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## DIDACTIC STRATEGY TO STRENGTHEN THE PROCESSES MATHEMATICAL TRAINING APPLIED TO STUDENTS

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*Karina Elizabeth Calderòn Montes*

Master's student in Education with  
Mention in Innovation and Educational  
Leadership, Instituto de Posgrado de  
la Universidad Técnica de Manabí  
Portoviejo - Ecuador

<https://orcid.org/0000-0002-2861-1968>

*Humberto Pastor Castillo Quintero*

Universidad de los Andes, Facultad de  
Humanidades y Educación, NUTULA  
Táchira, Venezuela

<https://0000-0001-5510-5780>

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**Abstract:** The present work promotes the application of a didactic strategy to facilitate the educational challenge in the current environment for the impartation of mathematical knowledge, which has represented one of the areas that frame a very complex and incomprehensible degree of understanding, when the student does not acquire the necessary interest in the subject. The objective of the investigative work was oriented to the strengthening of the mathematical formative processes through a didactic strategy that involves a system of activities and resources that allow obtaining a significant and effective learning of mathematics in the students of the Private Educational Unit “Lieutenant Hugo Ortiz Garces” with military discipline. The study was carried out assuming a mixed approach, for the collection and interpretation of quantifiable data and the qualitative understanding of aspects related to the implementation of the didactic strategy. The results showed a significant effectiveness of the didactic strategy in improving and obtaining significant learning in three evaluative moments.

**Keywords:** Didactics, training processes, educational challenge, motivation.

## INTRODUCTION

The exact sciences such as mathematics, which involve innovating and executing new educational strategies incorporating technology, which was often despised, but which is essential to reach students and maintain continuity in educational cycles, allowing communication through digital platforms, emails, telephones, etc. And at the same time giving way to know the infinite digital interactive tools that can be implemented in the classroom, facilitating student understanding and generating satisfactory results.

According to (Bernal 2021:10)

*“Mathematics is not complex, only that it must have a good practice, with a simple explanation and the use of tics (Information and Communication Technologies), giving way to a pleasant school environment.”*

The work of the teacher and the processing of knowledge acquired by the students were really facilitated; ICTs have become essential to transform the educational system, where the development of skills and digital competencies are essential to perform competitively, enhancing learning through collaborative, creative, innovative and meaningful strategies.

For this reason, the role of the teacher within the innovative process is essential, as stated by Pila, Andagoya and Fuertes (2020). The challenge persists in that it is not defined with absolute clarity what a Mathematics teacher must know in order to provide quality teaching; We will not always have the same students, with the same level and skills for the acquisition of knowledge, except the same environment, with the constant priority towards didactic innovation and renewing the pedagogical process, which allow obtaining students with their own reasoning, critics, observers and analysts. Ciccioli (2020)

For Opazo (2021:10)

*“These studies criticize the usual, lacking frames of reference to give new meaning to mathematical knowledge in different situations.”*

Human beings find ourselves in constant innovation, which is present in all areas allowing us to recognize all limitations and alter that order for the benefit of learning, all this has generated in teachers the need to diversify and contribute to improving their teaching process.

Taking Reynosa, et al. (2020:9), which states:

*“Didactic strategies, as a whole, demand to establish a dialogical, constant and triangular relationship between educators, students and methodologies, even if the student ignores or*

*not the methodologies used by the teacher for this purpose”.*

and Martínez, et al. (2018:12), states that:

*“The Mathematics subject has among the general methodological indications: to continuously systematize knowledge, skills and modes of mental activity, also trying to integrate the knowledge of students from different areas of Mathematics.*

So, mathematics is no exception, the general objective is to develop classroom management to strengthen mathematical processes applied to third-year high school students of the “Lieutenant Hugo Ortiz Garces” educational unit with military discipline, so that the student acquires their own abilities such as critical reasoning, their reasoning according to their perspectives on the subject seen and the ability to solve problems through strategies and calculation methods.

## **METHODOLOGY**

The present work was carried out in the private educational unit Lieutenant Hugo Ortiz Garcés with military discipline, located in the city of Portoviejo, obeys a didactic strategy to strengthen the mathematical training processes applied to third-year high school students, which was developed through a combination between didactic tools, resources and technology, giving way to a new way of teaching classes, which improved the environment within the classroom and provided the necessary and essential information for students.

