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THE TECHNIQUES OF COMPUTER SCIENCE AND COMMUNICATIONS IN THE DEVELOPMENT OF MATHEMATICAL SKILLS IN STUDENTS AT BASIC MIDDLE SCHOOL

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Abstract

The learning of mathematics continues to be a problem in Ecuador, this research aims to diagnose mathematical skills in the academic performance of students Básica Media de la Unidad Educativa Fiscomisional "Cinco de Mayo" del Cantón Chone, Provincia de Manabí period 2023-2024. The results of the research carried out by means of a diagnostic test are shown, as a way of contributing to the improvement of the academic performance of the students in the development of mathematical skills. The teaching-learning process presents difficulties that lead to poor academic performance. A categorization of topics on knowledge reached in the block of natural numbers, trigonometry and geometry was developed. The impact of the use of information and communication technologies on the resolution of exercises was measured through a survey of the students of the Sept Year of Basic Media. The qualitative, quantitative, and documentary method was applied, in addition to the inductive and descriptive method. The technique applied was a structured base test where the analysis and interpretation of the results obtained in the students was carried out. The results obtained from the diagnostic test showed weaknesses in the approach and resolution of exercises that affect academic performance, the need to improve this teaching process was observed. -learning through the application of strategies methodologies that allow strengthening this process through the new technologies.

Keywords: *TIC, Mathematical Skills, Academic Performance, Methodological Strategies.*

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1. Introduction

Today's society is driven by globalization and the use of Information and Communication Technologies (ICT). Despite its great importance today and the impact it has had, in the future it will take the reins and its evolution will cause a great impact. In the field of education, the implementation process has been long and is even currently being implemented. The relationship and development of ICT plays a very important role since it allows the entire educational community to improve its work; both teachers to teach better and students to increase their learning.

Given this perspective of new changes in terms of communication, obtaining information and knowledge formation, it is necessary for the educational system to evolve, generating new learning environments that promote contact, exchange and student participation (Macías, 2007).

Especially in the teaching of the mathematics area, the importance of the use of ICT increases due to the difficulties it presents. Currently, the aim is not to "do Mathematics", but rather to "understand Mathematics" and ICTs are a very important resource to improve this aspect and thus change the learning environment by improving this process in students.

Technological resources must have a pedagogical application and be supported by the different theories proposed by mathematics educators; Sánchez (2012) emphasizes the semiotic dimension of this language Sánchez (2012, p. 27. The didactics of mathematics, as a pedagogical science, focuses its study on the processes and resulting phenomena that occur inside the classroom and outside it. For this For this reason, ICT in the teaching-learning process of mathematics in Basic Media are used in technological tools, such as GeoGebra and Math way, which help to improve the learning of students in the Sixth Year of Basic.

The research was based on contributing in the teaching-learning processes in the development of basic secondary mathematical skills, in order to promote a significant improvement in academic performance in the area of mathematics. Cognitive skills allow you to carry out any task, therefore they were used continuously to learn, remember, manage information related to the moment in which you are in the learning process, these cognitive activities use them to identify and transform information into knowledge, these are a set of mental operations used by the child to learn in a given situation; as the basic procedures for the acquisition and construction of new knowledge (Carrasquero and Luzardo, 2014).

Cognitive development is an evolutionary state of the information process and expansion of knowledge, that is, the child represents cognitive awareness, interacts significantly with the information it obtains and assimilates the new information it perceives into its own structures.

Cognitive development, according to Villamizar and Donoso (2013), is the product of learning achieved through the mediation of peers and elders who support and stimulate their understanding and ability to use cultural instruments. It is the process by which children acquire the ability to become a critical and logical child, which predisposes them for learning, development of skills necessary for their development and resolution of problems present in their environment, their level of development will depend on the quality of biological brain functions, and experiences provided by their environment.

Academic performance is usually associated with skill mastery processes, degree of ability in the development of competencies, self-esteem, and the ability to integrate and demonstrate the knowledge acquired (Mello & Hernández, 2019, p. 8). Within the context of the subject of mathematics, regarding the development of skills, it corresponds to the results of the development and evaluation of the skills contained in the block of natural numbers and statistics, which in turn integrates the themes of the basic media.

