AN ANALYSIS OF THE IMPORTANCE OF MENTAL CALCULATION IN THE 5TH GRADE OF ELEMENTARY SCHOOL AT THE PEDRO LUDOVICO TEIXEIRA MUNICIPAL SCHOOL IN THE MUNICIPALITY OF COLINAS DO TOCANTINS

UMA ANÁLISE SOBRE A IMPORTÂNCIA DO CÁLCULO MENTAL NO 5º ANO DO ENSINO FUNDAMENTAL EM UMA ESCOLA MUNICIPAL PEDRO LUDOVICO TEIXEIRA NO MUNICÍPIO DE COLINAS DO TOCANTINS

UN ANÁLISIS DE LA IMPORTANCIA DEL CÁLCULO MENTAL EN EL 5º AÑO DE LA ENSEÑANZA PRIMARIA DE LA ESCUELA MUNICIPAL PEDRO LUDOVICO TEIXEIRA DEL MUNICIPIO DE COLINAS DO TOCANTINS

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ABSTRACT

This text is part of a research project on how students should be encouraged to perform mental calculations. The main hypothesis is that when stimulated, it can become a habitual and simple skill to improve calculation abilities in various contexts. This article explores the application of activities that stimulate mental calculation in the 5th grade of elementary school. The objective is to demonstrate the effectiveness of mental calculation in elementary school, showing how students' autonomy and critical thinking can be developed, promoting the acquisition of a skill that will be useful in daily activities ranging from simple to highly complex, involving numbers and mathematics as a whole. Through research with a qualitative and quantitative approach, the results obtained with 15 students from a class chosen due to their difficulty in performing simple calculations are presented. Practical activities were carried out, divided into two groups, which helped to identify difficulties with mental calculation. The group with simpler activities had a high number of correct answers. The use of calculators was not encouraged in any of the activities, as the focus was on evaluating the students' level of mental calculation skills. The more complex activities showed a higher error rate, and only 37% of the students achieved an excellent grade, meaning they had more than 60% correct answers out of the total grade. Analyzing the grades and the activities applied, the class had an average level, as some propositions that were considered simple were not solved.

Keywords: Mental Calculation. Mathematics. Teaching and Learning.

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RESUMO
Esse texto é parte de uma pesquisa sobre como o aluno deve ser estimulado a realizar o cálculo mental. A principal hipótese é que quando estimulado, pode incorporar como algo habitual e simples para aprimorar a habilidade de calcular em diversos contextos. Este artigo trabalha a aplicação da realização de atividades que estimulem o cálculo mental no 5º ano do Ensino Fundamental. O objetivo é demonstrar a eficácia da ferramenta do cálculo mental no Ensino Fundamental, mostrando como a autonomia e o pensamento crítico dos alunos podem ser desenvolvidos, promovendo a aquisição de uma habilidade que levarão para as atividades diárias de simples a alta complexidade que envolve os números e a matemática como um todo. Através de uma pesquisa com abordagem qualitativa e quantitativa, apresentam-se os resultados obtidos com 15 alunos de uma turma escolhida devido à dificuldade de fazer cálculos simples. Foram realizadas atividades práticas divididas em dois grupos que ajudaram a identificar as dificuldades quanto ao cálculo mental, o grupo de atividades mais simples teve grande número de acertos. O uso da calculadora não foi estimulado em nenhuma das atividades, pois o foco era avaliar o nível em que estavam sobre o cálculo pensado. As atividades mais complexas apresentaram nível maior de erros e apenas 37% dos alunos tiveram conceito ótimo, ou seja, tiveram mais que 60% de acertos do total da nota. Analisando as notas e as atividades aplicadas, a turma teve nível mediano, pois algumas proposições que eram consideradas simples, não foram resolvidas.

Palavras-chave: Cálculo Mental. Matemática. Ensino e Aprendizagem.

