Influence of the academic reinforcement workshop to improve the learning of integral calculation in second cycle's students of systems engineering and computing of the faculty of sciences semester 2022-II unasam-Huaraz, 2023

[Influencia del taller de reforzamiento académico para mejorar el aprendizaje del cálculo integral en estudiantes de segundo ciclo de ingeniería de sistemas e informática de la facultad de ciencias semestre 2022-II-unasam-Huaraz, 2023]

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Resumen

El objetivo de la investigación es determinar la influencia del Taller de reforzamiento académico en la mejora del aprendizaje del cálculo integral en estudiantes del segundo ciclo de Ingeniería de Sistemas e Informática de la Facultad de Ciencias, semestre 2022-II- UNASAM -Huaraz, 2023. La investigación es tipo aplicada, método cuantitativo y diseño pre experimental; se aplicaron dos instrumentos: Pre test y post test validados por dos expertos, aplicados a una muestra de 26 estudiantes. Las variables analizadas Taller de reforzamiento académico y aprendizaje del cálculo integral, en cuya investigación se formuló una hipótesis afirmativa y una hipótesis nula. Después de analizar los resultados, se afirma que sí existe influencia significativa del taller de reforzamiento académico en el aprendizaje del cálculo integral, de manera que se acepta la hipótesis afirmativa. La verificación de la hipótesis fue hecha aplicando el T de Student. Se concluye que existe influencia significativa del taller de reforzamiento académico en el aprendizaje del cálculo integral en estudiantes de la carrera profesional de Ingeniería de Sistemas e Informática, semestre 2022-II, UNASAM -Huaraz, 2023.

Palabras clave: Taller, reforzamiento, académico, aprendizaje, cálculo integral, trabajo en equipo, motivación.

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Abstract

The objective of the research is determining the influence of the Academic Reinforcement Workshop on improving the learning of integral calculus in students of the second cycle of Systems Engineering and Computer Science of the Faculty of Sciences, semester 2022-II-UNASAM -Huaraz, 2023. The research is applied type, quantitative method and pre-experimental design; Two instruments were applied: Pre test and post test validated by two experts, applied to a sample of 26 students. The variables analyzed Workshop on academic reinforcement and learning of integral calculus, in whose research an affirmative hypothesis and a null hypothesis were formulated. After analyzing the results, it is stated that there is a significant influence of the academic reinforcement workshop on the learning of integral calculus, so that the affirmative hypothesis is accepted. The verification of the hypothesis was done by applying Student's T. It is concluded that there is a significant influence of the academic reinforcement workshop on the learning of integral calculus in students of the professional career of Systems Engineering and Computer Science, semester 2022-II, UNASAM -Huaraz, 2023.

Keywords: Workshop, reinforcement, academic, learning, integral calculus, teamwork, motivation.

I. Introduction

We return from a process of purely virtual classes, which have not been of much benefit to our students. This process occurred due to the Covid 19 pandemic, which is being experienced worldwide. The objective of universities is to train university students with mathematical skills, abilities and competencies, specifically in the domain of indefinite and definite integrals, so that they self-construct, build and have individual and team capabilities; that allows them to identify and understand the role that knowledge of integrals plays in their professional training and in solving the problems of the context in which they operate. However, the learning of mathematics and specifically the knowledge of integrals constitute situations in which any higher level student can find himself, at an international level, students present deficiencies in the application of integration methods to obtain the indefinite integral. of a function, a considerable percentage of students are unaware of the application or usefulness of definite and indefinite integrals in solving the problems that arise in society.

