ACTIO Docência em Ciências

ACTIO: Docência em Ciências
ISSN: 2525-8923

http://periodicos.utfpr.edu.br/actio

Questions from 9th-grade students about the periodic table

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ABSTRACT

The study of the Periodic Table represents an essential part of the Natural Sciences curriculum in Lower Secondary Education. The aim of this article is to understand the interests of a 9th-grade class in relation to the Periodic Table. The participants in the study were 25 ninth-grade students from a public school in Santa Helena, Paraná, Brazil, who were asked to formulate questions about the Periodic Table. This is a qualitative, exploratory study in which the object of analysis consisted of 42 questions formulated by the students, subsequently analyzed through discursive textual analysis. From the analysis, four categories emerged for discussion: (i) the origin of the Periodic Table; (ii) the organization of chemical elements; (iii) the use of the Periodic Table; and (iv) the representation of chemical elements. The results indicate that the questions formulated by the students can serve as raw material for the development of educational proposals that value students' interests in the subject, such as the development of a Learning Unit from the perspective of Classroom Research. It is concluded that valuing students' interests, as expressed in their questions, enables them to deepen their knowledge and fosters the desire to learn about abstract topics such as the Periodic Table.
KEYWORDS: Classroom Research; Learning Unit; Students' Questions; Periodic Table.

Perguntas de estudantes do 9º ano do ensino fundamental sobre a tabela periódica

RESUMO

O estudo da Tabela Periódica representa parte essencial do currículo de Ciências da Natureza no Ensino Fundamental II. O objetivo deste artigo é compreender os interesses de uma turma de 9º ano do Ensino Fundamental em relação à Tabela Periódica. Os participantes do estudo foram 25 estudantes do 9º ano do Ensino Fundamental de uma escola pública de Santa Helena-PR, sendo solicitados a realizar perguntas sobre a Tabela Periódica. Trata-se de pesquisa qualitativa, do tipo exploratório, em que o objeto de estudo foram 42 perguntas formuladas pelos estudantes, analisadas posteriormente por meio da análise textual discursiva. Da análise emergiram quatro categorias para discussão: i) origem da Tabela Periódica; ii) organização dos elementos químicos; iii) utilização da Tabela Periódica e, iv) representação dos elementos químicos. Os resultados fornecem indicativos de que as perguntas formuladas pelos estudantes podem servir de matéria-prima para o desenvolvimento de propostas que valorizem os interesses dos estudantes sobre o assunto, como o desenvolvimento de uma Unidade de Aprendizagem na perspectiva da Pesquisa em Sala de Aula. Conclui-se que a valorização dos interesses dos estudantes, expressos em suas perguntas, possibilita que estes possam complexificar seus conhecimentos e fomentar o desejo de aprender sobre temas abstratos como a Tabela Periódica.
PALAVRAS-CHAVE: Pesquisa em Sala de Aula; Unidade de Aprendizagem; Pergunta dos estudantes; Tabela Periódica.

INTRODUCTION

In a school setting, knowledge is constructed and reconstructed, forming the foundation for the journey towards a more equal society — one that asserts its rights and can reflect on its actions. Knowledge is built upon challenges, and it is recommended that these spark students' curiosity, creativity and enthusiasm for learning (Moran, 2007).

Activities are sometimes designed to spark an interest in learning with the aim of fostering the knowledge necessary for each student's school life. However, the organisation of school knowledge typically follows a predetermined framework that often fails to consider students' own interests in learning (Gouw et al., 2015). This ultimately leads to disinterest in certain topics within the classroom context. It cannot be assumed that students have no desire to learn about a particular topic; rather, what is presented to them may not align with their own curiosities regarding the subject.

Classroom-based research (CBR) (Moraes, Galiazzi; & Ramos, 2012) is a method of fostering students' interest in various fields of knowledge. It is organised into three stages: questioning, constructing arguments and communicating. The authors recommend starting with questions posed by the students themselves on a specific topic. These questions provide the teacher with relevant information to guide their work, directing students towards developing arguments and communicating them. Encouraging students to formulate their own questions can be an effective way of organising classroom activities that are focused on a genuine desire to learn about a specific topic.

