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Mathematics for teaching rational numbers from ecology to elementary school students

Matemáticas para la enseñanza de números racionales desde la ecología a estudiantes de primaria

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Abstract

The development of educational activities for knowledge of rational numbers and the relationship that can be had with ecological elements provided by the medium, allows us to set purposes to analyze the factors that influence the learning process of mathematics in students of Basic Primary Education, where the lack of ownership of the concept, difficulties in modeling and the resolution of context-related problems are evident. The objective of this research was to design didactic strategies for teaching rational numbers from an ecological environment. The methodology used was from a practical and experimental research study; where the necessary procedures are applied to carry out the investigation. In the process, methodological guides were constructed using ecological elements, which allowed to develop the conceptualization of rational numbers. The information was collected through pilot tests that show the progress that students made at the conceptual level by the development of the proposed activities. Finally, a theoretical reflection that fits the characteristics and conditions of conceptual analysis (Rico, 2000) is made. Since its ecological environment, four activities that meet the goals in the study of rational numbers (conceptual structure, representation systems, contexts and ways to use) were constructed. From the collection of the information, the data were analyzed, different meanings were identified and ascribed to the conceptualization that students can do in the development of learning rational numbers, factors were identified from nature that making good use of them, become a motivating factor in the process of meaningful learning of mathematics.

Keywords:
Didactic, Rational Numbers, ecological environment, meaningful learning, conceptual analysis, factors of learning

Resumen

El desarrollo de actividades didácticas para el conocimiento de los números racionales y la relación que se pueden tener con los elementos ecológicos que aporta el medio permiten fijar propósitos para analizar los factores que influyen en el proceso del aprendizaje de las matemáticas en estudiantes de Educación Básica Primaria.

1. Introduction

In the teaching of mathematics is of great importance on how an issue should be developed to generate meaningful learning AUSUBEL (1968) by students around mathematical knowledge, both in learning and in the grasp of the contents, use their methods and strategies. Mathematics is a basic discipline in the development of the thinking of every human being, as they rest largely on organizational sense the future of any person and the development of his professional life, in different university careers. Some studies have shown [Fuentes, R. et al, 1988] that a considerable number of students face difficulties in understanding, assimilation, interpretation and application to specific situations, of knowledge related to different topics of mathematics.

For the Ministerio de Educación Nacional Colombiano (MEN), One of the purposes of mathematics education in the country, is to train mathematically competent citizens in the sense that they can be put to use mathematical knowledge built for the exercise of their democratic duties and rights, as well as to interpret the world and act over him in a responsible and informed way. Then, it is understood that this purpose leads to characterize the learning environments for mathematics training, such as those in which the three curricular organizers proposed in the guidelines and Curriculum standards make sense: 1) The five general processes of the mathematical activity 2) basic knowledge (five types of mathematical thinking) and 3) the basic learning rights. The (MEN, 2014), publishes the Basic Right of Learning (DBA), which are structured in coherence with the Curriculum Guidelines and Basic Standards of Competence (EBC). Therefore, its importance lies posed elements for building learning paths every year so that, as a result of a process, students achieve the EBCs proposed by each grade group. Reason why, it is necessary to note that DBAs are a support for the development of curricular proposals that can be articulated with the approaches, methodologies, strategies and contexts defined in each educational establishment, within the framework of materialized Institutional Educational projects in the area and classroom plans.

Among these knowledge we highlight the learning of rational numbers, where students have greater difficulties in the conceptualization of the subject and its relationship with the environment, although this cause can be protected by different factors outside the school, it is there, where we start , so that they can face a solution to the context in a positive and informed way.

Teaching of mathematics and the relationship with the ecological environment as a support for modeling problematic situations, presents restrictions by having to notice all the necessary conditions for learning the different topics that it contains, and at the same time exhorting the different tools that the ecological environment can offer us, so that students develop both, mathematical and ecological skills and can effectively visualize the purposes of the MEN in their standards and basic competencies established. This relationship will allow us to formulate the problem of teaching mathematics in terms of the ecological approach and will lead us to seek didactic strategies that promote student learning.

2. Approach the problem

In the results that the MEN shows annually in its list of external tests applied to the different educational institutions (Aprendamos, Supérate and testing SABER) can be evidenced that the fifth grade students of the Luis Carlos Galán Sarmiento Educational Institution of the Arjona village, have difficulties in the area of mathematics, specifically in numerical thinking and numerical systems, particularly in the appropriation of the concept of rational numbers, modeling and solution of problem situations related to the context.

The deficiencies evidenced above, represent a real risk to the permanence of the students in the school, because the lack of knowledge of certain areas and the low motivation to develop mathematical contents are grounds for dropping out and failure many students in the school and on the other hand, due to the mere difficulty experienced, the possibility of the academic life of many children in the institution decreases.

