Chemistry, education and health: The impact of mineral salts on human health

Jociele Cristine Alves Nogueira
PET-Chemistry Group, Center for Education and Health, Federal University of Campina Grande

Liliane Santos Gomes
PET-Chemistry Group, Center for Education and Health, Federal University of Campina Grande

José Carlos Oliveira Santos
PET-Chemistry Group, Center for Education and Health, Federal University of Campina Grande

ABSTRACT
Foods have nutrients that stand out for their specific chemical functions and particular physicochemical properties, and these certain characteristics play a fundamental role in the body, each having its specificities, directly influencing its functions and processes in the human body. In the context of the teaching of Chemistry, a subject that has received prominence is the chemistry associated with food, proposed in the official documents for teaching. The present study is focused on the application of contextualized themes during a chemistry class taught to high school students. This action was developed in the school environment, specifically by students belonging to the PET-Chemistry group of the Federal University of Campina Grande, whose main objective is to introduce and highlight the theme "Chemistry and health: Benefits of Mineral Salts for our health" as a relevant subject in the context of chemistry and in the daily life of students. According to the results, the students stated that they learned new fundamentals about the health benefits of mineral salts through the lecture, which is a promising indicator of the educational impact underlying this activity. In addition, most of them showed to be aware of the importance of consuming foods rich in mineral salts, thus highlighting the need for continuous dissemination of information on the subject.

Keywords: Health, Contextualization, Chemistry Teaching.

1 INTRODUCTION

Currently the Brazilian high school has been changing more and more to reach the needs that students have to develop effectively, traditionalist education has been a great villain in this sense, because it is known that no matter how many years have passed, some basic education institutions tend to remain with this outdated education, It is also based on technical teaching that is strictly concerned with preparing a future worker, a controlling learning, which prevents the personal growth of the student, making him not a critical being, who knows how to express himself and makes his contribution, thus preventing the student's own development. Thus, all these circumstances evidenced the need for the search for new active teaching methodologies that would contribute both to the chemical training of students and to the social formation, not only focusing on the transmission of content and preparation of the individual for the job market, but aspects far beyond that.

Even current studies prove that factors such as the context and the approaches used strongly influence the student's perception of their own learning capacity and ability. Thus, taking into account flexibility and

sensitivity to various influences, it is known that self-efficacy can be stimulated through activities that, in addition to moving beyond the subject to another environment and conviviality, encompass varied teaching techniques and encouraging cognitive development (MENCL et al., 2012).

Entering the chemistry milieu, for example, promoting belief in the ability to learn, among other emotional aspects, plays a vital role in increasing students' effort, dedication, and academic success. However, aspects such as the complexity of concepts, the need for abstraction and the separation between theoretical and practical teaching have contributed to arouse disinterest in students who see chemistry as something difficult and distant from reality (SALTA; TZOUGRAKI, 2004; CHEUNG, 2009).

A methodology that has been contributing a lot is the use of the association between everyday life and the concepts developed in the classroom, because in this way it will also be sought what the student has already experienced, that is, their previous knowledge about that particular subject that will be applied in class, for a better assimilation and understanding. The idea of this new contextualization arose with the reform of high school, based on the Law of Guidelines and Bases of Education (LDB-9.394/97), where it directs the understanding of knowledge for everyday use. It originated in the guidelines that are defined in the National Curriculum Parameters (PCNs), where they basically seek a chemistry teaching that focuses on the interface between scientific information and social context.

According to Thiesen (2008), the school is a living environment and, at the same time, an instrument of the subject's access to citizenship, creativity and autonomy. It must be constituted as a process of living, and not of preparation for life. That said, the school must contain, in itself, the expression of human coexistence, considering all its complexity and must be, by its nature and function, an interdisciplinary institution creating a connection between the act of teaching and the act of learning.

In the field of education, a subject that has received a lot of prominence is chemistry associated with food, which, by the way, is one of the indications present in official documents for high school is this correlation between knowledge in chemistry with diversified subjects (BRASIL, 2006). However, foods consist of nutrients that stand out for their specific chemical functions, specific structures and particular physicochemical properties, and these certain characteristics play fundamental roles in the body, each having its specificities, directly influencing its functions and processes in the human body.

