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Mathematical literacy from the perspective of inquiry teaching: building maps in a Science Club

ARTICLE

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Abstract
Mathematics teaching is challenging and often disconnected from students' reality. This harms the creative process and the stimulation of knowledge construction. We aim to understand how activities based on inquiry teaching promote mathematical literacy for 6th grade children, based on an Investigative Teaching Sequence (ITS) through the research problem: “with the available materials, how to build a map?”. The research has a qualitative, exploratory nature, involving club members whose graphic, drawing and writing records were discussed through content analysis based on emerging categories. The study revealed that inquiry-based teaching can positively influence Mathematics learning, highlighting the importance of this approach in the Science Club.
Keywords: Teaching Mathematics. Mathematics Literacy. Construction of Maps. Science Club.

Letramento matemático na perspectiva do ensino por investigação: construindo mapas em um Clube de Ciências

Resumo
O ensino de Matemática é desafiador e frequentemente desconectado da realidade dos estudantes. Isso prejudica o processo criativo e o estímulo à construção do conhecimento. Por isso, objetivamos compreender como as atividades baseadas no ensino por investigação promovem o letramento matemático para crianças do 6° ano, a partir de uma Sequência de Ensino Investigativa (SEI) por meio do problema de investigação: “com os materiais disponíveis, como construir um mapa?”. A pesquisa possui natureza qualitativa do tipo exploratória e envolveu clubistas[1] cujos registros gráficos, em desenho e escrita, foram discutidos por meio de análise de conteúdo a

[1] Como são chamadas as crianças matriculadas no Clube de Ciências.

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partir de categorias emergentes. O estudo revelou que o ensino por investigação pode influenciar positivamente o aprendizado de Matemática, destacando a importância dessa abordagem no Clube de Ciências.
Palavras-chave: Ensino de Matemática. Letramento Matemático. Ensino por Investigação. Construção de Mapas.

1 Introduction

When people talk about teaching mathematics, they refer to traditional mathematics teaching, which has been carried out in schools since the 18th century (Ribeiro, 2021). In contrast to this, Oliveira (2019) reports on the dichotomy between the classic approach, characterized mainly by lectures, and emerging innovative methods, which include methodologies that promote the role of students in the construction of their knowledge.

In this context, we highlight inquiry teaching, which, according to Carvalho (2013), is an educational strategy that puts research at the center of the learning process, thus making classes more motivating for students.

The learning process in this field goes beyond the mere understanding of previously established concepts, and mainly involves the ability to conduct analytical investigations appropriate to the corresponding level of education. Only through this investigative approach is it possible to achieve a true understanding of the field and its applicability to understanding and influencing the world around us (Braumann *et al.*, 2002).

In the Base Nacional Comum Curricular (BNCC), mathematical literacy is an objective to be achieved throughout basic education, while mathematical alphabetization is the essential starting point for students to subsequently develop mathematical literacy. In short, mathematical alphabetization is the foundation on which mathematical literacy is built (Brasil, 2018).

Micotti (1999) highlights the need for analytical ability, abstraction and flexible thinking in math teaching, as well as the application of concepts in different contexts. Mathematical literacy goes beyond basic operations and problem solving, integrating

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theory and practice in a way that is relevant to students' daily lives.

In view of the above, inquiry-based teaching has emerged as an important methodological approach for improving science teaching, including math teaching. This is due to the fact that, as noted by Carvalho (2018), teaching assessment involves more than just checking mastery of concepts; it also involves students' ability to express their ideas orally, argue based on logical reasoning, understand texts related to the content and communicate their solutions through writing.

The aim of this study was to understand how activities based on inquiry teaching promote mathematical literacy for 6th graders, using an Investigative Teaching Sequence (ITS). The research explored how investigative practices, including graphic records through drawings and writing, can contribute to this development.

Mathematical literacy: concept, importance and teaching approaches

Initially, literacy was discussed in the context of alphabetization, with a proposal to teach mathematics that was practical to everyday life, which became known as mathematical alphabetization, numeracy or “numeracia”, as indicated by the Parâmetro Curricular Nacional (PCN), which aimed to overcome and improve illiteracy rates. In this context, mathematically illiterate people are considered to be those who do not have the ability to understand and use basic mathematical concepts in their daily lives (Brasil, 1998).

