PRÁTICAS EDUCATIVAS, MEMÓRIAS E ORALIDADES

Rev.Pemo – Revista do PEMO

History, Literature and Mathematics: creativity in the Study Activity

ARTICLE

Bruno Silva Silvestre[i]
Universidade Estadual do Paraná, Campo Mourão, PR, Brasil
Everton José Goldoni Estevam[ii]
Universidade Estadual do Paraná, Campo Mourão, PR, Brasil

Abstract
The article focuses on mathematical learning processes with the question: what actions developed by eighth-grade students indicate creative processes when they experience the literature and history of mathematics in a teaching organization based on Cultural-Historical Theory? Related to this question, the aim is to analyze study actions that indicate creative processes in the appropriation of geometric concepts. A Didactic Experiment was carried out in an educational institution in the city of Goiânia, GO, Brazil. The data come from summaries of literature crystallized through texts and/or drawings, which represent concepts related to geometry, evidenced through episodes and scenes. It was observed that in the organization of teaching, in the multiple proposals for the involvement and development of actions, characterized by historical reflections and concepts derived from literature, creative processes stood out that showed signs of generalizing thought in the attribution of meaning to geometric production.
Keywords: Study Activity. Creative Processes. Literature and Geometry Teaching.

História, Literatura e Matemática: a criatividade na Atividade de Estudo

Resumo
O artigo apresenta-se com temática nos processos de aprendizagem matemática com a questão: quais ações desenvolvidas por estudantes do oitavo ano sinalizam processos criativos, ao vivenciarem a literatura e a história da matemática em uma organização de ensino, com base na Teoria Histórico-Cultural? Conexa à questão, objetiva-se analisar ações de estudo que indiquem processos criativos na apropriação de conceitos geométricos. Desenvolve-se um Experimento Didático em uma instituição de ensino da cidade de Goiânia, GO, Brasil. Os dados são oriundos de sínteses de literatura cristalizadas por meio de textos e/ou desenhos, que representam conceitos relacionados à geometria, evidenciados por meio de episódios e cenas. Observa-se que os processos criativos se destacam na organização do ensino, nas múltiplas propostas de envolvimento e desenvolvimento de ações, caracterizadas por reflexões históricas e conceitos advindos da literatura. Esses processos demonstram indícios de pensamento generalizante na atribuição de sentido à produção geométrica.
Palavras-chave: Atividade de Estudo. Processos Criativos. Literatura e Ensino de Geometria.

1 Introduction

In advocating for a humanized approach to mathematics education, one that enables those involved in schooling to develop a Pedagogical Activity fostering the genuine appropriation of mathematical concepts, we emphasize the importance of valuing knowledge production within the classroom (Moura, Araújo, Serrão, 2019). This appreciation extends both to the Teaching Activity, developed by the teacher, and to the Study Activity, carried out by the students.

Such knowledge production involves the teacher's deliberate actions in organizing a learning environment where, beyond the mere appropriation of mathematical knowledge, students also experience a process of humanization, grasping mathematical practice as something intertwined with the very history of humankind (Moura, Araújo, Serrão, 2019). In this context, the goal is to enable students to develop their thinking, moving from an empirical mode of production toward abstract thought, which allows for generalization (Elkonin, 2021).

Within this proposed organization, we conceive creative processes as catalysts for students' actions, allowing them to identify different ways of solving a given problem (Gontijo, 2006; Fleith, 2002). From a historical-cultural perspective, creative processes can foster the perception and attribution of meaning to the multiple dimensions of mathematical knowledge, as they converge with the human condition of cultural production. "Indeed, everything that surrounds us and has been conceived by the hand of man, the entire world of culture, unlike the world of nature, is the result of human creativity and imagination" (Vygotsky, 2012, p. 24).

With this understanding, we explore literature as a cultural medium that can bring students closer to possible connections between the history of mathematics and the concepts of geometry, particularly those related to knowledge of angles, proportionality, the circumference's outline, and its relationships with the sphere. To this end, we draw upon the experiment of Eratosthenes, previously examined in other studies (Gomes, Marques, 2023; Azevedo *et al.*, 2022; Santos, Voelzke, Araújo, 2012). However, our

Rev. Pemo, Fortaleza, v. 8, e15562, 2026
DOI: https://doi.org/10.47149/pemo.v8.e15562
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

study does not aim to replicate the experiment; rather, it seeks to situate students historically so that, through creativity, they may express their own understandings resulting from an instructional organization that enables them to access, study, reflect, interpret, analyze, and evaluate the conditions and means under which the experiment was conducted.

Thus, we aim to analyze study actions that reveal creative processes in the appropriation of geometric concepts, seeking to answer the following question: which actions developed by eighth-grade students signal creative processes as they engage with literature and the history of mathematics within an instructional organization based on Historical-Cultural Theory?

We structured the article into four sections. In the first, we discuss the organization of mathematics teaching that integrates literature and creative processes within students' study activities to foster the appropriation of concepts. Next, in the second section, we highlight the feasibility of conducting the research through the Formative Didactic Experiment, which served as the methodological framework for the study carried out in a school in the city of Goiânia. In the third section, we present the data produced by students in their synthesis processes through drawings and texts, and consequently, we discuss our analyses emphasizing indicators of students' creative productions. Finally, in the last section, we offer some reflections on the study activity, literature, and creative processes that permeated the research.

2 Organizing mathematics teaching for study: literature and creative processes

We understand the processes involved in teaching and learning through the Pedagogical Activity, which conceives the school as a privileged space for the appropriation of knowledge, mainly because it provides opportunities for the process of humanization (Moura, Araújo, Serrão, 2019). To humanize is to engage directly with all the situations necessary for individuals to become human, through the appropriation of

Rev. Pemo, Fortaleza, v. 8, e15562, 2026
DOI: https://doi.org/10.47149/pemo.v8.e15562
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

what societies have already produced and developed throughout their history. Therefore, the historical processes that permeate the production of knowledge are to be valued.

In our particular focus, historical production permeates mathematical knowledge in order to meet the needs and demands of specific societies throughout human development. To this end, we advocate a mode of instructional organization that values these historical processes, and we turn to literature as a means to promote teaching oriented toward this goal, thereby creating suitable spaces for learning.

Within this framework, the Study Activity constitutes part of the Pedagogical Activity, as it is actualized through the teacher's teaching actions in ways that enable the apprehension of the "[…] generalized modes of action in the world of scientific concepts" (Elkonin, 2021, p. 162). According to the author, the Study Activity comprises several essential stages: a) the presence of educational-cognitive motives that converge with broader interests related to objects of knowledge; b) study actions, which are a set of procedures developed by students and inherent to the resolution of assigned tasks; c) control, which "[…] consists in monitoring the coherence between the execution and the sequence of each specific action" (Elkonin, 2021, p. 165); and finally, d) evaluation, which identifies whether the student has indeed appropriated the modes of action required to progress to the next level of learning.

