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Body and playfulness: promising tools for teaching and learning mathematics

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Abstract

This paper will analyze the importance of playfulness as an instrument for learning mathematics, taking into account that the (human) body can develop not only motor skills, but also intellectual faculties that involve high levels of abstraction, such as the mathematical operations addition, subtraction, multiplication and division. The methodology used was action research, through the application of interviews to students, parents and teachers, as well as the systematization of experiences in the classroom through a field diary. It was found that traditional —monotonous— teaching does not allow students to be able to assess the importance of learning mathematics. It is concluded that it is necessary for the teacher to implement strategies that link the playful aspect and the body to improve teaching - learning processes, which allows that the conception of mathematics don't be not related only as far from reality, but that be granted the status of a knowledge that improves the processes of understanding and reflection, facilitating the solution of practical problems.

Keywords: Learning, mathematics, teaching method, thought process.

Introduction

Throughout the entire schooling process, but particularly throughout Primary Education, children find themselves in the midst of complex development processes, both in the physical and cognitive spheres; the possibility of establishing a connection between the two areas also means the strengthening of integral processes that unify the motor coordination of third grade students, whose ages are between 7 and 9 years.

In this same stage of development, children are learning from different fields, areas and subjects; and from the exercise of teaching, it is possible to recognize in some cases, and infer in others, that the methodology used for teaching Mathematics usually turns quickly in a series of formulas and procedures whose purpose is to solve operations, without giving greater significance to students' significant learning. That is, a process of mechanization is usually generated through which students memorize and execute, in order to meet the expectations of a third party (teachers or parents), but which only solve a specific problem, which along time does not contribute to the real construction of knowledge.

After a conversation with children and the analysis of the results of the tests, there are identified factors such as monotony, fear, creative flaws, disciplinary situations and other everyday elements of the classroom, which reduce the process of teaching mathematics to a mechanical and non- sense mechanical act that triggers in students lack of motivation, apathy and resistance to the area and the activities related to the development of numerical skills, such as calculating, ordering, measuring and multiplying; without considering the motivation and practical and/or cognitive usefulness that mathematical thought can represent in everyday life.

To that extent, learning mathematics from motor experiences introduces children to a new scenario, where motivation brings students closer to the comprehension and realization of activities of a numerical nature, but with emotional motivations when highlighting group work, the ludic component and the use of the body, among other motivational elements. Faced with this panorama, it was resorted to seek solutions; hence the need to design a teaching proposal for multiplication tables for the third grade of this institution, which took into account these questions: What are the reasons for students to be reluctant to mathematical operations? How the motor skills developed through games can be articulated with the teaching-learning of that subject? Is mathematical thinking a knowledge that allows students not only to solve riddles but also problems of practical life?

Jean Piaget (1991) states that the stage of mental development where children can acquire specific knowledge goes approximately from 7 to 12 years of age; they also use logic. Later, after this age

until adulthood, in the last stage, they make formal operations, reach abstract conclusions, can reflect on the thought, formulate hypotheses, etc.

Jerome Bruner is another theoretical reference who studies the importance of motivation in learning, rejecting rote memorization; he states: "Students should be encouraged to discover the world and relationships for themselves". (Bruner, 1995: 13). He also assigns the game a decisive role in the learning process of mathematics, stating: "The game is a kind of mathematical model, an artificial but very faithful representation of reality" (Bruner, 1995: 12).

Some authors (Vergnaud, 1995, D'Amore and Fandiño, 2015, Jiménez Vélez, 2001, 2005, Díaz 2008, Nunes de Almeida, 2002, Flórez Ochoa, 2013, Magaña 2016) highlight the importance of playfulness in the learning process of mathematics; likewise Aristizábal, Colorado and Gutiérrez (2016) state:

Current education requires people with critical, analytical, reflective capacity and this is achieved through the development of thought. A person with a high intellectual development is able to interpret, argue, propose, pose and solve problems in different contexts; therefore, for the acquisition of the numerical sense, it is necessary to provide rich, varied and significant situations that stimulate intelligence and imagination to children, through the game, as proposed by the curricular standards (p.118).

Ricardo Lucio (1989) conceptualizes didactics as knowledge that makes a process the central theme, and which guides its methods and strategies; in addition, he asserts: "And the horizon of didactics must be pedagogy, just as the horizon of pedagogy is a specific conception of man, of their growing up in society" (p.5).

José Enver Ayala warns that the body is an element that must be taken into account in the learning processes, both by the teacher and students; he states:

In a perspective of the subject as a whole, it is necessary to consider the body, corporeality and motor skills as elements that can not only contribute to the teaching process, but also constitute a necessary knowledge for teachers to develop their educational work, and motor skills understood as the axis of existence, as the constitution of life. (Ayala, 2013: 1345).

