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Analysis of hypotheses formulated by high school students in Natural Sciences[1]

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ABSTRACT

The main objective of this study was to examine the quality of hypotheses and prior knowledge of high school students at a public school in São Paulo. This analysis used a didactic sequence based on Inquiry-Based Teaching (IBT). The quality of the hypotheses was assessed using classifications and criteria established by Lakatos and Marconi (1991, 2003). The results indicated that the hypotheses consisted of straightforward statements accompanied by secondary complements. The analysis uncovered contradictions and unclear aspects in interpreting the problem, negatively impacting the students' critical thinking and perspectives. Furthermore, prior knowledge regarding water quality, mining activities, potability, and pollution from human activities was detected.

KEYWORDS: Hypothesis; Inquiry-based teaching; High school; Chemistry Education.

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Análise de hipóteses formuladas por estudantes do Ensino Médio em Ciências da Natureza

RESUMO

O objetivo central deste estudo foi analisar a qualidade das hipóteses e o conhecimento prévio de estudantes do Ensino Médio, de uma escola pública da cidade de São Paulo, inseridos em uma sequência didática baseada no Ensino por Investigação. A análise da qualidade das hipóteses seguiu classificações e critérios definidos por Lakatos e Marconi (1991, 2003). Os resultados indicaram que as hipóteses apresentaram enunciados considerados básicos seguidos por complementações secundárias. A análise identificou contradições e aspectos inconclusivos na interpretação do problema, impactando a criticidade e o posicionamento dos estudantes. Além disso, foi possível detectar o uso de conhecimentos prévios relacionados à qualidade da água com atividades de mineração, noção de potabilidade e poluição causada pela atividade humana.

PALAVRAS-CHAVE: Hipótese; Ensino por Investigação; Ensino Médio; Ensino de Química.

Análisis de las hipótesis formuladas por estudiantes de bachillerato en Ciencias Naturales

RESUMEN

El objetivo central de este estudio era analizar la calidad de las hipótesis y los conocimientos previos de estudiantes de secundaria, de una escuela pública de la ciudad de São Paulo, insertados en una secuencia didáctica basada en la Enseñanza por la Investigación. El análisis de la calidad de las hipótesis siguió clasificaciones y criterios definidos por Lakatos y Marconi (1991, 2003). Los resultados indicaron que las hipótesis presentaban enunciados considerados básicos seguidos de complementos secundarios. El análisis identificó contradicciones y aspectos no concluyentes en la interpretación del problema, impactando la criticidad y posicionamiento de los estudiantes. Además, se pudo detectar la utilización de conocimientos previos relacionados con la calidad del agua con las actividades mineras, la noción de potabilidad y la contaminación causada por la actividad humana.

Palabras clave: Hipótesis; Enseñanza Basada en la Investigación; Escuela secundaria; Enseñanza de la Química.

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Introduction

In March 2023, the United Nations (UN) hosted the Water Conference in New York, where the "United Nations World Water Development Report" was presented, warning of an imminent water shortage that will impact about 2.4 billion people in the coming years (Connor; Miletto, 2023).

The conservation and availability of water resources has been a global priority, evidenced by the UN's sixth Sustainable Development Goal (SDG 6), which seeks to ensure everybody has access to water and sanitation (UN, 2015). As a response to the challenges identified in the Report, the "Global Acceleration Framework - GAF" was launched, aiming to boost partnerships and improve indicators of access to drinking water, primarily through educational initiatives that intensify the development of skills related to the promotion and awareness of water consumption (Connor; Miletto, 2023).

Paro and Teixeira (2024) surveyed 126 articles to understand how "water" has been addressed in Brazilian schools in the last twenty years. The researchers detected its use and debated its importance at different educational stages under different approaches. They also noticed a predilection of researchers to develop scientific investigation activities in the classroom to promote the theme.