The lecture that will be reported below was based mainly on the perspective of a general and broad contextualization, since the starting point was the relationship between chemistry and the students' daily lives through the approach to food. From this theme, concepts of what should be developed for the scientific understanding of students were initially sought. Mineral salts fit perfectly into this context, as they perform very important functions in the body, in the regulation of cell activity and maintenance, facilitate the transport of various substances, maintain muscle and nerve activity, facilitate the transfer of compounds through cell membranes and composition of organic tissues and are also indirectly involved in the growth

process. However, it is important to consider that mineral balance is essential, as the excess or deficiency of one in particular can interfere with the metabolism of another, triggering adverse effects on the functioning of the body. Therefore, adequate and balanced intake of minerals is essential to maintain biological functions. (PINHEIRO et al., 2005).

Therefore, the study of chemistry in relation to food is considered essential for the citizenship formation of high school students, since, through the knowledge of chemistry, students are able to understand the composition of minerals and reflect on their eating habits in the light of science. In the context previously discussed, about the changes that high school has been undergoing, this theme emerges as an opportunity to apply chemistry contents in a practical way.

2 OBJECTIVE

The objective of this work is to present in a comprehensive way how the knowledge of chemistry, with a focus on Mineral Salts, can contribute to raise the awareness of the participants in relation to the significant influence of science in their daily routines. Also, to show how this understanding can play a crucial role in improving human health and promoting healthy habits.

3 METHODOLOGY

The present study is focused on the application of contextualized themes during a chemistry class taught to high school students at ECI EEM Prefeito Severino Pereira Gomes, located in Baraúna, Paraíba. This action was developed in the school environment, specifically by students belonging to the PET-Chemistry group at the Federal University of Campina Grande (UFCG) in September 2023. Its main objective is to introduce and highlight the topic "Chemistry and health: Benefits of Mineral Salts for our health" as a relevant subject in the context of chemistry and in the everyday life of students.

To achieve this purpose, the extension workers held a lecture using interdisciplinarity as an educational approach, aiming to promote a deeper and more holistic understanding of the topics, allowing students to recognize how concepts in the field of chemistry can relate to real-world problems.

Data collection was carried out systematically through the application of a questionnaire with objective questions. This information was later organized, analyzed, and described in quantitative terms, using percentage presentations and numerical tables. This approach is characteristic of a descriptive study, in which the main focus is to observe, document, examine and elucidate the elements that affect students' stimulus to acquire knowledge in chemistry. The aim is to highlight how chemistry is a science present in your daily life and relevant to human health. In addition, the team responsible for the application of this project had the principle of not interfering or manipulating any form of students' opinions and concepts.

Guaranteeing the complete privacy of the participants, ensuring anonymity and providing them with the freedom to participate in the activity at any time, without any external pressures.

4 DEVELOPMENT

Chemistry is a science that is intimately intertwined with virtually every aspect of human life. From the water they drink, to the personal hygiene products they use on a daily basis, to the food they consume. According to Pires (2011), the ability to know the chemical composition of food, that is, which nutrients should be part of the diet and the functions they perform in the body, are of great value at the time of eating.

Therefore, the lecture entitled "Chemistry and Health: Benefits of Mineral Salts for Our Health" comprehensively addressed the relationship between chemistry and the promotion of human health. During the presentation, the impacts of mineral salts on nutrition and body functioning were discussed, highlighting their relevance for a balanced diet and for maintaining a healthy body. The action provided participants with a deeper understanding of how chemical science plays a key role in everyday life, especially in the context of health, and how informed choices can contribute to overall well-being.

The first question of the questionnaire applied at the end of the extension activity addressed the participants' perception of their own consumption of mineral salts after attending the lecture. This inquiry was intended to stimulate a personal reflection on the influence of shared information on their food choices.

Graph 1: In view of what you saw in the lecture, how is your level of food in mineral salts?

Source: Survey data, 2023.

The analysis of the graph reveals valuable information about the participants' perception of their level of food in mineral salts after the lecture. First, it is noteworthy that most of them rated their eating level as "Good", representing 14 (fourteen) of the 26 (twenty-six) respondents. This suggests that their food choices related to mineral salts are at an acceptable level.