RESUMEN
Este texto forma parte de un proyecto de investigación sobre cómo estimular el cálculo mental en los estudiantes. La hipótesis principal es que, al estimularlo, puede convertirse en una habilidad habitual y sencilla para mejorar las habilidades de cálculo en diversos contextos. Este artículo explora la aplicación de actividades que estimulan el cálculo mental en 5.º de primaria. El objetivo es demostrar la eficacia del cálculo mental en primaria, mostrando cómo se puede desarrollar la autonomía y el pensamiento crítico de los estudiantes, promoviendo la adquisición de una habilidad útil en actividades cotidianas, desde las más sencillas hasta las más complejas, que involucran números y matemáticas en general. Mediante una investigación con un enfoque cualitativo y cuantitativo, se presentan los resultados obtenidos con 15 estudiantes de una clase seleccionada por su dificultad para realizar cálculos simples. Se realizaron actividades prácticas, divididos en dos grupos, lo que ayudó a identificar las dificultades con el cálculo mental. El grupo con actividades más sencillas tuvo un alto número de respuestas correctas. No se fomentó el uso de calculadoras en ninguna de las actividades, ya que el enfoque se centró en evaluar el nivel de cálculo mental de los estudiantes. Las actividades más complejas mostraron una mayor tasa de error, y solo el 37% de los estudiantes obtuvo una calificación excelente, lo que significa que obtuvieron más del 60% de respuestas correctas de la calificación total. Al analizar las calificaciones y las actividades aplicadas, la clase tuvo un nivel promedio, ya que algunas proposiciones consideradas simples no se resolvieron.

Palabras clave: Cálculo Mental. Matemáticas. Enseñanza y Aprendizaje.

1 INTRODUCTION

This work seeks to highlight the importance of mental calculation in Elementary School, specifically in the 5th grade. The definition of mental calculation, within the scope of the former National Curriculum Parameters (PCN) of Mathematics for the teaching of the first grades of Elementary School, contemplates that *"it can be said that one calculates mentally when an operation is carried out, using reliable procedures, without written records and without the use of instruments" (Brasil, 1997, p. 76).*

In the highlights of the PCN, there was a focus on the importance of simultaneously working on the different types of calculation and their foundations, including written calculation, estimates, mental calculation, and the use of calculators. In the current National Common Curriculum Base (BNCC) of 2017, an approach to the theme in the early years of Elementary School is planned.

This work presents the application and importance of developing activities in classrooms that stimulate mental calculation. Such activities can show that the student develops critical thinking and greater flexibility in operations with numbers. The main idea is not to eliminate the calculator or written calculation, but to associate them with the practice of mental calculation.

The main objective of this article is to demonstrate the potential of the practice of mental calculation in Elementary School, specifically in the 5th grade, showing how students' autonomy and critical thinking can be developed, promoting the acquisition of a skill that will lead to daily activities from simple to high complexity that involves numbers and mathematics as a whole.

The study was developed in the 5th grade of the Pedro Ludovico Teixeira Municipal School, in the municipality of Colinas do Tocantins, where it was diagnosed, after carrying out activities on the practice of head calculations, students' difficulties in performing mental calculations. It is not intended to point out solutions or causes, but rather to demonstrate how the problem occurs and suggest some activities that could stimulate this practice among students, giving them more autonomy in performing calculations with their heads.

After reading authors such as Kamii (2001), Parra (2001) and others, we initially have historical veins of the insertion of mental calculation in mathematics curricula. Subsequently, it was necessary to elaborate and apply a proposal for specific activities on mental calculation in the classroom, with the purpose of collecting data on the possibility of a more significant inclusion of mental calculation in basic school.

The proposal is to study a specific case, delve into the application of these activities in the 5th year of Elementary School at Escola Mul. Pedro Ludovico Teixeira in Colinas do

Tocantins. The investigation aims to search for answers, exploring mental calculation in its concepts and conceptions, as well as its importance as a necessary tool for the construction of knowledge of numbers and the four basic operations.

In addition to the exploration of the theme, the application of mental calculation as a proposal for intervention in the classroom will raise data that will support deeper studies on the possibility of including mental calculation in basic school, including in early grades. With the data that will be collected, it will be possible to demonstrate through Figures and other tools, the experiences lived in the application.