Researchers' preference for scientific investigations can be explained by the fact that they instigate students to solve problems that stimulate thought, as they promote "thinking, feeling and doing" (Azevedo, 2004). In recent years, methodological approaches have given special attention to how students think, feel, and carry out investigative activities, emphasizing Inquiry-based teaching (IBT). IBT promotes more significant space for investigations and argumentation about the phenomena studied, impacting traditional teaching approaches (Munford; Lima, 2007).

Inspired by this teaching perspective, researchers (Arruda, 2019; Barbosa et al., 2022; Martin; Ortiz, 2022; Sousa et al., 2023) have investigated how investigative didactic sequences can be promising in the development of the "water" theme, in different areas of Natural Sciences, exploring the various dimensions of IBT. According to Pozo and Crespo (2009), such an approach favors the approximation of the science taught in school to that practiced by university professors in research centers, laboratories, and universities.

Recent studies highlight the use of IBT to promote investigative learning at different levels of education. Arruda (2019) and Barbosa et al. (2022) used IBT sequences to explore water and single-celled algae issues, respectively. It was found that these approaches stimulated students' communication, critical thinking, and assimilation of scientific concepts. On the other hand, Moraes and Ortíz (2022) developed a guide of practical investigative classes focused on Botany for High School, concluding that this methodology promoted the students' protagonism and understanding of the topics covered. Sousa et al. (2023) applied a sequence based on the IBT to study the properties of water in high school students. It was noticed that the students could build relationships between the chemical concepts addressed and adopted a more active posture in constructing their knowledge.

The raising of hypotheses in investigative activities

Conceptually, one of the stages of IBT is the stage of elaboration of hypotheses, understood here as a way of engaging students in the intellectual and emotional spheres, exploring their perceptions and understandings of ideas and phenomena (Mortimer; Scott, 2002), representing situations in which they need to elaborate a general statement that justifies an observed phenomenon (Nascimento; Silva; Freire, 2014). In addition, hypotheses have the power of articulation and dialogue between theories, observations, and experiments, in addition to conducting investigations (Praia; Cachapuz; Gil-Pérez, 2002).

Gil and Castro (1996) state that stimulating the proposition of hypotheses is essential in investigative activities, as they guide students in their studies and can manifest previous knowledge. In addition, according to Lemke (1990), understanding hypotheses in an investigative context implies understanding that learning science also involves learning to communicate in a scientific language.

In the development of investigative activities, the elaboration stage of hypotheses is considered an essential pillar of scientific investigation and is remembered by several researchers (Carvalho, 2013; Gil; Castro, 1996; Locatelli, 2021). However, few studies have found that directly address the elaboration of hypotheses by students. However, some research on elaborating hypotheses in scientific investigations has been developed to establish possible analysis parameters in teaching and school learning situations.

Lima and Heidmann (2023) developed research in which they categorized scientific hypotheses from didactic historical texts with subdivisions into what they described as oncological and representational. On the other hand, Nunes and Motokane (2017) evaluated students' hypotheses in Ecology sequences using analysis criteria. Meanwhile, Kasseboehmer and Ferreira (2013) described an investigative activity in Chemistry, classifying students' hypotheses as coherent, not very coherent, and not coherent, aiming to understand how they would explain the perception of smells at long distances.

In general, research indicates that hypotheses play a crucial role in scientific investigation, offering solutions to problems and stimulating creativity. They prove to be essential tools for overcoming pedagogical obstacles. In addition, they can reflect students' conceptions of science and their previous knowledge, influenced by cultural, social, and political experiences, something highly valued in formulating hypotheses (Silva; Soares, 2013; Barros, 2017).

Our main objective is to analyze the quality of students' hypotheses regarding a problem related to drinking water consumption. We also aim to identify the previous knowledge manifested by high school students when confronted with a problem inserted in a didactic sequence based on IBT.

The quality of the hypotheses will be analyzed using the classifications and criteria stipulated by Lakatos and Marconi (1991, 2003). Table 1 shows the classifications of the hypotheses we used to analyze the structure of the student's statements.

Table 1: Characteristics of the hypotheses indicated in the literature.

