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Didactic strategy to promote logical-mathematical thinking in middle school students

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***Abstract*---**The research was based on investigating a didactic strategy that favors mathematical logical thinking to solve reasoning problems, through playful activities, which implies the incorporation of the game, so that the middle school students of the Ibarra Educational Unit # 2 of the Chone canton They will have quality learning. A diagnosis was made through field research, observing, and analyzing the difficulties encountered in mathematics; Topics from different authors were studied. The objective was to evaluate a didactic strategy to favor mathematical logical thinking, its quantitative approach and analytical methods were used - synthetic, inductive - deductive, statistical, surveys were applied to teachers, parents and observation sheet to teachers and students. The process of teaching mathematics requires learning that allows comprehensive problem solving that develops logical thinking, for which a didactic strategy such as playful activities is proposed, in which mental calculation is developed through a game guide. interactive. As a result, recreational activities were obtained as a didactic strategy that favors mathematical logical thinking, allowing students to be actors of their own knowledge with a high development of reasoning.

***Keywords*---**didactic strategy, logical thinking, mathematics

Introduction

The teaching of mathematics in the country has been based on the traditional method, which are mechanical processes that have favored memory rather than the development of logical mathematical thinking, because of the absence of adequate policies for educational development, insufficient preparation, training

and professionalization of a significant percentage of teachers, outdated bibliography and use of texts as didactic guides and not as reference books. (Paltan, 2011). Difficulties in learning in the subject of mathematics is a problem that has been observed for many years and more so now that due to two years of confinement due to the Covid 19 pandemic, parents have had to play the role of teachers at home and that due to ignorance of how to teach, there has not been an adequate control in the tasks, in addition to the work they have not provided timely guidance, causing deficits in the teaching-learning process, also due to ignorance of many teachers on how to apply teaching strategies online.

This project highlights the need to investigate the problem of the difficulty that exists in students in the development of logical thinking and that this in turn is favored through the use of a didactic strategy, with which it is intended to provide relevant information to teachers. with guidelines and strategies to develop mathematical logic and serves as a basis for the experiences of students to put it into practice in the environment where they operate and teachers will facilitate the teaching process. Due to the above, it is considered pertinent to carry out the proposal of the use of recreational activities (games) as a didactic strategy to favor the development of mathematical logical thinking in middle school students of the Ibarra Educational Unit # 2 of the Chone canton in the period academic year 2021-2022. The problem is related to the existence of factors that affect student learning, so the general objective is set, which is: Evaluate a didactic strategy to favor logical - mathematical thinking in students, which allowed knowing through of an exhaustive analysis why students fail to understand the different processes of basic operations. This research is carried out with the purpose of applying recreational activities as a didactic strategy in the teaching-learning processes to favor mathematical logical thinking.

A field investigation was carried out, where (Arias, 2006) defines this investigation as the one that consists of the collection of data directly from the investigated subjects or from the reality where the events occur without manipulating or controlling the variables. It will be of a documentary bibliographic type, according to the authors (Parraguez Carrasco, Chunga Chinguel, Flores Cubas, & Romero Cieza, 2017), "it is a systematic process of search, selection, reading, registration, organization, description, analysis and interpretation of extracted data of documentary sources, existing around a problem, in order to find answers and questions outlined in any area of human knowledge. It has a quantitative and qualitative approach, which according to (Sampieri, Fernández Collado, & Pilar Baptista, 2014), these are samples of scientific research to generate knowledge and its research process focuses on numerical measurements.

It was exploratory, according to (Fidia, 2006), it is the one that is carried out on an unknown or little studied subject or object, so its results constitute a close view of the object, a superficial level of knowledge was descriptive, which according to (Tamayo, 2006), this intuits the description, registration, analysis, interpretation, of the current nature and the structure or processes of the phenomena. It is of an explanatory nature that is responsible for finding the reason for the facts by establishing cause-effect relationships that allowed determining that the didactic strategy favors mathematical logical thinking. The inductive-deductive method was used, according to (Rodríguez Jiménez & Pérez

Jacinto, 2017), these are made up of two procedures that were used in the study of the causes and effects of mathematics learning difficulties; In addition to the analytical - synthetic, it was used to detail the summary of the investigation, the introduction and the conclusions.