We can say that children are mathematically literate when they are able to read, understand and interpret the signs and symbols of mathematical language “[...] and their attentive awareness turns to unveiling the meanings that are implicit” (Danyluk, 1988, p. 52).

With the implementation of the Base Nacional Comum Curricular (BNCC) and its organizational structure, which directs the planning of teacher training and updating of curricula and starts to differentiate alphabetization from literacy, it is oriented that: in the first two years of elementary school, pedagogical action should

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focus on alphabetization, in order to guarantee ample opportunities for students to appropriate the alphabetic writing system in a way that is articulated with the development of other reading and writing skills and their involvement in diversified literacy practices (Brasil, 2018).

According to the BNCC (2018, p. 265), "[...] Mathematics creates abstract systems, which organize and interrelate phenomena of space, movement, shapes and numbers, associated or not with phenomena of the physical world", in other words, mathematical literacy is defined as the skills and abilities to reason, represent, communicate and argue mathematically, in order to favor the establishment of conjectures, the formulation and resolution of problems in a variety of contexts.

In this sense, mathematical literacy allows students to recognize that mathematics is fundamental to understanding and interacting with the world, since it is present in social, cultural, ethical, political and economic issues, among others, highlighting its importance in everyday life. Therefore, its teaching should offer activities that provide critical and dynamic reflections beyond the school environment (Morais, 2019).

According to Arruda, Ferreira and Lacerda (2020), the conceptions presented on mathematical literacy result in learning being assigned to different contexts, according to the objective to be achieved. Mathematical literacy involves communication and encourages the individual to understand the role that mathematics plays in the world, as well as to use this knowledge in a way that satisfies their everyday needs.

To this end, mathematical literacy ensures that students recognize that mathematical knowledge is fundamental to understanding and acting in the world. The development of logical and critical thinking stimulates investigation and can be enjoyable through mathematical processes such as problem solving, investigation, project development and mathematical modeling (Brasil, 2018).

Mathematics, as a historical language created to solve human needs such as counting, measuring and organizing practical activities, promotes the development of

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fundamental skills such as reasoning, representation, communication, argumentation and critical thinking through learning processes (Boyer, 2019).

Mathematical literacy goes beyond understanding concepts, as it includes social relevance and cultural, historical and social dimensions. Challenging the hegemonic structures in mathematics teaching promotes emancipatory, epistemic and pedagogical attitudes. The hegemony of mathematical knowledge based on a colonial paradigm tends to keep schools and teachers impregnated by a monoculture perspective. In this sense, mathematical knowledge, due to its close relationship with the Ciências Exatas e Tecnológicas, is seen as powerful knowledge (Pereira; Godoy, 2023).

Mathematical literacy must be approached in a critical and contextualized way, considering the social and cultural dimensions, while decoloniality in mathematics education invites us to question and transform hegemonic practices, in a search for a more inclusive and diverse mathematics (Macedo, 2009).

Therefore, the teaching of mathematics through the approach of inquiry-based teaching contemplated from an ITS presents itself as a possible successful way to provide students not only with a genuine understanding of the subject, but also with the ability to apply it to understanding the world and influencing it (Carvalho, 2013; Carvalho *et al*., 2009).

Reis (2017) points out that contextualized mathematical problems can connect concepts taught at school with students' everyday lives, making it easier to understand and assimilate mathematical knowledge. Problem-solving methodology in a relevant context is a viable option for implementing this approach.

The approach of contextualized mathematical problems can contribute to the development of students' critical thinking and problem-solving skills, depending on how it is carried out. Faced with practical challenges, they are encouraged to think deeply and creatively, going beyond the simple application of formulas. This strengthens their understanding of mathematical concepts and prepares them for real-life situations that require analytical and problem-solving skills.

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Problem-solving methodology in a meaningful context not only makes learning more engaging, but also more effective in preparing students for future challenges.

