Zetetiké

DOI: 10.20396/zet.v31i00.8672203

1st Degree Polynomial Equations: stimulating creativity in education books

Equações Polinomiais do 1º Grau: estímulo à criatividade nos livros didáticos

Raimunda de Oliveira[1]

Cleia Alves Nogueira[2]

Abstract

This article presents results of the analysis of chapters related to the object of knowledge Polynomial Equations of the 1st degree, in Mathematics textbooks for the 7th year of Elementary School approved and distributed to teaching institutions in the National Textbook Program (in Portuguese, Programa Nacional do Livro Didático – PNLD). The objective of this analysis was to evaluate the potential of these materials present in most Brazilian classrooms for stimulating creativity in Mathematics. Twelve textbooks were analyzed, which make up the collections distributed in the period 2021/2024, according to data from the Ministry of Education (MEC). We conclude that the exercises/problems contained in textbooks, for the most part, are characterized as closed problems that demand low complexity cognitive processes such as memorization and repetition of procedures.

Keywords: Creativity; Textbook; Polynomial Equations of the 1st Degree; Mathematics.

Resumo

Este artigo apresenta resultados da análise de capítulos relacionados ao objeto de conhecimento "Equações Polinomiais do 1º grau", nos livros didáticos de Matemática do 7º ano do Ensino Fundamental aprovados e distribuídos a instituições de ensino no Programa Nacional do Livro Didático (PNLD). O objetivo desta análise foi avaliar a potencialidade desses materiais presentes na maioria das salas de aula brasileiras para o estímulo da criatividade em Matemática. Foram analisados 12 livros didáticos, que compõem as coleções distribuídas no período de 2021/2024, de acordo com dados do Ministério da Educação (MEC). Concluímos que os exercícios contidos nos livros didáticos, em sua maioria, são caracterizados como problemas fechados que demandam processos cognitivos de baixa complexidade, como memorização e repetição de procedimentos.

Palavras-chave: Criatividade; Livro Didático; Equações Polinomiais do 1º Grau; Matemática**.**

Submetido em: 01/02/2023 – **Aceito em**: 01/08/2023 – **Publicado em**: 24/10/2023

[1] PhD student in Education at the University of Brasília. Teacher at the State Department of Education of the Federal District, Brazil. E-mail: raioliveiramat@gmail.com ORCID: https://orcid.org/0000-0002-3052-

[2] PhD in Education from the University of Brasília. Retired Teacher from the State Department of Education of the Federal District, Brazil. E-mail: cleianog@gmail.com ORCID: https://orcid.org/0000-0003-0983-2631

DOI: 10.20396/zet.v31i00.8672203

Introduction

The present study aims to analyze the exercises proposed in Mathematics textbooks, specifically those introducing the concept of “Polynomial Equations of the 1st Degree”. The objective is to identify potential limitations and opportunities within this educational material to promote creativity among students.

Gontijo et al. (2021) emphasize that since the late 20th century, creativity has been regarded as essential for the advancement of sciences, particularly in relation to technological progress. Consequently, creativity has been deemed an integral part of educational objectives. In this context, fostering the development of creativity in students aligns with contemporary expectations regarding the role of schools.

Furthermore, reflecting on the widespread reach of the textbook across the national territory and its prestigious role in pedagogical practice, we can emphasize its importance in teaching and learning, and consequently, in fostering fundamental skills associated with this process, such as creativity. According to the latest statistical data provided by the Ministry of Education through the National Fund for Education Development (in Portuguese, Fundo Nacional de Desenvolvimento da Educação – FNDE, 2020), in the year 2020 alone, approximately 172 million books were distributed. This distribution benefited over 32 million students, which corresponds to approximately 70% of all students enrolled in public schools.

Given the extensive reach of textbooks and the necessary stimulation of creativity in teaching and learning processes, the research question arises: *Do the approved and distributed works through the National Textbook Program (PNLD) actually align with the proposed and legitimate curriculum guidelines and promote creativity through their exercises?*

To address the presented question, the object of knowledge “Polynomial Equations of the 1st Degree” was selected in the textbooks. This concept is understood to be fundamental in the field of Mathematics and is widely used in various branches of this field, including Arithmetic, Algebra, and Geometry. Moreover, it finds applications in other areas of knowledge such as Physics, Chemistry, and Economics (Ribeiro & Oliveira, 2015). Polynomial Equations of the 1st Degree hold substantial coverage within the curriculum of Basic Education.

According to the *National Curricular Common Base* (In Portuguese, *Base Nacional Comum Curricular* – BNCC, Ministry of Education – MEC, 2018), the conceptualization process around this content begins with the initial exploration of properties of equality in the

DOI: 10.20396/zet.v31i00.8672203

3rd year of Elementary School. This approach continues throughout this phase, but its formal definition is studied in the 7th year, which is the focus of this investigation.

To enhance understanding of the study and its methodology, we present the theoretical sections that underpin the conducted research. In the introductory section, we discuss the concept of creativity in mathematics and techniques that foster its development. In the following section, we explore the influence of the textbook in the teaching and learning process within the field of mathematics, while also presenting curriculum guidelines for teaching Polynomial Equations of the 1st Degree in the 7th year of Elementary School and their relationship with stimulating creativity. Subsequently, we highlight the utilized documentary research methodology and the findings that have emerged from this study.

Creativity and Mathematical Knowledge

According to the Organization for Economic Cooperation and Development (OECD, 2009), the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2016), and Vincent-Lancrin et al. (2019), creativity is one of the key skills to be developed in the 21st century. The educational context undoubtedly stands as the primary space where this development should truly occur. A societal (re)thinking is immediately necessary, recognizing creativity as fundamental knowledge for shaping future generations.

In response to this need, several public policies indicate the significance of creativity for the holistic development of individuals. An example of this is the second General Competency of Basic Education, included in the BNCC and proposed for all three educational stages. This competency emphasizes that education should:

> Exercise intellectual curiosity and employ the approach inherent to the sciences, including investigation, reflection, critical analysis, imagination, and creativity, to explore causes, develop and test hypotheses, formulate and solve problems, and create solutions (including technological ones) based on knowledge from different areas[3] (MEC, 2018, p. 9, own translation).

In addition to what the BNCC advocates, we emphasize that creativity has gained increasing emphasis in recent years, both among international and national researchers, who highlight its importance as an essential skill for the 21st century. According to Alencar and Fleith (2003), creativity is vital for human survival in a world of uncertainties and sudden changes, demanding creative solutions for the challenges of the present generation.

[3] Original excerpt: “Exercitar a curiosidade intelectual e recorrer à abordagem própria das ciências, incluindo a investigação, a reflexão, a análise crítica, a imaginação e a criatividade, para investigar causas, elaborar e testar hipóteses, formular e resolver problemas e criar soluções (inclusive tecnológicas) com base nos conhecimentos das diferentes áreas” (MEC, 2018, p. 9).