On the other hand, it is important to note that 9 (nine) students rated their eating level as "Poor". This indicates that a significant portion of the audience recognized the need to improve their eating practices.

This result can be interpreted as a positive sign, as it suggests that the activity raised awareness about the importance of mineral salts in the diet and encouraged them to reflect on their eating habits.

In relation to the 3 (three) who classified their food level as "Excellent", this may indicate that they already maintained a diet rich in mineral salts before the above and that the extension activity reinforced their confidence in this regard. Overall, these results indicate that the lecture had a positive impact, promoting awareness and reflection on the importance of this aspect in the daily diet.

The following question: "Would you like to receive more information about topics related to chemistry and health in the future?" was formulated to assess the students' continued interest in exploring topics related to chemistry and health after the completion of the extension activity. The answers to this question can provide valuable insights into audience engagement and their desire for additional knowledge. A positive feedback indicates the interest in receiving more information, therefore, it can be interpreted as a demonstration that the activity met the expectations of the participants and motivated them to continue exploring this field of study. On the other hand, negatives can indicate areas of improvement for future practices, helping to adapt the content to the needs and interests of the target audience.

Table 1: Would you like to receive more information on topics related to chemistry and health in the future?

Response options	**Total number of participants**
Yes, definitely	13
Yes, maybe	13
No thanks	0

Source: Survey data, 2023.

A total of thirteen (13) participants indicated that they would "Definitely" wish to receive more information on this topic in the future, demonstrating a clear interest and enthusiasm to continue exploring the topics related to chemistry and health. In addition, another thirteen (13) answered "Yes, maybe", suggesting a moderate interest, which may indicate a willingness to continue learning, although with a slightly lower level of commitment.

The fact that none of the participants answered "No thanks" is quite encouraging, as it suggests that the task aroused widespread and positive interest in the topic addressed. This result can be interpreted as an indication that the lecture was effective in engaging the audience and stimulating the desire to deepen knowledge in chemistry and health in the future. Therefore, the answers to this question indicate that there is a real demand for more information and activities related to this field, which can guide the planning of future educational initiatives.

The question "What action do you plan to take based on what you learned in this lecture about mineral salts?" was designed to assess the practical applicability of the knowledge gained during the lecture and to determine whether participants were motivated to translate the information into concrete actions in their everyday lives. The answers to this question can offer valuable data on the impact of the presentation and students' willingness to implement changes in their food choices or habits related to mineral salts. Results indicating the intention to adjust the diet, increase the intake of foods rich in mineral salts, or seek additional information on the subject suggest that the lecture had a positive and inspiring impact. On the other hand, resolutions that indicate the lack of action plans may indicate the need for greater emphasis on practical application in future educational activities on the topic.

Table 2: What action do you plan to take based on what you learned in this lecture on mineral salts?

Response options	**Total number of participants**
I don't plan to take any action	2
I plan to incorporate foods rich in mineral salts into my diet	15
I will continue to have a good diet rich in mineral salts	9

Source: Survey data, 2023.

The majority, represented by 15 (fifteen) of the 26 (twenty-six) students who participated in the lecture, indicated that they plan to incorporate foods rich in mineral salts into their diet. In addition, 9 (nine) answered that they intend to continue maintaining a diet rich in mineral salts, indicating that they already adopted healthy eating habits in this aspect and intend to continue. This demonstrates that the lecture not only positively influenced those planning to make changes, but also reinforced the commitment of those already following a balanced diet.

However, the response of two (2) students indicating that they do not plan to take any action may suggest that it may be necessary to further emphasize the importance and benefits of incorporating mineral salts into the diet.

The following question was formulated to assess students' understanding of the potential health risks related to poor food choices and insufficient intake of mineral salts, based on the information presented during the lecture. Their answers can provide data on the effectiveness of the activity in imparting knowledge about the possible negative impacts of a diet low in mineral salts. The participants' ability to identify and relate these harms to the content taught can indicate the degree of absorption of the information and their potential to apply this knowledge to their own food choices.

Table 3: According to what you saw in the lecture, what will cause harm to the body?