This research obeys a mixed approach, which allowed us to collect quantifiable data and, at the same time, adequate classroom management (independent variable) and necessary for the application of mathematical processes (dependent variable) in students was understood, described and qualitatively interpreted. third year of high school of the private educational unit “Tnte. Hugo Ortiz

Garces” with military discipline.

The total population for this research was made up of 24 third-year high school students, with ages ranging from 16 to 19 years old, and a teacher, where 100% of it was used, since it is an accessible population of studies, it was not considered. proceeded to select sample units. The expert agreement method was used to validate the viability of the didactic strategy.

The theoretical methods used are the inductive-deductive method as logical reasoning strategies, as well as the analysis-synthesis method, which allowed processing the necessary and appropriate theoretical references for the required diagnosis and finally the hermeneutic method that gave way to understanding. of terms and theoretical ideas immersed in the topic.

Through the interview with the students, so that they express their points of view about their expectations and proposals for educational improvement, the essential and important information for this article, based on simple questions; the survey (a questionnaire) and the observation (observation guide) of certain recorded, analyzed and contrasted facts leads to the theoretical information obtained and necessary to modify the didactic strategies in the training processes for the acquisition of mathematical knowledge.

The triangulation of information sources provided an alloy of all the empirical data collected and analyzed, which provided confirmation of the results obtained from the applied methods, simplifying the data investigated, which were incorporated into the development of this didactic strategy.

A question form and a test based on basic knowledge were used to diagnose the level of knowledge acquisition (parametric tests), giving rise to the need to innovate and modify the planning of the subject, involving interactive tools and resources, which facilitate the understanding of mathematical

processes, (Pearson's correlation coefficient), which helped to calculate the effect of change in the variables, after applying the strategy.

## RESULTS AND DISCUSSION

In order to achieve a didactic strategy that allows significant development, the methodology for teaching classes began to be changed, taking into account that the student is the one who learns and that not only a final evaluation must be taken as the basis for their qualification, but also There must be four fundamental parameters.

According to Parra and Agudelo (2020:53)

*“Innovation requires a teacher who moves between the fields of thought, inquiry, reflection, creation and transformation”.*

And to Parra and Rengifo (2021:3)

*“The pedagogical practices of teachers can get out of the traditional routine, involving innovative strategies that promote changes in learning.*

It was taken regarding the performance in classes, class work, homework and lessons; the same ones that will serve to demonstrate their potential in the subject, shortcomings and how you can help them to have a better development; In addition, it seeks to avoid classic rote learning, giving way to the student's own and unique reasoning, providing the ability to solve problems through translation and acquired critical thinking.

In this regard, Rivas (2017:20) states:

*“Educational innovation is like a vital force, present in schools, educators, projects and policies, which is capable of recognizing the limitations of the traditional educational matrix and altering it for the benefit of the 21st century learning rights of our students.”*

The use of interactive tools promotes the interest of the student in the subject, taking advantage of pages such as Wolfram Alpha, mathway, Sangakoo, cymath, among others that allow verifying the results, observing

processes and understanding the subject fluently, it is not giving way to copy, is to challenge them to do it alone and encourage them to try it at home. For educational innovation to contribute significantly, it is necessary to clearly establish the use of technology, since linking it to practice does not guarantee innovative processes. (Ortiz -2019)

Mathematical problems have several ways to reach the final answer, taking into account that the arrival process is important, within it strategies and artifices must be used, which involves various calculation issues, analysis of existing data, operations that can be used, which will help to solve it regardless of its complexity.

Valenzuela (2017:40) tells us that:

*“The purpose of educational innovation is to alter reality by modifying conceptions, attitudes, methods and interventions, in order to improve or transform the teaching-learning processes.*

The classes are taught through animated slides (step by step), with graphics, diagrams, videos, examples, didactic material on the subject, among others; facilitating the acquisition of efficient, effective, rapid and understandable knowledge. All the resources rest on the platform used by the institution, giving the student the possibility to review them at home, when for various reasons they cannot attend classes, generating educational continuity and the possibility of staying informed on the subject.