The transformative role of Science Clubs in mathematics education

The Science Club is a dynamic and stimulating environment that gives students the opportunity to explore scientific and mathematical concepts in a practical and interdisciplinary way, offering an important counterpoint to traditional classroom teaching (Fanfa, 2020). According to Almeida and Malheiro (2019), the Science Club is a privileged space for students to explore mathematical concepts in concrete situations and establish relationships between mathematics and other areas of scientific knowledge. The Club plays a crucial role in education by providing a unique platform for students to explore, question and experiment with mathematical concepts in a real-world context.

Malheiro (2016) points out that Science Clubs, as non-formal teaching spaces, promote collaboration and dialog between participants, benefiting not only the area of Mathematics, but the entire multidisciplinary body. Unlike the academic environment of the classroom, these non-formal teaching spaces allow students to apply mathematics in practical contexts, which is essential for a deeper understanding of the subject (Almeida; Malheiro, 2019).

In addition, interdisciplinarity is an outstanding feature of Science Clubs. Students have the opportunity to see how mathematics relates to other areas of scientific knowledge, such as physics, chemistry and biology. This connection between different disciplines not only enriches their understanding, but also demonstrates the relevance of mathematics in a wide range of contexts and practical applications (Rodrigues; Malheiro, 2023).

Mathematics can be integrated into the Science Club in creative ways, especially through practical projects involving analysis and problem-solving. For example, when designing scientific experiments, students often use calculations of

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measurements, proportions and estimates, which promotes reasoning, reflection and the construction of knowledge (Almeida; Malheiro, 2019).

In addition, the Science Club can offer opportunities to solve complex problems that require advanced mathematical skills. Students may face challenges such as mathematical modeling, statistical analysis of experimental data or solving problems that require algebraic thinking. These types of activities help students apply mathematical concepts to real-world scenarios, strengthening their skills and confidence in the subject (Miranda *et al*., 2018).

The integration of mathematics into teaching for 5th and 6th graders is not just about simple number decoding or counting. It is a teaching method that seeks to apply mathematics to everyday situations and strengthen understanding of mathematical concepts by enabling children to use this discipline to solve real problems and better understand the world around them (Rosa, 2019).

2 Methodology

This research is qualitative in nature with a descriptive exploratory approach, since the data is acquired through verbal or visual expressions, with the aim of deepening the understanding of meanings, without being restricted to numerical data. The data approach values the process over results or products (Lüdke; Scott, 2018).

This study is exploratory in nature, which allows for a more detailed analysis with the aim of gathering information and evidence on the resolution of the problem through the proposed activity (Severino, 2014).

The data collected was organized and analyzed using the Content Analysis proposed by Bardin (2011). Content Analysis must be based on a precise definition of the research objectives. According to Bardin, the phases of Content Analysis are organized into:

Pre-analysis, which aims to operationalize and systematize ideas, drawing up a precise outline for the development of the work; Analysis of the material, in which

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operations such as categorization and quantification of the information will be established; and Treatment of the results (interference and interpretation), in which the data is systematically transformed and grouped into units that allow an accurate description of the relevant characteristics of the content.

The Science Club in which the activity took place was founded in 2016 in the city of Castanhal, in the state of Pará, and later moved to Belém in 2022 in a collaboration between the Universidade Federal do Pará (UFPA) and the Universidade do Estado do Pará (UEPA). Throughout its history, the Club has accumulated a total of 122 academic productions, including dissertations, monographs, articles and other works. These results are the fruit of the participation of teacher-monitors who have been or still are part of the Club's activities.

We analyzed the accounts of 20 students from a Science Club in Northern Brazil, aged between 9 and 13. It is worth mentioning that the space is intended for non-formal teaching of science and mathematics to young people. It is also intended for the initial and continuing training of teachers and is the result of a teaching, research and extension project funded by the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq). Furthermore, in the year of the survey, around 20 teacher-monitors[2] were working. These range from undergraduates to doctors. The pedagogical model is based on constructivist foundations and interdisciplinarity, in line with the current needs of scientific education (Malheiro, 2016).

In the first analysis, the students were divided into 4 groups of 5 students each, so that the teacher-monitors could work better with a smaller group. The group analyzed in this work was made up of children who were in the 6th grade of middle school (although the Club also has 5th graders), who were previously selected according to their ease of communication as observed in other Club activities. We spent 8 hours on this activity, which took two Saturdays from 8am to 11am.

