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Mathematics Teaching-Learning Methodology and Its Impact on Academic Performance

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Abstract

Mathematical logical thinking is essential for the development of cognitive constructs of complexity, where the symbolic and abstract take shape, hence the importance of teaching-learning of mathematics, however the strategies in the educational process are not always diverse. which may have an impact on academic performance. Objectives: identify the main methodological elements of teaching-learning mathematics and their relationship with academic performance. Methodology: the research was developed based on a quantitative, non-experimental and descriptive approach. An instrument designed with 12 questions was used, whose Cronbach's Alpha validity was .890, indicating internal consistency. The sample was 383 teachers from public and private educational entities, characterized by not having normality with a value of p .000. Results: The type of classes in public and private educational institutions is generally synthetic-analytical libraries, the institutional guide text and sources from institutional are used as guide materials, in addition, educators reinforce memory and understanding in students to enhance learning significantly, they implement problem solving and presentations, and evaluating through tests and projects. Conclusions: the mathematics teaching-learning methodology that the educators of the Sierra regime apply implies a synthetic-analytical modality, in addition, strategies are used that vary according to the type of educational entity.

Keywords: *Abstraction, Teaching-Learning, Mathematical Logical Thinking, Psychopedagogy.*

INTRODUCTION

Abstract thinking is one of the capabilities of the human being that allows us to generate symbolic representations, images, ideas and schemes, which are structured without the presence of material objects. It is a construct, which is linked to logical and reasoning abilities, and is based on the mental images of daily life, which are reproduced in the brain in an abstract way.(1) According to Medina-Hidalgo(2)Cognitive abstraction includes in its reasoning processes complex elements such as inference, which constitutes one of the steps of the structures of logical thinking.

From another perspective, Romo-Santos(3) refers that symbolic thinking is based on associative structures, which are also linked to divergent cognitive schemes. Vargas-Mesa et al.(4)On the other hand, they propose that the symbolic is cognitively developed from the first stages of childhood through play, a component that stimulates creativity, hence its importance in the classroom. Even Briones-Espinoza et al.(5)highlights that mental images and the development of complex cognitions begin in childhood, stimulated through play.

In this context, the existence of various elements that can influence and condition academic performance is recognized, some of them being social, economic, family and hereditary.(6)Emotions constitute channelers that are directly linked to motivations and cognitive functioning. Mental performance within academics has close ties with psychopedagogical elements, neurocognitive abilities, culture and certain social phenomena.(7)

Faced with this, Martínez et al.(8)propose that certain stimuli and various psychopedagogical strategies are necessary to generate new learning, in addition, in the teaching-learning of mathematics, different didactic strategies are required that teachers must apply, being important the processes and resources that they have from the first levels of training.(9)

Within this brief context, the objective of this research focused on identifying the main methodological elements of mathematics teaching and learning and their relationship with academic performance.

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MATERIALS AND METHODS

The research was developed based on a quantitative, non-experimental and descriptive approach since it sought to characterize teachers around the mathematics teaching-learning methodology. For this purpose, a questionnaire was designed with 12 questions consistent with the research objective.[10]and for its assessment, the alternative of choosing elements and a Likert scale was used with values: 1. Totally disagree; 2. Disagree; 3. Indifferent; 4. Agree; and, 5. Totally agree.

A reliability test of the instrument was applied using Cronbach's Alpha, obtaining a value of .890, demonstrating that the questionnaire is good. The population was made up of 57,669 teachers nationwide (Sierra Regime) from public and private entities of Basic General Education in urban areas.[eleven], the sample being 383 teachers (183 public and 200 private). The sample has a 95% confidence level, significance of 0.05. The Kolmogorov-Smirnov test was used to identify the type of distribution, giving a value p .000 which indicates that it does not have normality, in this way the Mann-Whitney U test could be used to compare means.

The data were analyzed in the SPSS V25 software and the questionnaire was applied digitally through mass e-mail through an official research source to guarantee the teachers' attention to the study. The data collection period was between April and May 2024.

RESULTS

The results show that the significance is less than 0.05, understanding that the means differ between the public and private entity samples, that is, the findings present differences between both study groups. Thus, the type of classes in public and private educational institutions tends to be generally synthetic-analytical, but in the public sphere there is also a development of the synthetic and analytical modalities separately. Regarding the material used by teachers for mathematics classes in the public system, the average indicates the institutional guide text and in the private system they have access to sources from institutional libraries. Regarding planning in public education, educators prepare classes per day and in private education their plans are organized by quarters. In reinforcement to achieve significant learning, teachers in the public system consider that it is necessary to work on memory, while those in the private system consider that it is necessary to work on understanding. Furthermore, to motivate their students, public teachers pose problems for resolution and those in the private context, presentations. Finally, evaluations involve tests in the public educational system and projects in the private one (table 1).