The purpose of the Study Activity is to enable "the assimilation of generalized modes of action within the realm of scientific concepts and the qualitative changes in the child's psychic development [that] occur on this basis" (Davydov, Márkova, 2021, p. 199). Organizing teaching on this premise means providing learning environments in which students have greater contact with the object of knowledge, envisioning the historical processes behind its production and developing generalizing actions for solving the proposed tasks. Thus, we contend that literature and creative processes can converge in a dynamic that motivates students to study and can articulate the actions necessary for solving tasks that, in turn, promote mathematical learning intertwined with other areas of knowledge, fostering the process of scientific reasoning (Morais *et al.*, 2023).

Rev. Pemo, Fortaleza, v. 8, e15562, 2026
DOI: https://doi.org/10.47149/pemo.v8.e15562
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

In the field of mathematics education, Alves and Grutzmann (2020), Arnoud (2016), Smole, Cândido and Stancanelli (1999), Souza (2008), and Tramontin (2020) advocate literature as a means of organizing teaching for children, emphasizing the "awakening in the student, in the listener, of the playful, enchanting, mysterious side proposed by different stories, settings, and characters" (Alves, Grutzmann, 2020, p. 204). This principle can organize mathematics teaching not only in early childhood education but at any school level, since the element of playfulness is an important motivational factor for promoting learning (Silvestre, Barbosa, 2022).

From this perspective, literature can be an important ally in the process of mathematical learning, not only because it engages students' interests and stimulates the development of study, but also because it encompasses multiple perspectives through which knowledge is integrated, emphasizing contextualization. We argue that "integrating literature into mathematics classes represents a substantial shift in mathematics teaching, since students do not first learn mathematics to then apply it in the story, but rather explore mathematics and the story simultaneously" (Smole, Cândido, Stancanelli, 1999, p. 12).

Beyond simply motivating study, literature can give meaning to students' actions and engagement with the content itself. "Despite the importance of motivating factors, the pedagogical task consists in creating significant general motives that not only incite action but also give a determined meaning to what is being done" (Leontiev, 2017, p. 50).

The opportunity for students to engage in the Study Activity in ways that allow them to assign meaning to their actions concerning concepts related to geometry supports our view of literature as a medium through which mathematics, its cultural context of production, and the understanding of concepts inherent to literature itself can be interconnected (Hahn, Hollas, Andreis, 2012).

In this scenario, to mobilize students toward developing the Study Activity, we emphasize the necessary relationship between creative processes and motivation for studying mathematics (Gontijo, Silva, Carvalho, 2012). Thus, we concur with Gontijo (2006) that mathematical creativity can represent "[…] the ability to present numerous

Rev. Pemo, Fortaleza, v. 8, e15562, 2026
DOI: https://doi.org/10.47149/pemo.v8.e15562
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

appropriate solutions to a problem situation, such that these solutions focus on distinct aspects of the problem and/or on different ways of solving it, especially unusual ones (originality)" (Gontijo, 2006, p. 4).

Through an organized teaching process, students can engage in reading and interpreting the history of mathematics, expressing their creative manifestations through the development of graphic and textual syntheses. "Everything that surrounds us and has been conceived by the hand of man, the entire world of culture, unlike the world of nature, is the result of human creativity and imagination" (Vygotsky, 2012, p. 24). Therefore, embracing creativity within the process of knowledge acquisition provides the means for all individuals involved to appropriate the human conditions of doing mathematics, that is, to become humanized.

To address creativity in harmony with humanization requires openness to diverse manifestations of thought, including mathematical ones, that permeate creative processes. Regarding these processes, we concur with Fleith (2002, p. 29), who emphasizes that creative individuals "connect, in many and varied ways (for example, in spatial or verbal terms), blocks of information, creating a complex network of associations."

We understand, therefore, that an instructional organization capable of mobilizing individuals within the framework of Historical-Cultural Theory, valuing creativity and humanization, requires granting freedom in the processing of the proposed information.

In this context of fostering students' creative freedom, we organized a Formative Didactic Experiment that includes, in its structure, a Study Activity aimed, among other actions, at encouraging multiple responses after engaging in historical, contextual, and meaningful situations of mathematical knowledge production. In the next section, we will describe this study dynamic made possible through the Didactic Experiment.

3 Fostering creativity: the Formative Didactic Experiment

Rev. Pemo, Fortaleza, v. 8, e15562, 2026
DOI: https://doi.org/10.47149/pemo.v8.e15562
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

Methodologically, we developed the research through the Formative Didactic Experiment (FDE), which is generally structured within "a conception of developmental teaching and, consequently, its logic of organization and structuring of students' study activity" (Freitas, Libâneo, 2022, p. 7).

Following this organizational logic, we conducted the FDE in an educational institution in the city of Goiânia (GO), Brazil, during the first semester of 2024. The research involved approximately one hundred and twenty eighth-grade students[1] from four different classes. In line with the processes of developmental education, our organization focused on promoting students' Study Activity, encompassing four main stages:

Table 1 – Stages of Development of the Formative Didactic Experiment

Problem-posing	**Literary[2] and audiovisual experience[3]**	**Students' productions through syntheses**	**Collective sharing of productions**
Beginning of the study through the presentation of the theme, the book, the videos, and the proposal for creating syntheses.	Collective reading of the book with the students and viewing of videos about Eratosthenes' experiment.	Development of syntheses produced by the students through texts and artistic drawings.	Collective sharing and exhibition of students' productions.

Source: authors' work.

To address the study actions, we sought to create elements capable of establishing motives for the development of the proposed situations, as well as the actions and operations to be carried out, articulating the logical-historical through literature, synthesis, and the sharing of results.

The structure was divided into four moments to provide better didactic exemplification, allowing access to the history of the historical figure Eratosthenes and

1 For the analyses, we considered data that best demonstrated the students' syntheses of thought and creativity. We emphasize that we followed all ethical research procedures in the use of data through documents such as the Informed Consent Form (*TCLE*) of the students and their guardians.
2 Reading of the book *The Librarian Who Measured the Earth* (Lasky, 2001).
3 We used two videos: "Eratosthenes and the Circumference of the Earth" (https://www.youtube.com/watch?v=fu9Z7YuXLVE) and "The Experiment of Eratosthenes and the Shape of the Earth" (https://www.youtube.com/watch?v=JdUrK-zdRzk).

Rev. Pemo, Fortaleza, v. 8, e15562, 2026
DOI: https://doi.org/10.47149/pemo.v8.e15562
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

one of his great achievements, which was measuring the circumference of the Earth through a rudimentary experiment for his time (Lasky, 2001).

Together with the students, we organized a study experience through literature and videos that narrated and explained the history of mathematical knowledge production. This approach aligns with the idea that "[...] developmental learning is the form of organization of this assimilation adopted under the concrete historical conditions of a given society" (Davydov, Márkova, 2021, p. 197). After these experiences with historical study, the students produced a synthesis of what they had learned, using drawings and texts to explain and/or represent the situations.

