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Educação Matemática Debate

Creativity of students in the 5th grade of Elementary School in elaborating and solving problems: analysis of two activities involving elementary operations

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Article

Abstract: The study analyzes the creativity of 5th grade Elementary School students in elaborating and solving mathematical problems involving numbers. The research adopts a qualitative and documentary approach, based on two activities carried out by students in the classroom, in which they were encouraged to create and solve problems. The analysis reveals that the practice of problem posing favors the development of mathematical abilities and stimulates creative and critical thinking. The students demonstrated originality and flexibility when exploring different problem-solving and reformulation strategies. It was found that integrating creativity into the teaching of mathematics makes a significant contribution to understanding the content and engaging students in the learning process.

Keywords: Creativity. Elementary School. Elaborating and Solving Problems.

Creatividad de los alumnos de 5º año de Primaria en el elaboración y resolución de problemas: análisis de dos actividades con operaciones elementales

Resumen: Este estudio analiza la creatividad de los alumnos de 5º año de Primaria para elaborar y resolver problemas matemáticos relacionados con el tema de los números. La investigación adopta un enfoque cualitativo y documental, a partir de dos actividades realizadas por los alumnos en el aula, en las que se les animó a crear y resolver problemas. El análisis revela que la práctica de proponer problemas favorece el desarrollo de habilidades matemáticas y estimula el pensamiento creativo y crítico. Los alumnos demostraron originalidad y flexibilidad al explorar diferentes estrategias de resolución y reformulación de problemas. Se constató que la integración de la creatividad en la enseñanza de las matemáticas contribuye significativamente a la comprensión de los contenidos y a implicar a los alumnos en el proceso de aprendizaje.

Palabras clave: Creatividad. Escuela Primaria. Elaboración y Resolución de Problemas.

Criatividade de estudantes do 5º ano do Ensino Fundamental na elaboração e resolução de problemas: análise de duas atividades envolvendo operações elementares

Resumo: O estudo analisa a criatividade de estudantes do 5º ano do Ensino Fundamental na elaboração e resolução de problemas matemáticos envolvendo a temática Números. A pesquisa adota uma abordagem qualitativa e documental, baseada em duas atividades realizadas pelos estudantes em sala de aula, nas quais os estudantes foram incentivados a criar e solucionar problemas. A análise revela que a prática de proposição de problemas favorece o desenvolvimento de habilidades matemáticas e estimula o pensamento criativo e crítico. Os estudantes mostram originalidade e flexibilidade ao explorar diferentes estratégias de resolução e reformulação de problemas. Constatou-se que a integração da criatividade ao ensino da

Matemática contribui significativamente para a compreensão dos conteúdos e para o engajamento dos estudantes no processo de aprendizagem.

Palavras-chave: Criatividade. Ensino Fundamental. Elaboração e Resolução de Problemas.

1 Introduction

Teaching requires teachers to be innovative in all areas of knowledge, including Mathematics, where it is essential to create opportunities for students to develop their learning in a creative way. Mathematics is commonly considered challenging, both for teachers and students, and is widely recognized as one of the most complex curriculum components.

Considering this scenario, this article is an excerpt from a broader research, developed within the scope of a master's dissertation by the first author (Viana, 2024), which investigated the mathematical creativity manifested by students in the 5th grade of Elementary School (ES), focusing on the elaborating and solving problems. The research focused on content (knowledge objects) related to the theme of Numbers. According to the Base Nacional Comum Curricular National [Common Curriculum Base — BNCC], this guideline aims to strengthen numerical understanding and improve the use of elementary operations (Brasil, 2017), essential aspects for the progression of mathematical learning.

Specifically for the 5th grade of ES, the BNCC recommends that students deepen their knowledge of numbers and operations. One of the abilities provided for in the document, EF05MA07, guides the elaborating and solving problems involving addition and subtraction, encouraging not only calculation, but also logical reasoning and creativity in the search for solutions. This curriculum proposal reinforces that the teaching of Mathematics should go beyond the mechanization of calculations, stimulating students' autonomy and critical thinking.

Although these curriculum guidelines propose more meaningful teaching, research such as that of Nunes, Costa and Talher (2019), as well as classroom practices, reveal that 5th grade ES students face difficulties in learning Mathematics content. In this context, problem solving and problem posing emerge as an enriching opportunity, allowing students to explore problems from different approaches. In this way, the practice favors the development of creativity and promotes greater engagement in the learning process.

In teaching practice, working with problem solving goes beyond presenting questions to be solved. It involves encouraging students to develop innovative strategies and interactions that promote learning through the discovery of original solutions. Thus, the teacher, when teaching Mathematics content, should encourage students to question and critically reflect on the proposed problems, opening paths to new possibilities and perspectives (Viana et al., 2021). This expands the role of the student as an active agent in the construction of their own knowledge.