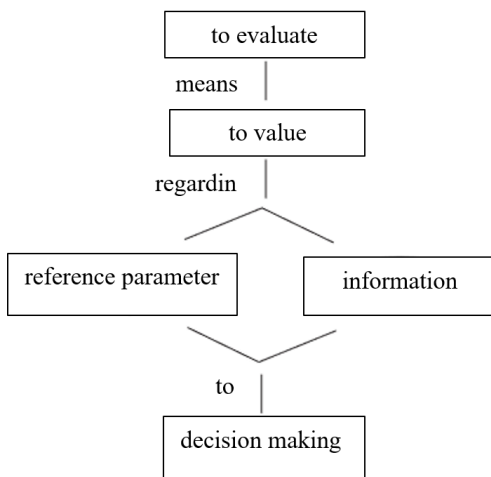
Referring to Gutiérrez, Gil, Zapata, Parra and Cardona (2018:26) tells us that:

*“The formative processes modify the role of the student turning him into an active subject of learning, and the teacher gives him the role of guide and counselor in the communicative exchange, to help resolve questions, doubts and possibilities in accessing resources, study materials and variety of forms of communication between participants.*

Teachers are not balanced and on par with technology, taking these resources that our students already use, interacting with them, providing possibilities for educational tools that adapt to society and the current environment; “Students solve the mathematical exercises at home like a copy and paste, but it is our duty to guide them, motivate them, establish a bond of communication, respect and responsibility within the classroom, so that they use these platforms in a positive way and acquire the desired knowledge”. (Gutierrez et al., 2018)

Web platforms allow innovation in the educational field. Yuen et., al (2019) and “mobile devices allow teachers to organize and carry out creative activities inside and outside the classroom”. Salas Ruedas et al., (2020). So the pedagogical and didactic innovation in the teaching and learning processes, represents being in agreement with the technology, taking the resources it provides, achieving an effective understanding.

Emphasizing that well-guided education is a basic tool to improve humanity and everything that has to do with innovation and transformation of the teaching and learning process is already on the world agenda. “Today there is more talk than ever about education and its meaning.” (Tusell, 2017)



Ausubel et al., (1983)

It is not changing the training, it is a matter of adding tools that contribute to an effective knowledge acquisition, under communication, classroom interaction, respect; that activates abilities and strengthens skills in students.

Educational models change over the years, under the need to not only innovate and modify “the processes and adaptations in the educational environment but also in the quantity, quality and speed and innovation of knowledge advances, to the evolution and progress in sciences such as Pedagogy or Psychology among others” (RODRÍGUEZ MORENO, MOLINA JAÉN, & MARTÍNEZ LABELLA, 2019)

We understand pedagogical practices as a set of actions that are carried out in a classroom, which are developed by the teacher and range from their way of communicating, behaving and acting, to mediation in learning. The teaching and learning process are related and communicate with each other (teacher, student and knowledge) in addition to the socio-educational environment (Martínez-Maldonado, Armengol Asparó, & Muñoz Moreno, 2019)

The formative processes “Are the ability of an individual to identify and understand the role that mathematics has in the world, make well-founded judgments and use and get involved with mathematics in those moments that present needs for their individual life as a citizen” Mendivil et al, (2017).

The training models linked to the theory of connectivism are increasingly flexible, open and participatory. (Recio Mayorca, Gutierrez Esteban, & Suarez Guerrero, 2021), specifically as a result of the social transformations generated by the use of technology, which changed the way we communicate in different social, cultural and family spheres, also promotes changes in the education, establishing technological means

as indispensable in the daily life of the student, changing the educational modalities, learning environments, contexts and interests of each person (Igelmo Zaldívar & Laudo Castillo, 2017).

Being necessary an alloy of knowledge and experiences in the educational field with digital tools and all that infinite space that promotes the digital society, with open, flexible educational reforms and adjusted to the needs of students, generating virtual communities where students interact. students and teachers the main axis is effective communication with equal opportunities.

Meaningful learning in education is situated neither on the objective nor on the subjective level, but on the slippery terrain that lies between these two extremes, reaching the required and necessary influence for effective communication, giving way to the liberating authority, in which a free expression of thoughts and ideas can be carried out, taking into account learning and mutual knowledge. For Ausubel et al., (1983:58)

*Meaningful learning is "the process through which new information (new knowledge) is related in a non-arbitrary and substantive (non-literal) way with the cognitive structure of the learner"*

The current educational leadership is collaborative where love for knowledge and love for our students is paramount to effectively reach their training. We must always carry in our memories that we are forming human beings with different feelings, perspectives and ideas.