Through this process, students' synthesis skills and creative thinking were explored through their productions. Subsequently, concluding the experiment, we held a collective sharing of the drawings and synthesis texts about the story of Eratosthenes and the development of mathematical knowledge.

To highlight the results in our analysis, we used the concept of *Unit*, proposed by Vygotsky (1991), considering it as the totality of what is sought to be achieved through research, especially because it incorporates the generality that encompasses all the particular elements that compose it. Thus, we present as a Unit the movement of students' synthesis, which reflects, throughout all detailed study actions, processes imbued with generalization.

From this Unit, we analyzed the students' creative processes, and the data produced are presented through Episodes and Scenes. In the Episodes, we sought to demonstrate the composition of moments in which the students' actions outlined the path followed throughout the didactic experiment. The Scenes, in turn, express particularities of the study actions that "[...] enable us to understand the phenomenon beyond its appearance [...]" (Araújo, Moraes, 2017, p. 68). In this structure, we describe two Episodes, encompassing a total of three Scenes, as detailed in Table 2.

Table 2 – Study episodes that signal students' creative processes

Episodes	Scenes
	Scene 1 – Drawings representing the historical part of

Rev. Pemo, Fortaleza, v. 8, e15562, 2026
DOI: https://doi.org/10.47149/pemo.v8.e15562
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

I – Drawing as representation and synthesis of the literature of mathematical knowledge	the development of mathematics. **Scene 2** – Drawings representing mathematical concepts.
II – The synthesis text as a movement of historical and mathematical study	**Scene 3** – The multiple determinations of explanatory modes of concepts related to geometry.

Source: authors' work.

We emphasize that the analysis was based on the perspective of historical-dialectical materialism, starting from the episodes and their respective scenes, aiming to "take hold of the material in its details, to analyze its different forms of development, and to investigate the intimate connection between them. Only after completing this work can the real movement be adequately described" (Marx, 1971, p. 28). Thus, we observe the objective reality crystallized in the students' actions as they developed the proposed situations through reading, interpretation, synthesis, and the collective sharing of their results, interconnected to describe the study movement that indicates possible creative processes.

The analysis encompasses the interrelation between the stages of the FDE's development, particularly in the students' production of syntheses, theoretically aligned with what we have been advocating. It therefore articulates the development of practical study actions with their corresponding theoretical foundations, aiming to demonstrate the indicators of creative processes fostered by the literary synthesis of mathematical and geometric knowledge production.

4 "Thinking is easy, putting it on paper is the hard part..." The movement of analysis through students' syntheses

In the syntheses produced by the students, the drawings that represented historical situations depicted characters such as Eratosthenes thinking about how he would measure the Earth, representations of the *bematists*[4], and camels used to measure the distance between two cities. The drawings that represented conceptual mathematical

[4] Specialists trained to measure distances with a certain degree of precision, using steps as the standard unit of measurement.

Rev. Pemo, Fortaleza, v. 8, e15562, 2026
DOI: https://doi.org/10.47149/pemo.v8.e15562
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

situations illustrated the Earth divided into fractions, the Earth compared to a grapefruit, and the experiment of Eratosthenes represented through the proportionality between the sun's rays and the inclination of the angle used to measure the circular sector formed.

The presentation of the data unfolds in two moments. The first refers to Episode I, which includes the movement of students' synthesis of thought when faced with the situations experienced through the FDE, materialized through drawings. The second moment, Episode II, describes some synthesis texts that also represent students' thought processes as they discussed the main situations they considered relevant.

Episode I – Drawing as representation and synthesis of the literature of mathematical knowledge

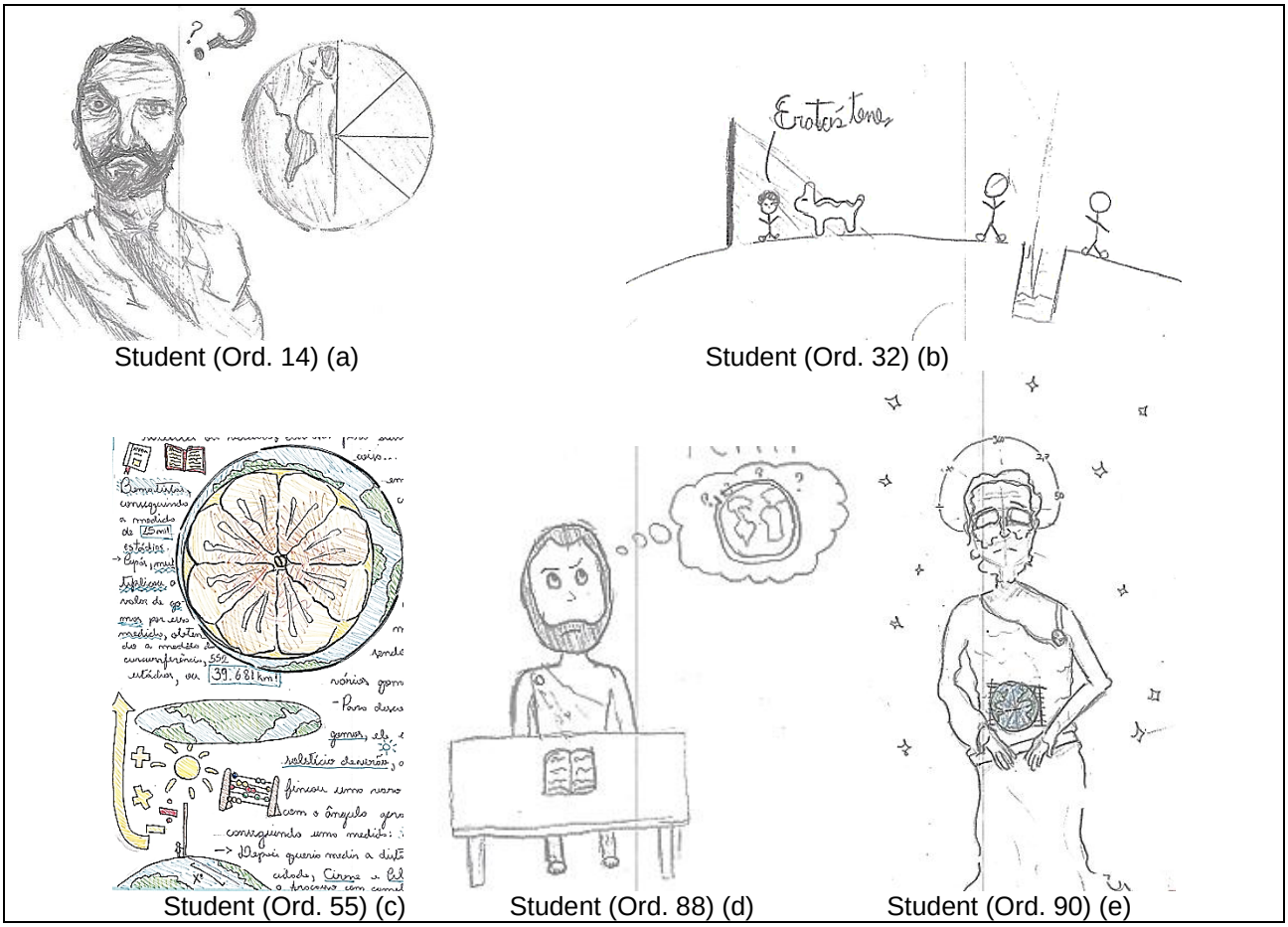
Described through two scenes, this episode highlights drawings that represent the historical processes of the development of mathematics and the evidence of concepts related to this same history, particularly the procedures necessary to measure the circumference of the Earth. We understand the drawings as spontaneous and creative expressions of the students, crystallized in their processes of synthesis. "Drawing [...] becomes a creativity associated with skill, with certain creative capacities and mastery in the use of materials" (Vygotsky, 2012, p. 135).