According to (Sampieri, Fernández Collado, & Pilar Baptista, 2014), they state that quantitative and qualitative procedures serve to manage data collection techniques to verify the hypothesis or establish causal relationships in a certain phenomenon, it was used to demonstrate and observe the results of data analysis and tabulations according to the technical instruments. Techniques are defined as the ability to make use of procedures and resources, according to (Gutiérrez, 2002), it is the procedure adopted by the teacher and the students during the teaching and learning process. A survey was applied to teachers and parents to find out the teacher's methodologies in learning mathematics, identify the contribution of parents in the development of logical thinking and to establish the basic skills for the development of mathematical logical thinking. was applied the observation sheet for teachers and students to analyze the interest of students in understanding mathematical content. According to (Carreira, 2013), learning difficulties refer to those that are manifested in the acquisition and use of reading, comprehension, written expression and mathematical reasoning abilities, during the teaching process and that can result in slower performance and even school failure.

Mathematics as a science is necessary in all aspects of life and is always present in other sciences, hence its importance in learning it. The insertion of playful activities in the teaching-learning process of this subject is considered fundamental, but it must be taken into account that the games are useful for the curriculum that is being followed and that they have an important utility must be selected and included. in the study program (Quinde, 2020). As he argues in his research (Paltan, 2011), the integrating axis of the Mathematics Area is to develop logical reasoning, to interpret and solve life's problems; that is, each year of Basic General Education, must promote in students the ability to pose and solve problems with the variety of didactic strategies that constitute the basis of the approach to work. Logical-mathematical knowledge then arises in the child, from a reflective thought, since the child builds it in his mind through relationships with objects, always developing from the simplest to the most complex, having as a particularity that the knowledge acquired once processed is not forgotten since the experience does not come from the objects but from their action on them (Paltan, 2011).

As argued by (Hidalgo, 2017) We can say that all school activities must be developed through play, since it allows the teacher to appropriate the knowledge in a meaningful way. In this way it can be said that learning is achieved for life. For Piaget, the game is characterized by the assimilation of the elements of reality without having to accept the limitations of its adaptation. Children learn mathematical logical thinking by interacting with the objects around them, activities should be sought according to attractive techniques so that children discover and interact in a playful way (Tripero, 2011). The development of logical thinking is key to the development of mathematical intelligence and is essential

for the well-being of children and their development, since this type of intelligence goes far beyond numerical abilities (Quinde, 2020).

Method

The inductive - deductive method was used to carry out the study of the causes and effects of learning difficulties in mathematics, in addition to the analytical - synthetic method to detail the summary of the research, the introduction and the conclusions. The statistician was used to demonstrate and observe the results of the data analysis and tabulations according to the technical application instruments, the survey was applied to teachers and parents to investigate the methodologies used by the teacher in learning mathematics, identify the contribution of parents in the development of logical thinking and to establish the basic skills for the development of mathematical logical thinking. The observation sheet was implemented for teachers and students to analyze the interest of students in understanding mathematical content. For the development of the research study, a population of 290 people and a randomly chosen representative sample of 88 people (19 teachers of the educational unit, 34 parents and 35 students) of the basic were taken.

Discussion

In this research work, the survey was used as a data collection technique that was applied through a questionnaire, designed in the application of Microsoft Forms (digital form), which was distributed online to teachers and parents; an observation sheet was also made to the teachers and students of the middle school through the Zoom platform, which allowed obtaining the results in real time, the 5 questions with the greatest relationship and impact on this object of study were chosen. Shown in Table 1, the 4 that were answered are shown.

Table 1
Questions answered

Variables	Frequency	Percentage (%)
Algorithm	4	21
Problem solving	3	16
Recreational activities	2	10
Handling of materials	10	53

The statistics collected showed that 53% of the teachers surveyed use the handling of materials as a didactic strategy for learning mathematics, the 21% teach through algorithms, 16% indicated that they pose problematic situations; while only 10% stated that they develop the class process with playful activities. Table 2 shows the question asked to the teachers where it is inquired whether these exercises facilitate the development of logical thinking for their students.

Table 2
Teachers implement exercises that develop logical thinking

Variables	Frequency	Percentage (%)
Yes	16	84
Sometimes	3	16

Through the results obtained, it was found that 84% of teachers do select exercises that facilitate their students' development of logical thinking and 16% indicated that only sometimes. Parents were asked that if their children solve mathematical problems they reason easily, these results are shown in Table 3.