The problem of teaching-learning integral calculus is generated in the sense that the thematic contents present a high level of decontextualization and disarticulation with respect to the remaining courses in which the student is enrolled, that is, mathematical topics that are new in their conception. and methodology, this leads the student to make significant efforts in the process of acquiring this knowledge. (García, 2013; Zúñiga, 2007; Camarena, 2010). The scientific literature indicates that studies carried out in various countries show that the problems presented in the teaching-learning process of integral calculus are not only manifested at the local level, but also at the international level. At the international level, it has been identified that the most frequent causes that hinder the learning of integral calculus, on the part of students, are due to the fact that the teaching-learning process has been developed with an axiomatized approach, in an algorithmic and with routine examples. So that mathematics could be considered as a set of rules and formulas that exist universally valid, due to these problems we found ourselves in the need to do extra or extracurricular hours in teaching integral calculus in Systems Engineering students. and computing, using a more dynamic methodology and also through some free software, to improve their learning of integral calculus, logically unrelated to the everyday life and environment of the subjects, whether they are students or educators (Cordero, 2005; Moreno, 2018).

At the national level, the teaching and learning process of comprehensive topics constitutes a problem in all universities in the country. Likewise, it is evident that the means and teaching-learning methodologies are carried out using blackboard, marker and the process of discursive explanation. The student listens to the process with little leading participation in the construction of learning, is a reality that is often foreign to university teachers, because Universities, Faculties or Directorates of Professional Schools subtly impose some SUMMITS that must be fulfilled almost 100%, added to this problems that appear during the academic semester, such as: the takeovers of university cities, teachers' strike and other problems that our teachers in universities often have to fight, from this reality It is evident that the media and methodology do not lend themselves to these times, they become even bland, often turning students into information recyclers, which is why there are many disapproved students.

At the local level, the Faculty of Sciences of the National University Santiago Antúnez de Mayolo in the city of Huaraz, specifically, the Professional School of Mathematics, is responsible for teaching all mathematics subjects in all the professional schools of the university, and among Among them is the subject of Mathematics II. The experience expressed in academic semesters and years of teaching this subject has shown that, due to the demand and level at which the topics are developed, students from the various professional schools present the following learning problems:

- Learning deficiencies in the topics of indefinite integral, learning problems in the conceptual definition of the indefinite integral, in its properties, and in problem-solving methods using methods of integration by substitution, by parts, trigonometric, trigonometric substitution and partial fractions.
- Learning deficiencies in the topics of definite integral, learning problems of sums as limits, in the conceptual definition of calculus theorems, mean value theorems and their respective problem solutions.
- They present learning problems in the topics of integration with polar coordinates, flat areas and regions, and volumes of solids.

Reason why it was proposed to hold these academic reinforcement workshops, whose purpose is to reinforce students in integral calculus or improve their learning, and be able to analyze, reason and infer integral calculus situations. Students must guarantee that their mathematical skills acquired during their first year of studies in courses such as basic mathematics and mathematics I (differential calculus), so that when they take the integral calculus course they do not have learning problems.

Due to the problematic reality exposed, the researchers propose the present research project with the purpose of improving the learning of integral calculus, in students of the Professional School of Systems and Computer Engineering, through the ACADEMIC REINFORCEMENT WORKSHOP, as a methodological strategy, to achieve competency achievements in the area of mathematics, specifically in Integral Calculus. Given these considerations, there is a need to ask the following question: How does the Academic Reinforcement Workshop influence the learning of integral calculus in students of the second cycle of Systems Engineering and Computer Science of the Faculty of Sciences, semester 2022- II- UNASAM - Huaraz, 2023?.

On the topic I am researching, there are some research works, relatively related to the proposal, that is, works on Academic reinforcement workshop and learning of integral calculus that will necessarily be taken into account in this research work.