Classification	Description	Forms
Basic	Considered the main answer, others can complement it, but not necessarily.	Statements that ensure the presence or absence of certain phenomena. Statements that describe the nature or attributes of certain events in a particular context. Statements that indicate the existence or not of relations between phenomena. Statements that foreshadow a variation that co-occurs, directly or inversely, between certain phenomena.
Secondary	These are statements that have a complementary value to the basic hypothesis.	They incorporate details into the generalization of the basic hypothesis. They insert unspecified aspects in the basic hypothesis. They point out the relationships that can be deduced from the former, analyze and segment a more general statement into more specific elements, expand the deeper and more detailed understanding of the subject in question, and indicate other possible relationships.

Source: Constructed from a reading of Lakatos and Marconi (2003, p.220).

In addition to the classifications, Lakatos and Marconi (1991) listed eleven characteristics that can help in defining a statement as a hypothesis (Table 2).

Table 2: Characteristics of the hypotheses indicated in the literature.

Criterion	Description
Logical consistency	The statement of hypotheses must not be contradictory and conform to the body of scientific knowledge.
Verifiability	The hypotheses must be verifiable.
Simplicity	Hypotheses should be parsimonious, avoiding complex statements.
Relevance	Hypotheses must have predictive and/or explanatory power.
Theoretical support	Hypotheses must be based on theory to increase the likelihood of genuinely contributing to scientific knowledge.
Specificity	The assumptions must indicate the operations and forecasts to which they must be subjected.
Plausibility and clarity	The hypotheses must propose something admissible and be formulated clearly to enable its understanding.
Depth, fertility, and originality	Hypotheses must specify the mechanisms by which they operate to reach deeper levels of reality, favor a more significant number of deductions, and express a new solution to the problem.

Source: Constructed from the 11 features indicated in the literature by Lakatos and Marconi (1991).

Methodology

The research developed refers to an excerpt from the master's dissertation of the first author of this article, with the second author as advisor. The Federal University of ABC Ethics Committee registered and approved the research under CAAE 59538922.2.0000.5594. The methodological procedures underlying this research involved the development of a didactic sequence inspired by IBT, divided into three phases: elaboration, development, and data analysis.

Setting and context of the research

The research was developed in a state school located in the South Zone of the city of São Paulo, close to the source of the Ipiranga River. This fact

boosted the partnership because the context involved reflections on access and use of water. The school operates full-time, and its curricular components are organized in training itineraries provided by the Department of Education of the State of São Paulo and guided by the educational reforms consolidated in the National Common Curriculum Base (BNCC).

Research participants

A third-year high school class of twenty students aged between 16 and 18 was involved. They were taking the "Ecological Footprint" training itinerary, which concentrated on curricular components of the Natural Sciences, emphasizing the water theme. The opportunity to integrate elements of scientific research into the course curriculum influenced the selection of the target audience for the research. Eleven students formally participated in the study, while the others followed the activities, but their data were not used.

Elaboration and development of the IBT Sequence (IBTS)

To develop the IBTS, we based ourselves on aspects of scientific research identified by Carvalho (2013) and Gil and Castro (1996). These aspects are organized in Table 03.

Table 3: Characteristic elements of an investigative activity considered when elaborating the IBTS.

1. Present relevant and contextualized problems appropriate to the student's level and age, encouraging reflection and decision-making.
2. Conducting qualitative analyses that help understand the situations' limits.
3. Stimulus to the proposition of hypotheses, a central action in the investigative activity, to guide students and evaluate previous knowledge.
4. Integration of various tools, such as didactic and technological resources, to expand the interpretation of problems.

5. Careful analysis of the results to ensure the reliability of the investigations, identifying possible conflicts between the expected and those obtained results. 6. Scientific activity must promote communication and integration by exposing hypotheses, presenting results, and constructing arguments.

Source: Produced from the reading and translation of Gil e Castro (1996, p. 156-157).

