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The use of food labels as an active methodology in high school chemistry learning

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ABSTRACT

In this period of uncertainty and transformations that we are living, it falls to the teacher to have the mission of teaching the students in a way they can assimilate what they have been taught with day-to-day applications. For this reason, the contextualizing of the contents that have been learned is a great strategy to improve the teaching and learning process. This study aims to analyze the possibilities of the methodologies used to facilitate the process of learning through the interpretation and analysis of food labels. This project was developed at Centro de Ensino Benedito Leite, in classes from the third year of high school (or junior year), totaling 82 students. Primarily, a questionnaire was applied and after that, expositive classes, thematic workshops (quiz and experiments) were organized, exploring the interpretation of the technical terms associated with the labels and the identification of some organic functions present on them, with discussions corresponding to the benefits and the damages when present in great amount in foods. And, in the end, an evaluation of the activity developed was apprehended, it was not selected that 51% of the students never read the labels before buying, while 24% never read the labels and 22% read the labels, signaling that the application of the practice performed associated with the substances contained in the foods will motivate adolescents/teenagers to exploit the labels and it turns into a necessary action. From the diagnostic analysis of the data, it was possible to realize the importance in using methodologies that make students owners of systemic knowledge, doing activities that can associate the scientific knowledge and the students' reality, in a way that stimulates the interest for Chemistry. After the students participated in the methodological activities of the project and through the evaluation questionnaire, the students should assign their level of agreement with the following statement "Studying chemistry through the food labels facilitated my learning" 58% of students answered it as “completely agree” and 32% “agree more or less”, resulting in a meaningful majority of approval of activities developed, conveying that innovative methodologies help in the teaching-learning process, turning people into critical and independent citizens. Lastly, by means of all the study performed and the educational activities presented, it was possible to confirm that the use of the interpretation of the food labels can assist and promote the process of critical and scientific training in a way to obtain a more interactive, dynamic and inclusive education.

Keywords: High school, Product labels, Organic Functions, Quiz, Games.

1 INTRODUCTION

The teacher's main challenge in the educational process is to teach the student to think and make him a critical subject. However, to this day, archaic models of teaching are used in the teaching-learning process. It is common for educational practice to be centered on the figure of the teacher and the students only passive subjects in the education process.

This form of teaching has proven to be ineffective in the face of great technological advances and changes in habits experienced by society. In this sense, the search for innovative and dynamic teaching methodologies for everyday school life represents an important step in the teaching-learning process, since static methodologies are no longer so appreciated by the current public. Thus, it is up to the teacher to play the most important role, which is to innovate in teaching proposals.

In view of the difficulties encountered in the teaching of chemistry, often presented in a traditional format, the need arises to seek in daily life the content that is studied in the classroom so that the student has a more efficient teaching, providing the teacher with a way to motivate students, to the point of ensuring the right choice of methodologies that promote the development of critical and scientific thinking.

In addition to the teaching difficulties, another issue is related to the health and well-being of students, because in Brazil there is a notorious increase in domestic consumption of processed foods, such as bread, sausages, canned goods, cookies, beverages and a wide variety of instant foods. This fact is due to the practicality that these foods provide and the lack of time for the preparation of the food itself, due to a more urban lifestyle. Thus, this growth had a negative impact, deteriorating the consumption patterns of this population. Malnutrition is associated with increased consumption of unhealthy foods, with excess sugar, fat and sodium, and deficiencies in fiber and micronutrients, which lead to an increase in overweight problems and, consequently, obesity in the population of Brazil and the world.

In the development of the project applied at the Benedito Leite Teaching Center and entitled "The Teaching of Chemistry through Food Labels" we sought to gather data/information with the purpose of answering the following research problem: Is it possible to use food labels as a teaching methodology in the discipline of Chemistry and thus form critical and conscious subjects of their food choices?

In view of this, the contextualization of the contents in the teaching of the discipline Chemistry emerges as a proposal to bring practical meaning to the concepts learned and to strengthen the relationship between theory and practice. The search for knowledge based on practical examples is important for students to understand the phenomena that surround them and their relevance.

For the development of the present work, data collected through the application of the project in the classroom, through questionnaires and direct observation, were used. The activities were developed in the months of November and December 2021, at the Bendito Leite Teaching Center, in 4 classes of the third year of high school and bibliographic research. Due to the research problem related to teaching methodologies, contextualization and food labels, we sought to select articles, manuals and books to reinforce the theoretical basis.