Chimarro (2022) in his research "Innovative Didactic Material for teaching Comprehensive Calculus in third-year BGU students of the "Teodoro Gómez de la Torre" Educational Unit, period 2021-2022. Ecuador, whose objective was: to determine how the implementation of innovative

teaching material affects the teaching of integral calculus in third-year BGU students of the "Teodoro Gómez de la Torre" Educational Unit, period 2021-2022. This is a mixed research; Quantitatively it is descriptive in scope with a non-experimental cross-sectional design and qualitatively it has an action research type design, a survey was applied, obtaining information that reflected; that teachers who teach integral calculus use the blackboard and texts, guides as the main teaching resources and very rarely rely on innovative teaching material. It was concluded that the implementation of innovative teaching material in the teaching of integral calculus in third-year BGU students of the "Teodoro Gómez de la Torre" Educational Unit, allows the student to actively participate in the construction of their learning. Bearing a certain relationship with the research proposal.

The findings found in the research work of Rojas (2022) of the doctoral thesis "Didactic alternative to contribute to the significance in the learning of differential and integral calculus in the Computer Science Engineering career" - Cuba are considered. Where her research objective was: to design a didactic alternative for the E-A process of differential and integral calculus that contributes to the significance of its learning in students of the Computer Science Engineering career. The methodology used was Qualitative-evaluative and was carried out through observations of class sessions, using distribution of absolute and relative frequencies, and median to study trends in student learning. Reaching the following conclusion, differential and integral calculus constitutes an obligatory topic in the conception of the study plans of various technical careers, particularly those that deal with the training of engineers in the area of computer sciences, having a significant learning differential and integral calculus, closely related to this work. Another finding by Lázaro (2020), in his thesis titled "Characterization of university dropouts and proposal for academic reinforcement workshops at the Universidad Católica Sedes Sapientiae Filial" – Universidad César Vallejo, presented to qualify for the academic degree of Master in University Teaching, and quantitative-descriptive methodologically, concludes that there are many factors that give rise to student dropout in young university students, one of the reasons being academic difficulty, derived from the way in which some teachers teach; Therefore, it is highly recommended that the University develop workshops, seminars, and extracurricular classes in order to reinforce the knowledge and abilities of students, preventing them from falling behind and falling into frustration, which often leads to dropping out. In the work of Espinoza (2017), in his research "Application of mathematical reinforcement workshops to improve the academic performance of the vector calculus course in the students of the first cycle of the Professional School of Environmental Engineering of the University "Alas Peruanas" -UAD Pisco 2016", aimed to test the application of mathematical reinforcement workshops. The method of this research is experimental, quasi-experimental design, where the population was made up of 34 students, distributed in two groups: 17 made up the experimental group and 17 the control group, requiring a sample of 34 students to whom a test was applied. pre-test and post-test, reaching the following conclusion: the mathematical reinforcement workshops improve the academic performance of the vector calculus course in the students of the first cycle of the Professional School of Environmental Engineering of Environmental Engineering of the "Alas Peruanas" University. - UAD Pisco 2016, related to research.

In the same way, the authors Chávez and Mendoza (2017), in their research "Academic reinforcement in mathematics learning and its relationship with academic performance in engineering students at the UNJBG of Tacna in 2016." Whose research objective was: Determine the relationship that exists between academic reinforcement in mathematics learning and academic performance in engineering students at the UNJBG of Tacna in 2016, a non-experimental, relational research was carried out that includes descriptive and explanatory, with a descriptive correlational research design, surveys were also applied to a total of 225 students, reaching the conclusion that the relationship that exists between academic reinforcement in learning mathematics and academic performance in students of the engineering schools of the UNJBG of Tacna in 2016 is direct and significant, said work is very similar to the research work.

Some concepts about Academic Reinforcement Workshop:

Workshop: The workshop is a practice of teamwork, through an exchange of speaking and listening, giving and receiving, arguing and defending positions, and seeking consensus, which are typical of a workshop.

Academic reinforcement: Academic reinforcement constitutes a process that allows the consolidation of learning in various subjects. Academic reinforcement in learning integral calculus, by the same student who seeks help for his learning from teachers in the mathematics area. Where the study environment must generate permanent motivation during a learning session.

