences the exchange of information in EBA students - Faculty of Pedagogy and Physical Culture -UNE, 2023 (In the posttest  $z = -5.658$ ,  $p < 0.05$ , values where the GE is favored by its average range that is equal to (37.14), being evident that it is greater than the CG that was obtained as a result (13.86). In the post-test after the proposal, according to the Mann Whitney U statistic, we can already see highly significant differences being the result), there are similar results in the study by More (2022), where it can be seen in the results obtained that, when carrying out the “U” evaluation, a score of p-value of 0.05 was obtained, which This means that a significant direct impact was established on solving quantity problems in the students studied, so it is evident that the STEM methodology is directly proportional to the second variable. For all these reasons, the researcher concluded that the study of the STEAM approach considerably intervenes in the resolution of quantity problems in students.



For his part, Jiménez (2022), results given by the activities carried out with the students, the STEAM method improves the ability to make agreements, discuss with foundations and propose alternatives to solve students' problems.

Regarding section 605, during the first period it was evident that 62% of the students presented a level in process in academic development, 24% presented a high level, 14% a poor level and no student presented a level very high, subsequently, it can be seen that 13% of the students presented a very high level, 20% presented a high level, 64% a level in progress and only 3% presented a poor level. For all this, the researcher concluded that it was possible to show that the STEAM methodology considerably improves the learning abilities of secondary school students.

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