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Materials and resources in the teaching and learning process of mathematics

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Abstract

The objective of this research is to improve academic performance in the mathematics of students in La Libertad Educational School by implementing materials and resources in the development of the educational process. With this strategy teachers shall further methodology applied, making the young students increase their level of motivation to learn mathematics. This research applies a quantitative, descriptive and transversal methodology. the technique of the survey, with questions drawn up with the Likert scale was used for data collection, the same as found that most teachers in the area of mathematics of the institution, do not use materials and resources at the time to give their classes, it made the teaching process very monotonous, causing a lack of students motivation and academic underachievement. In the development of research, teaching materials and resources applied to impart their math classes during the second quimestre, the expected results were obtained, the level of student motivation increased, and improved their academic performance.

Mathematics, Materials, Resources, Motivation.

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Introduction

Share experiences with professional mathematics teacher was the beginning for this research project. The traditional teaching process using blackboard and markers has made the signature like something difficult and boring to understand.

We like in an age where everything change and develop quickly, so now it is an obligation find new strategies to teach and learn. The bad grades in Mathematics is a real and enough indicator to show that exist a lack of motivation to learn the signature.

The teacher must have a complete vision of their students like a learning community and not only a group of students. Mathematical reasoning should prevail rather than simple memorization processes, so students may have the connection of mathematical ideas and their applications in solving problems.

The use of resources and materials for teaching and learning of mathematics constitute a strategy that teachers should use in their classes for students to experience a new learning environment, which is very motivating and will allow significant learning generated.

Teaching and learning of Mathematics

The mathematics learning is to build the sense knowledge is an essential both problem solving and reflection around them (Diaz, 2015) activity.

The process of learning of the mathematics is vitally important for students to have the ability to build their knowledge.

Teachers should seek and implement methods and strategies to arouse interest and taste for this important science; therefore the training of teachers is essential to provide knowledge, vision, methods, resources, attitudes and skills to students.

The goal of teaching mathematics is not just memorize a series of skills but students learn and are able to apply the knowledge acquired in solving problems. According to the authors (Flores, Lupiáñez , Berenguer , Marin, & Molina , 2011) to reach it, the student must come to create a chain of behavior : Make , Internalizing , organize, Hold , identify the conditions and recover .

According to (Piaget , 1972 , pp . 47-46) " It's amazing how everyone is convinced that there is enough to know to teach mathematics , without having to worry about how the concepts are actually built into the thinking subject."

Over time we have established two main approaches to teaching and learning of mathematics, behavioral and constructivist approach.

Conductive method is learning theory that believes learning is to change behavior, measuring learning by objective observable behaviors, regardless of the mental processes that occur in the development of certain activities. For example learn addition and multiplication tables. (Broadus Watson, 1974)

Constructivism is a pedagogical theory that aims to provide students with the necessary tools to build through its application to the processes to solve problematic situations that arise which will make their ideas are changed and continue to learn.

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According to (Carter M., 1993) is the idea that the individual holds both cognitive behavioral and social aspects, is not a product of the environment, but their own construction that was produced every day as a result of interactions between the two factors.

Example when student has already learned algorithms to perform multiplications, problems which apply different strategies to reach solutions thus create new mental structures that will allow for significant learning arise.

Today is conceivable mathematical learning with a cognitive-constructivist approach since it is made from concrete experiences which become a significant situation for students through which they can perform processes of abstraction and generalization. Discovery learning is an accurate way to obtain meaningful learning in students.

Math teacher education

The Constitution of the Republic of Ecuador establishes in Article 349 that the state shall guarantee to teachers at all levels and modalities stability, update, continuous training and educational improvement according to their needs and those of the national education system.

Teacher training in mathematics in recent years has evolved according to current educational laws proposed by the government for the purpose of improving educational quality in Ecuador. Currently there are training courses proposed by the Ministry of Education, ensuring that compliance with the provisions of Article 10, paragraph a, of the LOEI (Organic Law of Intercultural Education) concerning the rights and obligations of the teachers.

Math teacher should possess professional skills that consist of a set of knowledge, skills and abilities so that it can carry out its work in an effective manner, in this sense the authors (Larios Osorio, Font Moll, Spíndola Yanez, & Sosa Garza, 2012) state "that should be emphasized that the professionalization should not come solely from institutional recognition, but also personal development of teachers".

These competences are gotten with constant training, updated activities and researches of methods and techniques to learn, skills and instruments to improve more the learning teaching process.

It is also necessary that teachers must be identified like actors with responsibility about their training process, their skills, inside and outside knowledge, to show a effective and efficient labor, according the context. (Larios Osorio, Font Moll, Spíndola Yáñez, & Sosa Garza, 2012).

The continuous training process of math teachers allow to improve not only professional competence, the management inside the classroom, pedagogical and psychological aspects, to improve the learning students processes, by personal contact, it is so important the interaction between teacher and student.

The actual situation of math teaching and learning process show the training and update necessity in teachers, for this reason the government authorities offer on line services, with international universities, promoting the use of ITC in the teaching process. But it is more important the motivation of teachers to change and do different things using technological advances resources.