Some studies have examined unit-based learning (UBL) from the perspective of student-centred learning (SCL) in science education. For example, Freschi and Ramos (2009) investigated the process of reconstructing knowledge about the water cycle in a UBL unit developed for science classes with Year 5 students. Their results showed that the context of the teaching and learning process must be considered, and that students' prior knowledge must be acknowledged. Based on these findings, the authors propose that diverse activities which cater for students' interests can help to deepen and broaden their knowledge of the topic.

Galle (2016) conducted a study in which a learning unit focused on food was implemented with 9th-grade students. The study aimed to understand how conceptual, procedural and attitudinal knowledge is reconstructed during the learning process. The results showed that students expanded their knowledge by developing more complex procedures and attitudes when they saw themselves represented in the proposed activities. Furthermore, this representation stimulated their interest and desire to learn, demonstrating the importance of connecting the topics of study to students' needs.

Considering the initial stage of the CBR proposal — that is, the questioning phase — this article aims to understand the interests of a Year 10 class regarding the Periodic Table (PT), as identified through the questions formulated by the students themselves while observing a copy of this tool. This qualitative, exploratory study focuses on the forty-two questions posed by twenty-five Year 9 students after observing the Periodic Table projected onto a television screen. These were analysed using discursive text analysis (DTA), revealing four categories: the origin of the PT; the organisation of chemical elements; the use of the PT; and the representation of chemical elements. These categories are presented and discussed based on analytical metatexts.

It is worth noting that the article presents proposals for learning activities based on categories of interest emerging from students' questions on the topic, as well as approaches within different curricular components. The article presents the theoretical framework below, which discusses CBR and UA as possibilities for implementing the proposal in practice. It emphasises the relevance of the students' questions as raw material for organising the teacher's actions, the methodological approach of the research, the discussion of the results and the final considerations.

THEORETICAL FRAMEWORK

Classroom-based research (CBR) (Moraes; Galiazzi; & Ramos, 2012) is an approach that can help to conduct activities based on questions arising from students' investigative processes, thereby promoting more meaningful learning. CBR is a practical application of the principles of Educating Through Research, as set out by Pedro Demo in his eponymous book (Demo, 2007).

Regarding these assumptions, Demo (2007, p. 7) highlights the following four points: i) A class that merely promotes the transfer of knowledge does not move beyond the starting point and, in practice, hinders the student because it treats them as an object of teaching and instruction. It becomes training'. ii) For Demo, pedagogical interaction in school is only fruitful when mediated by reconstructive questioning. This is because it encourages students to expand their knowledge, thus enabling them to '[...] develop critical awareness, formulate and carry out their own life project within the historical context' (Demo, 2007, p. 10). iii) Regarding the value of research, Demo highlights the need to involve teachers and students in the process. This is not in the sense of professional academic research, but rather so that these individuals can interpret reality critically and reconstruct specific processes and products. iv) Finally, Demo (2007, p. 5) emphasises that research is crucial for ensuring constant innovation in knowledge, considering '[...] the definition of education as a process of forming human historical competence'.

The CBR proposal is based on students' questions and can facilitate learning and participation by engaging students and teachers in questioning discourses and the implicit and explicit truths in discursive formations. This process leads to the construction of arguments that reveal new truths (Moraes; Galiazzi; & Ramos, 2012, p. 12). CBR comprises three interrelated stages: questioning, constructing arguments, and communicating (Moraes; Galiazzi; & Ramos, 2012). These stages are interconnected, forming a continuous cycle of reflection, elaboration and dialogue.

We emphasise the importance of students constructing their own knowledge through questioning and arriving at new understandings through dialogue, which enables them to develop coherent arguments on specific themes or subjects and deepen their initial understanding (Ramos, 2012).

From the CBR perspective, a learning unit (LU) must involve students' questions, the construction of arguments and the dissemination of knowledge gained, given that 'questioning applies to everything that constitutes being, whether it be knowledge, attitudes, values, behaviours or ways of acting' (Moraes; Galiazzi & Ramos, 2012, p. 13). Consequently, the starting point of a learning unit designed in accordance with CBR principles is questions posed by students regarding a specific topic.