Thus, the present work seeks to contribute to the teaching-learning process through a more contextualized teaching proposal, which brings the content taught closer to the student's daily life and, as a consequence, provides students with scientific literacy. The project aimed to train critical, active citizens and holders of systemic knowledge, and for this, activities were carried out that related the scientific knowledge and the student's reality, in order to awaken the interest in chemistry.

2 THEORETICAL BACKGROUND

2.1 DIFFICULTIES IN THE TEACHING OF CHEMISTRY IN BRAZIL

The teaching of chemistry has been shown to be less and less efficient in its traditional format, in which the student has little participation in the learning process, and the teacher is delegated the role of knowledge holder, whose function is only to transmit what he knows (CAVALCANTE, 2016).

Understanding the difficulties encountered in this teaching format can be the first step to remedy these deficits and show students the importance of this discipline in everyone's lives, in order to arouse interest in its study. Especially in the teaching of chemistry, it is perceived that students have learning difficulties because they do not associate the content with their daily lives, thus making it uninteresting. This suggests that teaching is being done inefficiently (NUNES and ADORNI, 2010).

For SANTOS and SCHNETZLER (2000), the chemistry taught in schools has contributed little to the formation of more critical and autonomous citizens who know how to make judgments pertinent to their cultural and social context. The teaching of chemistry cannot be limited to the transmission of knowledge. It is necessary that the conceptual contents are related to the student's life, bringing him closer to his reality, giving "meaning to the world around us and understanding the meaning of scientific knowledge" (POZO; CRESPO, 2009, p. 118).

It is up to the teacher to bring to the classroom activities that arouse students' interest in studying chemistry so that it can be applied in their daily lives, in choices and decision-making. Which, according to Marques (2021), will lead to the formation of a critical citizen, capable of better understanding the world, positioning himself before it and contributing significantly to the review and construction of new knowledge.

Therefore, making the subject of Chemistry interesting for the student is a challenge for teachers, as some scientific concepts covered in the classroom often present comprehension problems. The following learning difficulties in Chemistry were listed by Santos *et al*. (2013) in a research carried out with 95 students of the 1st grade of High School from three schools of the state public education network in the municipality of Aracaju/SE: absence of mathematical basis, complexity of contents, teachers' methodology, attention deficit and interpretation difficulties. For the author, what contributes to high school students presenting difficulties in their study is the fact that they consider the understanding of chemical concepts complex.

In most schools, greater emphasis has been given to the form of teaching in which there is the transmission of knowledge and the memorization of facts, symbols, names, formulas, and the construction of chemical knowledge ends up not being absorbed in a useful way by the student. This practice has had a negative influence on students' learning, since they are unable to perceive the relationship between what they study in the classroom, nature and their own lives (MIRANDA; COSTA, 2007).

The lack of attractions in the school environment, combined with an increasingly technological and connected reality outside of it, have demotivated students and generated a lack of interest in the content covered in the classroom. From this perspective, motivation plays a fundamental role in the teaching-learning process. The motivated student gets involved with the concepts covered, takes pleasure in what is learned, and participates in the construction of new knowledge (LIRA, 2019).

For Milaré (2008), the use of themes in Science Teaching and Chemistry Teaching can collaborate in the realization of these points in the classroom, as they direct scientific knowledge to a practical purpose, attributing importance to students to what is studied and favoring interdisciplinarity. In addition, the inclusion of social topics in Chemistry classes helps to avoid the massive dumping of content and the need to memorize concepts and formulas, which characterize traditional teaching. They also collaborate with the discussion of social, political and economic aspects, which are non-disciplinary elements that help in the problematization and are part of the students' reality.

2.2 THE IMPORTANCE OF PLANNING AND THE USE OF NEW METHODOLOGIES IN THE TEACHING OF CHEMISTRY

The teaching of Chemistry is currently present in a relevant way in the educational routine, in which several times the main concern of teachers is the exposure of the largest amount of content possible, on the board and brush, in a conventional way without using other types of resources to make learning more practical for students.

Thus, the development of new teaching methodologies is essential in order to make learning more pleasurable and motivating for students. Among the most effective methodologies, the use of different didactic resources stands out, as long as they are appropriate to the space and time available in class, and that allow better work and overcome the difficulties associated with teaching and learning (PEREIRA *et al*., 2010).