Emotional intelligence and persuasion were applied to encourage students to strengthen their emotional weaknesses and allow themselves to try to learn and know subjects that are not within their preferences, which are seen as opportunities to acquire new skills and knowledge; I consider that we are human beings with errors that can be

reversed and strengthened for improvement as a person and element of society.

The educational challenge for the generation of teachers who have the challenge of marking a trajectory, let us remember that a new variable has been incorporated, which is the digital field, where the space and time where the student is located does not matter, managing to establish effective communication, which allows leaving a digital footprint that will serve as a path for other teachers, this leads to a more collaborative classroom leadership, where each member provides their unique and personal contribution, according to their way of thinking and feeling; Otherwise, without being aggressive, leading to group harmony, achieving personal and institutional purposes, through prior planning, organization and completion of tasks. The challenge in education focuses on 5 important and essential aspects that are:

- Social inclusion, significant axis
- Leadership in educational institutions
- Contents + Teaching + Technology
- New evaluation techniques
- Foster creativity Master Word (2017)

Starting from all the data obtained for the modification and use of a didactic strategy for the strengthening of the formative processes in the mathematical knowledge of the educational unit "Lieutenant Hugo Ortiz Garcés" with military discipline, it is evident that all the students of the third year of high school They wanted a change in this subject of exact sciences, to achieve this, a system of strategic activities was carried out in the classroom, such as argumentation, computational thinking, accidental learning, learning by doing and learning with the context, leading to:

- The need for contact with the teacher to maintain effective communication, which gives way to asking questions, solving

unknowns and clearing up doubts, which for various emotional or personal reasons are not expressed in class. It must be noted that adolescents tend to have problems in their self-esteem due to social and family paradigms, delimiting their abilities and communication in the classroom. (Argumentation)

- The use of technology that is essential in these times to go to the same level as the students and can make use of their potential and development in digital tools, for this reason in the private educational unit “Lieutenant Hugo Ortiz Garces” with discipline The purpose of the military was the acquisition of resources to improve the acquisition of knowledge in the different subjects taught in mathematics. (Computational Thinking)
- Allowing the different ways of reaching a desired answer to be exposed, allowing

the subject to be non-linear and repetitive, opening pathways to other mathematical processes, which infer various topics and which constitute a valid process, with sought-after strategies and procedures and reasoned by the student. (Accidental learning)

- The validity of the perspective that a student has on a practical exercise allows the development of reasoning and critical thinking skills necessary not only in mathematics but also in life. (learning with context)
- The different exposed points lead to the improvement in the comprehension of the subjects taught, ease to solve mathematical calculation exercises and the forgetfulness of the fear, dread, discontent, boredom, among other points, that were attributed in these classes. (Learning by doing science).

Activity system				
DIMENSION	ACTIVITY	GOAL	CONTENT TO DEVELOP	RESOURCES
Argumentation	Effective communication for the resolution of unknowns and possible solutions found	To promote intrinsic and extrinsic motivation in the student	<ul style="list-style-type: none"> <li>• Devise, through graphics and real situations, possible solutions through mathematical procedures.</li> <li>• Form with linear and quadratic elements, proportional to reality and with a mathematical approach.</li> <li>• Present exercises solved by different mathematical methods.</li> </ul>	<ul style="list-style-type: none"> <li>• Projector (videos)</li> <li>• laptop</li> <li>• rules</li> <li>• palettes</li> <li>• plasticine</li> <li>• interactive tabs</li> <li>• wolfram</li> <li>• Alpha</li> <li>• math way</li> </ul>
emotional analysis	Eye tracking and facial recognition to analyze how students learn and then respond differently to their emotional and cognitive states	To combine systems so that instruction can be more responsive to all students.	<ul style="list-style-type: none"> <li>• To direct the student to propose questions and answers on mathematical topics.</li> <li>• Resolution of mathematical activities that address the development of skills and strategies used by the student.</li> <li>• Incentives for student participation</li> </ul>	<ul style="list-style-type: none"> <li>• laptop</li> <li>• projector</li> <li>• interactive tabs</li> <li>• videos</li> <li>• book</li> <li>• platform</li> </ul>