Organising science education around moments of everyday life allows science to be taught and learnt from an investigative perspective, exploring everyday events and phenomena that can be examined and developed through investigative activities.

Questions are an integral component of the classroom environment, present in teaching materials, assessments and the teacher's discourse. Generally, students' questions are brief and aim to clarify specific doubts about the provided explanations (Specht; Ribeiro & Ramos, 2017). However, various factors can prevent students from asking questions that genuinely express their curiosity about the topic. In more advanced stages of schooling in particular, students may be reluctant to speak up for fear that their questions will be dismissed as 'silly' or reveal an alleged lack of knowledge on the subject. These factors highlight the complexity of the questioning process in the classroom and the importance of creating an environment that encourages open and non-judgemental expression of curiosity and interest (Galle, 2021).

Children are spontaneous by nature, which means they feel comfortable in different settings and tend to ask questions that reflect their curiosity about particular phenomena. However, given the potential of questions posed by students, especially those demonstrating curiosity about a particular subject, it is important to emphasise the need to provide space for these questions to emerge naturally. This is because students typically ask only a small number of questions, particularly in the upper elementary and high school grades (Specht; Ribeiro & Ramos, 2017).

Teachers can encourage this by offering activities that spark curiosity, such as conducting experiments, observing phenomena, reading texts or showing films, displaying images or presenting news from newspapers or magazines, and guiding students to ask questions whose answers are not obvious (Galle, 2021). The teacher's role in this process is important, as their welcoming and respectful attitude towards questions can be decisive in helping students feel confident enough to voice their own. Teachers are also responsible for helping students to formulate questions, particularly ensuring that they are clear (Galle, 2021)..

Questions posed by students can reveal interests and curiosities that extend beyond specific queries, offering teachers valuable insights for tailoring instructional planning. When students ask questions, teachers gain insight into not only immediate doubts, but also knowledge gaps, conceptual difficulties and specific interests that shape each student’s learning (Pauletti et al., 2021).

In this sense, questions act as a barometer, enabling teachers to identify areas where students need support or further exploration and allowing for more dynamic, needs-based planning. This pedagogical practice can be seen as a tool for strengthening engagement, since the content begins to reflect the students' context and genuine needs. Furthermore, as students realise that their questions play an active role in shaping the content, their interest and participation tend to increase, fostering a more interactive and meaningful learning environment (Galle, Pauletti & Ramos, 2016).

Using UA grounded in the CBR perspective to teach complex and abstract topics in the natural sciences, such as TP, may be a promising pedagogical approach. The traditional approach is often limited to a theoretical treatment, whether through teaching materials or the teacher's presentation method in the classroom. As this approach is distant from students' lived experiences, it can lead to disinterest and hinder understanding, since the content does not connect concretely with everyday experiences (Césa;, Reis; & Aliane, 2015).

Understanding the periodic table involves recognising its organisational structure, identifying the groups and periods, and understanding periodic trends such as electronegativity, atomic radius and ionisation energy. These fundamental concepts are introduced as early as elementary school and provide a basis for future exploration in diverse fields such as medicine, industry and the environment (Paraná, 2018). However, this structure can appear overly complex and abstract when taught in isolation, which highlights the importance of pedagogical strategies that facilitate the connection between chemical elements and everyday situations.

Incorporating activities that allow students to explore the application of chemical elements in objects and phenomena relevant to their daily lives helps to contextualise the content and create a meaningful and stimulating learning experience. This type of approach typically sparks students' curiosity. César, Reis and Aliane (2015) emphasise that establishing direct links between chemical elements and everyday items enables students to recognise the usefulness and relevance of knowledge about the periodic table (PT), which can counteract the perception that the subject is dull. For instance, demonstrating how elements such as iron (Fe) are used in household utensils or silicon (Si) in electronic devices enables students to link the symbols and properties of the periodic table to items and processes that form part of their daily lives.

Furthermore, organising investigative and experimental activities can encourage students to independently and practically explore the properties and applications of elements. Engaging students in diverse, interest-based activities promotes meaningful learning, reinforcing their understanding of elemental properties and their implications in real-world contexts (Moraes, 2008).

Therefore, it is believed that adopting a learning approach that incorporates CBR can make TP instruction more accessible and engaging. This enables students to understand the connections between scientific knowledge and the world around them by addressing their curiosity through questioning.