DOI: 10.20396/zet.v31i00.8672203

Novaes (1997) also highlights the importance of creativity for today's world, as a creative person can more easily adapt to changes in their environment. He states that "[...] creative individuals find it easier to face the difficulties that arise in their interactions with others, seeking a true encounter with themselves and with others"[4] (Novaes, 1997, p. 99, own translation).

According to Beghetto (2013), interest in creativity has gained prominence in recent years, capturing the attention of society and those involved in educational policies. According to the author, acknowledging the importance of creativity and the need for its enhancement is a point to be discussed, but how this can be effectively achieved is our great challenge. In this context, Glaveanu (2010) emphasizes that the primary area for the application of theories about creativity is education, and we understand that through its development, we can achieve our goals as individuals and as a society. Therefore, educational policies need to be directed towards fostering the perspective of developing students' creative potential, and according to Fonseca and Gontijo (2020), there are already initiatives guiding the formulation of curricula in this direction.

Among the various actions required to change this reality, the implementation of a curriculum that motivates students to explore knowledge in a contextualized manner stands out. This ensures their right to learning and their full development, including their creative capacity (Gontijo, Carvalho, Fonseca & Farias, 2019).

According to Gontijo et al. (2019, p. 14, own translation), "school is one of the main spaces for children and young people to experience and socialize, thus becoming a privileged place for pedagogical work that fosters the development of creativity."[5] However, this space still primarily focuses on knowledge reproduction. Undoubtedly, more discussions and new avenues need to be explored with the aim of transforming these spaces into potentially creative environments.

Recognizing this need, we understand that in order to develop students' creative potential in the context of mathematics education, it is first necessary for us to grasp what we understand by mathematical creativity. According to Gontijo (2007, p. 37, own translation), it is:

> [the] ability to present numerous appropriate solution possibilities for a problem situation, in a way that these focus on distinct aspects of the problem and/or differentiated ways of

[4] Original excerpt: "[...] personalidades criativas têm maior facilidade em enfrentar as dificuldades que surgem em suas interações com os outros, buscando um verdadeiro encontro consigo mesmas e com os demais" (Novaes, 1997, p. 99).

[5] Original excerpt: "a escola é um dos principais espaços de vivência e de socialização para as crianças e jovens, convertendo-se, portanto, em um lugar privilegiado para um trabalho pedagógico que favoreça o desenvolvimento da criatividade" (Gontijo et al, 2019, p. 14).

DOI: 10.20396/zet.v31i00.8672203

> solving it, especially uncommon approaches (originality), both in situations that require problem solving and elaboration, as well as in situations that call for the classification or organization of mathematical objects and/or elements based on their properties and attributes, whether textually, numerically, graphically, or in the form of a sequence of actions[6].

Based on this concept, we understand that for schools to work on activities that stimulate the creative potential of their students, it is necessary to begin with an understanding of the concept of creativity. Only then is it possible to outline the path or steps to develop it. In this way, we highlight the main skills necessary for the development of creative thinking: fluency, flexibility, and originality. Gontijo et al. (2019) explain that these skills refer to:

a) Fluency: the quantity of different ideas generated that constitute appropriate solutions to the proposed problems;

b) Flexibility: the number of different categories in which the generated solutions for each problem can be classified; and

c) Originality: the infrequency or unconventional nature of the generated ideas, meaning that appropriate solutions that diverge from the larger group of proposed solutions are considered original (Gontijo et al., 2019).

Gontijo (2015) highlights strategies for stimulating creativity, such as problem-solving, problem elaboration, and redefinition. As for creativity techniques, the author states that

> they aim to encourage students to solve problems, fostering the creation of original solutions, rules, principles, and generalizations, new algorithms, new questions and problems, and new mathematical models. Some techniques also enable a deep understanding of mathematical concepts as students investigate a problem. Furthermore, the use of creativity techniques can be a very effective way for students to develop a passion for learning mathematics[7] (Gontijo, 2015, p. 17, own translation).

[6] Original excerpt: "[a] capacidade de apresentar inúmeras possibilidades de solução apropriadas para uma situação-problema, de modo que estas focalizem aspectos distintos do problema e/ou formas diferenciadas de solucioná-lo, especialmente formas incomuns (originalidade), tanto em situações que requeiram a resolução e elaboração de problemas como em situações que solicitem a classificação ou organização de objetos e/ou elementos matemáticos em função de suas propriedades e atributos, seja textualmente, numericamente, graficamente ou na forma de uma sequência de ações" (Gontijo et al, 2007, p. 37).

[7] Original excerpt: "visam estimular os estudantes a resolverem problemas favorecendo a criação de soluções originais; regras, princípios e generalizações; novos algoritmos; novas questões e problemas e novos modelos matemáticos. Algumas técnicas possibilitam, também, uma profunda compreensão das concepções matemáticas enquanto os estudantes investigam um problema. [...] Além disso, o uso de técnicas de criatividade pode ser uma maneira muito eficaz para os alunos desenvolverem uma paixão pela aprendizagem da Matemática" (Gontijo, 2015, p. 17).

DOI: 10.20396/zet.v31i00.8672203

It’s important to note that, according to Gontijo et al. (2019), when we promote creativity in mathematics classes, we are not excluding the importance of acquiring mathematical skills and retaining information. Instead, creativity will be used to enhance the learning of this content, making classes more dynamic and meaningful for students.

Stimulation of creativity through open and closed problems

When we consider stimulating creative potential, we understand that it’s necessary to provide students with the opportunity to imagine, create, produce, or invent something new. In this sense, we believe that one of the pathways to stimulate creativity within the context of mathematics teaching and learning is through problem-solving. However, we recognize that problem-solving alone isn’t responsible for the development of creative potential; rather, it’s one of the avenues to achieve it.

According to Fonseca and Gontijo (2020), open problems are those that admit multiple possible paths to arrive at a solution, whereas closed problems have a limited number of paths. As indicated by the authors, open problems are recommended to stimulate creative thinking in mathematics; however, other researchers like Maker and Schiever (1991) claim that closed problems also contribute to the development of creativity.

In the model proposed by Maker and Schiever (1991), depicted in the following Figure 1, problems are presented on a scale ranging from Type I to Type VI. For these authors, a Type I problem is highly structured and closed, unlike a Type VI problem, which is largely unknown and needs to be constructed. For a Type I problem, knowing the method to reach the solution is sufficient, while for a Type VI problem, the method to obtain the solution is unknown both to the teacher and the student. When focusing on the number of possible answers a problem can have, Type I problems have a single correct answer, whereas a Type VI problem can have multiple answers or none.