The problem posing by students, especially in Elementary School, has aroused the interest of several researchers in Mathematics Education. Possamai and Allevato (2022, 2023, 2024) point out that this practice can contribute significantly to the integral development of students, in addition to fostering advances in the understanding of content and procedures related to Mathematics.

Based on this perspective, this study aims to analyze the creativity of 5th grade Elementary School students in creating and solving problems involving numbers. The activities developed during the research can offer new possibilities for teaching mathematics, encouraging teachers to work on content in order to value the contributions of students themselves through the creation of problems.

To provide the reader with a better understanding, the article is organized into three

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main sections, in addition to this introduction. The first section discusses the theoretical foundations that address the relationship between creativity and mathematics teaching, as well as the problem posing and solving in mathematics education. Next, the methodological procedures adopted in the research are described. Finally, the analyses of two activities proposed and developed by students in solving and posing problems involving numbers from the perspective of creativity are presented, concluding with the final considerations.

2 Relationship between creativity and mathematical learning

The term *creativity* has its roots in the verb *creare*, which means to originate, generate and form, carrying with it the dimension of birth and transformation (Cavalcanti, 2006). Defining creativity is a challenge, since, according to Leikin (2009), there are several conceptions on the subject that are constantly evolving.

In a society that values creativity in all areas of knowledge, it is essential that teachers recognize and value students' creativity. This involves observing the reasoning and strategies that students use to arrive at a solution, even if it is not correct, in addition to investigating how creativity can be stimulated in the teaching of Mathematics.

This paper adopts the definition of creativity in mathematical learning according to Gontijo (2007, p. 37), which characterizes it as

> the ability to present numerous possibilities of appropriate solutions for a problem situation, so that they focus on distinct aspects of the problem and/or different ways of solving it, especially unusual ways (originality), both in situations that require the solution and elaboration of problems and in situations that require the classification or organization of objects and/or mathematical elements according to their properties and attributes, whether textually, numerically, graphically or in the form of a sequence of actions.

This definition was chosen for its comprehensiveness and for Gontijo's (2007) attempt to summarize the various approaches that exist in the literature. Since the beginning of the 20th century, creativity has been considered an essential ability that can be developed and improved in the school context, especially in the teaching of Mathematics. Creativity allows us to see the essence of what it means to do and learn Mathematics (Liljedahl, 2008).

Learning Mathematics demands understanding, which requires teachers to have the abilities to spark students' interest and encourage them to develop cognitive aspects during classes. In this sense, Silver (1997, p. 75) observes that “in Mathematics, creativity can be widely developed in students, being essential for the development of abilities to learn the subject, which helps to demystify the idea that Mathematics is difficult and outside of people's context”.

Furthermore, Silver (1997) suggests that the connection between Mathematics and creativity goes beyond problematization, encompassing problem posing and problem solving. Therefore, it is essential that teachers ensure that students can create meaningful notions about Mathematics and adapt their language in the classroom, considering the differences between their native language and mathematical language.

This perspective is reinforced by Bezerra, Gontijo and Fonseca (2021), who emphasize creativity as a basic requirement for living in the current era and that it should be highlighted in teaching. The authors reinforce Silver's (1997) idea by pointing out that, despite the importance of creativity in Mathematics, the educational system still does not adequately value this aspect in the curriculum.

In this context, Mann (2006) argues that a Mathematics teaching devoid of creativity compromises students' ability to appreciate the beauty of knowledge construction and to fully develop their talents. D'Ambrósio (2012) corroborates this perspective by pointing out that Mathematics classes often fail to stimulate creativity and propose challenges based on investigation and exploration. In view of this, it is essential that classroom activities are planned in such a way as to promote students' interest and the appreciation of creative processes.

In view of this, Alencar and Fleith (2003) suggest that activities aimed at developing creativity should encourage students to generate ideas, formulate hypotheses and explore different situations. In the same sense, Gontijo (2007) defends problem solving and problem posing as effective strategies to promote creativity, while redefining Mathematics through its conceptual attributes. Thus, creativity is configured as a transformative perspective in the teaching of Mathematics, by valuing divergent thinking, the exploration of varied strategies and the proposal of activities that stimulate the creative potential of students.

Morais (2015) expands this understanding by stating that creativity is not limited to a specific area of knowledge, and can be intensified in different situations. According to the author, "the identification and promotion of creativity must occur in different areas of knowledge, in the design and use of the school curricula themselves [...]" (Morais, 2015, p. 6).

Convergently, Vale (2015, p. 40) warns that it is "limiting to associate creativity only with painting, music, writing or other art, since creativity can be found in any human activity, from science to business to education, and all of them require creative people to progress [...]".