METHODOLOGY

This study adopted a qualitative approach, which, according to Minayo (2012, p. 21), seeks to investigate aspects of reality that 'cannot or should not be quantified'. Within this qualitative framework, the study is characterised as exploratory. According to Gil (2008), the primary objective of exploratory research is to provide an initial, in-depth understanding of the phenomenon under study with a view to clarifying and making explicit its characteristics, or even developing hypotheses for future studies. This approach enables detailed investigation, highlighting the complexity and nuances of the phenomenon in question.

The research participants were twenty-five Year 9 students in the afternoon session at a state school in the municipality of Santa Helena, Paraná-Brazil, as part of the Natural Sciences curriculum, accompanied by one of the researchers and assisted by the class's homeroom teacher. According to the homeroom teacher, the participating class experiences learning difficulties. It is restless but participatory, with thirty-two students enrolled; however, only twenty-five were present on the day of the intervention, as some were absent and others had dropped out.

We emphasise that the content regarding the periodic table of chemical elements has not yet been covered with the students and forms part of the learning objectives for the thematic unit 'Matter and Energy'. According to Paraná (2018, p. 333), it is necessary to build knowledge in order to '[...] understand that chemical elements are organised in the periodic table according to their characteristics and properties, relating them to the maintenance of life, the natural world, and technology'.

Although the Paraná Curriculum Framework primarily addresses content on the periodic table in Year 9, students may already possess prior knowledge related to chemical elements before this stage, possibly because they have encountered related topics in an unsystematic manner.

In Year 7, the curriculum proposes that students learn about common chemical substances such as H_2, CO_2, H_2O, O_2, CH_4 and NH_3, and understand that substances are composed of chemical elements (Paraná, 2018, p. 324). In Year 7, the focus shifts to the composition of air, with students encouraged to demonstrate that air is a mixture of gases and identify its composition (Paraná, 2018, p. 329). In Year 8, students should develop an understanding of the human body as an integrated whole, recognising the structure, function and relationships of biological systems (Paraná, 2018, p. 331). This involves studying the organisation of living beings from an atomic level, consisting of atoms that constitute molecules.

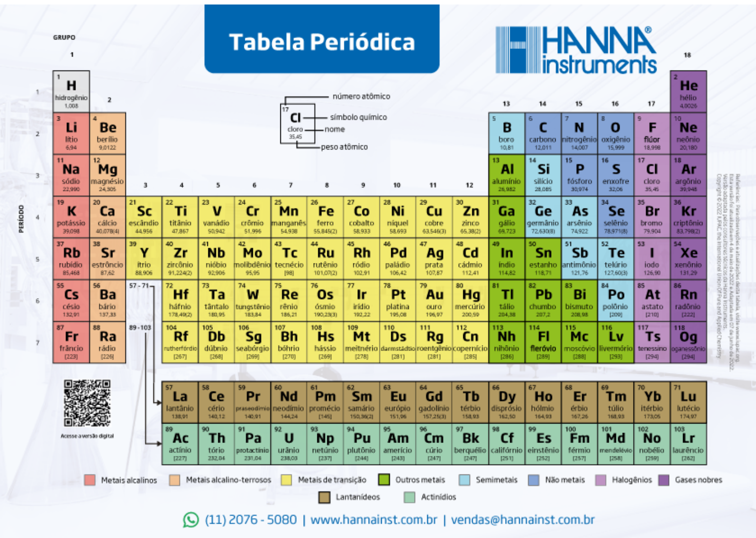
Therefore, to aid the development of new learning and the understanding of more complex and difficult-to-grasp concepts, such as those related to TP, the knowledge students have acquired throughout their educational journey must be taken into account. In this regard, the activity for generating information — the subject of analysis in this article — took place during a one-hour class in the Natural Sciences curriculum. This activity involved students asking questions about the Periodic Table. Students were presented with an image of the periodic table of chemical elements and asked to formulate at least one question based on what they observed. It should be noted that this content had not yet been covered in the course that academic year.

The following question was written on the board as a guide: ‘What questions can be formulated from a scientific perspective based on the observation of this image?’ The purpose of this prompt was to encourage the students to formulate scientific questions, recognising that developing reflections depends on an initial understanding of the presented image.