Researchers such as Parra and Flores (2008) analyzed the problems that students with low school achievement had regarding the concepts related to fractions and the resources used to solve mathematical problems and characterized the interaction between them. Regarding the handling of common fractions, they identified that the difficulties are inscribed in previous conceptions and the lack of correspondence between the sign and the culturally shared meaning. They recognized that

cooperative work and contextualization favor cognitive development, manifested in the ability to argue proposals for solving a problem situation.

2. Materials and Methods

The applied methodology has a qualitative approach, because it allows to investigate, analyze and understand, from a disciplinary vision (Mathematics) and didactics of the acquisition of the development of abilities and the analysis of the academic performance of the students of the seventh year of Básica Media de la Unidad Educativa Fiscomisional "Cinco de Mayo" del Cantón Chone, Provincia de Manabí periodo 2023-2024".In this category, the level of explanatory research was used, which related the causal findings associated with the independent variable (ICT) and how this influences the dependent variable (Development of mathematical skills), in the 2023 - 2024 school year.

As a qualitative approach in research that studies didactic phenomena, Quintana (2006) points out that education has to do with human actions, where the reality that is going to be analyzed is studied in its natural context that characterizes learning difficulties, taking Keep in mind that education has to do with social behavior.

Some quantitative contributions were evaluated as indicated by Hueso and Cascant (2012, P. 1) based on the use of statistical techniques to know certain aspects of interest about the population that is being studied, such as the collection of information through surveys and the analysis of data. data through descriptive statistics that allows a rigorous and systematic analysis of data in the social sciences, allowing the full integration of the complex educational reality; the inductive method, in order to study the research problem that originated in the Educational Unit, to know the causes of low academic performance in mathematics and to establish possible effects associated with the problem.

As the research process is mixed, there are differentiating epistemological situations between both approaches that provide understanding and precision Ochoa, Nava and Fusil (2020) (p. 21), this is how a diagnostic test and the documentary analysis of the strategies were applied. methodological, compared to a quantitative position of collection, analysis and interpretation within the framework of descriptive statistics, the situation under study was characterized, applying: the

observation of the study phenomenon to recognize the aspects that influenced the acquisition of the development of mathematical skills.

The population studied was 120 students of Basic High School and 1 Mathematics teacher from the Fiscomisional Educational Unit "Cinco de Mayo" of the Chone canton, of which 56 students of the seventh year of Basic High School were selected by intentional sampling.

3. Analysis and Discussion of the Results

The results obtained show the information collected from the diagnostic test to investigate the knowledge reached by the students who completed the Basic Middle education of the Fiscomisional Educational Unit "Cinco de Mayo" of the Chone canton. The 56 students in the seventh year of Basic Middle School were investigated, using structured questions, with the intention of identifying causes that affect academic performance in learning mathematics.

The development of skills raises the need to "understand and give meaning" to notions of thought Rico et.al (2000), coincide in pointing out that in the first grades of primary school it is necessary to draw attention to an important quality of thought such as It is the reflection, it is important that the teacher creates conditions in the teaching-learning process from these first grades, for a reflective analysis of the students of the exercises they carry out.

ICT in Education

Information and Communication Technologies is a very complex term to define because it groups many aspects and evolves very quickly, especially in recent times, this has evolved over the years and there is no exact definition. González (1996) defined it as the set of processes and products derived from the new tools (hardware and software), information supports, and communication channels related to the digitized storage, processing and transmission of information.

Regarding the Didactics of Mathematics, Ramírez (2012) stated that technology should be a transversal factor or axis of mathematics education and that curricula, pedagogical methods and the relationship with society should be changed on the part of mathematics education from the development of new technologies.

Technology has evolved over the years, and little by little it has become part of the teaching of Mathematics with the aim of providing a support instrument that promotes experimentation and exploration to facilitate better learning (Sánchez, 2003).

In addition, thanks to ICT, it has been possible to create a wide variety of software and technological programs that help increase the academic performance of students. These provide a great diversity of ways to represent situations, and this allows students to develop multiple resolution strategies and a better understanding of mathematical concepts.