From the position of a new educational proposal based on contextualized mathematical content, we hope that children will adapt to the school and fall in love with the opportunity to study mathematics from a different approach, involving the mathematical with the environmental. In this new proposal, the children learn and develop through new experiences, thus making their learning more lasting in time and permanent in their future life.

Based on the above raised the question arises of research: What is the appropriate strategy for teaching rational numbers students from fifth grade?

3. Objectives

3.1. Overall objective

Design teaching strategies to teach rational numbers from an ecological environment, elementary students.

3.2. Specific objectives

1. Identify the factors that influence the difficulties of the math learning process among fifth grade students in school.
2. Determine the learning strategies used by students to understand the concepts of rational numbers (fractional).
3. Develop activities using elements of the environment to learn rational numbers (Fractional).
4. Classify actions to improve student learning before and after developing teaching strategies.
5. Identify actions to improve students'learning of rational numbers and build them.

4. Rationale

This research begins with the identification of the problem of learning mathematics among fifth graders, which leads to design a proposal to teach mathematics in rational numbers framed from the classroom and the use of ecological resources through the development of didactic strategies of the environment, which allows us to overcome the difficulties that have been presented in the understanding of the concept of rational numbers (Fractional), their properties, algorithms and applications, which allows the strengthening of the mathematical foundation and the interaction with ecological objects of its environment.

Recent reforms to basic education have placed special emphasis on the development of mathematical thinking and reasoning; that students develop in environments conducive to learning and communication. In addition, work schemes have been proposed that follow a line of progress based on students'prior knowledge, problem solving using concrete material and personal tools, to achieve appropriate and consistent procedures with the development of the theory.

For the application of this proposal, the use of environmental elements is proposed as a motivational mechanism towards students, which seeks to reduce the factors that contribute to the difficulties and apathy of children in the learning of some Mathematical concepts. Aside of the use of the multiple objects offered by the environment where they develop, students are be able to identify and establish a relationship between the conceptualization of fractional numbers and the visualization of its basic representation from the medium.

In the development of the thematic in the classroom and the follow-up to learning, conceptual errors derived from its development continue to be presented. For which they have been applied as corrective mechanisms, increased hours of explanations, exercises, homework and extra-class sections; however, the error arises again when applying any evaluation criteria on a later opportunity.

It is these conceptual gaps in mathematics and, in particular, the issue of rational numbers in elementary school students, which seek to be remedied, and by motivating the student to construct a definition, based on interaction with concrete material, so that , when reviewing the class assignments, record events related to the subject and show a solid and coherent foundations that consolidate the learning.

Also, the importance of the topic was based on other concepts in the field of mathematics, other disciplines related to the daily context, which means that the development of mathematical skills related to the understanding of problematic situations in which rational numbers are immersed It becomes an indispensable factor for the comprehension and understanding of these natural phenomena.

This work aims to contribute to the understanding of the concept of fraction, properties, algorithm and different relationships with the curricular program that develops among students in fifth grade, so that it generates skills or competencies that allow them to solve problematic situations of their environment, at the same time, identify those ecological elements where the theme has a real importance in the growth of their learning. In addition, providing support to fellow teachers in their daily actions as educators and improve the results of students obtained in the various tests applied both nationally and locally, since the results that have been obtained are not favorable, which places the institution in a disadvantage compared to others of the same characteristics, preventing it from obtaining benefits granted by the Ministry of National Education.

5. Theoretical Framework

The research works taken as background have the sense of laying the solid foundations that support the theoretical framework of this study, this is how Castro (2015) conducted a research called ‘Significado de las fracciones en las matemáticas escolares y la formación inicial del maestro” with teachers who guide the knowledge of mathematics, in which determined the safety of their discipline and it evidences the meaning of fractions in students, where the researcher proposed to use a work model developing a didactic unit applied to numerical thinking numerical thinking. The research uses a methodology of conceptual analysis by the empirical method, which was divided into three phases, describing its main characteristics, the results aimed at improving the students’knowledge, from their knowledge acquired in advance, in Basic primary education, particularly emphasizing the cognitive and didactic analysis. In addition to the development of the three phases, the result of this research contributes to our work in the classroom to a growth in the methodological aspect and in the construction of didactic strategies that enriches the development and construction of knowledge in students.

Cano (2015) in his research “Unidad didáctica para la enseñanza de los fraccionarios en el grado cuarto de básica primaria Estudio de caso Institución Educativa Supá” oriented his work in evidencing the difficulties that students have in the mathematics’field with emphasis on the numerical thinking and numerical system, since these are reflected in the results obtained in the internal and external tests applied in the school, emphasizing the concepts related to the fractions, representations and operations that can be performed with this type of number, considering for it, a cognitive obstacle. Cano proposes the development of a teaching unit for teaching of fractional numbers in the fourth grade of the primary basic, whose proposal sought to overcome all these difficulties.