During the activity, the students were informed that they should write their questions on a piece of paper and that identification would not be required — that is to say, they did not need to include their names, meaning it would not be possible to tell which questions had been formulated by which student. Figure 1 shows the image that the students observed.

Figure 1

Periodic Table of the Elements.



Source: HANNA INSTRUMENTS. Tabela periódica dos elementos químicos [reprodução de imagem]. 2017. Disponível em: https://hannainst.com.br/tabela-periodica/. Acesso em: 15 abr. 2026.

Thanks to the anonymity, it became clear at this point that the whole class felt comfortable writing down their questions, with some students asking more than one. The researcher then set aside a fifteen-minute period so that all students could organise their questions and place them in a cardboard box.

Fifteen minutes later, all the students had handed in their questionnaires and the teacher was able to start the planned activities. For some students, this was their first exposure to the Periodic Table (TP), and their eagerness to learn about it was clear. The students' anticipation regarding the content was evident in the speed with which they formulated questions and the curiosity they displayed during the initial discussions. Other students showed no interest in the activity and some seemed “afraid” of the Periodic Table. Initial resistance to the topic was evident in comments expressing difficulty, unfamiliarity or alienation with regard to the Periodic Table.

A variety of student reactions were observed when they were encouraged to formulate questions during the activity. Some students were confident enough to write their questions directly on paper, while others hesitated and took longer to start. This hesitation appeared to stem from a lack of familiarity with the TP topic, uncertainty about the content, or a fear that their questions might be considered 'silly' or irrelevant.

Some students also had difficulty starting the activity and formulating questions, indicating that it becomes difficult to formulate scientific questions without initial guidance to aid understanding of the presented sign.

The students' questions, which were stored in a cardboard box, were set aside for later reading and analysis. A total of forty-two questions were submitted. Most students (13) asked more than one question, while others chose to ask only one (12).

The questions were analysed using ATD (Moraes & Galiazzi, 2013), a qualitative analysis method focused on interpreting data and information to generate new insights into phenomena and discourse. Lying between traditional content analysis and discourse analysis, it performs an interpretive, hermeneutic process. ATD is organised into three stages: unitarisation, categorisation and metatexts. Unitarisation involves breaking texts down into constituent units, categorisation involves establishing relationships between these units, and metatexts are analytical texts representing the new understanding of the body of information.

According to Moraes and Galiazzi (2013), there are three ways in which categories of analysis can be organised: a priori, emergent, or mixed. A priori categories are those defined by the researcher before beginning the analysis of the corpus. Emergent categories, on the other hand, arise during the analysis of the corpus and represent theoretical constructions developed by the researcher during the analytical process. Mixed categories combine both approaches, starting from a set of previously defined categories that can be supplemented or reorganised as the analysis progresses. In this study, we opted to use emergent categories.

During the unitarisation stage, each question formulated by the students was considered a unit of meaning and analysed in its entirety since each question addressed a specific issue regarding the periodic table. In some cases, a single question was broken down into more than one unit of meaning if it addressed more than one area of enquiry.

Categorisation occurred emergentively, based on repeated readings of the units of meaning to establish semantic relationships among the questions. This interpretive process enabled the construction of categories expressing the main lines of enquiry formulated by the students.

The metatexts were developed based on an interpretation of the constructed categories. They constitute analytical texts that link the students’ questions to the adopted theoretical framework. The metatexts are presented and discussed in the 'Results and Discussion' section.

RESULTS AND DISCUSSION

The analytical metatexts presented in this section were developed from the categories that emerged from the discursive textual analysis of the students' questions. These metatexts are the result of an interpretive process that links the identified units of meaning with the adopted theoretical framework.

Analysing the students' questions provided a comprehensive view of their main areas of interest and enquiry regarding the periodic table and chemical elements. This indicates patterns of curiosity and understanding that can be used to improve teaching in this area. Four categories emerged from the students’ interests expressed in their questions: the origin of the periodic table; the organisation of chemical elements; the use of the periodic table; and the representation of chemical elements. Table 1 shows the number of questions related to each of these categories.