[2] "Teacher-monitors" is how we refer to the masters, doctors, teachers in training and other volunteers who work at the Science Club.

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Throughout this work, we will use code names to refer to the students and we will keep their faces distorted in order to preserve their identities. It should be noted that, when enrolling in the Science Club, the students' parents and/or guardians are instructed to sign the Termo de Consentimento Livre e Esclarecido (TCLE), a document that authorizes the students' participation in the research carried out in this non-formal teaching environment.

The methodological approaches of the Investigative Teaching Sequence (ITS) are based on the principles of science and mathematics, with a focus on collaborative experimentation. Following Carvalho's (2013) proposal, the ITS stages include the formulation of the problem question, the execution of practical actions by the participants and the organization of knowledge through written and drawn reports.

Inquiry-based teaching puts the student at the center of learning, encouraging exploration, hypothesizing, collecting and analyzing data to develop a deep understanding of concepts. This method promotes skills such as curiosity and problem-solving, which are fundamental both at school and in everyday life.

By integrating teamwork, this methodology reinforces collaboration and dialogue between students, promoting the exchange of ideas and the development of social skills. Autonomy is encouraged by making students responsible for their own learning, while reflection allows them to critically analyze their experiences. These elements together form a holistic approach, preparing students to acquire specific knowledge and to become critical thinkers and engaged citizens (Clement, 2015).

The application of the ITS approach, as suggested by Carvalho (2013), proves to be highly effective in promoting meaningful learning by always addressing its four stages, namely:

Stage 1 – Distribution of the experimental material and proposition of the problem:

At this stage, the teacher-monitors propose the problem question and present the materials available for carrying out the investigative experimental procedures. They

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also encourage club members to actively interact with the materials, promoting an environment of exploration and discovery.

Stage 2 – Solving the problem:

During this time, the students handle the available objects, begin to formulate hypotheses and try to solve the problem.

Stage 3 – Systematization of the knowledge developed in the groups:

After completing the activity, the students share how they solved the problem and how they perceived the results.

Stage 4 – Writing and drawing:

The last stage of the ITS involves club members drawing and writing about their experiences on the day of the activity.

Of the 20 documents that emerged from stage 4 of the ITS, 5 records were selected that best represent and dissect the activity and, from these, 3 categories of analysis were created based on the students' graphic productions of drawings and writings: (A) Strictly written production, (B) Productions with drawings in evidence and (C) Written productions and drawings.

3 Results and Discussion

At first, we will describe the proposed activity based on the ITS according to Carvalho (2013). This detailing provides relevant elements that contribute to the elaboration of the club members' graphic productions and converge and highlight the

ITS stage analyzed in this study (Writing and drawing). The categories that emerged from reading the results of this study will also be discussed.

The moments related to the activity began with the proposition of the problem question: “with the materials available, how can you build a map?”. Four cardboard containers used for storing eggs were provided for each group, along with rubber bands used for attaching objects and PET bottle caps, scissors, digitized numbers on a piece of paper to mark the coordinates, glue and adhesive tape for attaching the containers.

The project consisted of representing a map of pirates in search of treasure. The students were encouraged to explore creativity, cooperation and the use of recyclable materials.

Figure 1 – Handling the materials provided

Source: Authors (2023).

After identifying the problem question and analyzing the materials, the students began to manipulate the objects to answer it. The activity aimed to introduce math concepts from advanced grades, such as the Cartesian plane, geographical location, creating figures from points on the plane and notions of dimensionality.

During the first stage, the monitors observed and asked strategic questions to guide the students towards consistent answers, without providing direct answers. The

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focus of the ITS approach is to center learning on the student, with the teacher as mediator. While the students were formulating hypotheses, the monitors asked questions such as: “What is the use of the rubber band in the construction of the map?”, “How can you locate yourself on the map?” and “How do the numbers relate to the map?”.

In the second stage of ITS, the students came up with hypotheses and tested them in practice. Alan suggested joining four egg tubs to form a square, inspired by the shape of maps he knew.

Discussions continued about where to place the numbers, highlighting that doubt and questioning are essential for the construction of knowledge, with error helping to clarify students' reasoning and doubts (Carvalho, 2013).