All activities were carried out during scientific research and based on the researcher's regency as a starting point of daily empirical perception with the students' difficulties in dealing specifically with mental calculation. After the application of the activities, an analysis of the results obtained and the benefits and effectiveness of the use of mental calculation in the classroom and in individual daily activities will be presented.

2 METHODOLOGICAL PROCEDURES

The research has a quantitative-qualitative approach, using as its main tool, the study of the results of activities applied to students of the 5th grade of elementary school at the school. The data presented were collected in a case study and aim to discover the acquired reactions and autonomy. With the reported data, it is possible to demonstrate through Figures and other tools, the experiences lived in the application, as well as critically analyze all the points observed.

Data collection was done through the observation of the activities carried out in the classroom by the teacher. The exercises consisted of proposing to the students calculations, mathematical and logical tasks in various ways that they needed to use mental calculation.

The classroom has 29 students, however, 15 children were selected from this number to participate in the activities, since class attendance was a hindrance to the consistency of the application of the tasks. The activities were applied during mathematics classes and were appropriate to the age group and grade of the students. The common age was between 9 and 11 years old. Given the vast experience of the observer in the classroom, all the activities carried out presented levels of common complexity and that the 5th year of Elementary School, considering that the student at this stage, must have sufficient mathematical perception to carry them out.

As a way to understand the students' performance, an activity that we call diagnostic was applied. The researcher was a regent teacher in the researched classroom, and everyone was informed about all the activities applied and their purpose.

The research was carried out in 2013, during the school term. In the first diagnostic stage, scores were assigned to each activity, where one group of activities had a maximum value of 8.0 and another group had a maximum value of 7.0. In the diagnostic activity on the theme, two groups of exercises were applied to the students and a grade was established for both. In the municipal school network, a use of 60% of the total value of the activities is considered for approval.

The students were divided into two groups of activities, with Group I with activities of low level of complexity, with a maximum score of 8.0, and Group II, with more difficult tasks, with a maximum score of 7.0. The grade considered satisfactory for the research was the average (60% of correct answers), that is, for the activities with a value of 8.0, the students should get a grade above 4.8, and for the activity that was worth 7.0, the students should get grades above 4.2.

In the first activity, copies were distributed to the students with simple calculations such as 3 + 3, in which they should have immediate answers, this activity had a maximum score of 8.0 and to have a satisfactory result, the student had to get 60% right, that is, above 4.8. The second activity contained problems that should be solved mathematically also using mental calculation, where the maximum score was 7.0 and the satisfactory result should be above 4.2.

As part of the activities, the Human Domino game was carried out in which each student received a strip of paper with two phrases indicating operations. Thus, each one should look for the one who has the answer to their question and pay attention to the colleague's question to check if they had the other's answer. As they completed each other, they were to stand next to each other, thus forming a circle.

The first activity applied consisted of performing common calculations such as 3+3 or 2+5, where 73% of the students achieved a grade above 60% of the value and 27% achieved a grade below average. The resource used by most was automatic calculation, or counting on the fingers, imagining the math in their heads and solving it, some used paper to write the math in another way. One student got all the calculations right, each resolution had a value of 1.0 point, however, it was considered half a point by the correct reasoning, but incorrect result, that is, the student used the appropriate reasoning, however, he did not reach the right result and the final answer was wrong.