Problem Type		**Problem**		**Method**		**Solution**	
		Teacher	Student	Teacher	Student	Teacher	Student
Closed	I	Specific	Known	Known	Known	Unknown	Unknown
	II	Specific	Known	Known	Unknown	Unknown	Unknown
	III	Specific	Known	Partially Known	Unknown	Unknown	Unknown
Open	IV	Specific	Known	Partially Known	Unknown	Partially Known	Unknown
	V	Specific	Known	Unknown	Unknown	Unknown	Unknown
	VI	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown

Figure 1 - Continuity Scale - Open-Ended Problems
Source: Fonseca & Gontijo (2021, p. 9)

In the face of the challenge of turning schools into potential spaces for the exercise of creativity, we will address in the next section of the text the importance of instructional

DOI: 10.20396/zet.v31i00.8672203

materials used in pedagogical practice, particularly the textbook. This is due to our understanding that such resources can enhance students' creativity, placing them at the heart of the educational process, as protagonists of their own learning experiences.

Textbook and its influence on the teaching-learning process

According to Gasparello (2004), textbooks have been essential tools for the establishment of formal and institutionalized education as we know it today. This process was marked by a series of regulations and mechanisms that defined the educational setting as the primary environment for knowledge development through a new model of educational conception. In this context, the textbook, initially created as manuals intended only for teachers, proposed what to teach and how to teach from its earliest uses.

A significant milestone in the expansion of textbook usage in public schools in Brazil was the establishment of the National Book Institute in 1937, which marked the inception of the National Program for Textbooks (in Portuguese, Programa Nacional do Livro Didático – PNLD). The aim of this program was to evaluate and distribute books to students in public elementary schools, later extending its scope to cover Basic Education as a whole. Consequently, for a large portion of public schools in Brazil, PNLD became the sole program catering to all students with individual learning materials, thus making the textbook a resource of significant use.

However, accessibility has sometimes led the textbook to assume more roles than it was intended for in many schools. Among these additional roles, the textbook has become the sole teaching instrument for teachers, even if it doesn't cater to the specific needs of all the communities using it. Furthermore, on several occasions, it takes on the role of the sole curricular guide, dictating which content should be studied or not (Macêdo, Brandão & Nunes, 2019).

The importance attributed to the textbook as a material for planning and conducting educational activities is undeniable. According to Marmolejo (2014), studying this material allows us to analyze what is emphasized more in terms of content and where we might be falling short in relation to curriculum proposals.

Another relevant aspect is highlighted in the National Textbook Guide for the Mathematics domain, a guiding document provided by the PNLD (MEC, 2016, p. 13, own translation), which emphasizes that:

> [...] the textbook adds another element to the teaching and learning process – its author – who engages in a dialogue with both the teacher and the student. Within this dialogue, the textbook becomes a carrier of choices regarding: the knowledge to

DOI: 10.20396/zet.v31i00.8672203

> be studied (Mathematics); the methods adopted to enable students to learn it more effectively; the curricular organization across the years of schooling[8].

In this scenario, when choosing a textbook, the teaching staff is actually adopting a teaching approach that needs to be aligned with the pedagogical proposal and epistemological foundations of their institution. From this premise arises the question: *Do the textbooks approved and distributed in the PNLD actually meet the endorsed curriculum proposals and guidelines, and do they promote creativity through their exercises?*

The presented question is broad, and to address it at least partially, we tie it to the object of knowledge "First-degree Polynomial Equations", specifically the part of this content studied in the 7th grade of Elementary School. The second proposed focus centers on the analysis of the Exercises/Problems present in the textbooks. Therefore, in the next section, we outline some important aspects about this content found in the official curriculum guidelines.

Polynomial Equations of the 1st Degree: Challenges and Curriculum Guidelines

The study of the teaching and learning process of equations arouses the interest of mathematics learning researchers, as it constitutes a content in which students have shown difficulties, especially when activities involve the transition from a descriptive statement to an algebraic expression (Benayad, 2012; Ribeiro & Oliveira, 2015; Lourenço & Oliveira, 2018).

Studies conducted by scholars such as Matos and Serrazina (1996), Gil (2008), and Xu, Stephens, and Zhang (2012) have focused on identifying the main challenges in the teaching and learning process of First-Degree Polynomial Equations. Matos and Serrazina (1996) attribute this difficulty to the excessive emphasis on memorization of problem-solving techniques. Gil (2008) points out that the greatest obstacle lies in reading and interpreting problems, preventing students from constructing meaning for the associated algebraic language. Xu et al. (2012), on the other hand, observed that although students can solve problems involving the four arithmetic operations, many have difficulty developing the relational thinking necessary to generalize the operation relationships to situations with variables, not just known numbers.

[8] Original excerpt: "[...] o livro didático traz para o processo de ensino e aprendizagem mais um elemento, o seu autor, que passa a dialogar com o professor e com o estudante. Nesse diálogo, o livro é portador de escolhas sobre: o saber a ser estudado (a Matemática); os métodos adotados para que os estudantes consigam aprendê-lo mais eficazmente; a organização curricular ao longo dos anos de escolaridade".

DOI: 10.20396/zet.v31i00.8672203

These researches reinforce the idea that the transition from mathematical language developed in arithmetic learning to algebraic language has been a moment of disruption. They also indicate that the manipulation of operations and numbers developed in the field of arithmetic has not become a tool in algebraic situations. Such researches corroborate the findings of large-scale assessments conducted by the National Institute for Educational Studies and Research Anísio Teixeira (Inep), an agency linked to the Ministry of Education (MEC) and responsible for the Basic Education Assessment System (In Portuguese, Sistema de Avaliação da Educação Básica – SAEB). The recent reports of these assessments in the years 2019 and 2021 indicate that about 50% of students in the Final Years of Elementary School are at proficiency levels 0 to 3, showing that they still cannot solve problem situations involving determining a numerical value in a first-degree algebraic expression within the set of natural numbers.

Results of studies and assessments like the ones highlighted have historically marked algebra learning. With the aim of changing this situation, the official curriculum guidelines present in the BNCC (MEC, 2018) emphasize problem-solving as the main methodology that drives the development of relational thinking and the generalization processes necessary for understanding algebra. In this learning context, Windsor (2010) points out that understanding algebra enables the expansion of thinking to solve concrete problems using abstraction and operation with mathematical objects logically.

Furthermore, since the focus of this work is to analyze the exercises of First-Degree Polynomial Equations in the 7th grade of Elementary School present in the textbooks, the curriculum guidelines such as the one highlighted in the BNCC text (MEC, 2018), along with the specific skills related to this content, constitute important parameters for conducting this research. In the skill text related to this content in the 7th-grade mathematics section, it reads: “solve and create problems that can be represented by First-Degree Polynomial Equations, reducible to the form ax + b = c, using the properties of equality”[9] (MEC, 2018, p. 307, own translation). This skill, which in practice constitutes a teaching objective, aligns with the general guidelines of the document and points to an expectation of manipulating the properties of equality as a tool to seek solutions to proposed situations, as well as emphasizing not only the application of this knowledge but also the production of the textual genre “mathematical problem” as cognitive processes to be developed by students.