Academic reinforcement workshop: It is the set of didactic tasks that lead to the strengthening of theoretical or practical knowledge, skills and abilities with performance criteria. Since, we are currently living in new times in which an enormous amount of possibly complex knowledge has been involved, so students must be prepared through these didactic tasks. In this new knowledge society, where everything is evolutionary, guided by information and communication technologies, so that people have a certain mathematical culture, keeping in mind that mathematics is an abstraction, a social construct with a base theory shared by individuals of the same group. Today students are being involved in a finite number of tasks that include quantitative, spatial, representative, probabilistic concepts and mathematical tasks. That is, we are not only talking about instrumental or applicative mathematics but also formative since it contributes to intellectual development, thus promoting capacities such as abstraction, generalization, inductive and deductive thinking, etc.

Likewise, we can observe that academic reinforcement workshops are necessary since there are many studies carried out that reflect the importance of academic reinforcement workshops, and above all they highlight that this is not an isolated process that can be carried out improvisedly, but rather which, on the contrary, requires planning, management and evaluation. The academic reinforcement processes are aimed at exploring students' interests, improving learning methodologies, guiding in special situations, etc. It must be taken into account that academic reinforcements not only involve pedagogical knowledge, but also encompass practical skills. (Córdova and Barrera 2019, p. 102).

II. Materials and Methods

Type of research
Due to its approach, it is a quantitative research. (Hernández, Fernández, and Baptista, 2014). The quantitative approach is sequential and evidentiary, starting from an idea that is limited and, once delimited, objectives and research questions are derived, the literature is reviewed and a framework or theoretical perspective is built.

Due to its usefulness, it is an applied type of research. Carrasco, (2009 p 43). Applied research is distinguished by its well-defined immediate practical purposes, that is, it is investigated to act, transform, modify or produce changes in a certain sector of reality; The purpose of which is the resolution of a practical problem, through academic reinforcement workshops as a didactic strategy, influences the learning of integral calculus in students of the Systems Engineering and Computer Science professional career at Unasam.

Due to its depth, it is an Explanatory level investigation (Niño, 2011, p.34) explanatory or causal research answers the question: Why? Through this research, the causes are discovered so that a certain fact or phenomenon under study behaves in such a way or its existence or nature is conditioned. The research is explanatory because it aims to explain how academic reinforcement workshops as a didactic strategy influence the learning of integral calculus in students of the professional career of Systems Engineering and Computer Science at Unasam.

Research design

The research design can be defined as a schematized structure or organization that the researcher adopts to relate and control the study variables. "It serves as an instrument of direction and restriction for the researcher, in this sense, it becomes a set of guidelines under which an experiment or study will be carried out" (Hernández, Fernández and Baptista, 2014). Statistical methods will be used to analyze the learning of integral calculus in the experimental group (single group).

The research design will be pre-experimental because the Academic Reinforcement Workshop will be applied to see how it influences the learning of Comprehensive Calculus, with the design model of a single group, pre and post test following the following scheme:

$$GE: \quad O_1 .... X .... O_2$$

Where:
EG: Experimental group (single)
O1: Pre-test
O2: post test
X: Academic Reinforcement Workshop Application

Population

In this research work, the study population is considered to be the students of the Faculty of Sciences, of the professional career of Systems Engineering and Computer Science, of the 2022-II semester, which constitutes a population mass of 26 students. Only all those who took their qualified practices and their midterm exams will be considered as the study population.

Table 1. Population and sample

Systems Engineering and Computer Science	Population (N)	Sample (n)
Students	26	26
Total	26	26

Source: General Studies Office (OGE)

Sampling

The determination of the sample size was carried out in a selected manner with the non-probabilistic method of an intentional deterministic type (Hernández, Fernández and Baptista, 2014).