Likewise, another author who has worked on the body-teaching relationship is Cecilia Seré Quintero (2011) who affirms: "There is no relationship of exclusion between language, teaching, education and the body." Teaching and education are always instances in word, inseparable from the corporeal; and therefore, subject to the structuring of the language" (Seré, 2011: 35). It is the human being a symbolic being who has built codes as sophisticated as mathematics; therefore, the relationship pointed out by this author is very close.

Other authors who have researched on the body and its relationship with education are Lucio Martínez Álvarez and Gustavo González Calvo (2016), Granda, (2002).

Materials and methods

The methodology used was action research. The process began with the application of a diagnostic test to students; later, the mechanics of work was explained to them, and through Google forms, students filled out a survey; these tools were used as a diagnostic strategy to know the level of acceptability and their thinking about the activities inherent to the math class. The population surveyed were 64 third-grade students, aged between 7 and 9 years of the Nazareth Technical Education Institution, in Nobsa and Chámeza.

Results

Next we present a series of interviews that were carried out with students with the objective of recovering their experiences and motivations in the area of mathematics. This work was developed using a digital questionnaire, using the tool *Google forms*, which allows to answer the questionnaire online. Students and people participating in the present investigative process were gathered to explain the use of the tool, so that the collected material could be reliable.

Survey of students

The children were explained, first on the board; then, a paper simulation was made, with the 13 questions and then, one by one, they presented their respective tests. They were also explained the purpose of this exercise, and that their names would not be recorded in the presented test; this with the intention of making the answers more reliable. It was the same (procedure) with each of the three groups that took the test.

In the first group, 72 parents were interviewed, 45 of them asked for help to filling out the form. Likewise, the 64 students who completed the test received an explanation, almost all of them helped their parents, but none of them asked for help from the teacher-researcher. Finally, the group of teachers prepared the survey privately, after observing the work developed with children and parents, since most of them are older and show some difficulties in the use of technological tools. The results obtained from the interviews with students are described below.

To the first question: Do you enjoy math classes? Students answered 50%, positively, 50%, negatively. The second question of the questionnaire was aimed at discovering the reasons that made students enjoy their class.

30% of students answered that they love math; 10% answered that they note that teachers prepares their classes with care; 27% of students answered that they like it, because there are different activities to write, and 33% of students said they like it for "other reasons" that were not specified.

The third question was aimed at recognizing the flaws or situations that affect the taste of children for mathematics: Why do not you like mathematics? The answers were more consistent, so they were grouped into only three options: 60% of students answered that they prefer another class; 10% think that the math class is boring; and 30% considered the class too short, as well as (the fact) that is taught always in the classroom.

With respect to academic performance, students are grouped around three answers: 50% of students have medium-high grades, between three and four; 20% have grades between two and three; and 30% do not remember their grades. Contrasting the results, most of them have obtained "good" or approval grades, which is important and significant for the subject, if considered in isolation with the factors described in the previous question.

For the question: Which of the latest math topics did you like the most and why? Students were asked to remember the classes that are or were related to the multiplication tables; however, only 25% explicitly mentioned the tables; 48% "all," which indicates that they refer to their attitude towards the class, rather than the same dynamics of it. 27% spoke of the divisions, that is, they left the subject.

For the question: Which of the covered topics was harder to understand? Why?

Explicitly, 40% said they had difficulty learning the multiplication tables. However, 60% stated that their difficulties are total; when expressing all, it follows that it is a general blockade to the matter, or one of the elements that compose it, because if there is a high degree of approval, such as students themselves expressed this in a previous question, it is not justifiable that 40% of students do poorly in the subject; rather it is about the self-perception and the personal location of the children around the subject.

The next question: What are the activities that teachers usually do in math classes? Related to the teaching of the class, this question is more explicit in relation to the didactics of the math classes, with the way in which the children perceive their teachers and the class itself. 40% said that teachers use the board very regularly; 10% said that teachers solve practical, quotidian problems in the classroom; 50% say that teachers use videos to set the class; and 100% express that they use music as a help.

The question: What was the overall average of your grades in the area of mathematics during the previous period? It intended to know if the children remembered their grades in the mathematics subject. 50% of students remembered to have grades between 3.0 and 4.0; 20% between 2.0 and 3.0; and 30% of students did not remember

them. When confronting this information with the teaching forms, it was possible to find out that, in fact, most of the children had passing grades, between 3.0 and 3.5, which generates a question about real learning, versus school promotion and significant learning of students.

The next question: Which of the latest math topics did you like the most and why? It collects information about the significant memories of students, in relation to mathematics (as a subject); the answers present a high degree of ambiguity, in some cases there is no coherence; for example, the answer "No" 37%. It is assumed that "No" means that there is no taste for a specific topic. 42% of students answered "All," which also involves a high degree of ambiguity and generates suspicion regarding the motivation of students; that is, it is likely that students have some degree of affinity with teachers or with some particularity of the class, more than with the subject as such, because they do not remember a specific topic.