Table 1

Categories emerging from students' questions.

Number of related questions	Category
16	TP Origins
12	Classification of chemical elements
09	TP Use
05	Representation of chemical elements

Source: The author (2026).

If the data is original and derived from field research conducted by the article's authors, this must be specified in the source, alongside the year in which the research was conducted. In this case, the source should be cited as follows: Own work (2024).

The first category, titled 'Origin of TP', stood out with a total of 16 questions, highlighting students' significant interest in understanding the historical and scientific processes that led to the development of this essential chemistry tool. Questions such as 'Who created this?' and 'Who invented it?' demonstrate a desire to learn more than just the immediate content, indicating an interest in connecting scientific knowledge with its historical trajectory.

This set of questions suggests that students value the context and history of the creation of the Periodic Table. The focus of the questions was on the reasons for its organisation, its construction process and the historical circumstances that guided its development. This reinforces the idea that introducing the topic through narratives about the evolution of science can be more engaging. These questions are similar to those commonly found in textbooks and assessments and may represent an initial familiarity with the topic. The desire to discover 'who' and 'how' reflects an initial bridge between the content and understanding of science. Furthermore, the fact that these questions focus on origin suggests that students may be encountering TP for the first time.

Based on these observations, students' interest in the history of science provides educators with an opportunity to integrate scientific concepts with the history of discoveries and developments, thereby encouraging the contextualisation of content (Moraes, 2008). This approach enables students to engage with the content and understand science as an evolving process built upon cumulative efforts.

Romero and Cunha (2019) discuss the importance of teaching the history of science at different levels of education, emphasising the use of popular science texts (PSTs) related to the periodic table.

Therefore, the desire to learn about the origin of the periodic table can be seen as an opportunity to incorporate the history of science into chemistry education. This can be achieved by using scientific texts to promote learning and encourage familiarity with scientific concepts.

The second category, 'Organization of the Chemical Elements', comprised twelve questions designed to gauge students' understanding of the criteria and principles that underpin the arrangement of elements in the periodic table. Topics covered by this set of questions include organisation by atomic number, physical and chemical properties, distribution across periods and groups, and the use of different colours in the table. Examples of questions include: 'Why are there different colours?' and 'How are the elements separated into groups?' These questions demonstrate the students' significant curiosity, revealing their desire to understand not only the structure of the periodic table, but also the scientific reasons behind its organisation.

This interest shows that students are seeking a systematic understanding of the periodic table. It suggests that they recognise the importance of colours, groupings and other visual patterns as aids to understanding the properties of the elements. By questioning these details, students demonstrate a desire to move beyond a superficial view and attain a well-founded understanding. This indicates that students perceive the periodic table not as an isolated resource, but as an essential organisational tool for understanding chemistry.

These observations suggest that educators can promote active learning by beginning the introduction to the periodic table with questions about its structure and organisation (Galiazzi, 2013). In this approach, students construct knowledge in a contextualised and applicable manner. Their curiosity about the logic behind the organisation of the elements suggests the possibility of exploring topics such as periodicity, properties and predictability, thereby broadening their understanding of the value of the Periodic Table as a scientific system that facilitates the study of chemistry and its interactions.

The third category, 'Applications of the Periodic Table', comprises nine questions reflecting students' interest in how the periodic table can be applied in everyday, practical situations. Questions such as 'What is the Periodic Table for?' and 'How are these elements present in everyday life?' demonstrate their curiosity about the usefulness and relevance of what they have learnt in their daily lives. Such questioning demonstrates that students seek meaningful learning, wanting to see the connection between what they study in the classroom and their lives outside of it.

An analysis of the questions indicates that students were not merely seeking immediate definitions; they demonstrated a need to understand the fundamentals and processes involved in constructing scientific knowledge. In other words, they want more than theoretical understanding; they want to see the immediate relevance of the content, especially in areas they consider applicable to daily activities, professions or other practical areas of life (Moraes, 2008). This need for purpose and applicability provides a valuable opportunity for educators to contextualise chemistry teaching, demonstrating how knowledge of chemical elements and their properties influences areas such as health, industry, the environment and technology.