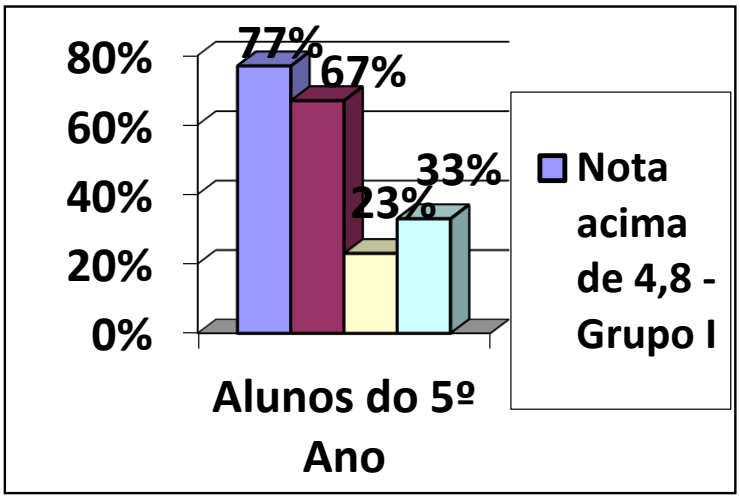
3 RESULTS AND DISCUSSION

During the performance of the activities, many looked at each calculation, thought, looked up, as in the realization of a mental writing, trying to associate the visualization of the calculation to solve it.

It was observed that most of the students had a higher than average grade, and the notorious difficulties of some of them can be explained by the knowledge already acquired previously. It is notorious in the students, the lack of stimulation for activities aimed at mental calculation in the previous grades. And many do not have the patience to calculate and reach the correct or estimated result. The resources used were almost always the same.

Figure 1

Grades by Activity Group



Source: Authors.

The simplest operations such as 1 + 1 or 2 + 1 had a large number of hits. When students had to resort to other tools, most tried to remember automatic multiplication table calculations, as several multiplication table memorization activities were done with everyone for some time. The use of the calculator was not encouraged in any of the activities, as the objective was to assess the level at which they were on the thought calculation. The association of the counts is natural in calculations like this, as it simplifies the process of acquiring the result.

In the second activity that consisted of completing a problem using calculus, such as "You have 4 notebooks". To complete 19, there are _____ left. In this task, 67% of the students achieved more than 60% of the total value and 33% obtained a grade below the average. The answers should be respectively: 15 notebooks, 23 erasers, 11 pencils, 14 books, 20 dolls, 12 balls, 9 stickers, 8 dresses. As in the previous activity, most achieved an above-average grade and the resources used involved automatic calculations with the

multiplication table, imagining the account in their heads, or writing the account in another way on paper to help.

The objective of this activity was to associate the student with daily situations to facilitate the calculation. Thus, each problem could easily be imagined to be solved. The inclusion of terms and objects from the children's daily lives can even lead them to remember real situations that may have involved the items in the question.

While doing the math, students could be observed trying to imagine probably a colleague, or brother, or sister with that certain amount of books, notebooks or erasers. This certainly helps in solving problems and also contributes to the day-to-day interaction of each one within the classroom.

Each time we explore the student's reality, we bring to the classroom another element that serves as a tool for learning, so each child learns by contextualizing what they have at home, in the family and with friends, whether they are from the school where they study or not.

The students had a reasonable amount of time to answer the activity in group I, as the level is quite simple and they should only resort to the calculation designed to solve the questions. However, an important observation is that only 01 student got all the calculations right, and the others achieved the grade through the table below:

Table 1

Diagnostic activity scores – Group I (Maximum Value: 8.0)

Note	Qty	%
8,0	1	7
7,5	4	26
7,0	2	13
6,0	1	7
5,5	1	7
5,0	2	13
4,0	3	20
2,5	1	7
Total	15	100

Source: Authors.

The activities of group II were more complex. The objective was to associate the concept of number individually and in the operation as a whole. For example, what is the result of the sum 1245+897= 2142 or 2340 or 2102. The students had more time to develop these questions, as the level of complexity was a little higher than the activities of the first group.

The results should be, respectively: 9474, 3150, 7012, 525, 5159, 14, 8805, 15 and 2916. For the addition operations, the ease was greater and most of the students got the

results right, the division and subtraction operations were the most difficult, according to the students and the errors demonstrated this. However, in general terms, the class performed well, they used the resources of writing the math in another way to solve, count on their fingers, help with the multiplication table and imagine the math in their heads to achieve the result.

For the diagnostic activity of group II, with a greater complexity in relation to the previous activities, the objective was to understand the level of each student to perform the calculations and identify the result without "guessing" the answer in order to get it right.