Despite these advantages, it must be considered that the use of ICT in this subject does not mean the absence of conceptualization, but rather they help as a support to achieve a better understanding. The use of ICT in Mathematics "goes beyond integrating ICT in the classroom but involves redefining the way we learn and teach mathematics" (Hodges & Conner, 2011).

Its design makes it suitable for use from Kindergarten to High School and even University, so practically any Mathematics teacher can design activities in GeoGebra to explain in the classroom. Some of its applications could be carried out in the primary stage can be seen in figures 1 and 2.

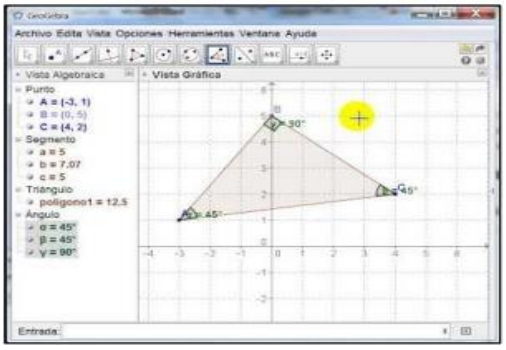


Figure 1: Example of a GeoGebra Application in the Seventh Year of Basic Secondary

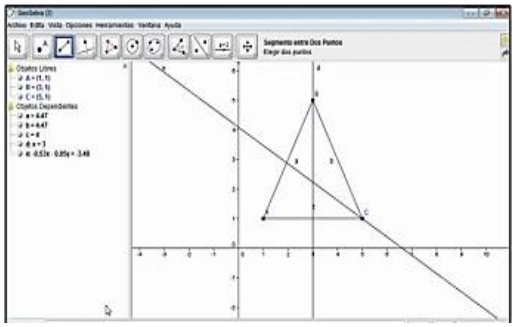


Figure 2: Example of a GeoGebra Application in the Seventh Year of Basic High School

Development of Math Skills

The acquisition of a child's mathematical skills will, in turn, favor the development of other more complex ones as he grows, and will allow him to be more competent in his life, being able to analyze situations, make decisions and solve problems in his life. daily.

Learning is defined as a process of relatively permanent change in a person's behavior generated by the Feldman (2005) experience (García, 2018). This is a matter through which a certain skill is acquired, or a new strategy of knowledge generated by the experience of a person is adopted.

The development of mathematical skills begins from the first years, and they are put into practice in each problem that is solved, in preschool, for example, it refers to counting and development of logical operations, classification, serialization and one-to-one correspondence (Ramirez, 2012).

The mathematical skills that preschool children manage must include the use of numbers in various situations and require putting into practice the counting principles, such as removing, matching, comparing, and distributing objects (Fuenlabrada, 2009).

In the development of thinking skills, the role of the educator is essential since they must help students to modify their cognitive structures (Díaz and Hernández, 2002). For this, the teacher must acquire a methodology that implies a change of attitude towards teaching, where students work, reflect and develop their own thought processes.

A mathematical competition. It is a human activity and occupies an important place in the development of knowledge, related to when, how and why to use certain knowledge as a tool. Description of competences in the area of mathematics of curricular units and can be seen in figure 3.

Figure 3: Competencies in the Mathematics Area

Teaching is the process of instruction and education that takes place in the school, in whose center is learning, therefore, it must be characterized by the union of the teacher's activity and that of the student with the objective of forming a certain quality. of pedagogical work (Gil, Blanco, and Guerrero, 2005). Teaching understood in this way is the process of motivating and guiding the external and internal activities of the students whose result is the obtaining of knowledge.

From another point of view, Pizarro (1985), (Reyes, 2003) define academic performance as a measure of responsive or indicative capacity that shows, in an estimative way, what a person has learned as a result of an instruction or training process.

To define academic performance, the grades obtained by students through the different evaluations are used, indicating the quality and quantity of knowledge. Mathematicians Paba and Palmezano (2008). For Gonzales, Días and López (2012) indicate the grades constitute the school and social indicator of the level of learning. academic performance is a multidimensional product in which a diversity of internal and external variables that affect the student must be considered, it must assess both the quantitative aspects of the learning process and the factors that influence it. The associated knowledge in the seventh year of Basic Media is:

This research aimed to analyze the development of mathematical skills in the academic performance of the students of the Sept Ano de Basic Media, the first question was related to situations that cause low

academic performance, the results are shown in Table 1.