Thus, in the following Scenes, we give credit to the students' creative processes as they express the possible transformations of objective reality into subjective reality. Their potential and artistic abilities, revealed through their drawings, are noteworthy.

Table 3 – Scene 1 – Drawings representing the historical part of the development of mathematics

Context/Setting: excerpt from some of the data produced by the students while they were developing the literary synthesis production through drawings.

DOI: https://doi.org/10.47149/pemo.v8.e15562
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X



Source: authors' data collection.

The Scene presents five drawings in which the students express, through their synthesis processes, representations of their personal impressions, freely stimulating their creative processes. "In the development of artistic creativity [...], including the visual arts, the principle of freedom must be observed as an essential condition for all creation" (Vygotsky, 2012, p. 136).

In (a), Eratosthenes is shown deep in thought, considering how he might achieve his goal, represented by the question of how to measure the Earth. Beside him, there is a depiction of the planet Earth, half of which relates to the idea of slicing the Earth into "segments" of a grapefruit, symbolizing the division into equal parts based on angles. In

DOI: https://doi.org/10.47149/pemo.v8.e15562
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

representation (b), there is a model of the experiment carried out in two cities, Syene[5] and Alexandria, showing a well in one of them where it would be possible to measure precisely the angle formed, in order to calculate the portion that the two cities represent in terms of the circular sector. Camels are shown to indicate the measurement of the distance between the two cities, as well as people, possibly referring to the *bematists*, known for the accuracy of their measurements.

In drawing (c), the Earth appears sectioned, again showing the possible relationship with the grapefruit's segments. Accompanying the representations of mathematical symbols – operation signs and an abacus – below, there is an individual next to a stake, symbolizing Eratosthenes observing the sun at its zenith in one of the cities. In (d), Eratosthenes is represented as a student reading a book and thinking about how he would develop the procedures to measure the Earth's circumference. Finally, in (e), Eratosthenes is represented as a divine being, someone significant for humanity, depicted with a halo above his head and stars surrounding his body. These creative manifestations reflected the students' capacity for systematization after engaging with literature that incorporated historical and mathematical elements (Hahn, Hollas, Andreis, 2012).

Regarding the meanings of the historical conditions portrayed in Lasky's (2001) work, the students demonstrated, from a perspective of freedom of expression, their interpretations of how Eratosthenes might have carried out the measurement of the Earth's circumference. The historical figure clearly occupies a central place in the syntheses created by the students, as they internalized the historical understanding of Eratosthenes's accomplishment, which inspired creativity in their modes of production, expressed through different perspectives in their syntheses (Gontijo, 2006; Fleith, 2002).

Thus, beyond demonstrating their understanding of the historical figure and, consequently, his role in the development of knowledge, the students' drawings reveal their comprehension of how the experiment was conducted. From the beginning, there is

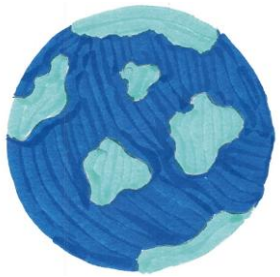
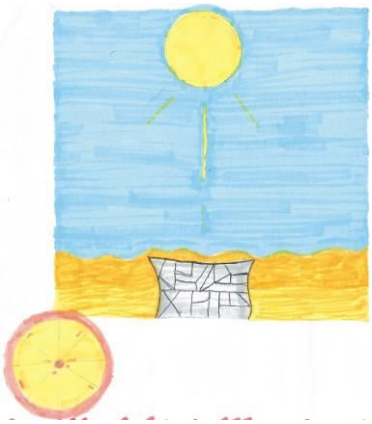
[5] Your current location is Aswan, in Egypt.

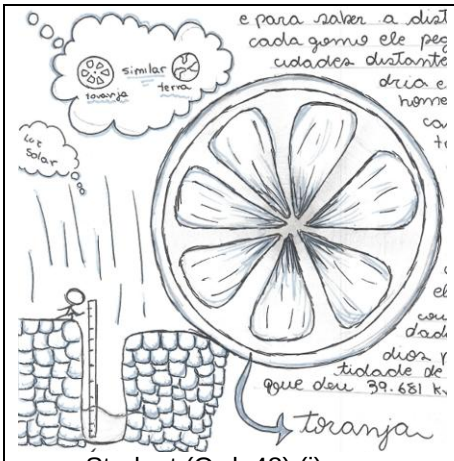
Rev. Pemo, Fortaleza, v. 8, e15562, 2026
DOI: https://doi.org/10.47149/pemo.v8.e15562
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

a clear comparison of the Earth to a “sphere,” allowing its circumference to be measured by analogy to the shape of a grapefruit. This comparison is highlighted for its historical value in representing the hypothetical principles of how the feat could have been achieved, emphasizing the possible relationships between literature and mathematics (Smole, Cândido, Stancanelli, 1999).

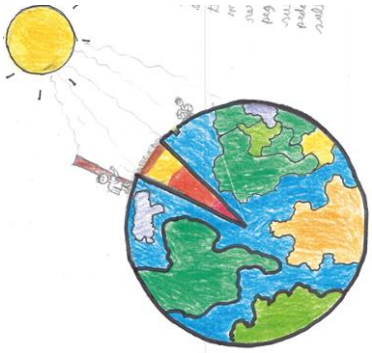
These analytical considerations are based on the understanding that “the [subjects’] relationship with their environment, which, through its complexity or simplicity and its traditions and influences, stimulates and guides the process of creativity” (Vygotsky, 2012, p. 58). Thus, following the study, dialogues, and perceptions enabled by the FDE, the students were able to express their syntheses creatively through drawings representing the situations they experienced in the school setting. Building on the ideas presented in this episode, in the next Scene we highlight a mathematical perspective on how the experiment developed by Eratosthenes took place.

Table 4 – Scene 2 – Drawings Representing Mathematical Concepts

Context/Setting: excerpt from some of the data produced by the students while they were developing the literary synthesis through drawings.			
			