Table 3
They reason mathematical problems easily

Variables	Frequency	Percentage (%)
Yes	7	21
No	2	6
Sometimes	25	73

It was investigated whether teachers teach reasoning problems to students in the teaching process, the results are shown in table 4.

Table 4
They implement reasoning problems

Variable	Frequency	Percentage (%)
Always	4	21
Almost always	5	26
In occasions	9	48
Never	1	5

The results showed that 73% of the parents indicated that their children, when solving mathematical problems, only reason easily at times; 21% said yes, while 6% said that their children do not reason easily when solving math exercises. Teachers were consulted if they carry out playful activities in the development of reasoning topics in the mathematics teaching process. The results are shown in table 5.

Table 5
Development of recreational activities by teachers

Variables	Frequency	Percentage (%)
Always	3	16
Almost always	4	21
Occasionally	10	53
Never	2	10

The statistics of the results obtained in an observation of the teaching process were verified that 53% of teachers use recreational activities in the development of their classes as a didactic strategy; 21% stated that they do so almost always; 16% as always; while 10% indicated that they never develop their classes with recreational activities. Teachers were asked if they implement mathematical reasoning problems, the results are shown in Table 6.

Table 6
Teachers apply reasoning problems

Variables	Frequency	Percentage (%)
Always	4	21
Almost always	5	26
Sometimes	9	48
Never	1	5

It was found that 48% of teachers sometimes raise reasoning problems in the class process; 26% of teachers do it almost always; 21% always, while 5% do not. Didactic strategies are pedagogical activities applied by the teacher during the didactic process, for which he requires resources that facilitate the learning process. Every didactic activity has a previous planning, in which the teacher proposes objectives that must be achieved by the students; These planned actions have as a strategy, activities that, guided by the educator, lead to achievement in learning (Álvarez, 2018). For Piaget, mathematical logical thinking is what the child builds by relating the experiences obtained in the manipulation of objects, which makes it possible to differentiate between an object with a rough texture and one with a smooth texture and establishes that they are different. Vygotsky makes a reference between the level of development, determined by the ability to independently solve a problem, and the level of potential, determined by guided action. (Paltan & Quilli, 2011).

As stated, (Becerill, 2019) in his research, logical thinking is important, because through it, the individual performs various actions in the course of his life, such as creating, paying attention to the moment of reading and writing, allowing to develop the ability to reason. As argued (Salazar, 2020) that recreational activities are all active and dynamic activities that each individual exercises voluntarily. Its purpose is not only to promote the game, but also to generate fruitful teaching in a sustained manner, this depends largely on the environment in which it is carried out. The application instruments were applied to 19 teachers, 34 parents and 35 students of the middle school of the Ibarra Educational Unit # 2, in which it is evident that, if didactic strategies such as recreational activities are not used, the development is not favored. mathematical logical thinking in students. As stated in the research (Cobos., 2018), playful activity fosters the development of skills, relationships, and a sense of humor in people, which predisposes the child's attention, motivating him in his learning, becoming a strategic tool for the teaching-learning process (Tatiana, Molano, & Calderón Rodríguez, 2015). The application of this activity allows children to achieve learning in an attractive and natural way, developing their skills and attitudes.

Conclusion

According to what was stated in the problem to favor the development of mathematical logical thinking in the middle school students of the Ibarra Educational Unit # 2 of the Chone canton in the 2021-2022 school period and according to the results obtained in the application of the application instruments, these give a favorable response to the independent variable, so it is verified that, if didactic strategies are not used in the subject of mathematics, logical thinking is not favored, for which the use of recreational activities is proposed in the teaching-learning processes, the same ones that are in accordance with the age of the students. According to the stated objectives and according to the results obtained in the application of the instruments, it can be evidenced that the students present difficulties in the development of logical thinking, since the teachers do not apply an adequate strategy to the cognitive level of the children. Therefore, it is very important to apply a didactic strategy based on playful activities (games) to achieve meaningful and functional learning.