Table 1: Circumstances that Affect Academic Performance in Learning Mathematics

Alternatives	Frequency	Percentage (%)
A: Teacher applies ICT in the teaching of mathematics	24	42.9
B: Complexity in solving exercises	14	25.0
C: Teacher motivates them in class	18	32.1

As can be seen, 75% of the students answered items A and C, ¾ parts of the group relate low academic performance with a lack of motivation and the non-application of ICT in the teaching process, only 25% of the respondents answered literal B, indicating the complexity of the contents, which means that the motivation and non-application of ICT affects the teaching-learning process.

The second question was related to the development of mathematical skills regarding exercises of basic operations of integers. Table 2 shows the results of the diagnostic test.

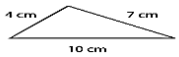
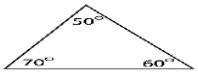
Table 2: Resolution of Exercises of Basic Operations of Integers

Alternatives	frequencies	Percentage (%)
A. Adding numbers: 624 723 + 181 347		
a. develops perfectly	42	75.0
b. does not develop perfectly	14	25.0
B. Subtraction of numbers: 432 842 – 221 826		
a. develops perfectly	46	82.1
b. does not develop perfectly	10	17.9
C. Multiplication of numbers: 854 x 26		
a. develops perfectly	26	46.4
b. does not develop perfectly	30	53.6
D. Division of numbers: 54 624/ 32		
a. develops perfectly	24	42.9
b. does not develop perfectly	32	57.1

As can be seen, most of the students perfectly develop the evaluation processes as shown in the table of values in each case. It is evident in the group that, in the evaluation of the students, 25% in addition of numbers, 17.9% in subtraction of numbers, 53.6% in multiplication of numbers and 57.1% in division of numbers, do not have a clear concept of analysis and development, producing that the main drawbacks are presented in the multiplication 53.6% and in the division 57.1%.

In the third question, it was related to the development of skills regarding trigonometry problems. The results of the diagnostic test are shown in Table 3.

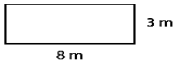
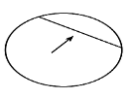
Table 3: Resolution of Trigonometry Exercises

Alternatives	frequencies	Percentage (%)
A. What is the perimeter of the triangle in the figure? 		
a. develops perfectly	26	46.4
b. does not develop perfectly	30	53.6
B. What is the name of the triangle according to the measure of its angles? 		
c. develops perfectly	24	37.5
d. does not develop perfectly	32	62.5

As can be seen, most of the students do not perfectly develop the evaluation processes as indicated in the table of values in each case. It is evident in the group that, in the diagnostic evaluation, the students 53.6% in the sum of the sides of the triangle, 62.5% in the difference of the triangles by their angles. More than half of the students have not correctly solved the calculation of the perimeter and the recognition of the triangle by its angles, the biggest drawbacks are manifested in both cases.

Table 4 shows the result of the development of skills regarding the resolution of geometry problems.

Table 4: Resolution of Geometry Exercises

Alternatives	frequencies	Percentage (%)
A. What is the area of the rectangle shown in the figure? 		
a. It develops perfectly.	27	48.2
b. It does not develop perfectly.	29	51.8
B. What element of the circle is being pointed to in the figure? 		
a. It develops perfectly.	20	35.7
b. It does not develop perfectly.	37	64.3

As can be seen, most of the students do not perfectly develop the evaluation processes as

indicated in the table of values in each case. It is evident in the group that, in the diagnostic test, the students 51.8% in the calculation of the area of the rectangle, 64.3% in the identification of the rope. More than half of the students in both cases have not perfectly solved the calculation of the rectangle and the recognition of the rope, which means that they do not develop their mathematical skills.

The biggest drawbacks that did not develop perfectly were multiplication 53.6% and division 57.1% of integers, trigonometry calculation 62.5% and geometry 64.3%.