Instrument

The initial data was collected through a pre-test to identify the level of the students and determine whether these students are taking the subject for the first time or taking the subject for the second or third time. This exam was designed following the textbook and the syllabus of the subject of Mathematics I, in the Professional Career of Systems Engineering and Informatics of the National University "Santiago Antúnez de Mayolo". While a post-test was used to show the level of the students at the end of the process. The pre and post test were validated through the content validity technique. Litwin (2003) states that content evaluation commonly involves an organized review of the contents of the questions to ensure whether they contain the contents they should or should not have. For this, 2 professors who regularly teach at these levels acted as experts to review the relevance and validity of these instruments.

Procedure

I must mention that the population was made up of 26 students, to whom the academic reinforcement workshop was applied since the 2022-II semester began, with three additional hours per week to their class hours, taking a pretest as an entrance evaluation. , and at the end of the semester a post test, as an exit evaluation. Their evaluations (graded and partial practices) were also considered.

Techniques for information processing

- The analysis of the data and its interpretation obtained from the information, the data were organized through a tabulation matrix in Excel and Statisitcal Product and Service Solution (SPSS).
- Interpretation of the influence of the independent variable on the other dependent variable.
- Determine the degree of generalization of the research results.
- Comparative tables: Systematize the information and contrast the elements of the Academic Reinforcement Workshop's influence on the learning of integral calculus.
- Describe the characteristics of the object of study.

III. Results

In accordance with the objectives set out in this research, the results are shown through the table, which are a reflection of the intervention that the teacher-researcher carried out during the 14 weeks through the pre-test and the post-test. The following table presents the Shapiro-Wilk test with which it was achieved
establish normality

Table 2. Shapiro-Wilk test to establish normality

	Statistics	gl	p-value
Score Pre Test	0,943	25	0,170
Score Indefinite Integral	0,940	25	0,150
Score Definite Integral	0,924	25	0,064
Score Application of Definite Integral	0,923	25	0,059
Score Post Test	0,899	25	0,057

Source: researcher's scores record

From the table it is observed that with the Shapiro-Wilk test, the value $p>0.05$ therefore we conclude that the grades follow a normal distribution.

Table 3. Average marks of the Pre Test, the Indefinite Integral, the Defined Integral, Applications of the Definite Integral and Post Test of the students' learning in the Integral Calculus course.

	Average Score	Standard deviation
Score Pre Test	3,08	1,869
Score Indefinite Integral	9,24	2,905
Score Definite Integral	7,80	4,435
Score Application of Definite Integral	9,28	4,098
Score Post Test	8,64	3,604

Source: researcher's scores record

From the table it is observed that the average grade of the Pre Test is 3.08 with a standard deviation of 1.869 and comparing with the average grades and standard deviation of the Indefinite Integral (9.24; 2.905), Defined Integral (7, 80; 4.435), Applications of the Definite Integral (9.28; 4.098) and Post Test (8.64; 3.604) after applying the academic reinforcement workshop the grades have improved significantly; from which we can affirm that the academic reinforcement workshop has a significant influence on the learning of integral calculus.

Hypothesis testing

Table 4. T-Student test of the Pre Test scores and Indefinite Integral scores in the Integral Calculus course.

	Media	t	g.l	p- evalue
Score Pre Test- Score Indefinite Integral	-6,160	-19,923	24	0,000

Source: researcher's scores record

H0 The academic reinforcement workshop does not significantly influence the improvement of learning of the indefinite integral
Ha: The academic reinforcement workshop significantly influences the improvement of learning of the indefinite integral
Performing the statistical analysis with the T-student test for related samples, comparing the Pre Tes grades and the Indefinite Integral grades, a significance ($p<0.05$) is obtained, confirming that the students' learning of the Indefinite Integral of the second cycle of Systems and Computer Engineering improves significantly with the academic reinforcement workshop with 95% confidence.

Table 5. T-Student test of the Pre Test scores and scores of the Definite Integral in the Integral Calculus course.

Score	Media	t	gl	p-value
Score Pre Test – Score definite Integral	-4,720	-7,183	24	0,000

Source: researcher's scores record.