However, the presence of creativity is not always evident in the classroom, especially when activities are limited to routine and mechanized exercises that prioritize speed and precision over creative thinking (Amaral, 2016). Most of the time, teachers do not notice students' spontaneous and intuitive thinking due to the lack of space for free activities and informal reflections that are important for the development of creative ideas. The lack of stimuli for creativity can compromise learning, as D'Ambrósio (2012, p. 95) warns, "the apparent acquisition of an execution routine leads to a lack of creativity and, consequently, inefficiency [...]".

In this scenario, Bezerra, Gontijo and Fonseca (2021) suggest that creativity can be stimulated through the use and resolution of problems, emphasizing that the teacher must create an environment that allows students to recognize their own capabilities. Polya (2006)[1] states that learning Mathematics requires creativity, ability and originality, with problem solving being a fertile field for innovations based on curiosity and imagination. In this sense, incorporating playfulness into Mathematics classes can improve interaction, facilitate learning and student engagement with the content.

Regarding this aspect, Gontijo (2015, p. 17) states that

> creative ability in Mathematics must also be characterized by the abundance or quantity of different ideas produced on the same subject (fluency), by the ability to change thinking or conceive different categories of responses (flexibility), by presenting infrequent or unusual responses (originality) and by presenting a large amount of details in an idea (elaboration).

Creativity is a transversal ability, which depends more on the methodology, experiences and culture of interaction in the classroom than on the content explored. It can also be collective

[1] The consulted work was translated and published in 2006, with the title *The art of solving problems*. However, its original English version was released in 1945, with the title *How to solve It*.

when, for example, students work in groups during interactive mathematical activities (Nunes, Costa and Talher, 2019).

3 Problem solving and problem posing in Mathematics Education

The idea of solving problems is present in the daily lives of those who work with Mathematics. However, many teachers do not place problems in a context that helps students understand the meaning of the concepts, which can hinder learning. Historically, problem solving has been an integral part of Mathematics curriculum in Basic Education.

The Hungarian mathematician George Polya (1887-1985) stands out as a central reference in this field. For the author, a problem is characterized by being a new situation, which encourages the student to conjecture and create solution strategies, which challenges their curiosity and arouses their interest (Polya, 2006).

From this point of view, the question arises: what is a problem?

In line with Polya's understanding (2006), researchers Allevato and Onuchic (2021) consider a *problem* as something that one does not know how to do, but that there is an interest in discovering and solving. According to the authors, for an activity to truly be a problem, the teacher cannot tell students the specific rules for solving it, since a problem must present an intellectual challenge to the student.

Van de Walle (2009, p. 57) defines a mathematical problem as "any task or activity for which students do not have prescribed or memorized rules or methods, nor is there a feeling on the part of students that there is a specific 'correct' method of solution". The author also states that solving problems should be a strategy that involves students in activities to think and develop Mathematics — as a resource that needs to be learned. As the author himself emphasizes,

> The problem solving should be seen as the main teaching strategy, in which the teaching work always begins with the 'students' so that students have the freedom to define different resolution strategies, using their prior knowledge and individual abilities (Van de Walle, 2009, p. 57).

Supporting this idea, Santos and Silva (2016) emphasize that Problem Solving as a methodological strategy in teaching Mathematics contributes to the development of fundamental attitudes and cognitive abilities, stimulating students' curiosity and creativity and enabling them to deal with new situations. The authors also emphasize that the same problem can be solved in different ways, since each student can interpret it in a particular way, without this meaning that the solution is incorrect. Furthermore, when faced with a mathematical problem, the student is challenged to explore the unknown and formulate strategies to find the solution.

In 1978, Hatfield presented an important idea for the Mathematics curriculum when he noted three ways of working on problem solving in the classroom. Later, in 1989, Schroeder and Lester (1989) confirmed these approaches: teaching about problem solving, teaching to solve problems, and teaching through problem solving. In Brazil, these perspectives have been studied since 1999 by Onuchic and further explored by Allevato and Onuchic (2021).

By deepening these studies, the authors argue that a good way to teach, learn and assess mathematical content would be to use a teaching methodology through problem solving. This approach points to a new way of conceiving problem solving, standing out as a way to teach mathematics in its essence, and not just to instruct on problem solving. It is assumed that the problem acts as a starting point and a guide for the assimilation of new mathematical concepts, procedures and content (Allevato and Onuchic, 2021).

Based on this concept, the authors emphasize that, for a mathematical activity to be truly configured as a problem, the teacher should not provide students with specific rules or methods for solving it. It is up to the teacher to select, adapt or create problems that are appropriate for the school year or grade, aligned with the learning objectives and compatible with the students' prior knowledge.