The diagnostic test applied to the 56 students of the seventh year of Basic High School shows that a considerable percentage of the students are not clear about the processes of solving basic operations of integers, calculation of trigonometry and geometry, which means that the population of Basic Media students do not develop cognitive skills.

With the application of the diagnostic test, it was possible to verify the existence of an unsatisfactory cognitive level that requires strengthening the development of skills, to achieve full mastery of these, essentially in the resolution of multiplication and division of integers, trigonometry and basic geometry, considering that Sept year is where the Basic needs are satisfied.

4. Conclusions

If the application of methodological strategies facilitates the learning of mathematics, the student will be motivated with the incorporation of ICT in their academic training. In addition, since the student is motivated with the use of technological tools in their teaching, significant learning can be built.

The need to improve the application of methodological strategies in the teaching-learning process to develop mathematical skills and the integration of ICT was demonstrated, noting that the inadequate application of processes and methods of solving mathematical problems affect academic performance and is observed the need to implement educational software in mathematics hours to develop skills in students.

It was obtained that the inadequate development of mathematical exercises affects the academic performance of this, and the need for teachers to apply strategies was observed.in the teaching-learning process through ICT. The use of technological tools will allow the student to focus on the approach to solving exercises, not on routine work and to be able to solve natural numbers, trigonometry and geometry.

References

[1] Carrasquero, Y., y Luzardo, F. (2014). Desarrollo de las habilidades cognitivas en niños de edad escolar. Multiciencias, 14(3), 297-303. Obtenido de https://www.redalyc.org/pdf/904/90432809008.pdf

[2] Cardoso, E.O. y Cerecedo, M.T. (2008). El desarrollo de las competencias matemáticas en la primar infancia. Revista Iberoamericana de Educación, 47, 1-11. Obtenido de http:// www.rieoei.org/deloslectores/2652Espinosav2.pdf.

[3] Díaz, Frida, y Hernández, Gerardo. (2002). Estrategias docentes para un aprendizaje significativo: Una interpretación constructivista (2a ed.). México, D.F.: McGraw Hill Interamericana. https://dfa.edomex.gob.mx/sites/dfa.edomex.gob.mx/files/files/2_%20estrategias-docentes-para-un-aprendizaje-significativo.pdf

[4] Fuenlabrada, I. (2009). ¿Hasta el 100? ¡NO! ¿Y las cuentas? Tampoco Entonces ¿Qué? México: SEP. https://es.slideshare.net/tirado/irma-fuen

[5] García, A. E. (2018). Estilos de aprendizaje y rendimiento académico. Revista Boletín Redipe, 7(7), 218-228. https://revista.redipe.org/index.php/1/article/view/536.

[6] Gil, N., Blanco, L., y Guerrero, E. (2005). El dominio afectivo en el aprendizaje de la matemática. Una revisión de sus descriptores básicos. Revista Iberoamericana de educación matemática, 2, 15–32. http://funes.uniandes.edu.co/14554/1/Gil2005El.pdf

[7] González, A. P. (1996). Las nuevas tecnologías en la formación ocupacional: retos y posibilidades en Bermejo y otros. Perspectivas de un futuro inmediato, (195- 226). https://www.eumed.net/rev/ced/17/hdd.htm

[8] González, A. P. (1996). Las nuevas tecnologías en la formación ocupacional: retos y posibilidades en Bermejo y otros. Perspectivas de un futuro inmediato, (195- 226). https://www.eumed.net/rev/ced/17/hdd.htm

[9] González, B.; Díaz, L. y López O. (2012). "Rendimiento académico y factores asociados. Aportaciones de algunas evaluaciones a gran escala", Bordón, vol. 64, núm. 2, pp. 51-68. cielo.org.mx/scielo.php?script=sci_nlinks&pid=S1405-66662018000401075000025&lng=en

[10] Hueso, A. y Cascant, M. (2012). "Metodología y técnicas cuantitativas de la investigación". (1era. Ed.). Editorial Universitat Politécnica de Valencia. https://openlibra.com/es/book/metodologia-y-tecnicas-cuantitativas-de-investigacion