The implementation of the didactic unit developed on the teaching of fractions, was based among others, on the theory of significant learning of AUSUBEL (1983), which tells us that significant learning when the contents are related is not arbitrary and substantial (not literally) with what the student already knows. It

must be understood by the substantial and non-arbitrary relationship, that what a child thinks is related to something within the context, existing, relevant, his cognitive structure, for example, an image, an already significant symbol, a concept or proposition. During the application of the teaching unit, Cano, assumed a group of 10 students, where he showed an activity that was carried out in a playful way and using concrete material, allows the construction of the theoretical foundations of fractional numbers in students, taking advantage of the methodology of the active urban school that encloses work collaboratively as an influential and motivating factor.

This paper identifies the different teaching strategies that can be applied to elementary school students for learning of rational numbers is consolidated and can be implemented in resolving problem situations that are related to the environment in which the student develops. On the other hand, seeks to improve the understanding of the concepts of fraction that students own, skills development from its environment. It also invites teachers to build teaching strategies that resemble with themes developed within the curriculum of the degree and following degrees adding degrees of difficulty that will increase the understanding of the different concepts of mathematics, as well as the use of concrete material which contribute to the construction of the terms related to this.

Something similar is observed in the study performed by Hoyos (2015) in their investigation "Diseño y aplicación de una propuesta didáctica para favorecer el aprendizaje significativo de las fracciones en los estudiantes del grado cuarto de la Institución Educativa José Asunción Silva del Municipio de Medellín" regarding the construction of the teaching unit as a strategy that enriches development and construction of knowledge in students, are determined from the difficulties presented in the math field by the students of the fourth grade of Educational Institution Jose Asuncion Silva, especially on numeric thinking and numeric systems; One of the concepts included in the different exercises developed in the classroom by teachers is the Fractions. From their perspective, Hoyos proposes to design and implement a classroom project, which aims at teaching fractions, to strengthen the skills that students can acquire, and to contribute in solving problems that coexist within your development environment; for this, contributes to a teaching unit of the set in the fourth grade of elementary primary in the institution, within the topics covered and considered within the curriculum.

The methodology on which Hoyos is based, is based on the analysis monograph of experience or the case study, where the research is taken as a practical and experimental study, to describes the steps for its development and then, to compare them with other similar studies and issue responsible conclusion. Likewise, the procedures necessary to develop the research in depth had as theoretical floor the method of discovery and teaching for understanding, supported by generative topics, achievements of understanding, performance and continuous qualification. (Ausubel and Perkins, 1983) in the development of their theories, persist, in that, the teacher must make use of the motivation for the student to achieve his learning through discovery, according to the educational process and establishing a coherent relationship with the mathematical modeling of problematic situations on which the study topic is based.

Finally, Hoyos at the conclusion of the research, states that, although learning about numerical thinking and numerical systems seems complex, by relating these to everyday situations, it is very interesting and understandable for the students, behaving these situations in a motivating factor that encourages the student to participate and develop group work. On the other hand, classes should be geared towards students seeking their own knowledge and drawing their own conclusions, and that these advances about fractions will have a rewarding and meaningful meaning when they put it to the test in common events of their daily lives (a quarter of an hour, half a day).

This study is useful for the present research since it makes evident the need to apply various didactic strategies in the teaching of rational numbers, the identification of factors which may favor the learning process, considering the environments surrounding the student and which give meaning to the mathematics he

learns. To take advantage of the context as a resource in the development of the topic, giving rise to questions and situations related to its environment that are going to be relevant in the sense of learning mathematics. In addition, it should be aware that the different strategies employed in the education of students seek to prevent the routine imposition of a single teaching style framework from generating restrictive habits in the learning of students.

The study done by Baquero (2007) in his research entitled "Ecología de la modelación matemática: los recorridos de estudio e investigación" publishes the results in the wake of the problems that are situated in the teaching of the faculties of experimental sciences (CCEE) took as its central focus the study of the ecology of mathematical modelling in this institutional setting, the study of the constraints that make harder the work and the conditions required for the current education systems to develop with complete normality in the application of mathematical modelling objectively with the problems of the environment and what it can offer to fix them. This research gives us the solid foundation to show a different way in teaching practice, for the teachers of the Luis Carlos Galán Sarmiento Institution of Arjona village to adopt in their curricular plans and developments in the classrooms, whereas the environment in the area where the school is located is a characteristic factor that can be exploited to the full.