In this sense, the problems should be proposed before the formal presentation of the mathematical content that could facilitate their resolution, in order to promote the autonomous construction of knowledge. For this type of approach in the classroom, the authors propose a didactic structure composed of ten stages, called the *Methodology of Teaching-Learning-Assessment of Mathematics through Problem Solving*:

> (1) problem proposition, (2) individual reading, (3) joint reading, (4) problem solving, (5) observing and encouraging, (6) recording resolutions on the board, (7) plenary, (8) seeking consensus, (9) formalizing content, (10) proposing and solving new problems (Allevato and Onuchic, 2021, p. 48).

These steps aim to actively involve students in the learning process and to develop problem-solving and problem-solving abilities. The steps suggested by the authors are described below.

1) *Posing and presenting the problem* — the teacher must select or accept a problem (called a generator) that is appropriate to the students' level of knowledge and that arouses their interest and curiosity. It is important that the problem be challenging and accessible, that is, it must be presented in a clear and understandable way, through a context that is meaningful to the students and that can increase their engagement and motivation.

2) *Individual reading* — in this step, the teacher allows the students to read the problem individually. They have time to think individually about the problem and try to find ways to solve it. This allows each of them the opportunity to develop their own understanding and initial strategy. It is essential that the teacher explains the context and objectives of the problem without providing direct solutions or clues.

3) *Joint reading* — after individual reading, the students are encouraged to work in small groups. At this point, a new reading is done; Students then discuss and refine their initial impressions and understandings of the problem, identifying data and objectives. Collaboration allows them to share ideas, discuss different strategies, and benefit from each other's perspectives.

4) *Problem solving* — students begin to apply strategies, using their prior knowledge to solve the problem.

5) *Observing and encouraging* — this is when the teacher observes and encourages students, guiding them when necessary so that they can make adjustments to their problem-solving strategies.

6) *Presenting results* — students review their solutions to check that they are correct and that all parts of the problem have been addressed; they then share their solutions and strategies with the class, explaining their ideas and how they arrived at the solution.

7) *Plenary* — the teacher encourages students to reflect on the problem-solving process, identifying what worked well and what could be improved.

8) *Seeking consensus* — at this stage, the teacher promotes a collective discussion, in

plenary, about the different strategies used, analyzing their effectiveness and addressing the main ideas addressed. The goal is to jointly build a consensus on the solutions presented. This step is important for students to reflect on their own approaches and learn from their peers.

9) *Formalization of content* — after students have solved the problem, the teacher formalizes the mathematical content involved in an organized manner. In this step, the teacher summarizes the main ideas and methods discussed, connecting them to the relevant mathematical concepts and procedures. It is important, at this point, for the teacher to help students systematize the knowledge acquired and recognize general patterns and principles.

10) *Posing new problems* — the teacher should propose similar or more complex problems so that students can apply the strategies and knowledge acquired. In addition, this step can be a time when the teacher can offer students the opportunity to create problems, based on the experiences lived in the previous steps.

These steps help to create a more active learning environment, in which students participate more directly in the construction of their own mathematical knowledge, developing critical and creative thinking abilities.

The last step can be configured as an extension of learning, as it helps to extend learning and assess students' understanding. Assessment can be done through reflective questions or new problems or activities that require the application of concepts constructed from the generating problems, and should be continuous and formative, focusing on student progress and the consolidation of knowledge.

This approach to *Teaching-Learning-Assessing Mathematics through Problem Solving* positions the teacher as a mediator, questioner of situations, and the student at the center of the educational process. Instead of simply memorizing formulas and techniques, students are challenged to solve problems that require critical and creative thinking to construct the learning of new mathematical concepts and procedures (Allevato and Onuchic, 2021).

In addition to improving understanding of mathematical concepts and procedures, this methodology prepares students to face more complex challenges outside the classroom, transforming the way Mathematics is taught and learned. In this way, teaching becomes dynamic, interactive and meaningful.

More than a methodological strategy, Problem Solving is an essential ability in the development of mathematical content in the classroom. In line with this perspective, the BNCC highlights mathematical processes based on problem solving "as privileged forms of mathematical activity, which is why they are, at the same time, an object and a strategy for learning throughout Elementary School [and Middle School]" (Brasil, 2017, p. 266).

Thus, the methodology proposed by Allevato and Onuchic (2021) aims to develop mathematical abilities in a structured way. They propose an approach that integrates theory and practice, encouraging students to approach problems in a systematic and creative way.

According to the BNCC, Elementary Education must be committed to mathematical literacy, understood as "the abilities and abilities to reason, represent, communicate and argue mathematically, in order to favor the establishment of conjectures, the formulating and solving problems [...]" (Brasil, 2017, p. 266). These aspects allow students to better understand the world and recognize Mathematics as an intellectual game that stimulates logical and critical reasoning, encourages investigation and can provide pleasure and satisfaction in learning (enjoyment).