Student (Ord. 08) (f)	Student (Ord. 11) (g)	Student (Ord. 13) (h)	Student (Ord. 13) (i)



Student (Ord. 48) (j)



Student (Ord. 87) (k)

Student (Ord. 67) (l)

Source: authors' data collection.

In this second Scene, we highlight, through seven selected drawings, the main and generalizing mathematical concept that enabled the Earth to be measured in terms of its circumference by Eratosthenes.

The concept of generalization, in this teaching context, refers to its function as a study task carried out by the students. The synthesis presented by them demonstrates the general process of understanding and appropriation of the knowledge studied, which materialized through the drawings (Davydov, Márkova, 2021; Elkonin, 2021). In drawing (f), we highlight the students' procedural representations showing the shape of the Earth, approximating the spherical form we know today. This relationship is further developed in the subsequent drawings (g) and (h), which connect the Earth to the shape of a grapefruit. The mathematical understanding of Eratosthenes' experiment emerges from this comparison, consolidating through the analogy between the grapefruit and the Earth, culminating in the depiction of a circular sector defined by a circumference.

Among the other drawings, (i) and (j) stand out for their creativity, as students represented the "well" as a central element to illustrate the precise moment of the "sun at its zenith." This representation gives personal meaning, grounded in mathematical reasoning, to the idea that while at one point on the planet the sun's rays cast no shadow, at another nearby point, at the same moment, a stake projected a shadow.

These representations reveal the students' mathematical and geometric understanding of the proportionality generated by the sun's rays at the same instant. They enable the comprehension of the circular sector depicted in the final drawings of the Scene, (k) and (l), which emphasize the measurement of the angle illustrated by the "segment," symbolically associated with the grapefruit. This process reflects how the literary production inspired reflections that indicate students' appropriation of knowledge (Alves, Grutzmann, 2020).

Thus, the creative manifestations expressed exemplify the mental relationships established by the students after experiencing reading, interpretation, viewing of explanatory videos, and sharing ideas related to the mathematical knowledge presented in Lasky's (2001) literary work. These manifestations highlight the various ways of representing the planet, integrating mathematical concepts with the history of mathematics and the broader history of human development. Moreover, they emphasize the mathematical conditions that made it possible to measure the Earth's circumference, reinforcing the connection between representations of the planet and the mathematical foundations that accompany the evolution of human thought.

In summary, within this episode and the composition of the Scenes, we highlight the students' perspectives as they engaged in reading and interpreting Lasky's (2001) text. The personal meanings attributed to this experience are revealed through the exploration of the story, filled with historical, mathematical, and conceptual significance, as well as connections to the development of knowledge (Fonseca, Cardoso, 2005).

It is worth noting that, through contact with literature, audiovisual resources such as instructional videos, and the interventions carried out by the researchers, the students who first encountered the proposed knowledge thereby formed "the first points of support for their future creativity" (Vygotsky, 2012, p. 47). Continuing the composition of our Unit of analysis, the second Episode will present the movement of students' creative synthesis as they use writing to represent their experiences and reflections during the development of the FDE.

Rev. Pemo, Fortaleza, v. 8, e15562, 2026
DOI: https://doi.org/10.47149/pemo.v8.e15562
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

Episode II – The Synthesis Text as a Movement of Historical and Mathematical Study

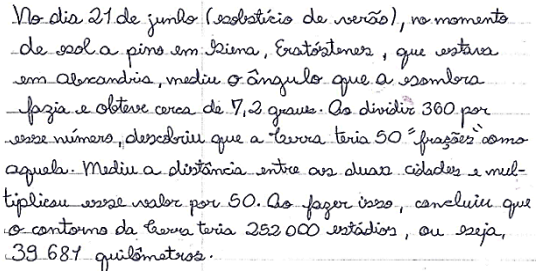
In this second Episode, we highlight the students' written productions as a way of organizing their ideas and models of thought, representing their school experiences. The analysis is conducted from the perspective of literary creativity, since, by experiencing the process, students engage in "special tasks, or themes, or are presented with a series of musical or artistic stimuli taken from reality, etc., with the aim of inducing literary creativity in children" (Vygotsky, 2012, p. 109).

Beyond serving as a motivational factor for study, it is important to note that:

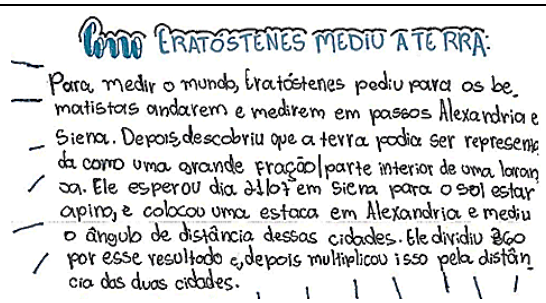
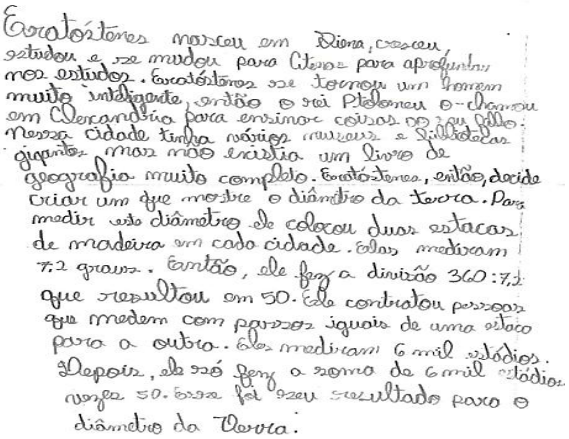
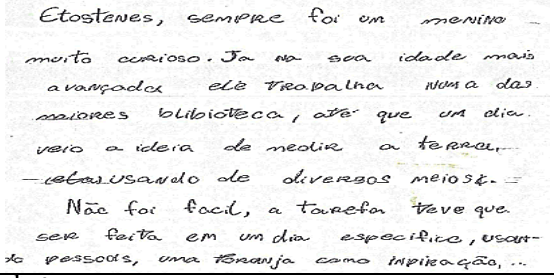
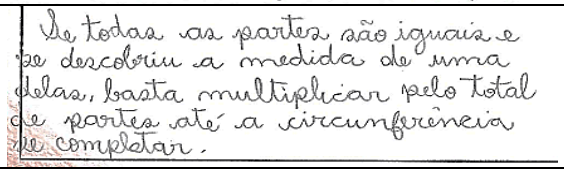
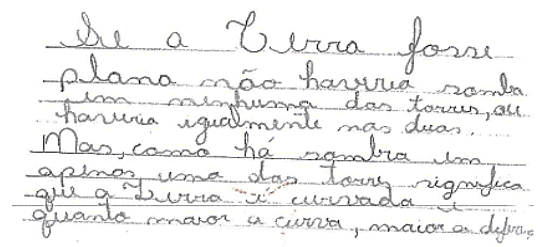
> The development of literary creativity [...] becomes immediately easier and more successful when [the child] is encouraged to write about a theme that is internally comprehensible, that moves them emotionally, and, most importantly, that awakens in them the desire to express their inner world through words. Often, a child writes poorly because there is nothing they truly want to write about (Vygotsky, 2012, p. 80).