In terms of evaluation of the students' level, some concepts were considered. For the activity of Group I with a value of 8.0, the following were assigned:

- Below-average grades: regular concept
- Scores between 50 and 60: good concept
- Scores above 60: optimal concept

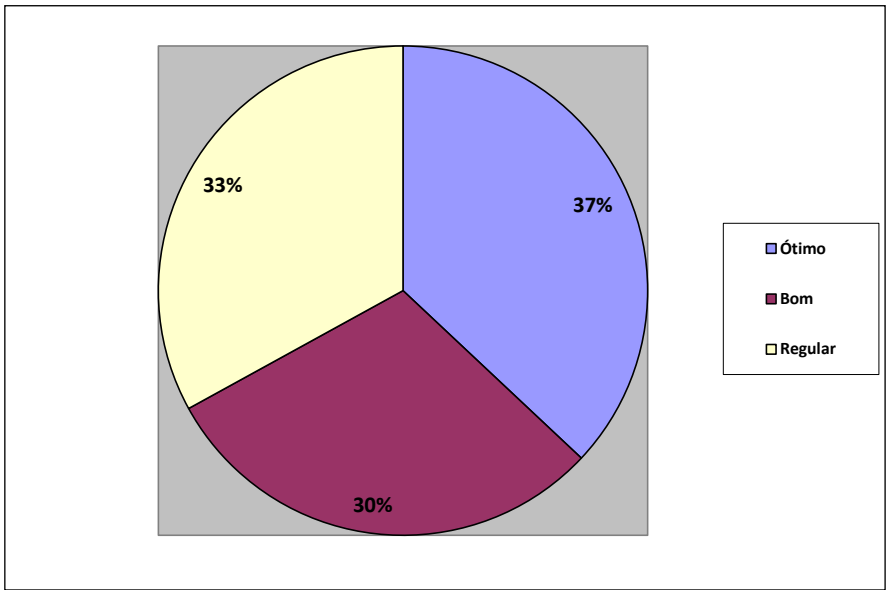
For the Group II activity, the classification was as follows:

- Below-average grades: regular concept
- Grades between 40 and 50: good concept
- Scores above 50: optimal concept

Thus, the conceptualization was as shown in the following Figure:

Figure 2

Class Concept in the Diagnostic Activity



Source: Authors.

Another activity applied was as a game so that the ability in a group and with greater agility on mental calculation could be perceived. The game was called Human Dominoes and consisted of the following procedure:

The human dominoes, after being well explained and started, did not generate major doubts and by playing, the students were able to carry out the activity. In the first resolutions before really understanding the game, some students presented difficulties, then little by little and with the interaction of the class they did what was asked more easily.

After many explanations and accomplishments of activities, we moved on to the stage in which the students would be stimulated to do the calculations mentally with another series of exercises. In view of the realization of the activities, we can make some considerations about the students' performance here. Everything that was carried out for the research presented a level appropriate to the research series.

It is observed that, in general, the level of the students can be considered average, as some simple propositions were not resolved. In another aspect, it must be taken into account that they did not do these activities in the first grades to be stimulated to do so. Therefore, there is a need to include more activities on calculus in the classroom, given its importance for the students' daily lives, not only in this grade, but throughout their lives.

When observed in a general context, the presence of "head-on" calculations in daily activities is notorious. Furthermore, it is also unquestionable that the child can develop skills with the use of this tool that will not be used only in mathematics.

> "In the school environment, mental calculation is still not as valued as the armed account. However, a reasoning that may seem disorganized, in fact, may be supported by properties of operations and the numbering system and should be encouraged already in the initial grades. To help you understand the different mental strategies of calculation and teach your students to use them more and more efficiently" (Drumond, 2014).

The curriculum guidelines for the teaching of Mathematics have mental calculation, and not only for Brazil, present among the suggestions of strategies for the execution of mathematical calculations that teachers can develop with their students in the classroom.