[11] Hodges, Thomas & Conner, Elizabeth. (2011). Reflections on a Technology-Rich Mathematics Classroom. Mathematics Teacher, 104(6), 432-438. https://eric.ed.gov/?id=EJ915488
[12] Macías, D. (10 de abril de 2007). Las nuevas tecnologías y el aprendizaje de las matemáticas. Revista Iberoamericana de Educación, 42 (4), 1-17. https://rieoei.org/historico/deloslectores/1517Macias.pdf
[13] Mello Román, J., & Hernández Estrada, A. (2019). Un estudio sobre el rendimiento académico en Matemáticas. Revista electrónica de investigación educativa. Ensenada, 21, 1-10.
[14] Ochoa, R., Nava, N., & Fusil, D. (2020). Comprensión epistemológica del tesista sobre investigaciones cuantitativas, cualitativas y mixtas. Orbis: revista de Ciencias Humanas(15), 13-22. https://dialnet.unirioja.es/servlet/articulo?codigo=7407375
[15] Paba, B., Lara, G., y Palmezano, R. (2008). "Estilos de aprendizaje y rendimiento académico en estudiantes universitarios", Revista de la Facultad de Ciencias de la Educación, vol. 5(2), pp. 99-106. https://www.scielo.org.mx/scielo.php?script=sci_nlinks&pid=S140566662018000401075000 45&lng=en
[16] Parra, M. Á. y Flores, R. (2008). Aprendizaje cooperativo en la solución de problemas con fracciones. Educación Matemática, 20(1), 31-52. México: Grupo Santillana. Obtenido de http://www.redalyc.org/articulo.oa?id=405120630003
[17] Quintana, A. (2006). Metodología de investigación científica cualitativa. En A. Quintana & W. Montgomery (Eds.), Psicología: Tópicos de actualidad (pp. 47–84). Lima, Perú: Universidad Nacional Mayor de San Marcos (UNMSM). Obtenido de https://goo.gl/pyfsXChttp://www.ubiobio.cl/miweb/webfile/media/267/3634305-Metodologia-de-Investigacion-Cualitativa-A-Quintana.pdf
[18] Riveros, V., Bernal, M. I. M., & Castro, R. (2011). Las tecnologías de la información y la comunicación en el proceso de instrucción de la matemática. Quórum académico, 8(15), 111-130. https://digitum.um.es/digitum/handle/10201/17247
[19] Ramírez, M. (2012). El aprendizaje de la matemática en los primeros años. Nota para el Diplomado de La enseñanza de la matemática en preescolar y primaria. México, D.F. Obtenido de https://www.researchgate.net/publication/28299293_El_aprendizaje_de_las_matematicas_a_los_tres_anos_Narracion_reflexiva_sobre_la_construccion_de_un_mercado_medieval.
[20] Reyes, Y. (2003) Relación entre el rendimiento académico, la ansiedad ante los exámenes, los rasgos de personalidad, el auto concepto y la asertividad de los estudiantes del primer año de psicología da la UNMSM. (Tesis para optar el título profesional). Universidad Nacional Mayor de San Marcos. Lima. Obtenido de http://sisbib.unmsm.edu.pe/bibvirtualdata/Tesis/Salud/Reyes_T_Y/T_completo.pdf.
[21] Rico, P. et.al. (2000). Hacia el perfeccionamiento de la escuela primaria. Habana: Pueblo y Educación. Obtenido de https://www.redalyc.org/journal/4757/475753184015/html/
[22] Sánchez, A. (2012). Incorporación de las TIC en el aprendizaje de la matemática en el sector universitario. Educación Matemática, 27(3). https://www.scielo.org.mx/scielo.php?script=sci_nlinks&pid=S2007-74672021000200120000018&lng=en
[23] Sánchez, J. (2003). Integración curricular de las TIC: concepto y modelos. Revista enfoques educacionales, 5(1), 51-65. https://enfoqueseducacionales.uchile.cl/index.php/REE/article/view/47512
[24] Villamizar, G. y Donoso, R. (2013). Definiciones y teorías sobre inteligencia. Revisión histórica. Psicogente, 16 (30), 407-423. Obtenido de https://www.redalyc.org/articulo.oa?id=497552364013