The cognitive processes indicated by the verbs of the BNCC skills were structured according to the Revised Bloom’s Taxonomy in its cognitive domain. This domain

[9] Original excerpt: “resolver e elaborar problemas que possam ser representados por Equações Polinomiais do 1º grau, redutíveis à forma ax + b = c, fazendo uso das propriedades da igualdade” (MEC, 2018, p. 307).

DOI: 10.20396/zet.v31i00.8672203

encompasses intellectual learning and presents a structure that increases in complexity. In this proposal to acquire a new skill belonging to the next level, the student must have mastered and acquired the skill of the previous level (Conklin, 2005).

According to Krathwohl (2002), the skills of the cognitive domain, highlighted in the Revised Bloom's Taxonomy, are organized in a two-dimensional perspective: the knowledge dimension - the material to be learned and the process dimension - the resource used by students to learn. In this last dimension, cognitive processes are organized as follows: 1) remembering: recognizing, identifying, and retrieving relevant knowledge from long-term memory; 2) understanding: establishing meanings from instructional messages, including oral, written, and graphical communications, connecting new and previously acquired knowledge; 3) applying: using a procedure and knowledge in different contexts; 4) analyzing: establishing a hierarchy of information (relevant and irrelevant) given a situation by fragmenting it, also determining which parts relate to others and to the global structure; 5) evaluating: making judgments based on criteria, standards, and critical sense; and 6) creating: generalizing knowledge to the point of revising ideas and including new propositions. Creating a perspective, solution, or model from acquired knowledge (Krathwohl, 2002).

The cognitive processes: solving and creating, present in the aforementioned skill regarding First-Degree Polynomial Equations in the 7th grade of Elementary School, are considered complex in relation to this knowledge and refer us, in the categorization of the cited Revised Bloom's Taxonomy, to the levels: applying and creating, which demand from the subject the use of procedures and knowledge in different contexts and the generalization of knowledge in order to create a new and original idea.

From this analysis, we can verify that by delineating these levels of cognitive process, the curriculum guidance indicates, among other possible highlights, that activities based on simpler processes, such as memorizing and decoding information, are insufficient to develop learning expectations. According to Smole and Diniz (2001), communication, especially writing, proposed in mathematics classes, particularly in problem elaboration, enables students to create more developed schemes of reasoning and application of knowledge.

Scholars of the oral and written production process, such as Koch and Elias (2012), point out that text elaboration requires the author to possess various types of knowledge, with a focus on: 1) linguistic knowledge - if in written form, the author needs to understand its orthographic and grammatical foundations; if in other forms, like oral, they need to communicate comprehensibly; 2) domain and encyclopedic knowledge - knowledge about the area or topic being addressed, necessitating study, research, or experiences related to what will be written; and 3) text knowledge - in other words, the author needs to activate

DOI: 10.20396/zet.v31i00.8672203

models they have experienced in their communicative practice to produce a text, in addition to aspects related to content, such as style, function, and medium of delivery.

Therefore, creating a problem should be an activity carried out within a teaching proposal that brings this intentionality into its organization, in a clear manner that allows students a path of study that promotes the development of the necessary knowledge for action, such as understanding the structure of the textual genre “problem” and the applicability of the mathematical concept involved.

Gontijo (2006) points out the formulation of problems as a relevant strategy for the development of creativity in mathematics. The elaboration or revision of problems allows students to critically reflect on the studied mathematical objects, the associated contexts, and the applicability of this knowledge through original production.

Based on the discussions presented, in the next section, we will describe the methodological journey of this research, the actions employed for the analysis of exercises within the textbooks, and the results obtained. We will address whether these materials manage to provide proposals that align with the challenges outlined by the curriculum guidelines.

Methodology

For the study proposed in this chapter, we conducted documentary research with the aim of analyzing exercises in mathematics textbooks for the 7th year of Elementary School. These exercises focus on teaching Linear Polynomial Equations of the 1st degree, in terms of their potential to stimulate the development of creativity.

We began with the idea that documentary analysis facilitates the observation of the development process of individuals, groups, concepts, knowledge, behaviors, mentalities, practices, among others (Cellard, 2008). The examined documents pertain to contemporary works, and the objective of this study is to describe the characteristics of these works and identify teaching trends present in the exercises within the textbooks.

For this study, 12 textbooks were selected from the collections in the Mathematics domain of the National Program for Textbooks (Programa Nacional do Livro Didático - PNLD) for the period 2021/2024. These are the approved instructional materials distributed to public educational institutions, based on data from the Ministry of Education (MEC).

Using a questionnaire developed by Gontijo (2020, in press), a Google Form was created to organize the collected data. This form covered the following aspects: i) Book identification, ii) Linear polynomial equations of the 1st degree: statistical data, iii)

DOI: 10.20396/zet.v31i00.8672203

Problems and exercises: stimulating skills, and iv) Types of problems: Continuum of Problems scale (Maker & Schiver, 1991).

Dados e informações coletadas Data and Collected Information

The initial examination of the textbook aimed to gather quantitative information regarding pagination, the number of sections dedicated to the study of Linear Polynomial Equations of the 1st degree, as well as identification data of the work. In Table 1, we present the data collected in sections 1 and 2 of the mapping form used.

Table 1 - List of analyzed textbooks in the research

Title	Author	Edition/ Publication Year	Sections or Chapters	Quantity of Pages with Explanatory Texts	Quantity of Pages with Exercises/ Problems	Quantity of with Exercises/ Problems
A Conquista da Matemática	José Ruy Giovanni Jr; Benedito Castrucci	4th edition/ 2018	3	11	9	39
Araribá Mais	Collective work - Editora Moderna	1st edition/ 2018	7	11	6	38
Convergências	Eduardo Chavante	2nd edition/ 2018	1	2	4	26
Geração Alpha	Carlos N. C. de Oliveira; Felipe Fugita	2nd edition/ 2018	1	11	6	38
Matemática Essencial	Patricia Moreno Pataro and Rodrigo Balestri	1st edition/ 2018	1	3	4	24
Matemática – Realidade e Tecnologia	Joamir Roberto de Souza	1st edition/ 2018	1	4	7	21
Matemática Bianchini	Edwaldo Bianchini	9th edition/ 2018	7	17	13	69
Matemática Compreensão e Prática	Ênio Silveira	4th edition/ 2018	4	10	11	86
Projeto Apoema	Linos Galdonne	2nd edition/ 2018	2	11	5	26
Teláris Matemática	Luiz Roberto Dante	3rd edition/ 2018	9	8	14	42
Tempo de Matemática	Miguel Asis Name	4th edition/ 2019	6	6	14	119
Trilhas da Matemática	Fausto Arnaud Sampaio	1st edition/ 2018	4	9	7	47

Source: Self-created

In Section 3 of the form, with the focus on performing a classification of the proposed exercises, we identified the cognitive process that each activity aimed to develop, with the objective of analyzing whether they met the skill proposed in the curriculum guidance for which they were designed: "solve and formulate problems that can be

DOI: 10.20396/zet.v31i00.8672203

represented by first-degree Polynomial Equations, reducible to the form ax + b = c, using the properties of equality"[10] (MEC, 2018, p. 307, own translation).