In addition, the document has indicated the association of problem solving with the elaboration of problems by students, highlighting its importance in the large and growing number of times that these processes are indicated as essential abilities to be developed throughout the school trajectory (Brasil, 2017).

Some researchers in Mathematics Education (English, 2020; Possamai and Allevato, 2022) also recommend this association. They emphasize that problem posing [elaboration] can be one of the ways to build student learning.

English (2020, p. 3) emphasizes that "problem posing should not be just an isolated activity, in which it becomes an end in itself, resulting in many missed opportunities to improve learning". According to Possamai and Allevato (2022), depending on the objectives, the elaboration of mathematical problems, especially for teaching and learning, is an art that combines creativity, solid knowledge of mathematical content and an in-depth understanding of students' mathematical learning.

Also according to these authors, the elaboration of mathematical problems by students can be a valuable practice for the construction of their learning, since it allows them to creatively apply the concepts and procedures they have already learned. Furthermore, it enables adaptations in certain situations (problems) that require the use of this knowledge.

While creating problems (or making adaptations), students consider different strategies and methods for solving them, which contributes to a deeper understanding of the multiple mathematical approaches. Therefore, pose (elaborating) problems also involves clearly presenting the demands and conditions of the problem, which strengthens the development of students' mathematical communication abilities.

> There are several potential benefits to including problem posing by students in Mathematics classes. They are related to the development of autonomy, creativity, critical thinking and the promotion of interest in Mathematics, fostering students' Comprehensive Education (Possamai and Allevato, 2023, p. 4).

In this way, problem posing can increase students' commitment, as it makes them more involved in the learning process itself. This is because they are actively engaged in the construction of knowledge, instead of just receiving ready-made and finished information. Furthermore, teachers can use problems created by students as a tool to assess their understanding of the mathematical content, concepts, and procedures discussed in the classroom.

According to Allevato and Onuchic (2021), concepts, mathematical procedures, ability, and abilities are constructed in the context of problem solving. This process promotes the understanding of sophisticated aspects of mathematical thinking, enabling the development of Mathematics teaching to develop in an environment of investigation guided by problem solving and problem posing.

In other words, by prioritizing the construction of knowledge through thinking, the role of problem posing and problem solving becomes fundamental to helping students understand mathematical meanings (Allevato and Possamai, 2022).

Therefore, well-designed problems indicate not only whether students have understood the concepts and procedures related to the topic under study, but also the depth of this understanding. The mathematical problem posing by students themselves strengthens their understanding of mathematical content, concepts and procedures, in addition to stimulating the development of essential abilities, such as creativity, critical thinking and problem solving.

This practice can be incorporated into the teaching of Mathematics to enrich the learning experience of students.

4 Context and methodological procedures of the research

The research was conducted with a class of 35 students in the 5th grade of elementary school in a municipal public school located in the city of Bacabeira, in the state of Maranhão (Brazil). This article aims to analyze the creativity of these students in the elaborating and solving mathematical problems involving the theme of *Numbers*.

This is a qualitative research, with a descriptive focus, whose data were constructed from the solving and elaboration of problems carried out by the students in their Math classes. The analysis of these problems was configured through the documentary method, that is, the data were analyzed from written originals (elaborating and solving problems) produced by the students, which had not yet received analytical treatment (Helder, 2006).

Participant observation was also used, carried out with the natural behavior of the students while they solved the proposed activities (Fiorentini and Lorenzato, 2012). The results of this observation will be presented in the next section.

5 Results and discussions: problem elaborating and problem solving

This section presents two activities in which students were encouraged to (re)elaborate problems related to the topic of *Numbers*, with the aim of being solved by their classmates. The elaboration of these problems involved the creation or reformulation of questions, allowing students to adjust questions or data to generate new answers or meet demands, as suggested by Possamai, Allevato and Strelow (2023). This process promoted reflection and stimulated students' creativity in the construction of challenging and relevant problems.

The activities were conducted based on the principles of the *Methodology of Teaching-Learning-Assessment of Mathematics through Problem Solving* (Allevato and Onuchic, 2021), in addition to being supported by Problem Posing, as discussed by Possamai and Allevato (2023, 2024).

The first problem, described in Table 1, was intended to encourage discussions and the (re)construction of knowledge about elementary operations. Students began by reading the problem individually, followed by a collective reading to ensure understanding and clarify any doubts. The activity also included unanswered questions, giving students the opportunity to reflect on the information provided and, based on this, reconstruct the problem to solve it.

Table 1: Problem — a question without a solution

Lucia has a box full of candies in the following flavors: milk, coconut and chocolate. a) How many candies are in the box? b) Were you able to solve this problem? c) What is missing? d) If you had the missing data, what operation would you do to solve the problem? e) Reelaborate the problem and present a solution for it.

