



Development of Mathematical Skills in Students of Basic



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Abstract

The objective of the research is to diagnose cognitive abilities in the academic performance of students in Basic Middle School based on learning styles with a constructivist approach in the Cinco de Mayo Fiscomisional Educational Unit in the Basic average period 2022. The results of the research carried out through a diagnostic test are shown, as a way of projecting the national educational dimension in the development of mathematical skills in its various forms. The teaching-learning process presents difficulties that lead to low academic performance. A categorization of topics on knowledge achieved in the block of natural numbers, fractions, and statistics was developed. was used as an instrument survey of students' natural, fractional and statistical numbers, the qualitative, quantitative, and documentary methods used, in addition to the inductive and descriptive methods. The technique was a structured base test to carry out the analysis and interpretation of the results obtained from the students, on the development of mathematical skills of Basic Media. The diagnosis made resulted in weaknesses in the approach and resolution of exercises that affect academic performance, so there is a need to improve this process through the application of methodological strategies that allow for strengthening the teaching-learning process through ICTs.

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1 Introduction

The research was based on contributing to the teaching-learning processes in the development of skills in Basic Middle Education, to promote a significant improvement in academic performance in the area of mathematics. Cognitive abilities allow to carry out any task, for this reason, they were used continuously to learn, remember, and manage information related to the moment in which it is in the learning process, cognitive abilities resort to them to identify and transform information into knowledge. The development of cognitive processes such as observation, attention, and processing, which involve analysis, synthesis, comparison, and ordering, among others, play an important role in student learning. Cognitive abilities are a set of mental operations used by the child to learn in a given situation; that is, it is determined as the basic procedures for the acquisition and construction of new knowledge (Carrasquero & Luzardo, 2014). Cognitive development is an evolutionary state of the information and knowledge expansion process, that is, the child represents cognitive awareness, interacts significantly with the information that it obtains, and assimilates the new information that it perceives into its own structures. Cognitive development according to Villamizar & Donoso (2013), is the product of learning achieved through mediation, 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 children, 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 (Brown & Burton, 1978; De Smedt et al., 2013; Alloway & Passolunghi, 2011).

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 (Roman & Hernandez, 2019). 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 Álvarez & Flores Macías (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 (Cragg & Gilmore, 2014; Mahendra, 2016; Mahayukti et al., 2017).

In the curriculum of compulsory education levels, in the introduction to mathematics, it is established that "the fundamental purpose of teaching mathematics is to develop the ability to think, reason, communicate, apply and assess the relationships between ideas and phenomena." real" (MINEDUC, 2016) (p. 50). The learning process is a planned act with clear goals, but its application is presented in stages and depends on each student, regarding their prior knowledge, motivation, and the complexity of the content to be learned. Academic performance is interpreted as the result of the learning process that can be influenced by multiple factors, this is how, in variational thinking, it is related to both the classroom climate and the teachers' strategies (Corredor-García & Bailey-Moreno, 2020), and the commitment to school activities and the motivation of the students to meet the proposed objectives and the academic reinforcement processes that are applied according to a defined institutional planning

2 Materials and Methods

The applied methodology has a qualitative approach, which allows to the investigation, analysis and understanding, 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 Middle Basic Education of the Cinco de Mayo Fiscalisinal Educational Unit. In this category, the explanatory research level was used, which related the causal findings associated with the independent variable (skill development) and how this influences the dependent variable (academic performance), in the 2022-2023 school year of first year. quarter. As a qualitative approach in research that studies didactic phenomena, [Quintana Peña \(2006\)](#), 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 human actions.

Some quantitative contributions were evaluated as indicated by [Hueso González & Cascant i Sempere \(2012\)](#), 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 the results. data through descriptive statistics that allows rigorous and systematic analysis of data in the social sciences, allowing full integration of the complexities of educational reality; the inductive method, 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

Since the research process is mixed, as indicated by [Ochoa et al. \(2020\)](#), there are differentiating epistemological situations between both approaches that provide understanding and precision (p. 21), this is how a diagnostic test and documentary analysis of methodological strategies were applied, compared to a quantitative collection position, 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 at Basic High School and 1 Mathematics teacher of the Cinco de Mayo Educational Unit of the Chone canton, of which 40 students of the seventh year of Basic High School were selected by intentional sampling, as a school grade and requirement for entry to the Upper Basic level.

3 Results and Discussions

The results obtained show the information collected from the diagnostic test to investigate the knowledge reached by the students who complete the Basic Middle education of the Cinco de Mayo Fiscalisinal Educational Unit of the Chone canton. The 40 seventh-year students of Basic Media were inquired through structured questions with the intention of identifying parameters that affect academic performance in learning the development of mathematical skills. It should be considered the seventh year of basic media. It is the final degree, and it is where the abilities raised at the beginning of the level must be fulfilled. 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 learning process from these first grades, for a reflective analysis of the students of the exercises that they carry out.