The problem presented to the students

Here, we chose to construct an open problem (Gil; Castro, 1996), and its presentation at the beginning of the investigative cycle could confer relevance and arouse interest in students. The problem elaborated for this research was the following:

> *Watching a news program, Victor follows the news that a riverside community located on river banks in the State of Amazonas suffers from the drinking water supply. Intrigued, Victor considered the news contradictory; after all, the river water would be an abundant resource for the community and, therefore, accessible for human consumption. According to your prior knowledge, discuss Victor's position, elaborating a hypothesis with justification on the sheet and the blackboard (Authors, 2025).*

The problem aimed to encourage reflection on the consumption and accessibility of drinking water in a riverside community, integrating students in debates on water resources through a qualitative analysis. Commands in the text were used to guide students in formulating hypotheses based on their previous knowledge and to stimulate criticality in the face of controversial issues. The strategic insertion of the term "drinking water" sought to generate cognitive conflict and promote discussions, detecting conceptual confusion. All strategies aimed to direct the hypotheses to the problem and avoid debates beyond the investigation's limits.

Construction of the IBTS

To create the IBTS, we integrated the theme "water" into the activities of the curricular component "Water Footprint and its impact on the environment." In the elaboration phase of the IBTS, a specific fact was decisive for its consolidation: the school's textbook, which contained a thematic unit dedicated to studying water. This made building a more personalized and integrated IBTS to the course possible, valuing the students' material. The description is presented in Table 04.

Table 04: Organization of the IBTS developed.

Class 01 45 minutes 1st stage	**Part 1 (10 min)**	Presentation of the research proposal to the students; Presentation of the relationship of the research with the curricular component "Water Footprint and its impact on the environment"; Invitation to students to participate in the study; Formation of working groups;
	Part 2 (10 min)	Distribution of textbooks in the classroom; Raising awareness on the topic of "drinking water" with the presentation of official UN data provided by the book (pages 139 and 140); Prior survey of the primary uses of water in the daily lives of students;
	Part 3 (10 min)	Presentation of a problem question about the water consumption of a river; Discussions about the problem among the members of the groups for the construction of hypotheses; Formalization of the texts referring to the hypotheses in the notebooks;
	Part 4 (15 min)	Presentation of the hypotheses on the blackboard in written format; Discussion of the hypotheses with the researcher and the class;
Class 02 45 minutes 2nd stage	**Part 1 (10 min)**	Reading of the text "The Planet Asks for Water" present in the textbook; Mediation with students during the reading of texts that presented a diversified language with the use of data and infographics, addressing water availability, consumption by countries, and concepts such as water cycle and potability;
	Part 2 (15 min)	Discussions in groups and with the researcher to broaden the view of the problem based on the data obtained in the readings of the texts;
	Part 3 (20 min)	Writing a scientific argument that answers the problem presented.

Source: The authors (2025).

Data collection and selection

The data were extracted from the groups' records and the researcher's logbook. During classes, students showed discomfort with the recordings of their discursive interactions. Therefore, we agreed not to use audio and image recordings during classes. Thus, all data collection and selection took place in written form, on the board, and paper, emphasizing the identification of the primary drinking water uses by the groups and the hypotheses elaborated during the class.

Data analysis

The data collected in this research were analyzed from two theoretical-methodological frameworks: i) qualitative analysis proposed by Bardin (1977): we carried out a qualitative analysis regarding the primary uses of drinking water mentioned by students and the previous knowledge detected in the students' hypotheses; and, ii) data analysis according to the classifications and criteria proposed by Lakatos and Marconi (1991; 2003). Initially, we focused on identifying elements that could characterize the statements as basic and secondary hypotheses. Subsequently, we mapped the characteristics of the utterances, aligning the look to the perception of logical consistency (see description in Table 2) present in the texts to detect the contradictory elements and following scientific knowledge, which would reveal, in theory, an observation of how students use their knowledge to explain the phenomena.

Results and discussion of data

Below, we present the main results of our analyses, divided into three fronts: students' uses of drinking water, analysis of hypotheses, and detection of previous knowledge manifested.

Students' Uses of Drinking Water

To sensitize students to the topic, the groups answered a question about the primary uses of water in their daily lives. The idea was to learn each group's usage profile. Written answers are given in Table 5.