As time went by, they decided to place the numbers diagonally, determined a cap as the starting line of the map and a cap as the finishing line and used the elastic band to mark the displacement from one cap to the other.

In stage three, which refers to the systematization of knowledge, they shared their map with the other groups and told a little about how they built it and what processes led them to build it that way. Without realizing it and even without knowing about the Cartesian plane, these students were already talking about the distance between two points, coordinates and the formation of figures, as can be seen in this comment made by one of the members of the group: “We have the starting point and the finishing point, which is represented by the elastic band, and to get there we need to travel the whole distance.”

To conclude the stages proposed by Carvalho (2013), they ended the investigative activity with the Writing and drawing stage, in which the students produced various drawings and writings about the activity.

The following is an analysis of what was produced by five students (not necessarily from the same group) during the entire investigative experiment.

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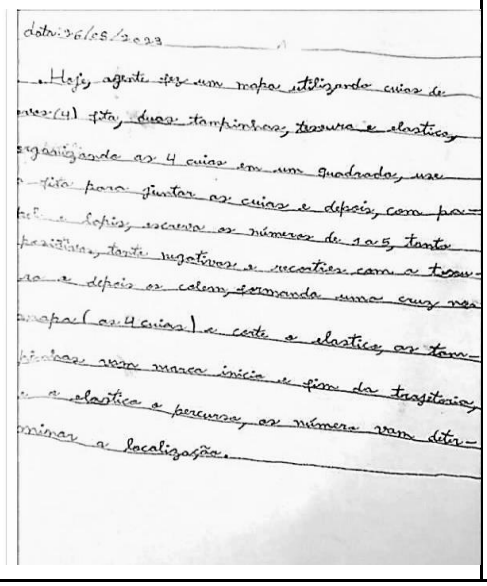
Category A: Strictly written productions

Figure 2 shows a record of the student Archimedes:

Figure 2 – Drawings and writings by student Archimedes in category A

	date: 26/08/2023 Today, we made a map using egg cups (4), ribbon, two caps, scissors and elastic, arranging the 4 cups in a square, use the ribbon to join the cups together and then, with paper and pencil, write the numbers from 1 to 5, both positive and negative, cut them out with the scissors and then glue them together, form a cross on the map (the 4 cups) and cut the elastic, the caps will mark the beginning and end of the path and the elastic the route, the numbers will determine the location.

Source: Authors (2023).

The analysis of Archimedes' report includes a little more detail about the student's experience in carrying out the activity. The report introduced in category A chooses not to draw pictures, but to write down the process of making the map. He describes the materials and their use in the assembly in detail. The student goes on to describe the activity using the caps to mark the beginning and end of the possible route. However, he inserts the rubber band as an alternative to connect the two points and says that the numbers are used to determine the location.

The interesting thing about this report is that he describes the location of points on a Cartesian plane even though he hasn't actually started this subject in his school grade, i.e. he only uses expressions and definitions from his world knowledge that are used in mathematics. The analysis revealed that the dynamics of the activities motivated the students at each stage, especially in the more challenging phases. As

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they progressed, the students were able to relate their discoveries to their everyday experiences.

This approach promoted a deeper understanding of the content, going beyond mechanical memorization. By facing difficulties, students have developed a critical and reflective attitude, which involves the ability to question, analyze and evaluate the information received, rather than just passively accepting it. This critical stance is essential for forming individuals who can make conscious and informed decisions, based on a broader and more contextualized understanding of reality. It allows students to take an active role in the learning process and, in the future, in their role in society, becoming more responsible citizens who are able to consciously intervene in social and ethical challenges (De Freitas; Almeida; Malheiro, 2019).

Considering the highlighted drawings, we will present category B, which relates to graphic productions exclusively with highlighted drawings.

Category B: Productions with drawings in evidence

Fibonacci's drawing falls into category B, as it only shows drawings, with no written work. The student represents the materials used to build the map, such as the containers that store eggs. It is a tangible and visually informative representation of the tools used in the activity. The inclusion of elements such as scissors, elastic, glue and PET bottle caps suggests a creative and practical process, in which each item plays a specific role in assembling the map.