The cognitive processes we evaluated in the exercises took into account the nature of the mathematical knowledge domain and the taxonomy proposed in the BNCC (MEC, 2018). Thus, the following profile of activities was established for each analyzed cognitive process:

• Memorizing and repeating procedures: These activities have low complexity. To perform this type of exercise, students need to follow previously presented models and perform straightforward calculations.

• Expressing or recording ideas: These activities involve reading and interpreting the given context and recording objective ideas.

• Investigating and solving problems: The proposed activities require students not to have immediate access to the expected result, which involves raising and testing hypotheses. Additionally, students need to apply the covered concept to solve the problem, even if they are still developing their understanding.

• Classifying and generalizing: These activities require categorizing information and producing synthesis based on identified patterns and regularities. Activities involving mathematical problem modeling were considered in this category as they require generalization of studied concepts.

• Arguing and making decisions: In these activities, students analyze the context and argue about the chosen resolution or creation paths, defending a viewpoint based on their conceptualization process. Activities stimulating critical thinking through open-ended questions and argumentation were considered in this category.

• Conjecturing and proving: Activities that demand the production of a conclusion based on generalization and the establishment of a mathematical proof.

• Elaborate and producing: Activities that require students to develop a problem, either partially or entirely, tailored to the studied concept and a specific context, making it functional and meaningful.

In Figure 2, we present a quantitative synthesis of the categorization of exercises based on the cognitive processes that are stimulated through their completion.

[10] Original excerpt: : "resolver e elaborar problemas que possam ser representados por Equações Polinomiais do 1º grau, redutíveis à forma ax + b = c, fazendo uso das propriedades da igualdade" (MEC, 2018, p. 307).

DOI: 10.20396/zet.v31i00.8672203

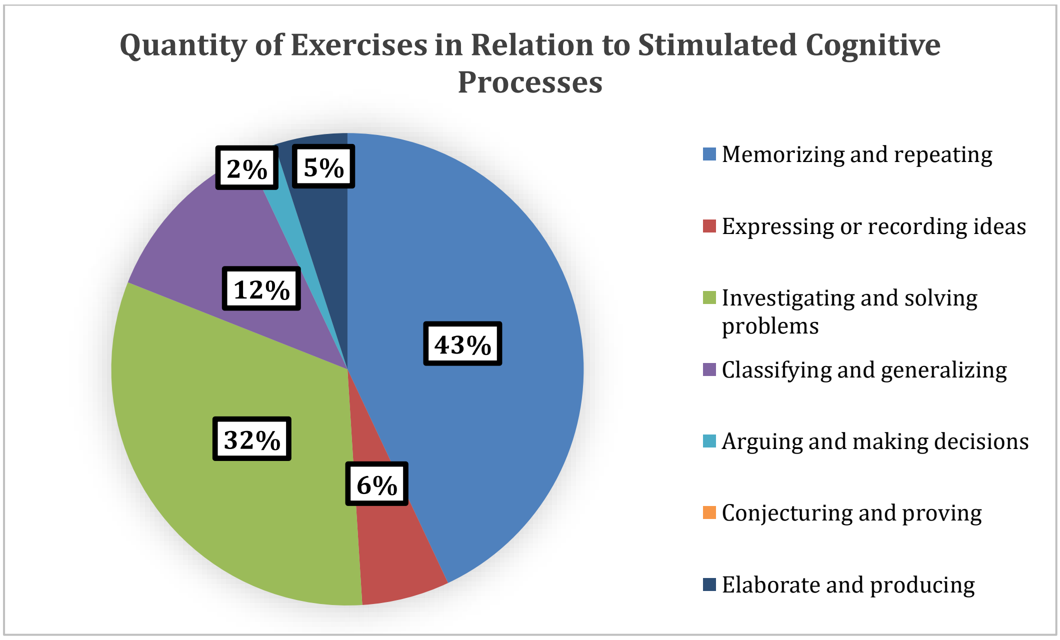


Figure 2 - Quantity of Exercises in Relation to Stimulated Cognitive Processes
Source: Self-created

In Section 4, with the aim of conducting a more direct analysis according to the stimulation of creativity in relation to the identification of problem existence, a mapping of exercises was performed using the categorization based on the Continuum of Problems scale proposed by Maker and Schiver (1991). As some books had a significant number of exercises, a tally was conducted based on frequency intervals: 1) from 1 to 3; 2) from 4 to 6; 3) from 7 to 9; and 4) 10 or more. Table 3 outlines the types of problems found in the collections:

Table 3 - Types of problems mapped in the textbooks

Title	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6
A Conquista da Matemática	10 or more	10 or more	10 or more	1 to 3	0	0
Araribá Mais	7 to 9	10 or more	10 or more	1 to 3	1 to 3	0
Convergências	4 to 6	7 to 9	7 to 9	1 to 3	0	0
Geração Alpha	7 to 9	10 or more	10 or more	1 to 3	1 to 3	0
Matemática - Essencial	7 to 9	10 or more	1 to 3	1 to 3	0	0
Matemática - Realidade e Tecnologia	10 or more	10 or more	1 to 3	0	1 to 3	0
Matemática Bianchini	10 or more	10 or more	10 or more	4 to 6	1 to 3	0
Matemática Compreensão e Prática	10 or more	10 or more	1 to 3	1 to 3	0	0
Projeto Apoema	4 to 6	10 or more	4 to 6	1 to 3	0	0
Teláris Matemática	10 or more	10 or more	1 to 3	4 to 6	1 to 3	0

DOI: 10.20396/zet.v31i00.8672203

Tempo de Matemática	10 or more	7 to 9	1 to 3	0	0	0
Trilhas da Matemática	10 or more	10 or more	1 to 3	1 to 3	1 to 3	0

Source: Self-created

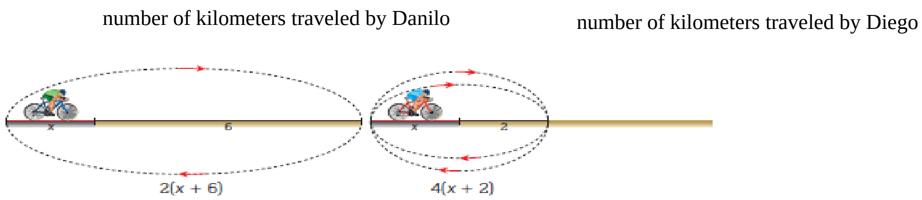
The collected data enabled analyses and reflections on the construction of the textbooks. In the next section, we propose a discussion about the questions raised in light of the findings of this study.