Thus, literature used within the FDE takes on a meaning that goes beyond simply motivating students. It plays the role of awakening the relationships established throughout human history, connecting them with students' inner worlds. In this way, it enables them to write about their experiences, combining elements of personal experience with historical and mathematical knowledge.

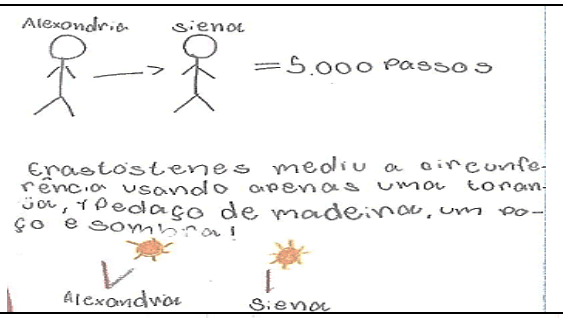
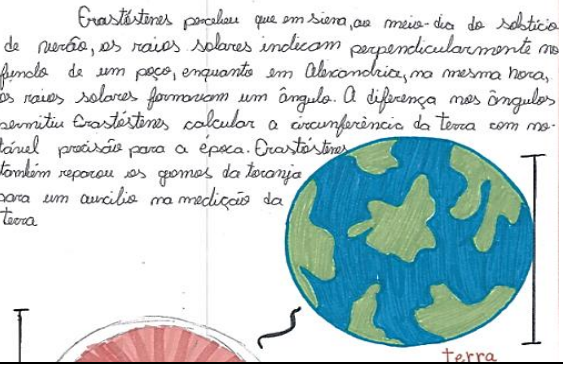
Table 5 – Scene 3 – The Multiple Determinations of the Explanatory Modes of Concepts Related to Geometry

Context/Setting: excerpt from some of the data produced by the students while developing the literary synthesis through writing.	
 No dia 21 de junho (solstício de verão), no momento de sol a pino em Síena, Eratóstenes, que estava em Alexandria, mediu o ângulo que a sombra fazia e obteve cerca de 7,2 graus. Ao dividir 360 por esse número, descobriu que a Terra teria 50 "frações" como aquela. Mediu a distância entre as duas cidades e multiplicou esse valor por 50. Ao fazer isso, concluiu que o contorno da Terra teria 252 000 estádios, ou seja, 39 681 quilômetros.	*On June 21 (summer solstice), at noon in Syene, Eratosthenes, who was in Alexandria, measured the angle of the shadow and found about 7.2 degrees. By dividing 360 by this number, he discovered that the Earth would have 50 "fractions" like that one. He measured the distance between the two cities and multiplied that value by 50. By doing so, he concluded that the circumference of the Earth would be 252,000 stadia, that is, 39,681 kilometers* (Estudante [Ord. 10])

Rev. Pemo, Fortaleza, v. 8, e15562, 2026
DOI: https://doi.org/10.47149/pemo.v8.e15562
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

	*To measure the world, Eratosthenes asked the bematists to walk and measure, in steps, the distance between Alexandria and Syene. Then he discovered that the Earth could be represented as a large fraction or inner part of an orange. He waited for the day of 06/21 in Syene for the sun to be at its zenith, placed a stick in Alexandria, and measured the angular distance between the two cities. He divided 360 by that result and then multiplied it by the distance between the cities* (Student [Ord. 21])
	*ratosthenes was born in Cyrene, grew up, studied, and moved to Athens to further his studies. He became a very intelligent man, so King Ptolemy invited him to Alexandria to teach his son. In that city there were many great museums and libraries, but there was no very complete geography book. Eratosthenes then decided to create one that showed the Earth's diameter [circumference]. To measure this diameter [circumference], he placed two wooden stakes in each city. They measured 7.2 degrees. Then he performed the division 360 ÷ 7.2, which resulted in 50. He hired people to measure with equal steps from one city to another. They measured 6,000 stadia. Then he simply multiplied 6,000 by 50. That was his result for the Earth's diameter [circumference]* (Student [Ord. 24])
	*Eratosthenes was always a very curious boy. In his later years, he worked in one of the largest libraries until one day he came up with the idea of measuring the Earth, using various methods. It was not easy; the task had to be done on a specific day, using people and a grapefruit as inspiration* (Student [Ord. 26])
	*[...]If all the parts are equal and the measure of one of them is known, it is enough to multiply it by the total number of parts until the circumference is completed* (Student [Ord. 63])
	*If the Earth were flat, there would be no shadow on either of the towers, or there would be the same on both. But since there is a shadow on only one of the towers, it means that the Earth is "curved," and the greater the curve, the greater the difference* (Student [Ord. 69])

Rev. Pemo, Fortaleza, v. 8, e15562, 2026
DOI: https://doi.org/10.47149/pemo.v8.e15562
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

	*Eratosthenes measured the circumference using only a grapefruit, a piece of wood, a well, and a shadow [...]* (Student [Ord. 76])
	*Eratosthenes noticed that in Syene, at noon on the summer solstice, the sun's rays reached perpendicularly to the bottom of a well, while in Alexandria, at the same hour, the sun's rays formed an angle. The difference in the angles allowed Eratosthenes to calculate the Earth's circumference with remarkable accuracy for the time. Eratosthenes also observed the grapefruit segments as an aid to measuring the Earth* (Student [Ord. 91])

Source: authors' data collection.

In this Scene, we selected eight students and, consequently, their descriptive syntheses in written form, in order to demonstrate the analysis of the evidence present in their models of literary creativity. Within this literary creativity, we highlight the representation of the character Eratosthenes and his production of mathematical knowledge, as well as the logical explanations conveyed through mental actions filled with meaning attributed to the significance of his achievement. These explanations describe how the character performed the measurement of the circular sector, which represented one of fifty parts of the Earth's totality, enabling the calculation of the planet's circumference.

The writing models vary, yet all share the same attribution of meaning as the students, in their own words, explain their personal interpretation of how they understood the mathematical experiment carried out by Eratosthenes, including the mathematical concepts involved.

Thus, literary creativity reflects the students' experiences, assigning meaning to Eratosthenes's experience, which, in turn, is shaped by the students' subjectivities and by

DOI: https://doi.org/10.47149/pemo.v8.e15562
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

the objectivity of what was accomplished. As emphasized by Vygotsky (2012), personal experiences, the ability to analyze relationships, and the creation of words that embody the reality of life stand out.

The students' literary creativity, in their synthesis processes, reveals their considerations regarding the explanations they deemed necessary. These explanations complement and fully connect to the drawings presented in the previous Scenes, justifying the total composition of the Scenes and conceiving them as a *Unit* that aims to signify the experiment studied.