Table 5: Main uses of drinking water reported by students.

Main uses of drinking water according to groups	**Group 1 (5 students)**	*"Cooking, washing dishes, watering plants, washing clothes, washing the yard, washing the car, washing the bathroom, brushing teeth, flushing the toilet, aquarium, pet bath, vaporizer, air humidifier, shaving."*
	Group 2 (5 students)	*"Cleaning, hydroelectric, sewage treatment, creation of matter, agriculture."*
	Group 3 (1 student)	*"Personal hygiene, food, cleaning, putting out fires, agriculture, power generation."*

Source: The authors (2025).

To assess the consumption of the groups participating in the research, we distributed the words mentioned in specific categories, allowing us to detect the main characteristics of the student groups' drinking water consumption profiles. Table 6 presents the results of this analysis.

Table 6: Main uses of drinking water reported by the students.

Category	Water Use	Frequency of occurrence
Hygiene	Dishwasher; Washing clothes; Wash the yard; Wash the car; Wash the bathroom; Brushing your teeth; Flushing in the toilet; Pet bathing; Personal hygiene; Brushing your teeth; Pet bathing; Cleaning	12
Domestic activities	Watering plants; Aquarium; Vaporizer; Air humidifier; Food Cooking	7
Production	Agriculture, hydropower, sewage treatment, power generation	4
Firefighting	Putting out fires	1
Total	25	

Source: The authors (2025).

The results' analysis revealed a predominance of the category "Hygiene," whose frequency of occurrence was equal to 12/25 (approximately half of the answers), followed by the categories "Domestic activities" (frequency of occurrence = 7/25) and "Production" (frequency of occurrence = 4/25). A fact that is considered curious is that the groups did not mention the need to drink water, an essential process for maintaining life.

Analysis of hypotheses

Table 7 presents the hypotheses produced by the students. During the intervention, the students recorded them on the board so that the productions of all the groups could be discussed.

Table 7: Hypotheses generated by the students.

Hypotheses	**Group 1 (5 students)**	*Yes, because there must be pollution, mining in the waters, acid rain in the locality, lack of finances, lack of communication, preservation area."*
	Group 2 (5 students)	*"According to our group's hypothesis, the river mentioned may be infected by heavy metals, such as mercury, caused by illegal mining."*
	Group 3 (1 student)	*"Victor probably deduced that the extraction of illegal minerals would have contaminated the river, and therefore, even being close to a river is not drinkable, as are several other problems, such as human waste or items/dirt."*

Source: The authors (2025).

The total number of responses analyzed was equivalent to three, corresponding to the number of groups participating in the activity. Next, we will examine the students' hypotheses.

Classification of hypotheses

According to the description provided in Table 1, the hypotheses were analyzed and classified into basic and secondary, according to their characteristics. The analysis by the group is presented below:

Group 1: the group did not respond to the commands of the question, disregarding Victor's position as they answered "Yes" to the problem. A curious fact is that the group complemented the statement with items that suggest the compromise of the river water by events such as "pollution", "mining", "presence of acid rain", "lack of financial in the locality", "lack of communication" and "preservation area", such items place the statement as a fundamental hypothesis because "they foreshadow a variation that co-occurs, direct or inverse, between certain phenomena" (Lakatos; Marconi, 2003) since they were listed by the group concomitantly. In addition, it was noted that the construction of a statement that "describes the nature or attributes of certain events in a particular context." corroborates the classification of the hypothesis as essential according to the criteria of Lakatos and Marconi (2003).

Group 2: We consider that in constructing the hypothesis of group 2, the excerpt "heavy metals may infect the river mentioned" contains the textual fragment considered as the main statement of the hypothesis, given the possibility of it expressing the central idea without complementation. The statement is related to the indication of the "existence or not of relations between phenomena" predicted by Lakatos and Marconi (2003) since being "infected" by heavy metals would make the water unfit for human consumption. The specification of heavy metals, explicit in "such as mercury"

and the causal relationship in "caused by illegal mining," added complementary value to the introductory statement. Such excerpts can be considered typical statements of secondary hypothesis.