Ho: The academic reinforcement workshop does not significantly influence the improvement in learning the definite integral
Ha: The academic reinforcement workshop significantly influences the improvement of learning the definite integral

Performing the statistical analysis with the T-student test for related samples, comparing the scores of the Pre Test and the scores of the Definite Integral, a significance ($p<0.05$) is obtained, confirming that the learning of the Definite Integral in the students of the second cycle of Systems and Computer Engineering with the academic reinforcement workshop improves significantly with 95% confidence.

Table 6. T-Student test of the Pre Test scores and the Post Test scores in the Integral Calculus course.

	Media	T	gl	p-value
Score Pre test – Score Post Test	-5,560	-11,671	24	0,000

Source: researcher's scores record.

Ho: The academic reinforcement workshop does not significantly influence the improvement of the learning of Comprehensive Calculus.
Ha: The academic reinforcement workshop significantly influences the improvement of the learning of Comprehensive Calculus.

Performing the statistical analysis with the T-student test for related samples, comparing the Pre-Test grades and the Post-Test grades, a significance ($p<0.05$) is obtained, confirming that the academic reinforcement workshop significantly influences the improvement. of learning integral calculus in students of the second cycle of Systems Engineering and Computer Science with 95% confidence.

IV. Conclusions

- When performing the statistical analysis with the T-student test for related samples, comparing the Pre-Test grades and the Post-Test grades, a significance ($p<0.05$) is obtained, confirming that the academic reinforcement workshop significantly influences the improvement of learning integral calculus in students of the second cycle of Systems Engineering and Computer Science, semester 2022-II, Unasam-2023, with 95% confidence.
- When performing the statistical analysis with the T-student test for related samples, comparing the Pre Test scores and the Indefinite Integral scores, a significance ($p<0.05$) is obtained, confirming that the learning of the Indefinite Integral in Students in the second cycle of Systems and Computer Engineering improve significantly with the academic reinforcement workshop with 95% confidence.
- When performing the statistical analysis with the T-student test for related samples, comparing the Pre Test scores and the scores of the Definite Integral, a significance ($p<0.05$) is obtained, confirming that the learning of the Defined integral in Students in the second cycle of Systems and Computer Engineering with the academic reinforcement workshop improve significantly with 95% confidence.

V. Acknowledgement

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Annex 1. Questionnaire

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PRE-TEST AND POST-TEST RESEARCH INSTRUMENT

Instructions:

This questionnaire refers to the Academic Reinforcement Workshop in the learning of integral Calculus in students of the professional career of Systems Engineering and Computer Science, as it refers to indefinite integral, definite integral and applications of the definite integral.

You have 120 minutes to answer the questionnaire, and consider that the development of the test is not decisive for the course average. It will be useful to the extent that you are sincere in your answers, having a rating of two points per question.

N°	OPINIONS
	INDEFINITE INTEGRAL
1	What do you understand by an indefinite integral?
2	In what cases can I apply the integration by parts method?
3	Are Trigonometric Integration and Integration by Trigonometric Substitution the same?
4	Calculate $\int \left(x - \sqrt{x} + 1 \right)\left(\sqrt{x} + 1 \right) dx$
	DEFINITE INTEGRAL
5	Calculate $\int_{1}^{3} \frac{x^2}{\sqrt{2x^3 + 7}} dx$
6	What is the difference between an indefinite and a definite integral?
7	Calculate $\int_{0}^{1} \frac{e^x}{e^x + e^{-x}} dx$
8	Calculate $\int_{0}^{1} \frac{arcsen\sqrt{x}}{\sqrt{x}\,(x-1)} dx$
	APPLICATIONS OF DEFINITE INTEGRAL
9	Calculate the area of the figure limited by the curves $y = x^2 \quad \wedge \quad y = \frac{x^3}{3}$
10	Calculate the area of the figure limited by the curves $y = 4 - x^2$ and the x axis, when rotating around the x axis

¡Thank you for your collaboration!