Moreover, Escolano and Gairín (2005), establish that difficulties in learning rational numbers are basically conceptual and procedural in terms of the relationships and operations of the numerical structure of rational numbers itself; associated with inappropriate processes in teaching practice. The study developed by Escolano and Gairín is of correlational descriptive level, therefore the research design is correlational descriptive transectional, which, when applied to the five grades of primary, it was possible to conclude from the respective analysis of the information, that in the understanding of the meanings of the rational number there exists a persistent crossing of the part-all meaning, in the interpretation of the meanings of measurement, reason, ratio and operator. It is evident that there is a direct relationship between the competences that the student has, to develop the algorithms of the basic operations with fractions and the knowledge of the properties of the rational number and its foundation.

These findings of deficiencies in the understanding of rational numbers, their properties and the applications of operations in the different problematic situations associated with the school environment, motivate this research for the creation of didactic strategies in the teaching of fractional numbers, to overcome the different difficulties that students are reflecting when solving problematic situations in their environment, grounded in the theoretical knowledge imparted in the class and objectively related to the use of the different elements provided by the ecological environment.

6. Methodology

This work is a practical and experimental research study, where the necessary procedures are applied to carry out the research. These are based on the method of discovery and supported by generative topics and continuous assessment, developed by David Ausubel, where the identification of students'previous knowledge, becomes the starting point for starting the learning process.

Research paradigm

Research models associated with investigation are considered as the set of assumptions, premises and postulates defined by the scientific community. In addition to supporting a series of rules necessary to formulate and develop a research, it involves the use of a method and a way of explaining, interpreting or understanding the results obtained in the research.

The process of analyzing the results obtained on the teaching of rational numbers makes it possible to identify the distance between the duty to be faced with the actual or current situation of educational practice,

establishing appropriate teaching strategies that demonstrate positive results regarding the learning of the students on institutionally formative setting.

According to (María Teresa Buitrago, 1999) teaching could be defined as an "exploratory study of school life, so that the actors involved in it can immerse themselves in the school reality, so that, from the description and preliminary explanation of the manifestations of the problem addressed, so, it can be shown the weakness, strengths, opportunities and threats they have in the institutional framework".

The reason revolves around the actors of the process; the students, appropriate the problem identified and expand their frame of reference in relation to the mathematical object of study with the sole objective of evidencing weaknesses, opportunities, strengths and threats to expose the different difficulties in the application of the concept of rational numbers in the resolution of problem situations.

Here are the steps that were made in the development of the research.

STEPS	OBJECTIVE	ACTIVITIES
steps 1 Documentation	Search information concerning teaching concepts of rational numbers using a teaching unit.	• Bibliographic review of teaching units related to the teaching of rational numbers • Bibliographical review on teaching units related to the teaching of rational numbers • Consult research databases on the same line. Bibliographical review on the design and implementation of a teaching unit applied mathematics to teaching rational numbers.
Step 2 Diagnosis and Analysis	Identify different challenges, opportunities, strengths and weaknesses in teaching rational numbers (Fractional)	• Design of diagnostic activities. • Diagnostic workshop students fifth (5th). • Analysis by the technique of matrix DOFA
Step 3 Strategies design	Design class planning based on the teaching of rational numbers (fractional) using resources from the ecological environment in the fifth grade students of the primary Luis Carlos Galán Sarmiento E.I	• Development of different strategies for teaching rational numbers (fractions). • Application of these activities using ecological elements of the environment where the student lives. • Pose and solve environmental problem situations that are related to rational numbers (fractions). • Application of the different strategies of teaching rational numbers, designed for the teaching unit. • Group and individual exercise solution
Step 4 Implementation and evaluation of results	Apply strategies for teaching activities contextualized rational numbers (fractions) using ecological elements	• Apply the teaching strategy • Evaluate the learning processes of students to the use ecological elements. • Generate a teaching practice for teaching rational numbers in the fifth grade, which serve as a model for the development of the subject.

Figura 1. steps for research development

We used the DOFA analysis, which identifies weaknesses, opportunities, strengths and weaknesses of the various components that could be associated with the teaching of rational numbers as object of mathematical study.

From this perspective, the DOFA matrix is understood as an instrument that seeks to provide the information needed by developing teaching strategy, using ecological elements; and from analysis, maximize opportunities and minimize weaknesses and threats or difficulties through institutional strengths. In this way develop a research work that contributes to improving the results presented by students can implement teaching strategies in the sense of obtaining solution to the constituent objectives associated with the research problem. Given the above, the present research work is part of the application of a DOFA matrix which, by applying some concepts related to the mathematical object developed through strategies teaching of rational numbers and using ecological elements contribute in the construction of a teaching unit teaching and learning.

The development of strategies was followed through guides where students tested the objectivity of the theoretical concepts taught in the classroom and which must be related to possible problem situations that could be identified in the learning process of the covered topics. Therefore, the data collected were related to the proposed objectives, since it could be identified the way in which students learn and the applicability in which they can establish environmental situations.