Therefore, realizing how important this tool is for students in the teaching and learning of mathematics, it is necessary to demonstrate a study carried out through field research, how the "head counts" can be relevant for the development of students' critical and autonomous thinking.

In view of these questions, it is relevant to study the effectiveness of activities that stimulate this type of calculation in practical terms. To this end, it is ideal to apply the tool in

the classroom and observe the results obtained later. This is what this research is about, after many years with experience in the classroom, it is questioned why when reaching the 5th year of Elementary School, students have so much difficulty with counts, if mental calculation should already be stimulated in previous grades.

There are several uses of numbers, however, not so many people make use of them mentally, this often happens because they have not been stimulated to this practice. People become accustomed to calculators or become enemies of numbers due to learning disabilities and math trauma. This statement is not so rarely noted when we hear that it is the worst subject, or the most difficult. But the fact is that children should be stimulated from an early age to manipulate numbers mentally.

Mental calculation has appeared in some form in mathematics curricula for more than 70 years (Brocardo & Serrazina, 2008). However, it is noted that the advancement of technology contributes to the devaluation of basic calculation skills. For Elementary School I, the 2007 Guide to the National Textbook Plan (PNLD) emphasizes that "a good pedagogical work for the construction of this indispensable competence in the formation of the student" (Brasil, 2006, p. 27). In this way, mental calculation and its importance can be included in the construction of the entire contextualization of the number, it plays a fundamental role in the educational context for students in the initial grades that are the basis for future learning.

Thus, it is necessary to reflect on the importance of mental calculation for the construction of student autonomy, taking a look at its value and role in the field of mathematics education. It can be inferred that students have less and less capacity for mental calculation and more difficulty with basic operations.

In this research, students had a common performance, and were encouraged to use support materials for calculus such as pencil and paper. Thus, the definition of mental calculation is not unanimous, however, it is agreed that when calculating mentally, strategies are mobilized that allow speed and efficiency in the response, and as several authors argue, paper and pencil can be used for intermediate calculations.

If each student is encouraged to do so, he incorporates it into his daily life by noting how effective it is. We rely on Kamii and Livingston (2001, p.104), when they state that "children become inventive as they are encouraged to be inventive". Thus, practice with children reveals that when asked to perform a task, in the case of basic calculations and that they cannot use pencil and paper or calculator, it is observed that they find their own ways to solve it. This is because the brain, when motivated, finds its ways out to solve problems.

Playfulness develops the student's individual autonomy. By involving these activities, the educator can create an environment in the classroom that provides space for the

acquisition of new knowledge, that is, students have to feel free to find their paths, including making mistakes and speaking their minds without censorship. This stimulates learning naturally. If such a practice applies in other disciplines, in mathematics it cannot be different.

When planning a class, the teacher needs to have as one of his goals the search for student autonomy. According to Parra (1996), "responding to social need indicates an approximation with calculus that makes students capable of choosing the appropriate procedures, finding results and judging the validity of the answers".

Therefore, the tool used to solve mathematical calculations must be chosen by each one according to the need or even requirement of their activity. But for this to happen, it is necessary to know different ways of carrying them out. Over time, the calculator has been used more and more for this purpose, and this can be an important tool, however, associated with other techniques such as mental calculation.

Children can use different tools to calculate and this was observed in the activities. Pimentel and Vale (2009, p. 4) observed that many children aged 3 and 4 need to count on their fingers to calculate 16 + 10. To discuss and problematize such situations and others involving calculus, it is also suggested to work with tables and number lines to stimulate the discovery of numerical patterns and develop mental calculation skills.

Teacher training is quite broad, however, there is a lack of didactic resources for the activities to be carried out. Workshops and constant training activities are carried out, however, the schools do not have the physical resources to subsidize the teachers. Even for the application of the activities of this work, all costs were personal, due to the school's lack of needs.

The family structure of the students also influences. Many belong to families with different compositions, and those responsible do not follow the student's school development as they should. Finally, in the face of this system, it is possible to understand that the deficiencies are many, however, some attitudes are possible. The application of the activities was a challenge, but the students developed them all without difficulty.