Source: Adapted from Itacarambi (2010)

Figure 1 shows some of the answers and the problem reformulated by the students, organized into pairs, called D_1, D_2 e D_3.

The pairs recognized that, without the data, it would not be possible to answer the proposed questions. For some students, the dependence on numerical information is significant, since the use of numbers becomes essential to justify their operations.

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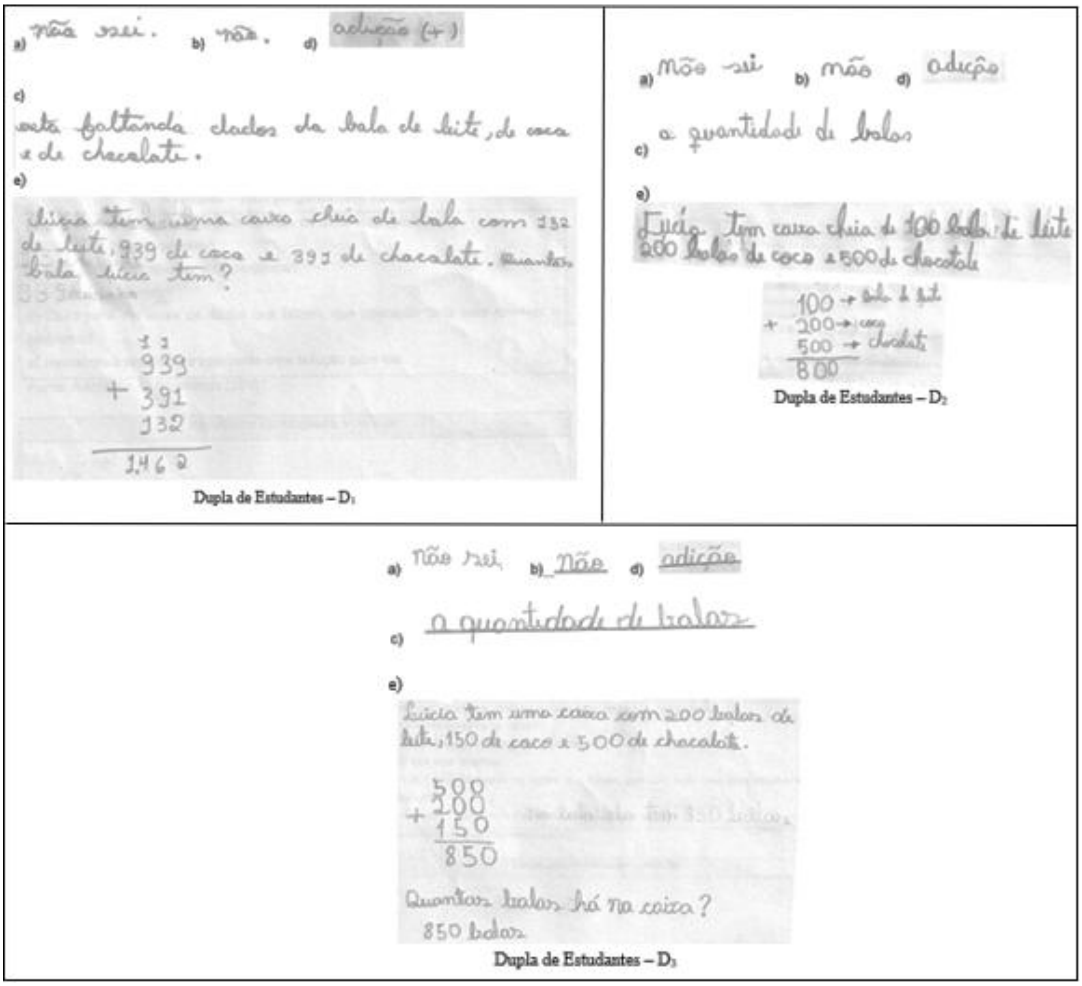

Figure 1: Protocol of responses presented by pairs of students (Research Data, 2024)

The students realized that the difficulty in solving the problem was not due to a lack of understanding, but rather to the absence of essential information. They commented that this type of problem seemed incomplete, but that its resolution would be simple if the necessary data were available. The challenge of reworking the problem and presenting a solution in item (c) provided greater involvement in the construction of knowledge, also increasing the students' enthusiasm during the activity.

Reinforcing this thought, it is worth highlighting that problem posing activities require students to create problems based on information (triggering element) and a command (prompt) that directs their actions. One possibility is to modify the statement to propose a new problem or to maintain the data and change the statement, in which the context or part of a previous problem is modified to construct a new one (Possamai and Allevato, 2024).

The analysis of students' creativity in the problems they created can be done based on some main elements. First, it is interesting to observe how each pair interpreted and contextualized the problem, bringing a particular situation to the statement. The way the data was presented demonstrates an attempt at personalization, revealing the students' ability to adapt and reformulate the problem in their own way.