Furthermore, the proposal of a didactic unit as a strategy for the teaching of rational numbers using ecological means that the environment offers to the students of the fifth grade of primary supports the solutions of the problems arising from the daily experiences with which pupils live together. Hence, didactic make sense, both active, teaching, as passive, learning or being taught, and also transitive, in the sense of learning for itself, it has long been recognized as an educational tool that covers teaching processes such as learning and self-learning. According to (Kant, quoted by González, 2001) “didactics is the space that is given to the student to interrogate and interrogate himself, when the teacher asks his disciples what they want to learn”.

Taking advantage from the elements of the ecological environment that can be used for teaching and understanding of the concept of rational numbers and the application of their properties, representations and exercise of operations between them, allow within the development of a new teaching strategy, a process of mediation between subjects who transdiscipline the sciences, while enabling knowledge in the construction of reliable paths of answers to different problem situations. (Magnendzo, 1991) asserts that “problems arise from the value and cognitive tensions that students face in their daily lives in the family, at school, in the community, in society”. This activity based on teaching strategy enables students to acquire the necessary information within the classroom, to formulate proposals for the construction of knowledge referring to the mathematical object outside of it, applying it and socializing all the knowledge to give solution to the problem under study; and at the same time taking into account the conditions under which the mathematical concept will be developed and its relationship with the ecological environment.

Finally, the application of different tools and collecting information, a process of analysis of the data was started, using statistical, which served as support for it, it can be inferred and generalized the results to the population of students from the educational institution.

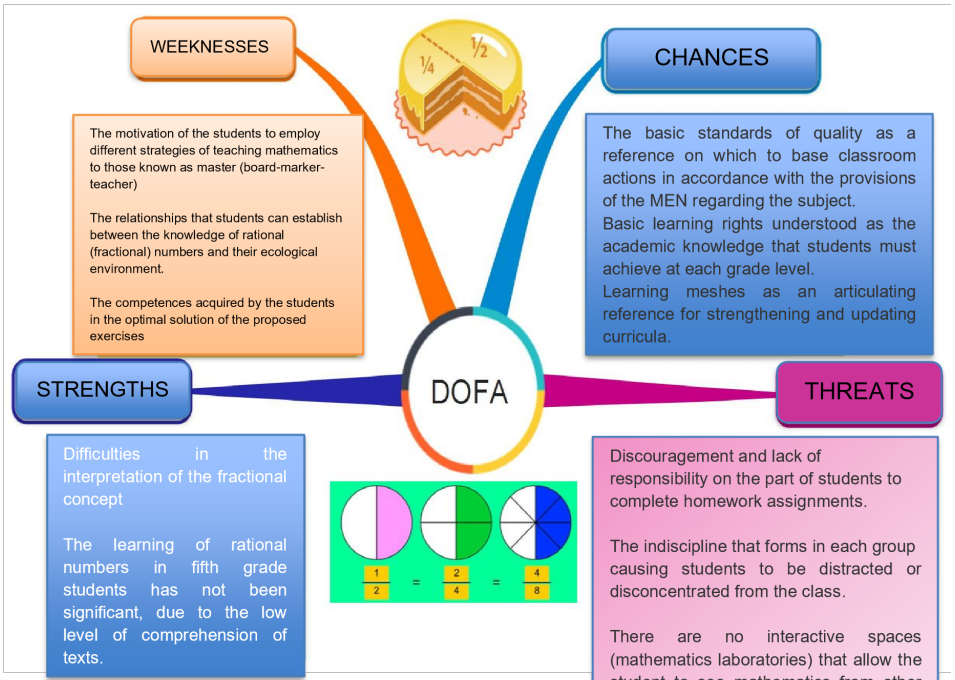

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Figura 2. Own source: Oviedo 2019

Diagnosis

The diagnosis of the students had a knowledge about learning mathematics and particularly of rational numbers, it is developed through the DOFA matrix; set in step 2 of the research, which involves the identification of the different challenges, opportunities, strengths and weaknesses in teaching rational numbers (Fractional).

Weaknesses

- Difficulties arise in interpreting the concept of fractions when this is related to a situation where the average problem it operates.
- Learning of rational numbers in primary has not been significant, since when the student reaches baccalaureate degrees, teaching the concept should start from scratch, showing a total lack of knowledge by the student, it means, “like you never he had taught”.
- The test results know to grade 5 shows clearly this difficulty in numerical thinking, including the issue at hand.
- Serious difficulties evidenced by students for reading comprehension and interpretation of situations problems of their environment.