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These formative activities on line are developed at the web, this facilitates the interchange of experiences, elaboration and share of information and communication, to be used in the classroom.

Materials and resources for teaching and learning Mathematics

Through research and educational innovation in the subject of mathematics, it has been determined how important is the active participation of students in their learning process. This view is enhanced by the use of materials and resources in the classroom, as with manipulation, exploration and questioning of alternative solutions, students will have meaningful experiences for their learning process.

Although the resources and materials used in the classroom have the same purpose and can be used interchangeably, it is necessary to differentiate according to the purpose for which they were created. A resource is any means, that has not been designed specifically for the learning of any mathematical notion, the teacher can incorporate into their teaching examples: calculators, multi-base blocks, some websites, games, etc. The materials are means that initially designed and created with an educational purpose, even if that is not their only field of application examples: worksheets prepared by teachers, handy resources, magazines, coins, banknotes, etc. (Carretero, Coriat, & Nieto, 1995). Resource materials and also they can be classified into two groups: those that can be manipulated in physical form and those who are about technology, like an additional support is. Meanwhile the author (Cascallana, 1988) called structured materials to materials, and unstructured to resources.

The material and resources will allow to teachers to send different activities to students to learn mathematics concepts. The selection of them has a real important part in the teaching learning process, the teacher must choose the specific materials that help students understand the signature and develop their skills. The Mathematic context are divided in four blocks: numeric, geometric, algebra and functions, statistics and probability. The teacher must consider the materials to be used for this proposal.

To the first block

For first block numbers are materials developed to address the first numerical concepts such as multi-base Cuisenaire rods or blocks, which serve to build the decimal numbering system and its properties.

To study geometry a useful material is garboard, is a proposed Gattegno and distributed in Spain by Puig Adam (Cascallana, 1988) structured material, which consists of a square board with nails in the scheduled vertices, on which you can build polygons, a grid for analysis. There are also puzzles and Pentominoes to construct geometric figures.
Technological materials like Graphmatica and geogebra are very helpful when making graphs with complete accuracy.

The use of materials and technological resources has great potential for education, such as tablets, calculators and computers allow the properties and algebraic relationships and the different representations of functions. For that you need to plan in detail that we want to use that competence is to be developed, which tasks should be designed and the evaluation system should be implemented for its development. (Lupiáñez & Codina, 2004).

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For the study block statistics where analysis and interpretation of data collected on different types of phenomena are made, have available spreadsheets are a very useful technological resource that organize, explore and graphically display large amounts of data. The use of dice, playing cards and gambling allow students to address problems and random probability calculus.

There are other materials and resources that are very versatile, such as tangram is a puzzle consisting of seven geometric figures with which content can be treated as perimeters and areas, fractional relationships, irrational numbers, equivalences and similarities among others. Origami or paper folding part of traditional games in family life, yields similar to those drawn with a ruler and compass, symmetries, translations and construction of polygons, polyhedral and fractal geometric figures; with these activities facilitates understanding of geometric concepts. (Ledesma, 1996).

When the teacher includes within its planning the use of any material or unusual resource it is likely to be a change in behavior regarding students' attention, because it is not something they are used to, so it's being done more frequently to assimilate that is part of the process and give the importance for learning in the classroom, which will become a math lab in which students significantly increase their participation.

Troubleshooting

One of the most important components in the teaching and learning of mathematics is the approach and problem solving; they must occur continuously during the process and not leave them to work in isolation.

Problem solving is closely related to creativity and is defined as the ability to generate new ideas and solve all kinds of problems and challenges. (Said Nieto, 2004) is a competition that students should acquire during their learning of mathematics, often used this ability throughout their lives.

Through problem solving students can raise questions, make mistakes and research, as well as enjoy their learning process as they will be immersed in the construction of their own knowledge acquiring a greater understanding of the subject.

The teacher can promote the development of mathematical thinking in students through problem solving, it is necessary to analyze their competencies, to determine if they are ready to venture into the process and to obtain the expected results. The following aspects will determine whether students are ready to solve problems:

- It must have basic knowledge about concepts, formulas and algorithms on specific issues that are involved in the proposed problems.
- Apply cognitive strategies or heuristics to explore and understand the problems through graphical representations decompose into simpler analyze situations or through another similar problem.
- Metacognitive strategies that allow students to know their limitations, determine what you need or use knowledge. By this the student will control and monitor their own cognitive process.
- Trust and affective components by controlling their emotional states that allow you to feel able and willing to engage in mathematical activities.

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To start solving problems with students, teachers suggested considering the following activities:

- Have advance preparation, read articles and books on problem solving.
- Take into account that work to solve problems with students are slow and sometimes very slow, the fruits of this process are not seen immediately.
- Dedicate one or several working sessions with students about the advantages and disadvantages that arise in solving problems, and the importance and the objectives pursued.
- Solve problems with student models, taking into account the degree of difficulty and using various processes and a method, for example Polya is highly recommended. In this way students are helped to develop a number of strategies to solve problems.
- Present problems that increase the interest of students in order that it can foster a good working environment and to deepen the basic strategies and most relevant content.