Response options	Total number of participants
Lack of mineral salts	0
Excess mineral salts	3
The lack and excess of mineral salts	23

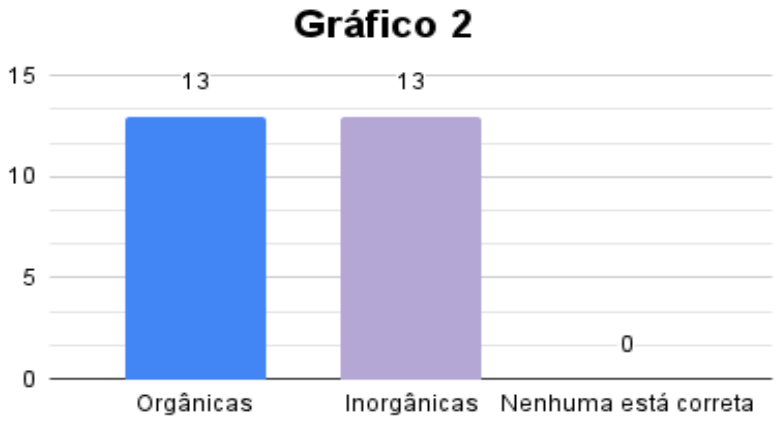
Source: Survey data, 2023.

The analysis of the answers reveals that the majority of the students, represented by 23 (twenty-three) of the respondents, correctly identified that both the lack and the excess of mineral salts in the diet can cause harm to the body. Demonstrating a solid understanding of the information presented during the lecture, as both scenarios were addressed as potential health risks. The ability of the participants to recognize that the balance in the intake of mineral salts is essential for the maintenance of health is a positive indicator of the transmission of knowledge.

However, the answer of 3 (three) students indicating only the "excess of mineral salts" as a cause of harm to the body, without mentioning the lack, can be seen as an opportunity to clarify or deepen the understanding of this specific topic.

The question "Mineral salts are what type of substance?" aimed to assess the student's understanding of the nature of the substances that make up mineral salts, based on the information presented during the explanation. Their answers are indicative of the degree of absorption of the concept and the chemical terminology associated with mineral salts. The students' ability to recognize mineral salts as a specific type of substance, often formed by combinations of ionic minerals, can demonstrate the effectiveness of the lecture in conveying complex chemical concepts in an accessible way.

Figure 2: What kind of substance are mineral salts?



Source: Survey data, 2023.

The fact that 13 (thirteen) participants identified the mineral salts as "Organic" and another 13 (thirteen) classified them as "Inorganic" suggests that there was an almost equal division between the responses. However, this divergence indicates that some students may have had an incomplete or inaccurate understanding of the concept, since mineral salts are categorized as inorganic substances in chemistry, containing no carbon in their composition.

The following question was formulated in order to obtain data on the effectiveness of the lecture in transmitting new and relevant information on the subject, where this will help to evaluate the communicative environment and learning objectives, in addition to showing if the content was informative and well presented, if convincing arguments about the benefits of mineral salts were used.

The mentioned question had as options the alternatives "YES" and "NO", from it it was obtained that 100% of the students who participated in the activity absorbed at least some topic about the various benefits that mineral salts have, in this way, they evaluated the event in a positive way, a very relevant aspect, because based on this it can be said that the method and approaches used brought effective results. That said, the alternative "NO" was totally null and void, since it did not have any result in the face of the perspective presented.

Chart 3: Do you believe you have learned something new about the health benefits of mineral salts from this lecture?

Source: Survey data, 2023.

The sixth question aimed to assess the degree of prior knowledge of the participants about the relevance of mineral salts in food and health. Through it, we sought to understand if the students were already aware of the importance of these nutrients before the lecture. This information is crucial for the evaluation of the impact of the educational activity, since it allows us to verify whether the lecture was able to clarify and broaden the students' understanding of the theme. In addition, this issue also assists in identifying gaps in public discernment and identifying the need for greater awareness of the health benefits of mineral salts.

Graph 4: Were you aware of the importance of consuming foods rich in mineral salts?

Source: Survey data, 2023.