Research Results

A first relevant point concerns the distribution of pages between explanatory texts and exercises, where it was observed that the majority of works presented a greater number of pages dedicated to explanations. The works that stand out in this regard are: *A Conquista da Matemática*, *Araribá Mais*, *Geração Alpha*, *Matemática Bianchini*, *Matemática Compreensão e Prática*, *Projeto Apoema*, and *Trilhas da Matemática*. These works, in general, not only provide explanations and definitions but also emphasize the presentation of solved problems, as detected through repetitions or variations in the context of problems that demonstrate the resolution approach. In Figure 3, we highlight one of the solved exercises presented in one of the works.

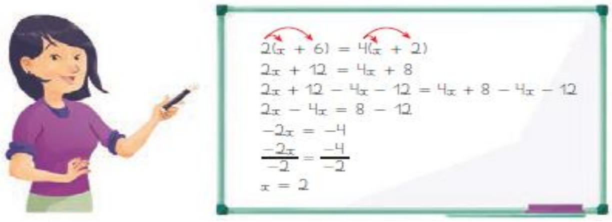
Situation 2

Danilo and Diego are cyclists who decided to ride along a road that has both an asphalted section and a dirt section.
Danilo crossed the asphalted section and an additional 6 km of the dirt section. Then, he returned to the starting point.
Diego covered the asphalted section and an additional 2 km of the dirt section, then returned to the starting point. He repeated this route twice.
When they did the calculations, they found out that they had covered the same distance. How many kilometers is the asphalted section?
Let's outline the situation by indicating the length of the asphalted section as x.



Since the number of kilometers traveled is the same, we write the following equation:
2(x + 6) - 4(x + 2)
Let's eliminate the parentheses by applying the distributive property of multiplication.
Then, we continue with the resolution:

DOI: 10.20396/zet.v31i00.8672203



Checking:
Danilo covered: 2(2 + 6) – 2.0 = 16
Diogo covered: 4(2 + 2) = 4.4 = 16
Therefore, the asphalted section is 2 kilometers long

Equal distances (16 km)

Figure 3 - Solved Exercise/Problem
Source: Bianchini (2018, p. 131)

On the presented book page, there is no space or indication for the student to at least attempt the solution. This indication was also not found in the pedagogical guidelines for the teacher present on the page's margin. This type of approach could limit the stimulation of creativity, as it doesn't allow students to create their own solution paths or ask questions. According to Laycock (1970), creativity in mathematics is the ability to examine a situation or problem from different perspectives, identifying patterns and differences, generating multiple solution ideas, and knowing how to choose the most suitable method. In a book with many repetitions of how to model and solve a problem, such aspects would be disadvantaged.

In all 12 works, the cognitive processes of memorizing and repeating procedures have the highest quantity of exercises. In terms of exercise typology, most of them fall into Types 1 to 3, closed problems, according to the scale used. In Figure 4, we present an example of an activity categorized for the development of this low-complexity cognitive process.

17. Observe the example and solve the following equations in the same manner.
If 20 = x + 1, then: x + 1 = 20, therefore x = 20 – 1, therefore x = 19.
The root of the equation is 19.

a) 5 = x + 3 (Answer 2)
b) 7 = 10 + x (Answer -3)
c) 15 = x + 20 (Answer -5)
d) -7 = x + 50 (Answer -57)

Figure 4 - Memorization and Repetition of Procedures Exercise/Problem
Source: Name (2019, p. 116)

Despite the majority presence of closed problems, there is variability among Types 1 to 3. In Figure 5, an example of a Type 3 problem is highlighted, where the problem is specific for the teacher, but the method that the student will use is only partially known,

DOI: 10.20396/zet.v31i00.8672203

opening up possibilities for the student to argue about their solving methods in the classroom.

11 (UFPE) In a 16-question test, each correct answer adds 5 points, and each wrong answer subtracts 1 point. If a student answered all the questions and obtained a total of 38 points, how many questions did they answer incorrectly? Option d
a) 4
b) 5
d) 7
e) 8

Figure 5 - Type 3 Problem

Source: Editora Moderna (2018, p. 185)

In a classroom where the teacher can develop interventions beyond what is proposed in the used textbook, Type 3 problems like the one highlighted can be further explored and discussed in class, creating additional spaces for learning and stimulating creative thinking. According to Sequera Guerra (2006), activities that stimulate creative thinking in math classes are established in an environment where the teacher promotes motivation, curiosity, self-confidence, playful engagement with creative reasoning, and flexibility of production by students; facilitates the development of important skills such as learning to view a problem from different perspectives, inventing their own problem-solving techniques, and discussing and setting goals; proposes challenging problems connected with meaningful experiences for students.

Regarding the development of the cognitive process "elaborate," it was possible to count a total of 31 elaboration problems in the 12 evaluated works, classified as Type 4 or 5, according to the scale used. This quantity represents only about 5% of the total proposed exercises. The elaboration problems, present in all works albeit with a relatively lower frequency than expected, have the potential to develop the cognitive process emphasized in the highlighted skill. However, in most cases, these problems were approached as isolated activities, often without adequate prior preparation.

In Figure 6, we present a common profile of the elaboration problems featured in the exercise lists of the books.

18) Propose the statement of a problem that can be solved using the equation $\frac{x}{5} + 38 = 4x$.
Personal response.

Figure 6 - Elaboration Problem

Source: Iezzi, Dolce & Machado (2018, p. 255)

This type of problem appears among the other tasks without any discussion about the textual genre to be produced, nor about the why and for whom the text is being produced. In other works, this writing dialogue is better evidenced through the exchange of productions as challenges among students of the same class. Koch and Elias (2012), in relation to

DOI: 10.20396/zet.v31i00.8672203

writing as a guided activity in school, emphasize that teachers must not forget the communicative function of the activity for constructing meaning for those who write.

Furthermore, producing a text, even a mathematical problem, demands the activation of knowledge of the communicative situation, in other words, knowledge of the genre. During the analysis of the works, it was found that only in one of the books were problems found that guide students through a complete process, encompassing reading, interpretation, modeling, resolution, and reflection on the nature of the problem as a textual genre. This activity is highlighted in Figure 7 below.