TABLE 1. Mann-Whitney U Of Methodology In Mathematics Teaching-Learning

Item	Entity	N	Average range	Sum of ranks	Half	Dev. Standard	Mann-Whitney U	Wilcoxon W	Z	Asymptotic sig. (bilateral)
Class type	Public	183	181.21	33161.5	2.70	0.657	16325.5	33161.5	-3,067	0.002
	Private	200	201.87	40374.5	2.88	0.436				
Material used	Public	183	282.70	56540.0	4.19	0.482	160.0	16996.0	-17,413	0.000
	Private	200	92.87	16996.0	1.86	0.750				
Lesson planning	Public	183	93.87	17178.0	1.42	0.494	342.0	17178.0	-17,051	0.000
	Private	200	281.79	56358.0	3.73	0.775				
Aspects to reinforce student	Public	183	92.46	16921.0	1.56	0.550	85.0	16921.0	-17,403	0.000
	Private	200	283.08	56615.0	4.02	0.601				
Student motivation	Public	183	98.81	18082.0	2.38	0.668	1246.0	18082.0	-16,301	0.000
	Private	200	277.27	55454.0	4.16	0.643				
Assessment	Public	183	109.92	20114.5	2.91	1,103	3278.5	20114.5	-14,688	0.000
	Private	200	267.11	53421.5	4.59	0.494				

Regarding teachers' perception of the methodologies applied to mathematics teaching-learning (Table 2), differences are presented between the means of the samples of public and private educational entities in that the significance in the Mann-Whitney U test was .000. (<.05). Item 1 analyzes whether the methodological

actions implemented have improved the academic performance of the students, public educators demonstrate that they are not sure and private educators indicate with certainty that it has been achieved. In item 2, public educators do not indicate certainty that methodological strategies influence the teaching-learning of mathematics, but private educators believe with certainty that they do. In the next item, teachers from both groups indicate the use of technological and digital tools to increase the academic performance of students. Educators also agree that students achieve significant learning through the methodological processes they apply in teaching mathematics (item 4). Item 5 denotes that public teachers do not implement differentiated methodological strategies for students with different learning rates, however those in the private educational system do. Furthermore, public teachers state thatThe performance of their students in problem solving is not a consequence of learning mathematics, but those in the private sector consider that it has a direct relationship.

TABLE 2.Mann-Whitney U teacher perception

Item	Entity	N	Average range	Sum of ranks	Half	Dev. Standard	Mann-Whitney U	Wilcoxon W	Z	Asymptotic sig. (bilateral)
Item 1	Public	183	100.45	18383.0	3.38	0.964	1547.0	18383.0	-16,778	,000
	Private	200	275.77	55153.0	4.87	0.337				
Item 2	Public	183	103.12	18871.0	3.21	1,091	2035.0	18871.0	-16,154	,000
	Private	200	273.33	54665.0	4.82	0.389				
Item 3	Public	183	145.01	26536.0	4.15	1,162	9700.0	26536.0	-10,899	,000
	Private	200	235.00	47000.0	5.00	0.000				
Item 4	Public	183	155.39	28436.0	4.34	1,127	11600.0	28436.0	-9,365	,000
	Private	200	225.50	45100.0	5.00	0.000				
Item 5	Public	183	108.86	19921.5	2.72	1,030	3085.5	19921.5	-14,860	,000
	Private	200	268.07	53614.5	4.40	0.490				
Item 6	Public	183	92.72	16967.0	1.78	0.573	131.0	16967.0	-17,514	,000
	Private	200	282.85	56569.0	4.35	0.470				

DISCUSSION

The methodological elements used in the teaching-learning of mathematics in basic general education, highland region in Ecuador are characterized by synthetic-analytical classes, in which materials such as the guide text and sources from institutional libraries are used, in addition to the Educators usually prepare their classes daily or quarterly. Regarding the reinforcement of the students, work is done on memory and comprehension, while to motivate them, problems and presentations are used and the evaluation system is given through tests and projects.

In this regard, the findings of Deleg-Tacuri[12]They are similar in finding that educators consider it necessary to use methodological strategies in the teaching-learning of mathematics, and they also claim to always use them to improve the development of students' logical thinking. However, in this study it was determined that they only sometimes receive training in the management of methodological strategies to teach mathematics. On the other hand, the most used strategies are the use of teaching materials and group work to achieve significant learning, but they also incorporate games and dynamics as a motivational action in class.

While, with the results of Cartuche-Sanmartin et al.[13]There are differences in that they identified that among the strategies used in teaching mathematics are master classes, in-class exercises and individual workshops, so the student becomes a passive actor in the learning process, they recognize that in their process of inquiry, educators use traditional didactic actions, lacking innovation, so students do not show interest in the subject, they conclude about the importance of didactic activities for strengthening the critical, social, emotional skills and creativity of students .

These actions can influence and condition the academic performance of students as they require the activation of cognitive processes (6,8). Mora (9) points out in this regard the need to apply different didactic strategies from the first years of study; in this regard, games have been mentioned as an alternative to stimulate creativity and develop complex cognitions from an early age.

CONCLUSION

The mathematics teaching-learning methodology that the educators of the Sierra regime apply involves a synthetic-analytical modality, in addition, strategies are used that vary according to the type of educational entity, whether it is public or private, thus to improve performance. academic development of the students, in the area of mathematics, actions are carried out such as strengthening the abilities of analysis, memory, and research; they are also motivated with problems to solve or dynamic presentation activities and they are evaluated through tests or projects.However, educators in the public system are not more certain that their actions have an impact on the academic performance of students, differing from teachers in the private system who safely assume that their strategies manage to impact it positively, and may be related to the availability of resources, lack of support, and other limiting factors that public vs. private education have, an issue that has been questioned and debated for years in order to improve the quality of training in said sector, but without success.

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