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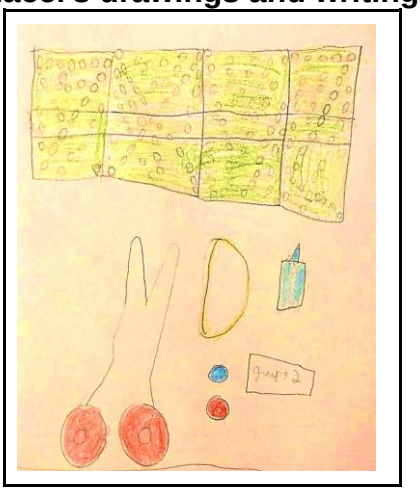
Figure 3 – Fibonacci's drawings and writings in category B



Source: Authors (2023).

The use of different materials, such as scissors, elastic, glue and bottle caps, demonstrates a creative and diverse approach to teaching mathematics. This allows children to explore concepts in a visual way and to develop motor skills and group work. The process of building the map reflects learning and discovery, making teaching more enjoyable and engaging and helping to dispel the fear associated with mathematics.

Figure 4 – Drawings and writings by student Mary Ellen in category B

Source: Authors (2023).

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The drawing in this category highlights the collaboration and joint exploration between three girls following a map. Although it contains a written record (“Agente” – “Us”), this element is not considered relevant to the group activity, which valued the creative process and the individual learning of each participant.

The presence of the map indicates a planned and directed journey, while the three girls holding hands symbolize cooperation and solidarity in the pursuit of a common goal. The image conveys a sense of adventure and discovery, with the children engaged in exploring and navigating the space represented on the map.

The drawing evokes an atmosphere of camaraderie and teamwork, where each child contributes to the group's progress. It highlights values such as friendship, collaboration and joy in learning, suggesting an enriching experience. As well as absorbing geographical, mathematical and location knowledge, children develop social and emotional skills that are essential for life in society. The use of concrete and manipulative materials in the teaching of mathematics is essential, as it allows students to visualize and interact directly with abstract concepts. This approach facilitates the understanding of content and contributes to building a solid foundation of mathematical knowledge (Fiorentini, 1990).

In addition, the use of concrete and manipulative materials promotes collaboration and group work. When students have the opportunity to manipulate objects and solve mathematical problems together, they are encouraged to discuss ideas, share strategies and collaborate in the search for solutions. The use of concrete materials not only strengthens students' individual understanding, but also develops important social skills such as communication, cooperation and teamwork. This enriches the learning experience and creates a more dynamic, participatory and collaborative classroom environment.

We also highlight category C, which includes the written and drawn reports based on the proposed investigative activity.

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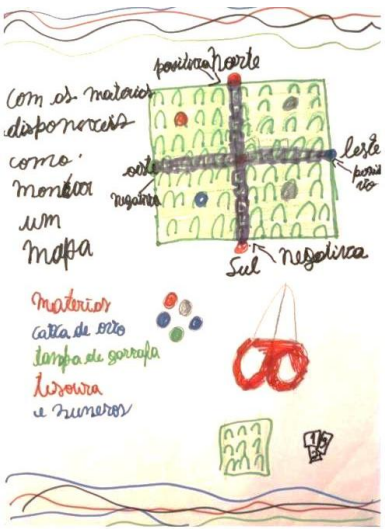
Category C: Written productions and drawings

These materials form part of category C, which shows content designed and written to better represent the activity carried out on that date. The student chooses to record her inferences visually and in writing.

Figure 5 – Drawings and writings by student Hipatia in category C

	With the materials available how to make a map North - positive East - positive South - negative West - negative materials: eggshell, bottle cap, scissors and numbers

Source: Authors (2023).