Computational thinking	To guide students in the proper use of technology, taking advantage of its benefits for effective knowledge	To encourage students to be computer coders.	<ul style="list-style-type: none"> <li>Addressing complex challenges in all aspects of their lives.</li> <li>Division of large problems into smaller ones</li> <li>Recognition of the relationship with problems solved in the past (pattern recognition).</li> <li>Identification and development of the steps that will be necessary to reach a solution (algorithms) and refinement of these steps (debugging).</li> </ul>	<ul style="list-style-type: none"> <li>laptop</li> <li>projector</li> <li>interactive tabs</li> <li>free math platforms</li> <li>Sangakoo</li> <li>cymath</li> </ul>
Accidental learning and stealthy evaluation	To generate activities related to mathematical learning and learn unconsciously.	To learn through daily routines.	<ul style="list-style-type: none"> <li>Incidental learning supported by technology</li> <li>Encourage students to re-conceptualize</li> <li>Fragmentation of isolated learning as part of coherent trajectories</li> </ul>	<ul style="list-style-type: none"> <li>Laptop</li> <li>projector</li> <li>platforms</li> <li>interactive worksheets (liveworksheets.com)</li> </ul>
To learn by doing science	To engage with authentic science tools and practices, to control remote laboratory experiments	Student understanding by offering hands-on investigations and direct observation opportunities that complement textbook learning.	<ul style="list-style-type: none"> <li>Develop scientific inquiry skills.</li> <li>Improve conceptual understanding</li> <li>Increase motivation</li> </ul>	<ul style="list-style-type: none"> <li>Laptop</li> <li>projector</li> <li>friendly and recycled material</li> </ul>

Prior to calculating the statistics related to the analysis of variance, the assumption of homogeneity was determined. Equality of variances was evidenced assuming the Levene statistic.

Levene's statistic	gl1	gl2	Value
2,521	2	72	0,087

The hypothesis of equality of variances is accepted (value: > 0,05)

Table 1 - Test for homogeneity of variances based on the mean

	N	Average	Deviation	Minimum	Maximum
Before	25	6,92	1,525	4	9
During	25	7,97	1,201	5	10
Final	25	8,96	,957	7	10
Total	75	7,95	1,491	4	10

The difference in means is significant at the 0.05 level.

Table 2 - Descriptive

## Hypothesis

$$H_o: \mu_1 = \mu_2 = \mu_3$$

$H_a$ : Not all stockings are the same

	Sum of squares	gl	Root mean square	F	Value
Between groups	52,033	2	26,017	16,663	,000
Inside groups	112,414	72	1,561		
Total	164,447	74			

Table 3 - ANOVA of a factor

Sufficient evidence is available to reject the null hypothesis ( $F=16.663$ ; Value:  $<0.05$ ). Consequently, the qualifications obtained before, during and at the end that helped to improve reasoning and the ability to carry



out mathematical processes, using interactive cards, slides, graphic computers, explanatory videos and other means of application of the evaluations, evidenced different and statistically significant results. that contributed to an improvement in student performance. This analysis is complemented using Tukey's HSD post hoc test (multiple comparisons).

improve the reasoning and the ability to carry out mathematical processes, using interactive cards, slides, graphic computers, explanatory videos and other means of application of the evaluations, evidenced different and statistically significant results that contributed to an improvement in student achievement.

C) The use of technology, argumentation, accidental learning, learning by doing and the knowledge acquired with the context is essential in these times and thus they can make use of their potential and development in digital tools.

Process	subset for alpha = 0.05			
	B	1	2	3
Before	25	6,9		
		2		
During	25		7,9	
			7	
Final	25			8,96
Value		1,0	1,0	1,000
.		00	00	

Table 4 - Homogeneous subsets: HSD Tukey<sup>a</sup>

The means for the groups in the homogeneous subsets are displayed.

a) Use the sample size of the harmonic mean = 25,000.

Results are obtained that confirm the significant difference in the means of the three evaluation phases. At the end of the process, there was evidence of greater performance in the process carried out through the strategies put into practice. the three subsets whose means differ significantly (at the 0.05 level) do not present statistically significant differences among themselves (value: 1,000).

## CONCLUSIONS

A) Students require a didactic strategy that directs them along a path of knowledge that involves reasoning, creativity, and motivation; the latter being essential in the development of mathematical processes

B) The qualifications obtained before, during and at the end that allowed to

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