An analysis of these questions also suggests that when introducing TP, it is essential for teachers to provide examples of how this knowledge can be applied to practical problems and real-life situations. This helps to satisfy students' curiosity about how what they learn can be applied in practice (César, Reis & Aliane, 2015). This sparks interest and fosters an investigative and critical mindset, motivating students to view chemistry as a relevant subject for understanding the world around them.

Although the fourth category, 'Representation of Chemical Elements', consists of only five questions, it offers important insights into how students perceive the symbols and numerical representations in the periodic table. The questions ask why there are 'codes' in the table, indicating that students are interested in understanding the purpose of symbols and atomic and mass numbers. This curiosity reveals an interest in the practical significance of chemical codes and their contribution to the organisation and use of the elements.

Based on these questions, it is clear that the students wanted to understand the coding system in the Periodic Table and the criteria that determine its organisation. They wanted to know what the symbols represented, why they were used, and how they aided the recognition and study of the elements. This need for clarification is a significant aspect of the teaching and learning process, as it demonstrates that the scientific symbols presented by teachers can appear complex and enigmatic to students, particularly those who are just beginning to study chemistry.

An analysis of this category suggests that contextualising symbols and numbers by comparing them to other common coding systems can facilitate students' understanding. Explaining the importance of each symbolic element and relating it to fundamental chemical properties can make these 'codes' more accessible and meaningful. Exploring how atomic and mass numbers are essential for identifying the unique characteristics of each element enables the teacher to connect theory to practice, promoting more integrated and comprehensible learning.

Teachers can use this initial interest in symbolic representations to develop practical and playful activities that explore the use of symbols and numbers. Examples include simplified tables and diagrams, as well as educational games. These activities can help to reinforce familiarity with these codes and stimulate the development of more intuitive and engaged learning.

The questions demonstrate a desire to learn more about the subject than is typically covered in the curriculum or present in the textbooks made available to students (Galle, 2021). Thus, the questions can serve as a guide for conducting activities and foster a desire to learn specific content — in this case, TP.

To explore the topic of TP in greater depth and enable students to reconstruct or develop their existing knowledge, a teaching unit could be structured from the CBR perspective. Table 2 below provides suggestions for practical, interactive activities that can be implemented to encourage the construction of coherent arguments and the development of students' knowledge.

Table 2

Tips for implementing UAs

Organizing activities	Implementation suggestions
Group Division and Answer Generation	The students would be organised into groups, with each group being assigned a specific topic. Based on the questions raised, each group would then develop detailed, well-reasoned answers. These would then be presen. The teacher would act as a mentor, suggesting materials and sources, such as books, websites and scientific journals, and offering support with creating the posters and presenting them in class.ted in the form of posters to be displayed at a school seminar.
Hands-On Activity with Samples of Everyday Materials	In this activity, the teacher will present samples of everyday materials such as table salt, vinegar, baking soda and chalk, alongside their chemical formulas. Students would then analyse these materials to identify the elements present in each sample, creating a table to list their characteristics and compositions. Later, there would be a session to share the results to encourage the exchange of knowledge.
A Study of Essential Minerals for the Human Body	Students would be given a list of minerals that are necessary for the human body to function, such as iron, calcium, magnesium and potassium. Using this list, they would locate the minerals on the periodic table and identify their groups, periods and classifications (e.g. metals, non-metals and alkaline earth metals). Next, they would research the health benefits of these minerals, where they are found in nature, and the effects of deficiency or excess. The activity would conclude with a class presentation of the results.
TP Coloring Activity	To help students organise and classify the elements more effectively, each student would receive a black-and-white copy of the periodic table. After an introductory lesson on the periodic table and its history, they would colour the elements according to their category (metals, non-metals, noble gases, etc.). This visual activity would reinforce their understanding of the periodic table's structure and organisation, linking theory and practice.
Socializing and Answering Questions	To reinforce learning, a group activity will be conducted to address any questions the class has about the TP. Group seminars, games and interactive exercises would help to consolidate the material while encouraging the exchange of ideas and collaborative problem solving.
Encouraging Research Through Questioning	In this approach, students are encouraged to seek answers to their own questions by responding to their questions with new questions. The class could be divided into groups and guided in their research of reliable sources to answer their questions, thereby promoting active and exploratory learning about TP.