Development of mathematical skills

The acquisition of a child's mathematical skills will, in turn, favor the development of other more complex ones as he grows up, and will allow him to be more competent in his life, being able to analyze situations, make decisions and solve problems. problems in context. Learning is defined as a process of a relatively permanent change in the behavior of a person generated by the experience [Feldman \(2005\)](#), cited by [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 [Ramírez & De Castro \(2012\)](#). The mathematical skills that preschool children manage must include the use of numbers in various situations and require putting into practice the counting principles, thus, removing, equaling, 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 & 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. Mathematical competence is linked to being able to do, related to when, how and why to use certain knowledge as a tool. The dimensions covered by being mathematically competent can be seen in figure 1

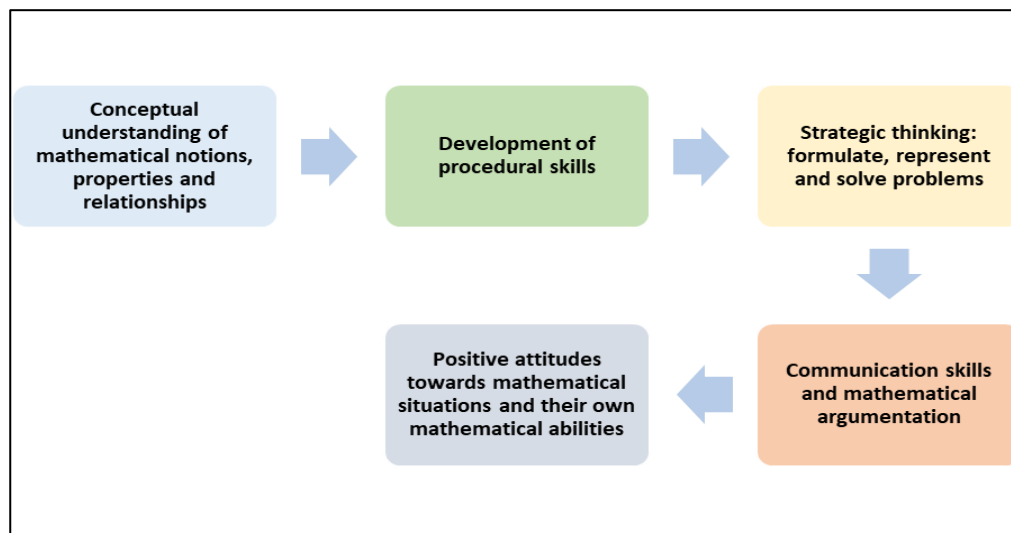


Figure 1. Dimensions covered by being mathematically competent

Source: [Cardoso & Cerecedo \(2008\)](#)

Academic performance in mathematics

Teaching is the process of instruction and education that is developed in the school, in whose center is learning, therefore, it must be characterized by the union of the activity of the teacher and that of the student with the objective of forming a certain quality of pedagogical work ([Ignacio et al., 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, cited in ([Reyes Tejada, 2003](#)), defines academic performance as a measure of responsive or indicative capacity that shows, in an estimative way, what a person has learned as a consequence of a process of instruction or training.

To define academic performance, the grades obtained by students through the different assessments are used, indicating the quality and quantity of mathematical knowledge [Paba et al. \(2008\)](#). For [González Barbera et al. \(2012\)](#) indicate that 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 academic performance of students, thus avoiding substitution processes in the sub-level of study, if the academic reinforcement is applied according to defined institutional planning, the results of the diagnostic tests and the formative evaluation in each school year, including the implementation of virtual learning environments and applications within of the classroom that "encourage cognitive, creative and participatory development". ([Martínez et al., 2020](#)). The associated knowledge in the seventh year of Básica Media are: In this research, with the objective of analyzing the development of mathematical skills In

the academic performance of the students of Basic Media, the first question was related to situations that cause low academic performance, showing the results in table 1.

Table 1
Situations that affect the academic performance of learning mathematical skills

Alternatives	Frequency	Percentage (%)
A: State of health	2	5
B: Teacher motivates them in class	12	30
C: Teacher applies ICTs in the teaching process	18	45
D: Complexity in the contents	8	20

As observed, 75% of the students answered items B and C, $\frac{3}{4}$ parts of the group relate low academic performance with the lack of motivation and the non-application of ICTs in the teaching process, only 25% of the respondents answered literals A and D, relating the state of health with the complexity of the contents, which means that the motivation and application of ICTs affects the teaching-learning process. In the case of the second question, it was related to the development of skills regarding mathematical problems of basic number operations. The results of the diagnostic test are shown in Table 2.