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References

Álvarez, EG (2018). Didactic strategies in meaningful learning in the middle sublevel. p. 10. University of Guayaquil. Faculty of Philosophy, Letters and Educational Sciences. http://repositorio.ug.edu.ec/bitstream/redug/35785/1/BFILO-PD-LP1-19-296.pdf

Becerill, TA (2019). Methodological strategies in the development of mathematical logical thinking skills in the middle sublevel. p. 32. http://repositorio.ug.edu.ec/bitstream/redug/45994/1/BFILO-PD-LP1-19302%20FALCON%20COELLO.pdf

Bedón Arias, PM, Bedón Arias, PM, & Santana Castañeda, ME (2016). Didactic strategies and the development of mathematical logical thinking. Technical University of Ambato. Faculty of Human Sciences and Education. https://repositorio.uta.edu.ec/bitstream/123456789/18585/1/tesis%20SANTANA%2020%20de%20Enero.pdf

Cobos., ME (2018). The playful activities as didactic strategies in the basic average. p.23. http://repositorio.unemi.edu.ec/handle/123456789/4937

Salazar, ME (2020). Methodological activities in the strengthening of mathematical logical thinking in the middle sublevel. Guayaquil. p-23. http://repositorio.ug.edu.ec/bitstream/redug/53412/1/BFILO-PD-LP1-20P017%20SALAZAR%20SUAREZ.pdf

Hidalgo, MI (2017). Methodological strategies for the development of mathematical logical thinking. https://revistas.unesum.edu.ec/index.php/unesumciencias/article/view/28-EstrategiasMetodologicasParaElDesarrolloDelPensami-6595073%20(2).pdf

García, JGJ SI (2017). A proposal to innovate the teaching-learning process in mathematics. Electronic Journal on Technology, Education and Society . Vol. 4 No 7 https://www.ctes.org.mx/index.php/ctes/article/view/654/736

Paltan, G. & Quilli, K. (2011). Methodological strategies to develop mathematical logical reasoning. p. 15. Basin. http://dspace.ucuenca.edu.ec/bitstream/123456789/1870/1/teb60.pdf

Quinde, MC (2020). Playful activities in the learning of mathematics for high school http://repositorio.ug.edu.ec/bitstream/redug/51649/1/YAGUAL%20QUINDE%20MARTHA.pdf

Tubón escobar, FJ, & moretacuñalata, JM (2017). "The logical-mathematical reasoning in the teaching-learning process in the students of Middle Basic Education. http://repositorio.utc.edu.ec/bitstream/27000/3907/1/T-UTC-0445.pdf

Tripero, A. (2011). Piaget and the value of the game in his Structuralist Theory. E-Innova BUCM. http://webs.ucm.es/BUCM/revcul/e-learning-innova/6/art431.php#. Ysc1t3bMLIU

Z, JH (2016). The game as a didactic strategy to develop numerical thinking in the four basic operations. Sophia. http://www.scielo.org.co/pdf/sph/v12n1/v12n1a08.pdf

Balestrini, M. (2020). Methodological framework.Caracas. Venezuela: BL Associated Consultants. Retrieved from http://virtual. city. edu/thesispub/0094671/cap03. pdf.

Rodríguez Jiménez, A., & Pérez Jacinto, AO (January 2017). Scientific methods of inquiry and construction of knowledge. EAN(82), pp.179-200. http://www.scielo.org.co/pdf/ean/n82/0120-8160-ean-82-00179.pdf

Parraguez Carrasco, ,. S., Chunga Chinguel, G. R., Flores Cubas, M. M., & Romero Cieza, R. Y. (2017). El estudio y la investigación documental: estrategias metodológicas y herramientas TIC. https://dialnet.unirioja.e

Sampieri, RH, Fernández Collado, C., & Pilar Baptista, L. (2014). Definitions of quantitative and qualitative approaches, their similarities and differences. https://www.uca.ac.cr/wp-content/uploads/2017/10/Investigacion.pdf

Carreira, CF (2013). Main difficulties in learning Mathematics. Guidelines for teachers of Primary Education. UNIR International University of La Rioja, 22. https://reunir.unir.net/bitstream/handle/123456789/1588/2013_02_04_TFM_ESTUDIO_DEL_TRABAJO.pdf?sequence=1

Widana, I.K., Dewi, G.A.O.C., Suryasa, W. (2020). Ergonomics approach to improve student concentration on learning process of professional ethics. *Journal of Advanced Research in Dynamical and Control Systems*, *12*(7), 429-445.

Widana, I.K., Sumetri, N.W., Sutapa, I.K., Suryasa, W. (2021). Anthropometric measures for better cardiovascular and musculoskeletal health. *Computer Applications in Engineering Education*, *29*(3), 550–561. https://doi.org/10.1002/cae.22202