Source: The Author (2026).

Another suggestion would be to promote integration with other components of the curriculum, as outlined in Table 3. For example, content related to TP could be incorporated into the science curriculum to develop strategies that enrich the teaching and learning process by drawing on different disciplinary contexts.

Table 3

Opportunities for integration with other curriculum components

Curricular component	Possibilities of teaching content related to the periodic table.
Arts	Use the periodic table to learn about elements by colouring in their columns and rows. This will help you identify the noble gases, metals and nonmetals..
Biology	Discuss the importance of certain nutrients for human health and their sources in the diet.
Physical Education	Create board games, card games and quizzes based on the chemical elements.
Geography	Investigate the significance of chemical components in different types of soil, and how these components change depending on the topsoil, climate and biome of a given region.
History	Discuss the historical context of TP, how it was developed and applied, and its significance.
Portuguese	Describe the importance and use of TP and chemical elements in our daily lives in written form and present these texts.

Source: The Author (2026).

Providing space for students to construct arguments, or in other words, listening to their voices, is a fundamental part of the process (Pauletti et al., 2021). Fostering dialogue enables students to become active participants in the teaching and learning process. Consequently, they play an active role in constructing, developing and understanding their own knowledge.

CONCLUSION AND FUTURE WORK

This study aimed to understand the interests of a Year 10 class regarding the TP, as identified through the questions posed by the students while observing a sample of the tool. The students' questions revealed their doubts and a quest for contextualised understanding that goes beyond mere memorisation and aims to apply concepts in practice.

Analysis of the students' questions revealed their desire to understand the origin, organisation, use and representation of the chemical elements present in their daily lives. This suggests that general chemistry could be taught in a more meaningful way that is closer to the students' reality. These findings reinforce the importance of listening to and valuing students' questions as part of student-centred pedagogical practice, where students' needs and interests are integrated into the teaching and learning process. This can help educators design activities that promote active and collaborative learning and increase students' engagement and interest.

Analysis of the students’ questions revealed their desire to understand the origin, organisation, use and representation of the chemical elements present in their daily lives. This suggests that general chemistry could be taught in a way that is more meaningful and closer to students' reality. These findings reinforce the importance of listening to and valuing students’ questions as part of a student-centred pedagogical approach, in which students' needs and interests are incorporated into the teaching and learning process. This approach can help educators to design activities that promote active and collaborative learning, thereby increasing students' engagement and interest.

We suggest that future studies implement one of the proposed teaching units in a Year 10 class, in order to investigate students’ perceptions and evaluate the effectiveness of this teaching model. This will enable us to assess how students respond to a more contextualised approach to TP, and whether it improves their understanding of the concepts and increases their interest in the related content.

Furthermore, this research is intended to guide teachers' classroom activities, offering insights to help them adapt their teaching practices to their students' specific needs and interests. Based on the obtained data and the presented reflections, teachers will find ways to adopt approaches that address students’ questions and curiosity, thereby encouraging engagement and autonomy.

THANKS TO

This study was conducted with the support of the Brazilian Agency for the Support and Evaluation of Graduate Education (CAPES), under Funding Code 001.

NOTES

The article was translated into English by Luciana Alves Bonfim, who holds a Master's degree in Language and Literature from UNIOESTE – Cascavel Campus (2016), and to whom we extend our thanks for her contribution.

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Received: Feb. 3th, 2026
Approved: Feb. 20, 2026
DOI: https://doi.org/10.3895/actio.v11n1.19864

How to cite:
Moss, N. WQ.; Galle, L. A. V.; & Justina, L. A. D. (2026). Questions from 9th-grade students about the periodic table. ***ACTIO***, 11(1), 1-18. https://doi.org/10.3895/actio.v11n1.19864

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Recebido: 03 fev. 2025
Aprovado: 20 fev. 2026
DOI: https://doi.org/10.3895/actio.v11n1.19864

Como citar:
Moss, N. WQ.; Galle, L. A. V.; & Justina, L. A. D. (2026). Perguntas de estudantes do 9º ano do ensino fundamental sobre a tabela periódica. ***ACTIO***, 11(1), 1-18. https://doi.org/10.3895/actio.v11n1.19864

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