When considering the writing-synthesis moment, we adopted the criterion of literary freedom, without imposing specific content to be written, but rather providing a space for students to synthesize their study moments through representative drawings of the situations experienced in the school setting. "The child writes best about what most interests them, especially when they have understood the subject. It is necessary to teach the child to write about what strongly interests them and about what they have thought deeply and know well" (Vygotsky, 2012, p. 80).

Throughout the Episodes and Scenes, we sought to demonstrate the manifestation of students' creativity, which, in turn, converges with the intentional organization of the FDE and with the conditions that enabled them to express their study actions. Experiencing such situations may offer "new ways of viewing and experiencing methodological resources for the teaching-learning processes of mathematics" (Oliveira, Silva, Tomé, 2022, p. 12). In this regard, mathematical activity contextualized through literature stands out as an educational resource.

We believe that "just as individuals express their life, so they are. What they are, therefore, coincides with their production, both with what they produce and with the way in which they produce it" (Marx, Engels, 1986, p. 27–28).

The students' actions, within the study conditions, revealed four fundamental elements – history, literature, creativity, and interpretation – that awakened their mental activity. These elements enabled generalizing thought by highlighting what was most relevant and assimilated by them throughout the learning process.

Rev. Pemo, Fortaleza, v. 8, e15562, 2026
DOI: https://doi.org/10.47149/pemo.v8.e15562
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

The organization of teaching, grounded in the Study Activity and developed through access to literature – which addressed the history of mathematics and, consequently, the production of mathematical knowledge – fostered creative skills among students, allowing them to interpret and assign personal meaning to the significance of mathematics. It is important to emphasize that, without proper reflection, "subjective activity does not lead to creativity or to the creation of objects necessary to humanity, but rather to production without practical results" (Kopnin, 1978, p. 126).

Thus, the processes (operations) that unfolded from the systematic organization of the Formative Didactic Experiment – through multiple forms associated with the components of study, the engagement with videos and literature, the open proposal for recording their syntheses, the encouragement of multiple representations, and the freedom of expression across different languages – contributed to reflection and consequently fostered creativity as one of the key actions within the Study Activity. This signals the realization of creative processes that revealed the diverse mathematical and geometric appropriations achieved by the students. In this way, the mental actions developed throughout the FDE enabled generalizing thought, culminating in the synthesis of situations through the explanatory drawings and synthesis texts they produced.

5 Some considerations

We emphasize that the actions developed by the eighth-grade students, which indicate creative processes as they engaged with literature and the history of mathematics within a teaching organization based on Historical-Cultural Theory through the Study Activity, are manifestations of information processing. These processes involve generalizing thought and can be evidenced through artistic expressions such as drawings and synthesis texts that reflect the contexts explored.

It is important to highlight that such study actions were only possible through a teaching organization that, intentionally, enabled students' freedom of production in their synthesis processes. These processes revealed the meanings attributed to the geometric

Rev. Pemo, Fortaleza, v. 8, e15562, 2026
DOI: https://doi.org/10.47149/pemo.v8.e15562
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

concepts explored through multiple classroom experiences and interactions. Thus, our analyses allow us to conclude that the study actions indicating creative processes in the appropriation of geometric concepts occurred after the students engaged in experiences involving literature, interpretation, analysis, and reflection. These processes were made possible by the multiple determinations of these elements, which crystallized in the students' syntheses about history, characters, and the production of mathematical knowledge. Such actions indicate the generalization of the moments experienced in the study activity, demonstrating the students' creativity in their thinking processes and in their ability to articulate and synthesize ideas through texts and drawings.

Therefore, we emphasize that providing teaching situations articulated with scientific knowledge (including geometric knowledge) and literature, when guided by a pedagogical foundation that values the principle of freedom and the multiplicity of possible solutions, can promote the development of generalizing thought, which is of great significance for historical-cultural studies.

Acknowledgment

To the *Coordination for the Improvement of Higher Education Personnel (CAPES)*, for the Postdoctoral Fellowship granted to the first author, supervised by the second (PDPG-POSDOC-88887.923475/2023-00).

References

ALVES, A. M. M.; GRUTZMANN, T. P. Literatura infantil no ensino de matemática: relações presentes na formação inicial do futuro docente**. Caderno de Letra**s, Pelotas, n. 38, 2020. DOI.: https://doi.org/10.15210/cdl.v0i38.19678.

ARAÚJO, E. S.; MORAES, S. P. G. Dos princípios da pesquisa em educação como atividade. In: MOURA, M. O. (Org.). **Educação escolar e a pesquisa na teoria histórico-cultural.** São Paulo: Edições Loyola, 2017. p. 47-70.

ARNOUD, D. S. **Matemáticas presentes em livros de leitura:** possibilidades para a educação infantil. 182 f. Dissertação (Mestrado Profissional em Ensino de Matemática) – Instituto de Matemática, Universidade Federal do Rio Grande do Sul, Porto Alegre, 2016.

AZEVEDO, L. O. A.; RIBEIRO, O. S.; COSTA, N. C.; SINNECKER, E. H. C. P.; GANDELMAN, M. Revisitando o experimento de Eratóstenes: medida do raio da Terra. **Revista Brasileira de Ensino de Física**, v. 44, e20210354, 2022. DOI.: https://doi.org/10.1590/1806-9126-RBEF-2021-035.

DAVYDOV, V. V.; MÁRKOVA, A. A concepção de atividade de estudo dos alunos**.** In: PUENTES, R.; CARDOSO, C. G. C.; AMORIM, P. A. P. (Orgs.). **Teoria da atividade de estudo:** contribuições de D. B. Elkonin, V. V. Davydov e V. V. Repkin*.* 3. ed. Curitiba: CRV; Uberlândia: EDUFU, 2021. p. 189-211.

ELKONIN, D. B. Atividade de estudo: sua estrutura e formação. In: PUENTES, R. V.; CARDOSO, C. G. C.; AMORIM, P. A. P. (Orgs.). **Teoria da atividade de estudo:** contribuições de D. B. Elkonin, V. V. Davydov e V. V. Repki*n.* Curitiba: CRV; Uberlândia: EDUFU, 2021.

FLEITH, D. S. Ambientes educacionais que promovem a criatividade e a excelência. **Sobredotação**, Braga (Portugal), v. 3, n. 1, p. 27-37, 2002.

FONSECA, M. C. F.; CARDOSO, C. A. Educação Matemática e letramento: textos para ensinar Matemática, Matemática para ler o texto**.** In: NACARATO, A. M.; LOPES, C. E. (Orgs.). **Escritas e leituras na Educação Matemática***.* Belo Horizonte: Autêntica, 2005. p. 63-76.

FREITAS, R. A. M.; LIBÂNEO, J. C. O experimento didático formativo na perspectiva da teoria do ensino desenvolvimental. **Educação e Pesquisa**, v. 48, e246996, 2022. DOI.: https://doi.org/10.1590/S1678-4634202248246996.