When planning their didactic activities, teachers should create situations and activities designed to promote a better understanding and acquisition of knowledge. Planning consists of an activity of predicting which action will be carried out, where objectives, procedures, resources and forms of evaluation are defined based on an educational intentionality (LIBÂNEO, 2008).

Understanding the reason why this subject is studied is an important step in motivating students and facilitating the teaching-learning process. Some compounds studied in high school in which their structural formula, nomenclature according to IUPAC, are known, have names known in the student's daily life and could be better presented. As an example, we have the acid present in vinegar, which is a carboxylic acid, whose usual name is acetic acid and is the main component of vinegar used in food preparation.

There are many phenomena in our daily lives that can be explained through the study of Chemistry. Making a relationship between these phenomena and the contents learned in the classroom is important in the learning process of the discipline, since it facilitates the assimilation of the contents and makes them more interesting for the students (CHASSOT, 2004).

In order for the student to be able to see the importance of studying chemistry, more effective teaching methodologies should be employed, with the objective of stimulating the student in the teaching-learning process. Contextualization, therefore, presents itself in this perspective as a great ally of the teacher in this process.

There is a need to talk about chemical education, which prioritizes the teaching-learning process in a contextualized way with the student's daily life, problematizing and dialoguing so that it can stimulate students' reasoning, making them realize the importance of chemistry in a technological society (ROCHA AND VASCONCELOS, 2016). In this sense, the National Curriculum Parameters for Secondary Education (PCNEM) emphasize that content and themes should favor the understanding of the natural, social, political, and economic world. (BRAZIL, 1999)

Therefore, in order to have a quality education, it is important to search for new teaching methodologies, in order to motivate learning and promote the student's interest in this discipline that many still consider unimportant in their daily lives. (GARCIA, *et al*., 2017)

2.3 NUTRITION LABELING AND ITS FUNCTIONS

According to ANVISA and UNB (2005), nutritional labeling is defined as any description intended to guide the consumer about the nutritional properties of a food, including information regarding the energy value and the main nutrients. As Bendino (2012) assures us, nutritional labeling serves as a communication vehicle between the consumer and the producer.

For ANVISA and UnB (2005, p. 5), nutritional labeling makes life easier for consumers because it presents nutritional information regarding the amount that can be consumed, shows how much that portion of food contributes to the total nutrients that should be ingested per day, which allows for more conscious choices:

> Nutritional labeling makes it easier to choose healthy foods based on the information contained in food labels, one of the strategies designed by the National Food Policy to reduce the rates of overweight, obesity and chronic degenerative diseases associated with the population's

> eating habits. Nutritional labeling, as one of the actions defined for the implementation of this Policy, was regulated by the National Health Surveillance Agency - ANVISA in March 2001.

Nutrition labeling applies to all food and beverages produced, marketed and packaged in the absence of the customer and ready for offer to the consumer. Evidently, the use of food labels emerged with the objective of facilitating communication between producers and consumers, as a way to show the important information contained therein and that should be used in the proper choice of food. (CAVADA, 2012)

In summary, the label is the identity of the product, with it it is possible to know the most important information regarding what the consumer is buying, as it presents information about the composition of the food, which can provide a basis for consumption choices, with repercussions on health. The packaging must also present the quantity of the product, the identification of the origin, the identification of the batch and the expiration date of the merchandise (ANVISA, 2002).

> Many ordinances regulate what a label should or should not contain. The purpose of these regulations is to ensure quality products in good hygienic conditions for the entire Brazilian population, aiming at maintaining health. In this sense, nutritional labeling allows you to know and identify the composition of foods, since it exposes all the necessary information to the consumer. (ANVISA and UnB 2005, p. 3).

Therefore, it is important to understand that nutrition labelling is an important tool for a healthy life, but it is necessary to understand that its existence alone does not guarantee consumers conscious choices, this is only possible if the consumer acquires the ability to interpret these labels.

2.4 APPLICATION OF FOOD LABELS IN THE TEACHING-LEARNING PROCESS

One of the strategies that can be used in chemistry classes is the interpretation of packaging labels, in order to make the student know the terms inserted in these labels and understand their importance. Packaging labels are considered an essential communication tool for the well-being of consumers, as they point out the origin, nutritional properties and constituents of products. Labels are fundamental tools to inform and guide the consumer about the quality and nutrient portion of food, allowing them to make thoughtful choices in diets made on a daily basis. According to Marko (2018), through this approach, the teacher, in addition to dealing better with the content and concepts to be worked on in schools, will be better prepared to choose and elaborate materials, methodologies and assessments in their own teaching practices.