Group 3: The group was the only one addressing the water potability issue. When reporting that "even being close to a river is not drinkable," there is a statement that can be considered the main one because the fact that the water is not drinkable would justify the non-consumption by the riverside community. This makes it possible to insert it into the basic hypothesis classification. Other excerpts, such as "river would have been contaminated," "extraction of illegal minerals," and "various other problems such as human waste or items/dirt." offer a complement to the central idea already exposed above. Such excerpts can be interpreted as secondary hypotheses.

In general, it was possible to observe that the hypotheses presented answers considered to be the main ones, with textual fragments that are characterized as basic hypotheses because they enunciated, in some way, the description of events (water consumption) in a particular context (riverside community), something typical of hypotheses considered fundamental. In addition, the groups complemented their central ideas by using statements that incorporated details into generalizing the basic hypothesis, expanding the understanding of the problem, and indicating other possible relationships.

Analysis of the logical consistency of the hypotheses

Among the eleven criteria that characterize a hypothesis according to Lakatos and Marconi (1991), we chose to use "logical consistency" as an analysis criterion because we considered that the sample produced by the students would provide substantial subsidies to the research objectives. When analyzing the logical consistency of the hypotheses, we rely on "The statement of the hypotheses cannot have contradictions and must be following the body of scientific knowledge," shown in Table 2. Next, we will present the results regarding the contradictions and conformity with the scientific knowledge found.

On the contradictions found

The reading of the hypotheses revealed problems related to their constructions since the groups did not respond to the command that requested a discussion about Victor's position. It was expected that they would detect the conceptual confusion in the problem in "Victor considered the news contradictory. After all, the river's water would be an abundant resource for the community, therefore, accessible for human consumption.". In this sense, the logical consistency of the hypotheses was compromised due to the contradictions in the texts of the 3 groups (Table 8).

Table 8: Analysis of the logical consistency of the hypotheses based on identifying contradictions.

Groups	Identified Aspects
1	It did not address Victor's position as requested. A "Yes" answer was provided, apparently unconnected with the command of the question. A narrative about problems transversal to what is exposed in the question was constructed, such as pollution, water mining, acid rain, lack of financial resources, lack of communication, and preservation area.
2	It did not address Victor's position as requested, the Inappropriate use of the term "infected," and the allegation of possible contamination by heavy metals due to illegal mining without justification.
3	Despite analyzing Victor's position, the group interpreted the problem distortedly. The group assumed that Victor inferred that the river was contaminated because of the extraction of illegal minerals and, therefore, that its waters were unfit for consumption.

Source: The authors (2025).

All hypotheses detected contradictory and inconclusive aspects. Preliminarily, we raised doubts about the groups' degree of understanding of the problem presented since the command of the question explicitly requested analyzing Victor's critical position. We believe that mistakes in interpreting the problem text have generated inconsistencies in the construction of the statement.

In compliance with scientific knowledge

Although direct approaches related to positioning the problem character were not possible to identify in the hypotheses, structuring elements based on scientific knowledge were noted to justify the non-use of river water. In Table 9, we present a deeper analysis of what was found.

Table 9: Analysis of logical consistency from the identification of the use of scientific knowledge in the hypotheses.

Group	Compliance with scientific knowledge	Comments
1	The text showed traces of the students' not believing it was possible to consume river water " because there must be pollution, mining in the waters, acid rain in the locality..." The excerpt denotes the presence of knowledge anchored in concepts related to the environmental impacts caused by pollution, mining activity, and acid rain.	The text demonstrates students' understanding of the environmental impacts of pollution, mining activities, and acid rain. They recognize that these factors can contaminate river water, making it unsuitable for human consumption. This suggests an awareness of environmental issues and their effects on health and the environment.
2	The group's text demonstrated compliance with scientific knowledge related to the effects of illegal mining and possible contamination of water bodies by heavy metals, such as mercury.	The text discusses the environmental impact of illegal mining, especially the release of heavy metals, and its harmful effects on human health and aquatic ecosystems. A specific example of heavy metal is given to illustrate the concept.
3	In "and for this reason, even being close to a river is not drinkable like many other problems such as human garbage or items/dirt.". The text points to the understanding that because it is not drinkable, the river water would not be a safe source for human consumption by a community that lives near it.	The mention of human waste and other debris suggests an awareness of the various pollutants that can contaminate water, making it unfit for human consumption. This indicates an understanding of public health issues and the importance of safe water sources for local communities. In addition, the group demonstrated conceptual mastery by describing the river water as non-potable.