Table 2
Resolution of basic operations

Alternatives	Frequencies	Percentage (%)
A. Addition of numbers: $843\,265 + 212\,834$		
a. Develops perfectly	32	80.0
b. Does not develop perfectly	8	20.0
B. Subtraction of numbers: $632\,511 - 321\,879$		
a. Develops perfectly	30	75.0
b. Does not develop perfectly	10	25.0
C. Multiplication of numbers: 658×32		
a. Develops perfectly	25	62.5
b. Does not develop perfectly	15	37.5
D. Division of numbers: $62\,738 / 25$		
a. Develops perfectly	22	55.0
b. Does not develop perfectly	18	45.0

As can be seen, most of the students develop the evaluation processes perfectly as shown in the table of values in each case. It is evident in the group that, in the evaluation, the students 20% in addition of numbers, 25% in subtraction of numbers, 37.5% in the multiplication of numbers and 45% in the division of numbers, do not have a concept of analysis and understanding, obtaining that the main drawbacks are presented in the multiplication 37.5% and in the division 45.0%. In the third question, it was related to the development of skills regarding mathematical problems of basic operations with fractions. The results of the diagnostic test are displayed in table 3.

Table 3
Resolution of basic operations with fractions

Alternatives	Frequencies	Percentage (%)
A. Sum of heterogeneous fractions: $\frac{3}{4} + \frac{2}{5}$		
a. Develops perfectly	22	55.0
b. Does not develop perfectly	18	45.0
B. Subtracts heterogeneous fractions: $\frac{5}{3} -$		

1/4			
a.	Develops perfectly	25	62.5
b.	Does not develop perfectly	15	37.5
C.	Fraction multiplication: $2/3 \times 2/6$		
a.	Develops perfectly	21	52.5
b.	Does not develop perfectly	19	47.5
D.	Division of fractions: $3/10 / 2/7$		
a.	Develops perfectly	18	45.0
b.	Does not develop perfectly	22	55.0

As most students can appreciate perfectly develops 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 45% in the sum of heterogeneous fractions, 37.5% in subtraction of heterogeneous fractions, 47.5% in the multiplication of fractions and 55% in the division of fractions, they do not correctly perform the basic operations of fractions. The $\frac{3}{4}$ parts of students have perfectly solved the basic operations of fractions, manifesting the greatest drawbacks in the division of fractions 55%. Table 4 shows the result of the development of skills regarding the resolution of addition and subtraction of integers with parentheses and percentages in everyday applications.

Table 4

Resolution of addition and subtraction of integers with parentheses and percentages applied to everyday life

Alternatives	Frequencies	Percentage (%)
A. Add and subtract with parentheses: $7 - (-4) + (-5) - 2$		
a. Develop perfectly.	24	60.0
b. Does not develop perfectly.	16	40.0
B. Percentage with daily applications: How much must be paid for a purchase of 1,489 plus VAT (12%)?		
a. It develops perfectly.	28	70.0
b. Does not develop perfectly.	12	30.0

As can be seen, 8 out of 10 students perfectly solve addition and subtraction with parentheses 60%, but only 7 out of 10 students perfectly solve a second-degree equation 70% with applications in everyday life. The biggest drawbacks that did not develop perfectly were addition and subtraction with parentheses 40% and percentage with daily applications 30%. In the case of the fifth question, it was related to the development of skills regarding analyzing and interpreting the meaning of calculating measures of central tendency: mean and median. The results of the diagnostic test are shown in Table 5.

Table 5

Resolution of measures of central tendency: mean and median

Alternative	Frequencies	Percentage (%)
A. The following data correspond to the age of a group of 7 students in the seventh year of Basic General Education: 11, 12, 11, 13, 12, 12, 12		
B: Find mean and median.	22	55
C: Find a measure of central tendency.	8	20
D: There is no measure.	10	25

As can be seen in the results, 55% of the students could find the mean and median of the measures of central tendency, 20% only found one measure of central tendency, and 25% could not find any measure of central tendency. The most frequent drawbacks in developing the skills were: analyzing and interpreting the meaning of the central tendency measures of the statistical data set, with the average age being 12 years.

The diagnostic test applied to the 40 students of the seventh year of Basic Media shows that a considerable percentage of the students are not clear about the processes of solving basic operations of numbers, basic operations of fractions, addition and subtraction with parentheses, percentage and measures of central tendency, which means that the population of students in Basic Media does not develop cognitive abilities (Hannula & Lehtinen, 2005; Vukovic et al., 2010; Cunska & Savicka, 2012). 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 natural numbers, multiplication and division of fractions and measures of central tendency, considering that the seventh year of Middle School is where the established skills must be developed to move on to High School (Boaler, 1998; Chamoso et al., 2012; Merkley & Ansari, 2016).

4 Conclusion

The results of the research show the need to improve methodological teaching-learning strategies in the development of mathematical skills and motivation in the face of the active process in students, considering the existing knowledge in the group of students to achieve adequate cognitive development in solving exercises. It was possible to notice that the inadequate application of processes and methods of solving mathematical problems affects academic performance and the need to implement hours of pedagogical reinforcement in the subject associated with the development of skills is observed. It was found that the inadequate development of mathematical exercises in the improvement of skills affects the academic performance of this, and the need to perfect the strategies applied by teachers and use methodological strategies in the teaching-learning process through ICTs, being able achieved through methodological and motivational strategies focused on the student and their integral development, in the possibilities of cooperative learning of permanent accompaniment programs in the school environment

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