Analyzing the data provided above, the following percentages of responses can be observed: 23.1% "Yes", that is, a quarter of the participants indicated that they were already aware of the importance of consuming foods rich in mineral salts, a percentage suggesting that a significant part of the audience already has some knowledge about the topic. 53.8% "Somewhat", i.e., the majority expressed having, although not much, some familiarity with the importance of mineral salts in the diet. This portion of the class expresses an opportunity to carry out other activities to provide additional information and consolidate the existing understanding. 23.1% "No", a smaller portion pointed out a lack of information about the importance of consuming foods rich in mineral salts, demonstrating the need to dedicate a specific time to address the concerns and doubts of these students.

The objective of the next question was to understand the perceptions and possible causes attributed by the students to the lack of mineral salts in the diet. The answers to this question can provide valuable data on the attitudes, knowledge, and barriers perceived by listeners regarding the adequate consumption of mineral salts. In addition to indicating the level of public awareness regarding the underlying causes of a diet low in mineral salts, this will help to identify whether lack of understanding, conscious choices or other factors are noted as the main influencers. It can also reveal the degree of nutritional understanding of the students, highlight the eating habits and their lifestyles that often act as obstacles to a diet rich in mineral salts. Thus including lack of time, food availability or personal preferences.

Table 4: Which factor do you believe most influences a diet low in mineral salts, i.e., a poor diet?

Response options	Total number of participants
Day-to-day hustle and bustle	1
Processed foods taste better	9
Lack of information on the importance of foods rich in mineral salts	16
Other. Quote.	0

Source: Survey data, 2023.

Analyzing the answers referred to Table 4, it is seen that in the first alternative: Day-to-day rush, only one student points out this factor as the main influencer for a diet low in mineral salts. Processed foods are tastier, 9 (nine) attributed poor diet to the attractiveness of processed foods in terms of flavor, so it is seen that these processed foods can be more convenient and desired to the palate, which strongly influences food choices. The lack of information about the importance of foods rich in mineral salts was the most frequent response, where 16 (sixteen) students expressed that this is a significant factor that contributes to this deficiency in diet. Finally, there was the "Other" option where 0 (zero) participants indicated other factors that were not included in the options provided.

In view of the above, the most common answer highlights the lack of information as the main influencing factor for a diet low in mineral salts, this shows that there is a need for education and awareness about the importance of these nutrients for the functioning of the animal organism, although some participants mention the attractiveness of industrialized foods can highlight the importance of addressing not only knowledge, but also the sensory and taste aspects in promoting healthy food choices. As a result, practical strategies are needed to incorporate foods rich in mineral salts into the daily routine, following the day-to-day rush as a real challenge for many people.

The 9th question sought to evaluate the impact of the lecture on the students' understanding and awareness of the importance of mineral salts in the daily diet. The alternatives present in this question were "YES" and "NO", so the answers can indicate whether the participants felt that the action was effective in transmitting clear and understandable information about the importance of mineral salts, making it evident whether the educational objectives were achieved or not.

Graph 5: In your perception, did the lecture help you understand the importance of mineral salts present in daily diets?

Source: Survey data, 2023.

The data presented very clear and positive results in relation to the question "In your perception, did the lecture help you understand the importance of mineral salts present in daily diets?". Positive Answers (Yes-100%), so that all participants answered affirmatively, stating that the lecture was effective in helping them understand the importance of mineral salts in daily diets. The unanimity in the positive responses is a sign that the activity was well structured and efficient in communicating the concepts related to mineral salts, as the students not only understood, but also expressed understanding about the importance of these elements in the diet, so the approach was effective and can be maintained.

The next question aimed to identify if the students had a good perception of the lecture and if it brought substantial information about the theme, which is of total importance to assess whether the content met the students' expectations and need for knowledge. Also evaluating if there was a good language used and a clear organization of the contents, if it cleared all the pertinent doubts.

Table 5: Do you consider that the lecture was informative and enlightening on the topic?