<table>
<tr><td colspan="2">(Obmep) After flipping a coin 2014 times, Antônio counted 997 heads. Continuing to flip the coin, how many consecutive heads should he obtain for the number of heads to become equal to half the total number of tosses?
Option c
a)10 b) 15 c) 20 d) 30 e) 40
</td></tr>
<tr><td>Interpretation and Identification of Data</td><td>• Analyze the information in the statement and note down the ones you consider relevant for solving the problem. Personal response.
• What is the relationship between the number of consecutive heads and the total number of tosses at the end of the experiment?
• They are equal.</td></tr>
<tr><td>Resolution Plan</td><td>• Write an algebraic expression representing the total number of heads at the end of the tosses. 999 + x
• Write another algebraic expression representing the total number of tosses. 2014 + x
• How would you indicate half of the value represented by the previous algebraic expression? $\frac{2014+x}{2}$
• Write an equation relating the created algebraic expressions. $999 + x = \frac{2014+x}{2}$</td></tr>
<tr><td>Resolution</td><td>• Join a colleague.
• Show him/her your resolution plan and check for common ideas between you.
• Discuss the differences and similarities of each plan and choose one of the plans for the execution of the resolution process.
<u>Note</u>
Solve the problem collectively, but make individual records in your notebook. Example of resolution: $999 + x = \frac{(2014+x)}{2}$
1994 + 2x = 2014 + x, so x=20.</td></tr>
<tr><td>Verification</td><td>• Reread the problem and check if all the conditions in the statement have been satisfied.</td></tr>
</table>

Figure 7 - Solving as a Team - Step-by-Step Resolution

Source: Silveira (2018, p. 98)

In the task highlighted in Figure 6, it is evident that the intention of the activity is for students to develop the habit of reading, interpreting, selecting data, and mathematically modeling the situation, following a problem-solving approach similar to that presented by Polya (1978). Polya defined a series of steps to aid in comprehending the proposed situation in its entirety: understanding the problem; devising a plan, executing the plan, and looking back or verifying.

DOI: 10.20396/zet.v31i00.8672203

Evaluating the 31 exercises focused on problem creation, we can identify that since they involve open problems, allowing for different answers, they provide students with space for imagination and creation. Consequently, it is in these activities that the stimulus for creativity is most potent within the studied textbooks. In the perspective of Gontijo (2007), who highlights the elements of originality, flexibility, and fluency as central to creativity in mathematics, we can understand that problem creation has enhanced these three elements, but particularly originality. However, the absence of other types of open problems in the textbooks, tasks that enable the production of different answers through various paths, inhibits the other elements, such as flexibility and fluency.

Concluding Remarks

According to the curriculum guidelines, the study of Linear Polynomial Equations in the 7th year of Elementary School should be guided by the skill described as "(EF07MA18) Solve and create problems that can be represented by linear polynomial equations of the 1st degree, reducible to the form ax + b = c, making use of the properties of equality" (MEC, 2018, p. 307, own translation)[11]. The cognitive processes indicated in this skill reflect a stimulus for creativity in mathematics, as problem solving and creation, materialized in teaching strategies, are crucial for the development of creative thinking (Gontijo, 2015).

However, in the analysis of the exercise profile in the section related to the development of the knowledge area "Linear Polynomial Equations of the 1st degree," found in 12 textbooks approved by the PNLD for the 7th year of Elementary School, it is identified that the level of "memorization," demonstrated through repetitive model activities, constitutes the vast majority. In attempting to relate these exercises to problems, they were categorized on the Continuum of Problems scale (Maker & Schiver, 1991) as Type 1 problems, closed problems, where only the final result is unknown to the student, or Type 2 problems, where the method is also unknown to the student. However, both types indicate a low demand for autonomy and authorial processes by the solving individual and provide little stimulus for creativity.

In the study, the focus was on 31 exercises found in 12 textbooks, categorized as open problems of Type 4 or 5 with a focus on problem creation. According to our analysis, these exercises have the highest potential to develop creativity, as they allow students space for imagination and creation. However, these activities account for only 5% of the total and generally appear as isolated exercises, lacking the momentum for creation to take place in a

[11] Original excerpt: "(EF07MA18) Resolver e elaborar problemas que possam ser representados por equações polinomiais de 1º grau, redutíveis à forma ax + b = c, fazendo uso das propriedades da igualdade" (MEC, 2018, p. 307).

DOI: 10.20396/zet.v31i00.8672203

more contextualized manner with a sense-building process.

Thus, in the proposed exercises within the textbooks, the design of activities still tends to revolve around tasks that involve repetition of procedures and/or the solution of closed problems, activities that require low cognitive complexity in terms of memorization and offer little stimulation for students' creative thinking. In this context, it is up to the teacher to expand the possibilities based on this material or other teaching resources.

References

Alencar, E. M. L. S. de, & Fleith, D. de S. (2003). Contribuições teóricas recentes ao estudo da criatividade. *Psicologia: Teoria e Pesquisa*, 19(1), 1-8. https://doi.org/10.1590/S0102-37722003000100002.

Cellard, A. (2008). A Análise Documental. In J. Poupart (Ed.), *A pesquisa qualitativa: enfoques epistemológicos e metodológicos* (pp. 295-316). Petrópolis: Vozes.

Conklin, J. (2005). Review of *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives Complete Edition*, by L. W. Anderson, D. Krathwohl, P. Airasian, K. A. Cruikshank, R. E. Mayer, P. Pintrich, J. Raths, & M. C. Wittrock. *Educational Horizons*, *83*(3), 154-159. Retirado em October 23, 2020, de: http://www.jstor.org/stable/4292652

Beghetto, R. A. (2013). Creativity: development and enhancement. In J. A. Plucker, & C. M. Callahan (Eds.), *Critical issues and practices in gifted education: What the research says* (2a ed) (pp. 183-196). Waco: Prufrock Press

Benayad, M. A. (2012). Analyse des besoins en formation des enseignants de mathématiques du secondaire. In J. L. Dorier, & S. Coutat (Eds.), *Enseignement des mathématiques et contrat social: enjeux et défis pour le 21 e siècle – Actes du colloque EMF2012* (SPE1, pp. 1479-1487). Gèneve.

Fundo Nacional de Desenvolvimento – FNDE. (2020). *Histórico do Programa Nacional do Livro Didático (PNLD)*. Retirado em 15 de janeiro, 2023, de: http://www.fnde.gov.br/component/k2/item/518-histórico

Fonseca, M. G., & Gontijo, C. H. (2020). Pensamento crítico e criativo em Matemática em diretrizes curriculares nacionais. *Ensino em Re-Vista*, *27*(3), 956-978. https://doi.org/10.14393/ER-v27n3a2020-8

Fonseca, M. G., & Gontijo, C. H. (2021). Pensamento Crítico e Criativo em Matemática: uma abordagem a partir de Problemas Fechados e Problemas Abertos. *Perspectivas da Educação Matemática*, *14*(34), 1-18. https://doi.org/10.46312/pem.v14i34.12515

Gasparello, A. M. (2004) *Construtores de identidades: a pedagogia da nação nos livros didáticos da escola secundária brasileira*. São Paulo: Iglu.