- Students do not establish relations conceptualization of mathematics with building everyday element. The resources that have educational institutions that serve for teaching

Opportunities

- From the institutional educational project, it understood as a dynamic reflection permanent reconstruction of school horizons, search relevance to the requirements of the national and the local socio-cultural environment.
- The curriculum understood as an organizing principle of the various elements that determine educational practice. It is not understood in isolation, but as a process that integrates criteria and evaluation approaches, competence and develop skills, knowledge, forms of communication, approaches to building knowledge relevant discipline, cognitive and social development.
- The basic quality standards as references on which actions should be based classroom, to ensure that children and young people get the appropriate quality knowledge to their degree and level of study; basis established by the MEN respect to the subject.
- Learning basic rights understood as academic skills that students must achieve at each grade.
- The reference matrix as the tool to guide the skills assessed by ICFES, and interprets the basic standards, and the knowledge gained evidence competencies demonstrated by students.
- Meshes learning as an articulator of reference for strengthening and updating curriculum focused on learning from grade to grade students in the areas reciprocated.
- The constant and permanent training in the pedagogical aspect of your body upgrade teacher.

Strengths

- The motivation of students to the different strategies used to teach mathematics known as magisterial, (board-marker-teaching).
- Relationships that can establish students between knowledge of rational numbers (fractional) and its ecological environment.
- The satisfaction of getting an optimal solution by students in solving exercises, to the same as when they face challenges and skills with other colleagues.
- Work in cooperative groups as pedagogical strategies proposed by groups of teachers in support of the Ministries of Education (PTA).
- The interest of teachers in implementing strategies and methodologies to make more dynamic and enjoyable classes.
- The sense of belonging and membership policies campus to raise the academic level of the area of mathematics.

Threats

- Disorganization in enrollment for the number of students enrolled per classroom (45 students) and sometimes surpasses becoming school isolation.

- Maldistribution of teachers in the institution, since no continuity mechanisms apply processes in grades.
- The number of support classroom teachers to serve a student with special educational needs diagnosed.
- The low participation of parents to the various school activities.
- Demotivation and little responsibility for students to meet with homework.
- Institutional activism without prior notice retards the development of area plans.
- In parents there is the claim that their children overcome all achievements ignoring the lack of commitment of these, blaming teachers for poor performance.
- Indiscipline they formed in each group, so that other students are distracted or desconcentre class.
- You do not have interactive spaces (math lab) that allow the student to see from other perspectives mathematics.

Analysis for the development of teaching strategies

The DOFA matrix aims to guide the strategic planning of the development of the proposed research work, which allows to integrate processes that anticipate or minimize the different difficulties or threats of the environment, leading to the strengthening of weaknesses, the strengthening of internal and external strengths and making the most of the opportunities presented. The result obtained is a set of strategic pedagogical activities for the teaching of rational (fractional) numbers, which would form the didactic unit. In the same way, diagnosis (DOFA matrix) must be continuously evaluated at all stages of research development.

In the revision of the DOFA matrix, the most important points in the development of the matrix should be determined, in order to start its evaluation and to give it the level of importance in the Process as such, this without disproving the important contribution that could be reflected from those processes that were less relevant. It must be recognized that all steps are part of the development of the work.

It will be continued with the implementation of the different strategies that will lead to the enhancement of strengths and opportunities, to avoid the weaknesses and to plan the activities of contingencies that allow to face the materialization of the threats. Accordingly, the actions and strategies must include plans for each of the weaknesses that were considered as opportunities for improvement or that represent reinforcements for the development of work. From elsewhere, in order to take advantage of both internal and external strengths considered as opportunities for the group of students, actions that enhance the development of knowledge must be developed, as an intrinsic objective in the development of research. All these actions must be very precise and sufficiently analyzed, since they represent weaknesses that put at risk the success of the development of strategies.

Finally, the leading plans that allow the implementation of actions for each of the generally external strengths, which in one way or another endanger the development of research work, must be given priority, In other words, action plans must be detailed and carefully studied in order to counter the negative effects of a threat to the success of research. These actions must be strategically focused to create opportunities for improvement in teaching, the progress of identifying them are points in favor of intervention, should be socialized to the teaching staff and to the different members of the educational community emphasizing the bond of the parents.

The diagnostic workshop and the pedagogical activities used for the development of research work are presented.

6.1. Type of research

According to (María Teresa Buitrago, 1999) teaching could be defined as an "exploratory study of school life, so that the actors involved in it can immerse themselves in the school reality, so that, from the description and preliminary explanation of the manifestations of the problem addressed, so, it can be shown the weakness, strengths, opportunities and threats they have in the institutional framework".

6.2. Collection of information

6.2.1. Techniques of collecting information

The method for data collection was applied survey. a representative sample of teachers of mathematics judges of Arjona-Cesar was selected to identify weaknesses that students have in learning rational numbers, using a simple random sampling.