This type of contextualization is an important aspect of creativity, as it allows students to connect the mathematical problem to everyday elements, facilitating understanding and encouraging engagement.

Thus, it can be seen that problem posing is a fundamental means for developing students' mathematical and creative abilities. Problem reformulation can also aim to expand and consolidate learning, and can encompass different types of activities (Possamai and Allevato, 2022).

Proposing activities in which students complete data from a problem or restructure a presented problem is an accessible strategy for introducing problem-posing activities. These activities offer a frame of reference, providing greater predictability about what is expected of students, reducing uncertainty and facilitating understanding of the task.

By providing an already structured starting point, students can focus on small adjustments or additions, such as choosing variables or defining the context. This makes the experience less challenging for beginners and increases confidence when exploring problem-creating (Possamai and Allevato, 2023).

> For problem-posing activities that aim to assess students' mathematical understanding of a given content or procedure or from which they wish to construct new learning, more structured starting points are more suitable, providing a mathematical expression, a problem to be continued or modified, for example (Possamai and Allevato, 2023, p. 5).

For teachers, this approach also has practical benefits, especially when it comes to adapting activities from textbooks. Based on the basic structure of existing problems, the teacher can make specific modifications that encourage students to actively participate, proposing or completing problems with new data or scenarios.

This restructuring allows the teacher to work with problem posing in a more dynamic and interactive way, without having to create entirely new materials. In addition, students' familiarity with the format of the problems facilitates the incorporation of specific teaching objectives, allowing the teacher to focus on the development of mathematical competences and problem-solving abilities in a more integrated and contextualized way (Possamai, Allevato and Strelow, 2023).

The second activity (Table 2) consists of the student reading a text, who must, based on their understanding, create a problem using the data provided in the text and present the corresponding solution.

Table 2: Developing and solving a problem

Read the following text: *Helena and Cristiane were responsible for a food drive for donation. They managed to collect the same amount of food. Helena collected 1,369 kilograms (kg) of food in total, 520 kg of rice, 260 kg of beans and 589 kg of different types of flour. Cristiane collected 264 kg of pasta, 234 kg of sugar and the rest in different types of flour.* Based on the text, create a problem for a colleague to solve.

Source: Adapted from Giovanni Junior (2018)

This activity implicitly intends to go beyond simply solving the problem; students are expected to reflect on the implications of the variables and conditions involved. When working with the proposal to complete or restructure problems, students are encouraged to question what would happen if some data were changed or if an additional condition were added or removed.

This type of reflection promotes a deeper understanding of the mathematical relationships and the consequences of each element in the problem, awakening an investigative and critical stance. In this way, students do not simply answer a closed question, but explore the possibilities in the situation presented, which can lead to valuable insights into how small adjustments can significantly modify the context and the solution of the problem.

In addition, this approach aims to encourage students to become proposers of new problems in different contexts. Based on the initial experience of restructuring a known problem, they develop a basis for applying this creative process to other situations and themes, using the same principles of questioning and adaptation.

By posing problems in new contexts, students exercise their ability to identify relevant variables and construct mathematically coherent scenarios, expanding their analytical and creative capabilities. This gradual construction process allows students to progress from a guided activity to a more autonomous and original one, strengthening their ability to independently propose complex problems.

For the teacher, this movement offers an opportunity to observe the students' development in posing problems, in addition to promoting more active and contextualized learning.

The problem in Table 2 consists of a question whose answer is personal and will depend on the question to be asked. In this case, all students should know how many kilograms of different types of flour Cristiane collected. In the protocol presented in Figure 2, the students recorded the question and, based on this, solved the problem.