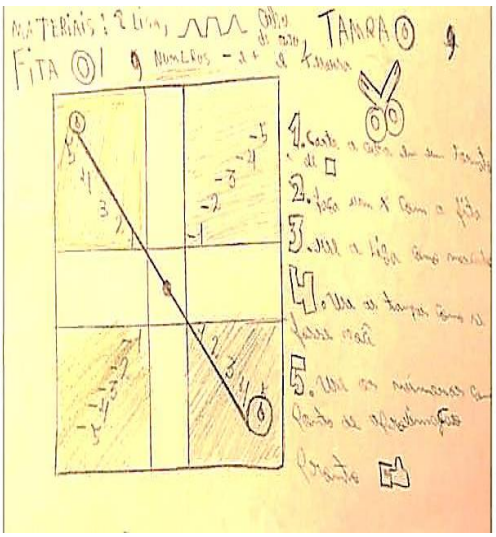
The student used different materials and explored concepts such as map directions, cardinal points and numerical organization such as a Cartesian plane, in a creative way and without adhering to school formalisms. Bottle caps were strategically used to indicate directions. The analysis highlights the importance of approaches that encourage problematization, investigation and exploration, as opposed to simple memorization, to promote deeper learning in mathematics.

When asked why she had built two lines, one horizontal and one vertical, the student replied: “I wanted to divide the map into the four points of the compass, north, south, east and west, to locate myself within it.”

Thus, when implementing the Investigative Teaching Sequence, we realized that investigative experimentation is an effective didactic strategy in mathematics education,

as it promotes effective learning. This contributes to the development of cognitive structures that allow students to understand the world around them (Ribeiro, 2017).

Figure 6 – Drawings and writings by student Euclides in category C

	Materials: elastic, egg container, cap, ribbon, 9 numbers – and + and scissors 1. Cut the container into a square 2. make an X with the tape 3. use the elastic as a marker 4. use the lids as if they were you 5. use numbers as a point of approximation finished

Source: Authors (2023).

This report, which is part of category C, includes writing and drawing. Euclides writes down the procedures for assembling the map, as well as briefly drawing a finished map. The student uses a lid to represent the person on the map and their location, and the numbers represent points of approximation to the location found.

During the activity, the student was asked the following question: “Why do these negative numbers exist?” and he replied: “Positive numbers are for moving forward, and negative numbers are when we move backwards.”

The group differed from the others and positioned the numbers diagonally on their map, with the positive numbers facing each other and the negative numbers also facing each other. They interpreted the positives as a path to follow and the negatives as areas to avoid when building the map.

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It is important to analyze the various perspectives that the Cartesian plane can offer when seen through the eyes of a child. The basic and standard model presented by René Descartes shows us that, opposite the infinite and positive group of positive numbers, there is an infinite group of negative numbers governed by the number line. And, when viewed on the Cartesian plane, you can see that it is formed by two of these number lines that are perpendicular to each other (Diefenthäler; Battisti, 2015).

The map model presented by the student is an alternative presented by René Descartes in the 17th century, which is also a representation of a Cartesian plane. It can be used in lessons by teachers as a playful and interactive way of locating points.

4 Conclusions

The study explored mathematical literacy from the perspective of inquiry teaching, highlighting problem solving in a unique context: a Science Club. The qualitative and documentary approach made it possible to identify relevant aspects of the impact of inquiry teaching on the learning of 5th and 6th grade students.

During the map-making activity, the students used simple resources. The analysis of the graphic records, including writings and drawings, provided an in-depth understanding of the process of solving the activity in an investigative and interactive environment.

The results indicate that the students, even without having been formally introduced to the Cartesian plane, demonstrated an intuitive understanding when manipulating the materials to create maps. The hypotheses raised by the students and the decisions made during the activity show the development of conceptual skills, such as notions of dimensionality and distance between points.

When we analyzed the students' reports in the Writing and drawing stage, we saw that they individually expressed the concepts they had learned, such as the use of numbers, coordinates and cardinal directions in the construction of maps. This

activity not only reinforced mathematical concepts, but also integrated elements of geography, such as spatial understanding and orientation in physical space.

The inquiry teaching approach in the Science Club provided meaningful learning by encouraging students to make connections between mathematics and other subjects, such as geography, as they applied abstract concepts in concrete and practical contexts. This interdisciplinary approach allowed the students to see the usefulness of mathematics in solving real problems, promoting a broader and more applicable understanding of knowledge.

The Investigative Teaching Sequence (ITS) proved to be effective, promoting questioning, collaboration and reflection. The reports revealed diverse understandings of mathematical concepts, highlighting the importance of different approaches to quality teaching.

The research indicates that inquiry teaching in the Science Club positively influences mathematical literacy, offering contextualized and meaningful learning for middle school students.

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