Gil, K. H. (2008). *Reflexões sobre as dificuldades dos alunos na aprendizagem de Álgebra*. (Dissertação de Mestrado). Porto Alegre: Pontifícia Universidade Católica do Rio

DOI: 10.20396/zet.v31i00.8672203

Grande do Sul. Retirado em 12 de janeiro, 2023, de: https://repositorio.pucrs.br/dspace/handle/10923/2962

Glaveanu, V. (2010). Paradigms in the study of creativity: Introducing the perspective of cultural psychology. *New Ideas in Psychology*, *28*, 79-93. https://doi.org/10.1016/j.newideapsych.2009.07.007

Gontijo, C. H. (2006). Estratégias para o desenvolvimento da criatividade em matemática. *Linhas Crítica*s, 12(23), 229-244. https://doi.org/10.26512/lc.v12i23.3321.

Gontijo, C. H. (2007). *Relações entre criatividade, criatividade em matemática e motivação em matemática de alunos do ensino médio*. (Tese de doutorado em Psicologia). Brasília: Universidade de Brasília.

Gontijo, C. H. (2015). Técnicas de criatividade para estimular o pensamento matemático. *Educação e Matemática, 135*, 16-20.

Gontijo, C. H. (2020). *Roteiro para análise de capítulos de livros didáticos – estímulo à criatividade em Matemática*. Brasília: UnB (não publicado).

Gontijo, C. H., Carvalho, A. T. de, Fonseca, M. G., & Farias, M. P. de. (2019). *Criatividade em matemática: conceitos, metodologias e avaliação*. Brasília: Editora da Universidade de Brasília.

Gontijo, C. H., Fonseca, M. G., Carvalho, A.T. de, & Bezerra, W. W. V. de. (2021). Criatividade em matemática: alguns elementos históricos na constituição do campo de pesquisa e de intervenção pedagógica. *REnCiMa, 12*(5), 1-24. https://doi.org/10.26843/rencima.v12n5a20.

Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Texeira – INEP. (2022). *Dados da 1ª etapa do Censo Escolar*. Retirado em 15 de janeiro, 2023, de: https://www.gov.br/inep/pt-br/assuntos/noticias/censo-escolar/inep-divulga-dados-da-1a-etapa-do-censo-escolar-2021.

Krathwohl, D. R. (2002). A revision of Bloom's taxonomy: an overview. *Theory in Practice*, *41*(4), 212-218. Retirado em 28 de fevereiro, 2022, de: https://www.depauw.edu/files/resources/krathwohl.pdf.

Koch, I. V., & Elias, V. M. (2012). *Ler e escrever: estratégias de produção textual*. São Paulo: Contexto.

Laycock, M. (1970). Creative mathematics at Nueva. *The Arithmetic Teacher. National Council of Teachers of Mathematics*, *17*(4), 325-328. https://doi.org/10.5951/AT.17.4.0325

Macêdo, J. A., Brandão, D. P., & Nunes, D. M. (2019). Limites e possibilidades do uso do livro didático de Matemática nos processos de ensino e de aprendizagem. *Redalyc*, *3*(7), 68-86. https://doi.org/10.24116/emd.v3n7a04

DOI: 10.20396/zet.v31i00.8672203

Maker, C. J., & Schiever, S. (1991). Enrichment and acceleration: an overview and new directions. In G. Davis, & N. Colangelo (Eds.), *Handbook of gifted education* (pp. 99-110). Boston: Allyn & Bacon.

Marmolejo, G. A. (2014). *Desarrollo de la visualización a través del área de superficies planas. Análisis de libros de texto colombianos y españoles*. (Tese de doutorado em Educação). Salamanca: Universidade de Salamanca.

Matos, J. M., & Serrazina, M. L. (1996). *Didática da Matemática*. Lisboa: Universidade Aberta.

Ministério da Educação – MEC. (2016). *Guia Nacional do Livro Didático*. Retirado em 20 de janeiro, 2023, de: http://www.fnde.gov.br/index.php/programas/programas-do-livro/consultas/editais-programas-livro/item/13526-edital-pnld-2022. /

Ministério da Educação – MEC. (2018). *Base Nacional Curricular Comum (BNCC)*. Retirado em 28 de janeiro, 2023, de: http://basenacionalcomum.mec.gov.br/

Novaes, M. H. (1997). *Psicologia da criatividade*. Rio de Janeiro: Vozes.

Organização das Nações Unidas para a Educação, a Ciência e a Cultura – UNESCO. (2016). *Assessment of transversal competencies in education: Policy and practice in the Asian – Pacific Region*. Paris: UNESCO Bangkok Office.

Organization for Economic Cooperation and Development – OECD. (2009). *Education at a glance: 2009 indicators*. Washington, DC: OECD.

Polya, G. (1978). *A arte de resolver problemas*. Rio de Janeiro: Interciência.

Ribeiro, A. J., & Oliveira, F. A. P. V. S. (2016). Conhecimentos mobilizados por professores ao planejarem aulas sobre equações. *Zetetike*, *23*(2), 311-327. https://doi.org/10.20396/zet.v23i44.8646541.

Sequera Guerra, E. C. (2006). Creatividad em educación matemática. In S. Torre, & V. Violant (Eds.), *Comprender y evaluar la creatividad* (pp. 475-470). Málaga: Aljibe.

Smole, K. S., & Diniz, M. I. (2001). *Ler escrever e resolver problemas: habilidades básicas para aprender matemática*. Porto Alegre: Artmed.

Vincent-Lancrin, S., González-Sancho, C., Bouckaert, M., De Luca, F., Fernández-Barrerra, M., Jacotin, G., Urgel, J., & Vidal, Q. (2019). *Fostering Students' Creativity and Critical Thinking: What It Means in School. Educational Research and Innovation*. Paris: OECD Publishing. https://doi.org/10.1787/62212c37-en.

Windsor, W. (2010). Algebraic Thinking: A Problem Solving Approach. *Shaping the future of mathematics education Proceedings of the 33rd annual conference of the Mathematics Education Research Group of Australia* (pp. 665-672). Fremantle: MERGA.

Xu, W., Stephens, M., & Zhang, Q. (2012). Profiling students' capacities to link Number and Algebra in years 5, 6 and 7 in Nanjing, China. In J. Dindyal, L.P. Cheng, & S. F. Ng (Eds.), Mathematics educations: Expanding horizons. *Proceedings of the 35th*

DOI: 10.20396/zet.v31i00.8672203

annual conference of the Mathematics Education Research Group of Australia (pp. 801-808). Fremantle: MERGA.