21% answered the table of 7; this answer is interesting, since it is one of the classes that the researcher had the opportunity to observe and on which she received a scheme, on the part of teachers; therefore, it is emphasized that the activities that teachers developed in the classroom around the learning of the table of 7 were significant for some of students, as they remember it with pleasure. In the same way, it happens with division, which other students mention. The opposite happens with students who mention that they do not remember the topics.

The question: Which of the last subjects seen in mathematics did you find it more difficult to understand? Why? It sought to strengthen the previous topic, that is, to investigate why certain students like or not mathematics. The answers obtained, if reviewed in isolation, let us know that only 10% of students have a thorough understanding of the subject, because all the others report issues that were not understood (that they didn't understand). 40% of them mention that they had no understanding of the topics addressed; and 50% specifically mention the multiplication tables, which allows us to conclude that in the end children present difficulties in this subject.

The next question: Do you use many materials in math classes (like games, tokens, others) when learning math? 70% of students responded that no games or materials are used, from which it can be interpreted that most of the children did not perceive changes in the activities or these were not significant for them.

As a summary of this survey, it can be concluded that students present different versions of their taste for the class; however, it is clear that the academic performance is not optimal and that children in general are not highly motivated with the math class. That they identify a repeated pattern in the ludic methodology of teachers; and that they do not show much clarity with respect to the concepts, and sometimes, to the intentions of teachers.

Discussion

When carrying out the teaching exercise with students, it was possible to detect a series of shortcomings, related in principle with apathy and disinterest in mathematics. Faced with this reality, it was developed a diagnostic exercise with students. As a general feature, students show disinterest in the multiplication tables and indisposition with the topics and activities that take place; they have little participation in class, and tend to get distracted during the pedagogical sessions.

When inquiring about the reasons, it is found that in general terms, students especially consider the learning of multiplication tables as a difficult path to travel; memorizing procedures that allow the development of any exercise or problem that teachers can teach is complicated; this type of teaching has been considered as one of the outstanding factors to explain why the levels of student learning in the area of mathematics is low and going downhill; students do not understand the way of teaching of their teachers; students assume that it is difficult, therefore, they don't integrate this subject into their life projects, arising in them apathy towards the subject, which increases as academic life goes on.

On the other hand, learning problems produce different effects on students, such as school failure, development of apathy towards mathematics, low

self-esteem, sadness and disinterest in students. These negative consequences condition and significantly limit the teaching and learning of mathematics, making this subject one of the least accepted areas in the educational community.

Paying attention to the reliability level of the surveys, the result is positive as it shows that children in general like the class. However, the reasons do not show with enthusiasm; on the contrary, they seem to be just satisfied; for example, the reason that obtained the highest score was "because there are activities different than writing."

In the same way, and through an applied questionnaire, it was identified that students have difficulty remembering the multiplication tables, and apparently, teachers do not use innovative strategies for the teaching-learning of mathematics. Likewise, it was evidenced in the questionnaires developed with high-school teachers that in many occasions the low performance in the area of mathematics is due to the lack of clarity about the multiplication tables, a situation that does not allow that the learning of new topics be fluid, and that be possible to advance in the teaching of new concepts.

Conclusions

Although the learning of mathematics requires high levels of abstraction, concentration and disciplined work, it is necessary to make more dynamic the teaching of mathematical operations; specifically, the multiplication tables, looking for ways of teaching that link playfulness, in order to enable that students of primary school be interested in acquiring this knowledge, that they feel motivated in the classroom, avoiding rote learning by following unmodifiable guides, which students perceive as monotonous exercises; therefore, it is necessary that teachers seeks to innovate in their didactic.

The body also has a decisive role in children's learning; this can be used as a tool that enables meaningful learning. In addition, knowledge is experienced from a perceptual field, because in traditional teaching only the cognitive (component) has been prioritized, limiting it in students to intellectual abilities, but it is necessary to link the body, the motor skills, in order to correct the mind-body dichotomy.

Teaching mathematics in isolation, only in its abstraction, without students seeing this knowledge as relevant to solve problems of daily life, is another difficulty that must be taken into account when designing teaching strategies; otherwise, this subject and the related activities will be seen as subjects in which the only thing that is done is not to write.

It is necessary that teachers incorporate playfulness in the processes of teaching mathematical operations: addition, division, subtraction and multiplication; providing students with knowledge that be useful to improve their processes of reflection and understanding. It is providing them with a tool that will be promising to face higher levels of abstraction. Although concrete thinking is decisive, formal logical thinking allows to make abstractions, reflect on what is thought, formulate hypotheses and other intellectual activities in which students will be involved, either in their academic field or in the resolution of everyday problems.

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