Response options	**Total number of participants**
Very informative	21
Informative	5
Neutral	0
Not very informative	0
Not informative	0

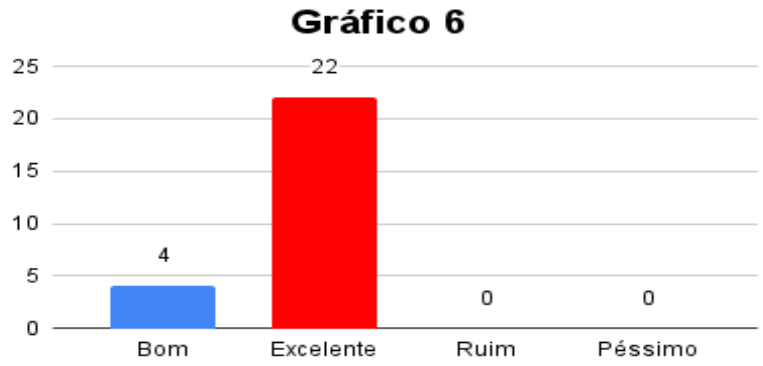
Source: Survey data, 2023.

By analyzing the Table, we have a positive overview of the students' perception regarding the informativeness and clarification of the lecture on mineral salts. Among the alternatives, most students (21) considered the lecture as "Very Informative", which indicates that they probably felt that the presentation met their expectations regarding the amount and depth of information provided. In addition to the students

who considered it "Very Informative", there were others who rated it as "Informative" (5 students). In the options "Neutral" (0), "Not Informative" (0), "Not Informative" (0); none expressed negative or neutral perceptions.

To conclude, the degree of satisfaction of the students in relation to the lecture was evaluated. Such answers will help with the improvement of some elements such as: communication skills, clarity in presentation and ability to maintain the audience's interest; The question also seeks to understand whether the class considered the content relevant and useful. In addition to identifying opportunities for improvement, guiding adjustments in the approach, content or dynamics of the class.

Graph 6: What is the degree of satisfaction with the lecture addressed?



Source: Survey data, 2023.

It should be noted that the vast majority of the class evaluated the lecture as "Excellent" (22 students), stating that the presentation met or exceeded the audience's expectations in terms of content and impact. Some students also rated it as "Good" (4 students), although this rating is lower than "Excellent", it is still a positive evaluation. On the other hand, the alternatives "Bad" and "Very Bad" had no classifications, so that none of the participants expressed significant dissatisfaction or dissatisfaction with the didactics addressed.

The participants' answers indicate positive results and a solid understanding of the main concepts covered in the lecture, such as the importance of mineral salts in the diet and the possible harms of both the lack and excess of these substances. Indicating good aspects about the chosen method of educational approach. Interdisciplinarity not only enriches the learning experience but also prepares students to face the multifaceted challenges of the real world with a broader and more integrated perspective. For Paulo Freire (1987), interdisciplinarity refers to the method by which the individual constructs his knowledge through his relationship with the context, with reality, with his culture.

5 FINAL THOUGHTS

The theme in focus proved to be notoriously influential from the perspective of the participants, since most of them unequivocally evaluated the level of enrichment of their intake of mineral salts as 'Good', which strongly insinuates that the activity under analysis played a preponderant role in raising awareness about the importance of these chemical elements in the context of human nutrition. In addition, it is noteworthy that some of the students, inspired by the knowledge acquired, demonstrated the deliberate intention of consciously incorporating foods abundant in mineral salts into their diets. In general, all students stated that they had learned new fundamentals about the health benefits of mineral salts through the lecture, which is a promising indicator of the educational impact underlying this activity. In addition, most of them showed that they are aware of the importance of consuming foods rich in mineral salts, thus highlighting the need for continuous dissemination of information on this crucial topic.

With regard to the understanding of the harms associated with mineral salts, it is noteworthy that most of the students correctly identified that both deficiency and excess of these substances can be harmful to the body, which attests to a solid understanding of the content covered.

The favorable evaluation of the lecture, with the majority of participants qualifying it as "Very informative" and "Informative", denotes that the activity was effective in transmitting relevant and enlightening information. In addition, the interest expressed by the students in receiving more information related to the intersection between chemistry and health in the future is a clear indication that the action not only motivated, but also stimulated the desire for continuous learning.

Finally, the high degree of satisfaction of the participants in relation to the lecture, with the majority classifying it as "Excellent," reflects an extremely positive evaluation of the event and evidences the success of the initiative in promoting awareness about the importance of mineral salts for health.

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