GOMES, T. M.; MARQUES, I. A. Reinventando o método de Eratóstenes. **Revista Brasileira de Ensino de Física**, v. 45, e20220307, 2023. DOI.: https://doi.org/10.1590/1806-9126-RBEF-2022-030.

GONTIJO, C. H. Resolução e formulação de problemas: caminhos para o desenvolvimento da criatividade em Matemática. In: SIPEMAT – **Simpósio Internacional de Pesquisa em Educação Matemática.** Recife: Universidade Federal de Pernambuco, 2006.

GONTIJO, C. H.; SILVA, E. B.; CARVALHO, R. P. F. A criatividade e as situações didáticas no ensino e aprendizagem da matemática**. Linhas Críticas**, v. 18, n. 35, p. 29–46, 2012. DOI.: https://doi.org/10.26512/lc.v18i35.3839.

Rev. Pemo, Fortaleza, v. 8, e15562, 2026
DOI: https://doi.org/10.47149/pemo.v8.e15562
https://revistas.uece.br/index.php/revpemo
ISSN: 2675-519X

HANH, C. T.; HOLLAS, J.; ANDREIS, R. F. Matemática e literatura: novas concepções pedagógicas na construção significativa de conhecimentos matemáticos. **Revemat:** Revista Eletrônica de Educação Matemática, Florianópolis, v. 7, n. 1, p. 18-31, 2012.

KOPNIN, P. V. **A dialética como lógica e teoria do conhecimento.** Trad. Paulo Bezerra. Rio de Janeiro: Civilização Brasileira, 1978.

LASKY, K. **O bibliotecário que mediu a Terra.** São Paulo: Moderna, 2001.

LEONTIEV, A. N. As necessidades e os motivos da atividade**.** *In*: LONGAREZI, A. M.; PUENTES, R. V. (Orgs.). **Ensino desenvolvimental:** antologia. Livro I. Trad. Ademir Damazio et al. Uberlândia: EDUFU, 2017. p. 39-57. DOI.: https://doi.org/10.14393/edufu-978-85-7078-433-9.

MARX, K. **O capital.** Livro 1. Rio de Janeiro: Civilização Brasileira, 1971.

MARX, K.; ENGELS, F. **A ideologia alemã:** Feuerbach. 2. ed. São Paulo: Hucitec, 1986.

MORAIS, S. L. de; SILVA, D. D.; MORAIS, M. B. de; RODRIGUES, R. C. Matemática e astronomia: uma proposta interdisciplinar voltada para a alfabetização científica. Práticas Educativas, Memórias e Oralidades – **Rev. Pemo,** v. 5, p. e510422, 2023. DOI.: https://doi.org/10.47149/pemo.v5.e510422.

MOURA, M. O.; ARAÚJO, E. S.; SERRÃO, M. I. B. Atividade orientadora de ensino: fundamentos. **Linhas Críticas**, v. 24, p. e19817, 2019. DOI.: https://doi.org/10.26512/lc.v24i0.19817.

OLIVEIRA, S. A.; SILVA, J. M. B.; TOMÉ, N. M. de A. Caixa matemática problematizadora como recurso didático-pedagógico-brincante**.** Práticas Educativas, Memórias e Oralidades – **Rev. Pemo,** v. 4, p. e49162, 2022. DOI.: https://doi.org/10.47149/pemo.v4.e49162.

SMOLE, K. C.; CANDIDO, P. T.; STANCANELLI, R. **Matemática e literatura infantil.** 2. ed. Belo Horizonte: Lê, 1999.

SANTOS, A. J.; VOELZKE, M. R.; ARAÚJO, M. S. T. O projeto Eratóstenes: a reprodução de um experimento histórico como recurso para a inserção de conceitos da astronomia no ensino médio. **Caderno Brasileiro de Ensino de Física**, v. 29, n. 3, p. 1137–1174, 2012. DOI.: https://doi.org/10.5007/2175-7941.2012v29n3p1137.

SILVESTRE, B. S.; BARBOSA, I. G. **Formação docente e as relações dialéticas da brincadeira e do jogo nas teorias de Elkonin, Vigotski, Luria, Leontiev e Wallon.**

Educação & Formação, v. 7, p. e7339, 2022. DOI.: https://doi.org/10.25053/redufor.v7.e7339.

SOUZA, A. P. G. **Histórias infantis e matemática:** a mobilização de recursos, a apropriação de conhecimentos e a receptividade de alunos de 4ª série do ensino fundamental. 207 f. Dissertação (Mestrado em Educação) – Centro de Educação e Ciências Humanas, Universidade Federal de São Carlos, São Carlos, 2008.

TRAMONTIN, L. E. **A literatura infantil como estratégia de aprendizagem no ensino de matemática**: 2º ano do ensino fundamental I**.** 75 f. Dissertação (Mestrado em Ensino de Ciência e Tecnologia) – Universidade Tecnológica Federal do Paraná, Ponta Grossa, 2020.

VIGOTSKI, S. L. **Pensamento e linguagem.** São Paulo: Martins Fontes, 1991.

VYGOTSKY, L. S. **Imaginação e criatividade na infância.** Tradução do russo, introdução e notas de João Pedro Fróis. Lisboa: Dinalivro, 2012.

[i] **Bruno Silva Silvestre,** ORCID: https://orcid.org/0000-0003-3530-3522
Universidade Estadual do Paraná, Campo Mourão
Doutor em Educação em Ciências e Matemática. Professor da SME Goiânia e Estagiário de Pós-Doutorado na Universidade Estadual do Paraná. Campo Mourão, PR - Brasil
Authorship contribution: general development of writing, methodological research and development, analysis, and final elaboration.
Lattes: http://lattes.cnpq.br/1973974591721665
E-mail: brunosilvestre.prof@gmail.com

[ii] **Everton José Goldoni Estevam,** ORCID: https://orcid.org/0000-0001-6433-5289
Universidade Estadual do Paraná, Campo Mourão
Doutor em Ensino de Ciências e Educação Matemática. Professor Associado da Universidade Estadual do Paraná e do Programa de Pós-Graduação em Educação Matemática. Campo Mourão, PR - Brasil.
Authorship contribution: general guidance, collaboration in analysis and content review, with proposals for theoretical deepening and expansion of the manuscript.
Lattes: http://lattes.cnpq.br/7355643831417416
E-mail: evertonjgestevam@gmail.com

Responsible publisher: Genifer Andrade

***Ad hoc* experts:** Ademir Donizeti Caldeira e Raimundo Santos de Castro.

How to cite this article (ABNT):
SILVESTRE, Bruno Silva.; ESTEVAM, Everton José Goldoni. History, Literature and Mathematics: creativity in the Study Activity. **Rev. Pemo**, Fortaleza, v. 8, e15562, 2026. Available in: https://revistas.uece.br/index.php/revpemo/article/view/15562

Received on May 15, 2025.
Accepted on August 11, 2025.
Published in January 1, 2026.