6.2.2. Population and Sample

For the calculation of the sample we were used Simple Random Sampling finite population, with a confidence level of 90 %, using the following formula:

$$n = \frac{Z^2 pqN}{e^2(N-1) + Z^2 pq} \tag{1}$$

Where:
n = number of elements in the sample.
N = number of elements in the universe.
p = Probability that presents.
q = Probability.
Z^2 = critical value corresponding to the confidence level chosen.
e = margin of error or inaccuracy allowed.

$$n = \frac{(1{,}645)^2(0{,}4)(0{,}6)(35)}{(0{,}1)^2(35-1) + (1{,}645)^2(0{,}4)(0{,}6)} = \frac{22{,}73061}{0{,}989446} = 22{,}9739 \approx 23 \tag{2}$$

n = number of teachers of the path was 23

In the path 23 teachers applied survey instrument type and the following results were obtained:

7. Results

The data obtained were used to perform two types of analysis:

- **Descriptive analysis;** In order to know the purpose of how Arjonaâs mathematics teachers contextualize the programmatic contents of mathematics in elementary school towards the construction of problem-generating nuclei in the classroom
- **Correlational and inferential analysis;** in order to make a predictive study of the results obtained by primary school students when contextualized mathematical situations are analyzed. Regarding to the analysis and interpretation of the results, a tool was designed and applied for this research, which made it possible to gather general information from teachers, related to their professional profile and opinions about how teachers guide the process of teaching mathematics. In relation to the results obtained from the instrument applied, the following information was obtained:

8. Analysis and interpretation of results

For this research was designed and implemented an instrument that allowed to collect general information for teachers related to their professional profile and opinions about how teachers guide the teaching process of mathematics.

Regarding the results of the applied instrument it had the following information:

- Professional profile of respondents:

professional profile of teachers	Percentage of teachers
Undergraduate degree	60%
Title of specialists	18%
Master's degree	1%
another title	twenty-one%

Figura 3. Own source: Oviedo 2019

- Old time:

Experience of teachers	Percentage of teachers
Less than 10 years	18.1%
Between 10 and 15 years	0.0%
Between 15 and 20 years	36.4%
More than 20 years of experience	45,5%

Figura 4. Own source: Oviedo 2019

- Regarding the plannings of the subject: 70 % planned in groups and 30 % planned individually. In relation to the resources used for the development of teaching:

Range	Board	Text books	Guides	Electronic books	Internet	Software	Movies	Videos	Tutorials	WEB sites	ther
alto	0%	5%	2%				4%	4%	8%		5%
Medio	0%	%	8%	8%	6%	8%	4%	4%	6%	8%	5%
Bajo				2%	4%	2%	2%	2%	6%	2%	ifty%

Figura 5. Own source: Oviedo 2019

- Evaluation Process; It was intended to know the form of teacher evaluation in the area of mathematics:

Considerations	Percentages	
	yes	no
Individual assessment	100%	0%
group evaluation	100%	0%
Collaborative work	90%	10%
open assessment	63%	37%
closed evaluation	36%	64%
Icfes type evaluation	9%	91%
Evaluation projects	18%	82%
Evaluation case study	9%	91%

Figura 6. Own source: Oviedo 2019

- Planning:

considerations	Percentage of teachers		
Presents topics from a context	55%	Four. Five%	0%
It recognizes and relates the value of the context in formulating mathematical situations	5%	Four. Five%	0%
To make planning articulates the information with teachers in the different areas of the institution	9%	91%	0%
You recognize and uses the environment for the development of actions in the classroom	36%	63%	0%

Figura 7. Own source: Oviedo 2019

9. Conclusions and recommendations

Mathematics, as well as other areas of knowledge, are present in the educational process to contribute to the overall development of students with the perspective that can meet the challenges of the twenty-first century. Therefore, it is proposed a mathematical education that fosters learning broader and more durable than traditional ones, which not only emphasizes on learning concepts and procedures but processes applicable and useful widely thought to learn.

This research supports the conclusion that:

- 60 % of teachers are still with undergraduate degree without specialized studies in the specific area.
- 45.5 % of teachers surveyed have extensive experience in the exercise of his profession, yet their experience does not guarantee the update on what methodological strategies for teaching is required.
- Most teachers plan in groups and by area, however there is no conceptual transversality.
- In relation to the resources used for the development of their teaching activity, most teachers use the board, textbooks and guides for the development of learning activities at a high level.
- The use of TICs is part of a sophism in most teachers and they refuse to incorporate them in the development of the process in the classroom.
- In relation to standardization in the planning for the development of thoughts: numerical, spatial, metric, random and variational; most teachers work more in function of the development of thoughts: numerical, metric and spatial, leaving aside the development of random and variational thinking.
- There are inconsistencies between what teachers say about teaching strategies and the type of assessment they apply to their students.