Also it is necessary that the teacher shows an adequate treatment, analyzing strategies and solution techniques, "acting" the thinking and contrasting with other people. (Echenique Urdiain, 2006).

The adequate use of ITC skills in problem resolution helps to use strategies dynamic mathematics objects, measuring long, areas and superficies, geometric places and algebra operations, it helps to understand concepts and inference of results.

Objectives

General Objective

Apply materials and resources in the teaching learning process of Mathematics to improve the students´ academic performance

Specific Objectives

To encourage the teachers in the use of materials and resources in the classroom to stronger the teaching and learning of math.
Foster teamwork in students, through the use of materials and resources in the subject of mathematics to improve their academic level

2. Materials and methods

For the development of research a mixed methodology based on qualitative and quantitative model was used because it is considered that with the integration of both approaches will be achieved correctly apply resources and materials in the teaching and learning of mathematics, which will students, acquire math skills.

Inductive and deductive methods help to draw conclusions from the analysis of particular situations to reach the general and vice versa. The inductive method was used so central to the analysis of the problem of learning mathematics through student surveys to determine the degree of motivation that exists in this important subject and to make recommendations to teachers in the area over the use of materials and resources used in the classroom. The deductive method was used for the analysis of resources and materials that can be used in math classes, know its features, applications and limitations, to link them with the essential contents of the subject and select those that are appropriate for achieving the general objectives of the area.

The research was conducted in a population of 185 people, made up of 175 Freshmen General Unified Baccalaureate, and 10 teachers in the area of Mathematics Education "La Libertad School"

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Population	N°	%
Students	175	94,6
Teachers	10	5,4
Total	185	100

Table 1 Population

Instrument: Survey

3. Results

To meet the objectives, instruments for collecting information with which data used for the determination of levels of motivation in students regarding the subject of mathematics was obtained , and the degree of implementation of resources were developed and materials by teachers at the time of teaching their classes . Surveys were conducted in two stages, at the end of the first five months to analyze the problem and at the end of the second five months , after application of resources and classroom materials . These results are summarized in the following tables:

Survey to 1st High school level Students

Indicator	Result	Percentage
Always	0	0 %
Sometimes	20	11,43 %
Never	155	88,57 %
Total	175	100 %

Table 2 Does the math teacher use material and resources to teach?

Instrument: Survey

The results show that 88, 57% of students tell that their teachers don´t use materials and resources to teach math, and can infer the teaching process is monotonous, causing lack of motivation to students to learn the signature.
Survey to 1st high school level Teacher

Indicator	Result	Percentage
Always	0	0 %
Sometimes	2	20 %
Never	8	80 %
Total	10	100 %

Table 3 Do you use material and resources to teach math?

Instrument: Survey

At the end of the first five months the teachers answer they include in their class plans the use of materials and resources ,20 % do that sometimes, and the 80% never.

It is important the use of these material and resources , in order students learn and understand math in a better way.
Survey to First High School Level Students

Indicator	Result	Percentage
Always	153	87,43 %
Sometimes	22	12,57 %
Never	0	%
Total	175	100 %

Table 4 When the teacher uses material and resources to teach math, do you feel motivated to learn?

Instrument: Survey

After teachers used materials and resources to teach math, the students answer 87,43% increase their motivation for study math. The motivation and skills have an important role in the teaching learning process, a motivated student increases her confidence and can break the idea that mathematics are difficult.
Survey to 1st High School teachers

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Indicator	Result	Percentage
Always	7	70 %
Sometimes	3	30 %
Never	0	0 %
Total	10	100 %

Table 5 Using materials and resources in your math class increase the students' performance?

Instrument: Survey

70% of teachers said the performance of their students improved using materials and resources to teach their classes. When a student is motivated, increase his interest and attention for signature and desire to learn the signature, likes to understand it and feel satisfied because can resolve the homework, increasing their academic performance.

Conclusions

The purpose of this research is break with the idea that math is difficult and antisocial, using strategies that include materials and resources in the classroom, changing this signature funny and easy going for students.

The results show the increasing of academic performance in the students after the use of new strategies by their teachers.
This strategy is not new but teachers didn't know about it or don´t have enough time to use them.

The use of resources and materials in the teaching learning process of Math, increase the motivation in students, add ITC in pedagogical process, and the teachers will improve their methodology develop interactive classes, doing active and collaborative learning in students.

At social level with collaborative groups, the students improve their interpersonal relations, sharing experiences and encourage the practice of values like solidarity, friendship, respect and tolerance.

Recommendations

Materials and resources selected by the teacher must be according to the content of classes' plans.

The math teacher will select the material and resource from the web, they must be easy to get and elaborate, attractive to students, to motivate and wake up the interest for studying Math.

Not all mathematic contents could be taught by material and resources. They can´t be too used because can cause the opposite reaction in students.

It is necessary to continue researching about this topic inside the classroom, with the objective of improve the teaching learning Math process in the basic level.

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