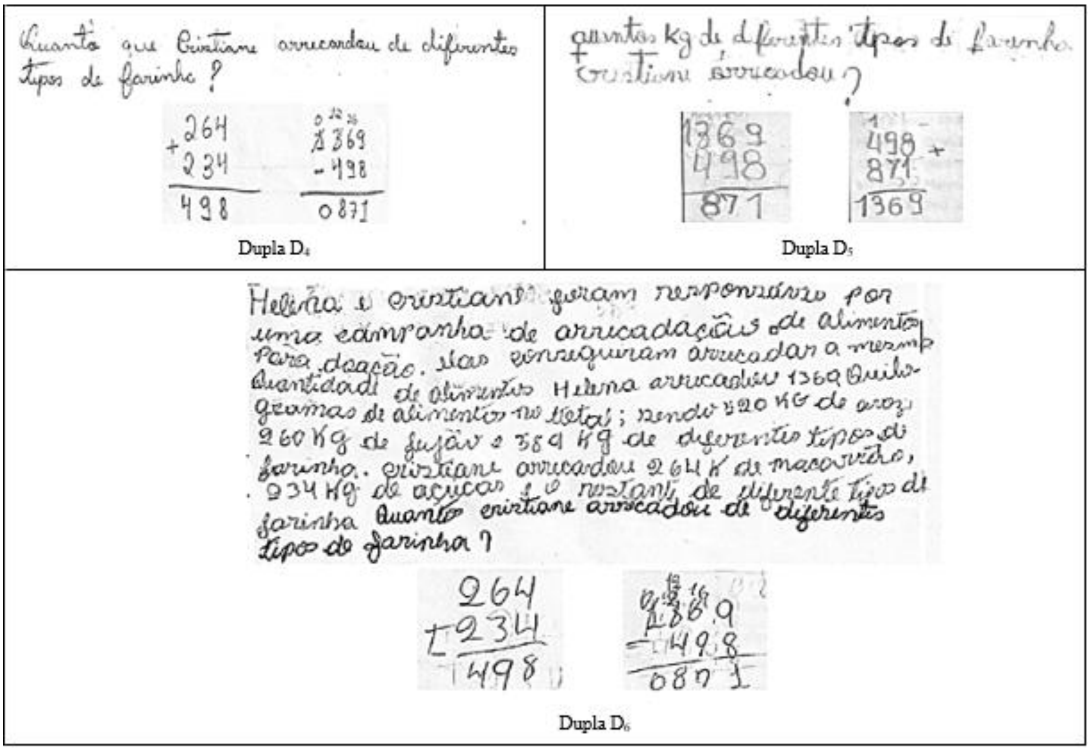

Figure 2: Protocol of problems created by pairs D_4, D_5 and D_6 based on data from Table 2 (Research Data, 2024)

In Table 2, which presents this activity, the students noticed the lack of information about the quantity of different types of flour collected by Cristiane. In view of this, they decided to question and try to find out this information. It was observed that the students found it easy to propose and solve the problem, arriving at the result of 871 kg.

It is noted that, although they presented the mathematical operations used in the calculations, the students did not explicitly state in writing what this quantity actually was. This tendency is common among 5th grade students, who generally consider the final result of the calculation as the answer to the problem, without the need for a written explanation of the meaning of the value obtained.

This activity enabled the development of abilities associated with divergent thinking, which is the ability to produce alternatives in a question to arrive at the same result, resulting from creative thinking.

It is understood that the role of the teacher is not limited to merely transmitting knowledge; Your pedagogical practice should motivate students to recognize their abilities and the various possibilities for creation, encouraging their autonomy in carrying out tasks.

It is important to consider the knowledge brought by students, since it is relevant for the development of new abilities in a creative way. In this sense, Gontijo (2007) points out some characteristics that contribute to identifying the creative subject in mathematical activities, such as the search for solutions and the pleasure in interacting with other people to discuss new results of a problem based on one or more hypotheses. This process contributes to improving the ability to understand (re)solutions.

The analysis of students' creativity in creating these problems can be done by considering some specific aspects observed in the statements and solutions. First, there is a careful contextualization in relation to the topic addressed, demonstrating the ability to connect mathematical content with elements of the real world, which can facilitate the understanding and engagement of readers with the proposed problem.

This practice is essential to foster students' autonomy and confidence. By creating their own problems, they exercise the ability to invent and test hypotheses, moving from being mere receivers of knowledge to active agents in the construction of their learning.

Problem posing guides students to a position of explorers, allowing them to integrate their personal experiences and prior knowledge to develop solutions that go beyond the mechanical application of formulas.

6 Final considerations

This study aimed to analyze the creativity of 5th grade Elementary School students in elaborating and solving problems involving *Numbers*. Based on the proposed activities, it was possible to observe that the practice of creating problems by the students themselves not only promoted the development of their mathematical abilities, but also encouraged critical and creative thinking.

Problem-posing activities proved to be an important instrument for stimulating students' autonomy, allowing them to explore different strategies and solutions. When faced with situations that required reworking and adapting problems, students demonstrated the ability to think flexibly and originally, going beyond the simple reproduction of previously learned procedures. This approach allowed them not only to better understand the mathematical concepts involved, but also to exercise abilities such as creativity and divergent thinking.

Creativity, as discussed throughout the article, is not limited to isolated activities, and it is essential that mathematics teaching continuously integrates it into everyday school life. Problem posing, in addition to promoting understanding of the content, also motivates students to become more actively involved in their own learning process, taking on a leading role.

Therefore, the results of this research reinforce the importance of incorporating practices that stimulate creativity in the teaching of Mathematics, especially through problem solving and problem posing. This approach not only enriches the teaching and learning process, but also contributes to the integral development of students, preparing them to deal with complex challenges, both in the school context and in their future lives.

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