The main advantage of applying activities that stimulate mental calculation is that the child learns to build personal calculation strategies and to decide, in various situations, on the most effective one. He also acquires habits of reflection on calculations and has permanent means of approximation and control over what he obtains using techniques such as algorithms. By estimating results, it can self-correct: if the answer is too far from the estimate, something is wrong.

4 CONCLUSION

In view of the applications of the activities and the research carried out, it was possible to understand the process of development and stimulation of mental calculation, in addition to understanding how the student can be more autonomous in this process.

Conti and Nunes (2019) make an important reflection to be made: it is that, even though this modality is cited and valued in textbooks and other Brazilian documents, it does not mean that there really is a work in the classroom with it, because the greatest agents in the classroom are the teachers, and not the textbooks. Teachers, whether they have degrees in Mathematics or Pedagogy, were often not prepared to deal with the practice of mental calculation in the classroom.

It is unanimous the understanding of how relevant it is to provoke the student to be thinking, safe, contesting and creative. According to Paulo Freire (2002): there is no teaching without research and research without teaching. These what-to's are found in each other's bodies. While I teach I continue seeking, searching. I teach because I seek, because I inquired, because I inquire and I inquire myself. I research to verify, verifying, I intervene, intervening, educating and educating myself. I research to know and what I still don't know and communicate or announce the news.

Thus, analyzing the teaching of calculus in elementary school was a complex task, however, pleasurable, given the daily teaching practice for many years, it is possible to be clear about many aspects that are not included in official documents. The students of the 5th year of Elementary School of the Pedro Ludovico Teixeira Municipal School, were the background of this work and through them it was possible to realize that the application of the curricula is quite deficient in the municipal education system.

Mental calculation is still a challenge, because despite being among the curricular matrices, it is one of the most practical contents of mathematics. Performing the calculations by head, or with the head, in an agile and efficient way is only real through stimulation, practice, repetition. And for that, the teacher needs to diversify in the classroom. Thus, there are many challenges to be overcome.

It is important to emphasize once again that mental calculation contributes significantly and abundantly to the development of learning with understanding. According to Sadovisky quoted by Wolman and Quaranta (undated) when he states that it is necessary to think of a student who is convinced that, in some way, he can face complex situations, in the sense that he can start trying to introduce himself into the problems that are posed to him, "roll up his sleeves", experiment with what he knows, make decisions, respect and consider the

production of others, introduce oneself into it in order to understand it, discuss it, assume it, etc.

Perhaps such a statement leads one to think that this is a utopia, however, as educators the attempt is always for a thinking, reflective, safe, flexible, autonomous, aggregating and creative student. In fact, this is a right of individuals, not just children.

Hope (p. 54, 1996) said that a correct answer can be the destination of a mental calculation, but it is the path followed, more than the destination, that reveals the traveler's understanding. A person who knows how to calculate mentally is more likely to travel by other paths than a person who does not have this ability.

In view of the realization of the activities, we can make some considerations about the students' performance here. Everything that was carried out for the research presented a level appropriate to the research series.

It is observed that, in general, the level of the students can be considered average, as some simple propositions were not resolved. In another aspect, it must be taken into account that they did not do these activities in the first grades to be stimulated to do so. Therefore, it is recommended to include more activities on calculus in the classroom, given its importance for the students' daily lives, not only in this grade, but throughout their lives.

This recommendation is based on the observation that many of the problems in which estimation is used are linked to day-to-day issues. For example: how long it takes to get somewhere or how much gasoline is needed. When it comes to mental calculation, both exact and approximate results, memory is an important tool.

These questions should be proposed in specific didactic sequences, systematization activities and as permanent work, linked to the contents seen in the classroom. And so we believe it is possible to provide means for the student to develop their own techniques, discover their own paths and become this thinking, autonomous and creative being. And whenever there is a class that stimulates the development of this being, there will be a true educator, not only about mental calculation, but about any other contents. Because one must educate for life.

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