Source: The authors (2025).

In general, the analysis of the quality of the hypotheses allowed us to detect that the groups have points in common related to conformity with scientific knowledge. The groups linked the pollution of the river to alleged

mining activities that were responsible for the contamination of the water by heavy metals. These justifications may be related to the fact that Brazil is a country with intense mining activity and a history of contamination of water resources by waste disposal in riverbeds and/or accidents involving dams (such as those that occurred in the cities of Brumadinho and Mariana, in Minas Gerais), among others.

Detection of prior knowledge manifested in the hypotheses

From the conception that prior knowledge can manifest itself in raising hypotheses, we focus our attention on analyzing the quality of the hypotheses in terms related to the scientific conformity with which the students built their statements.

Thus, we could recognize aspects related to prior knowledge present in the context worked. Below, we present a synthesis of the knowledge detected: environmental pollution; mining activities; occurrence of acid rain in the locality; environmental preservation; the possibility of contamination of the river by heavy metals; the relationship between water contamination and mining activities; illegal mining of minerals; the notion of potability of water indicating quality for human consumption; environmental pollution resulting from human practices.

In the scientific context, we recognize that prior knowledge is considered in investigations since it considers the student's perspective through their experiences and relationships established with knowledge linked to a problem or idea. According to Silva and Soares (2013), prior knowledge is a category that stands out in the interpretation and reading of data, being a way for students to start a process that leads them to organize their thinking based on the understanding of some concept, phenomenon or content, being able to modify a particular conception considered insufficient or inadequate for an exposed situation. In our

analysis, it was possible to perceive the predominance of knowledge related to water contamination by mining-related activities.

It is essential to mention that after the presentation of the hypotheses, spare steps raised discussions about the texts produced with the following questions:

i) Is the water of a river drinkable?

ii) Disregarding the existence of mining companies in the vicinity and the context of the presence of heavy metals, would it be suitable for human consumption?

iii) Can infection and contamination terms be used synonymously?

The questions were asked as a focus of discussion to generate concerns about what had been exposed. In the following stage, the students carried out readings and discussions in groups about texts in the book and, with the help of the internet, researched parameters recognized by official agencies, such as those that determine whether or not a particular sample of water is drinkable. It was hoped that at this stage, students would have access to reliable information (present in the book) that would lead them to rethink the issue involving consumption and the concept of drinking water.

Final considerations

Returning to the central objective of this research, which consisted of "analyzing the quality of students' hypotheses in a problem related to the consumption of drinking water, also aiming to identify the previous knowledge manifested by them, when they are confronted with a problem inserted in a didactic sequence based on Inquiry-based teaching." we concluded, initially, that the ITS developed allowed the realization of the intended analyses.

The mobilization of students to form groups and face the problem allowed us to identify that the main uses of water were related to hygiene,

followed by domestic activities. Notably, the students did not mention water use for drinking, a relevant point due to the shortage of drinking water predicted by the UN.

The students formulated basic hypotheses centered on the inadequacy of river water for consumption, and secondary hypotheses highlighted water contamination caused by factors such as mining and acid rain. However, the answers presented some inconsistencies, possibly due to difficulties interpreting the problem.

The students' texts reflected previous scientific knowledge, especially related to Chemistry and the impact of human activities on water quality. The analysis showed that the students focused more on contamination than on the potability of the water.

It is concluded that the research achieved its objectives, suggesting the need for additional studies on textual interpretation to improve students' understanding of scientific investigations and their impact on teaching and learning.

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