- The teachers surveyed do not relate pedagogical strategies for teaching to the planning of the educational process, nor do they see them as a component of a more general activity within their daily work.
- The teachers surveyed were based on the development of the skills of doing and are neglecting the competencies of being and knowing how to do in context.

Regarding students concludes:

- Thinking and numerical systems seem complex, however, the specific processes that develop mathematical thinking by relating to everyday situations are very interesting and understandable to students.
- The problem situations encourage participation and group work.
- A lot of attention is aroused in a class when students are directed to seek knowledge and draw their own conclusions.
- The advances evidenced by students in the topic of rational numbers (fractional) is gratifying and significant, is noticed when in their daily life mention the relation of the topic with common events like the distribution of class hours (a quarter of an hour, half an hour, a sixth of an hour), farm animals and their useful mathematical representation that can be adjusted to the understandings of numerical sets, to the multiple constructions that students can make using elements of the ecological environment, plus they can be useful for themselves.
- Advances evidenced by students in the field of rational numbers (fractional) is rewarding and meaningful notice when in their daily lives mention the relation of the subject with common events such as the distribution of class time (a quarter of an hour, half hour, a sixth time), animals field and useful mathematical representation that can be adjusted to the understandings of number sets, the multiple constructs can students using elements of the ecological environment also can be useful for themselves.
- Generating questions for students and problem situations in the classroom stimulates them for the development of thought, encourages research, invites them to discover new knowledge; at this point it is essential to remember the role of teacher as guide, guide and facilitator of the learning process and not as possessor of knowledge always looking for the improvement of the quality of education and the improvement of their students.

Recommendations

- After having reviewed all the literature of different authors and their approach to the subject matter of the research carried out, to make a thorough observation and interaction with the educational community, with the excellent willingness to work with students we propose the following guidelines to improve the Learning Process of Mathematics in the fifth grade of primary school of the Educational Institution Luis Carlos Galan Sarmiento of the Municipalities of Arjona-Astrea from Cesar department.
- We began emphasizing the context, which has to do with the environment surrounding the student and to give meaning to learning mathematics. To take advantage of the context as a resource in the teaching process continuous intervention of the teacher to modify and enrich this context with the intention that students learn is necessary.

- These interventions generate interesting practices, questions and situations that, because they are related to their environment, are relevant to the student and give meaning to mathematics. This is how problematic situations arise from the broader context. The design of a problematic situation must be such that, in addition to compromising the studentâs affectivity, it triggers the expected learning processes. The problematic situation becomes a micro-learning environment that can come from everyday life, mathematics and other sciences. It could be said that the problematic situation is conditioned to a greater or lesser extent by factors constituting each context.

Other suggestions:

- It is necessary to relate the learning content with the everyday experience of students and present them and teach them in a context of problematic situations from their environment.
- It is essential to carry out any intervention work in the classroom have a diagnosis suitable for determining the starting point from contextualization, methodological and evaluation of such intervention.
- The contextualization part of a project is enriched by an adequate analysis of the diagnosis made, because to make the diagnosis and not to analyze it would be to stay in the middle of the path of any technique used to clarify the problem; these results should be evaluated by making some sort of classification so as to be able to plan the different strategies that would contribute to the methodology to be used.
- For there to be meaningful learning of fractions must work with defined units, the operation that is exemplified must handle universal units, as one of three equal parts into which a sheet of paper is divided, for example, it is usually expressed as the third part or one third. For our students who start learning in fractions this can cause problems because the definition of the unit is not clear (paper size, for example, may be variable).
- In the development of the teaching unit, the different arbitrary units of measurement can be identified by establishing a relationship with the use of rational numbers and standardized units of measurement, works with units such as meter and liter. For example, talking about 1/3 of a meter makes more sense and makes it easier to relate the part to the whole.
- The use of material from the ecological environment is of great help for the development of the activities, since a great majority of the students sustain their attention in this type of material.
- Through the family parentsâ school, it is possible to strengthen support tools and solution alternatives to address the factors that influence the learning process of students. Of the students identified with learning problems, orient them through the care routes established by the institution and do the respective accompaniment to improve the process of learning mathematics.
- Carry out more frequent pedagogical activities in and outside the classroom in mathematics, that the different transversal projects use the mathematical tools.
- To give students constant feedback on the advantages of applying, of putting into practice the learning styles according to the characteristics of each student. To speak with parents and/or respondents in the case of students who need specialized external accompaniment, so that in this way improve the process of learning mathematics.

- Apply problem situations in all classes and in all areas of training, creating a culture that, if there is a problem, there is also a solution. Bear in mind that all the external tests carried out by the ICFES and as proposed by the OECD, through the PISA report, this type of thematic evaluation will be more constant.

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