The importance of nutritional labeling of foods to encourage healthy eating is notable in most of the analyses and research that involve various academic areas and its relationship with strategies to reduce the risk of chronic diseases. It is understood that many food consumers are not curious about the information on food labels, so they are unaware of the advantages they bring (ESTEVES.2017).

For Santana and Fonseca (2006), the study based on the handling of packaging will have more meaning for students because it is part of their reality and therefore will help them to understand the meaning of the information presented, in addition to encouraging them to acquire the habit of reading the label and verifying the data provided. It is also important that the teacher encourages them to seek information from manufacturers, so that they can exercise their citizenship in a respectful and, above all, well-founded way.

It should be noted that educational actions need to be established to instruct the population about the relevance of reading food labels and their nutritional information, so that consumers would be sensitized to a better choice of food (HIPÓLITO & FRANCISCO, 2015). Through these assumptions, there is a need to understand the degree of difficulties and development of the scientific argumentation that students who frequent conventional supermarkets have in relation to food labels and their nutritional information.

According to Marques *et al*. (2008), labeling can contribute to the teaching of different subjects of Chemistry at the secondary level. As these authors assure, the content of the Periodic Table, for example, could be explained by means of the symbols of the chemical elements that are found on the labels of the products. Understanding and correctly interpreting the information printed on the labels of everyday foods educates, raises awareness and facilitates the understanding of the role of Chemistry as an applied and useful science in daily life (PORTO, 2013).

In this context, nutritional labels can be a great ally in the teaching of chemistry, as they allow the development of chemical, physical and biological concepts related to food, providing students with the development of attitudes that contribute to the formation of critical citizens. In addition, they must know how to interpret the information on the labels, to make decisions that will interfere in the choice of products that are more appropriate to their daily needs, thus collaborating for disease prevention and a healthier lifestyle.

2.5 INCREASE IN THE CONSUMPTION OF PROCESSED FOODS

The consumption of processed foods has grown significantly in recent years, whether for the ease of acquisition, or for adaptation to busy life or even for the taste. However, all justifications are valid for the consumption of processed foods, so, even with social isolation and families spending more time at home, the consumption of these products grew, contrary to what was expected. So, industries are investing more and more in substances that make foods with texture, color and flavor more attractive to consumers of all ages. For Kadooca *et al*. (2019) It is necessary to be careful when ingesting these foods, as there are companies that use additives to mask the quality of products that should not be consumed, that is, the misuse of these substances can be extremely dangerous.

Additives are defined as "substances intentionally added to foods for the purpose of preserving, intensifying, or modifying their properties, as long as they do not impair their nutritional value" and are prohibited from being added to foods if there is proof or suspicion that their consumption is not safe for humans. (CAMPESTRINI, *et. al*, 2005)

Thus, it is necessary to study and constantly supervise, both the possible side effects of the additives in circulation, and how companies are using them in their production. It is up to the consumer to police themselves, avoiding exaggerations and consuming only safe amounts of each food and, whenever they are in doubt about this limit, check with the manufacturer. Special attention should be paid to children, who, because they have significantly lower body weight, should consume lower amounts of each additive (POLONIUM; PERES, 2009).

According to Gonsalves (2001), it is very difficult to eliminate all risk factors from our diet and make one hundred percent correct and healthy choices, but it is possible to use common sense by making choices that provide an increase in the consumption of healthier foods and a decrease in those that are more harmful to our health. It is up to us, citizens, with the help of scientific knowledge, to analyze whether such technology is contributing to benefits or harms to our health and consequently to our quality of life.

3 OBJECTIVES

3.1 GENERAL OBJECTIVE

- To verify the level of development of scientific argumentation of high school students through didactic activities applied in chemistry classes involving the reading and interpretation of labels of food products.

3.2 SPECIFIC OBJECTIVES

- Conduct a survey through questionnaires with high school students about their knowledge of the items that make up the labels of processed foods;
- Demonstrate, through contextualized classes, for high school students, the importance of the society that consumes industrialized foods in interpreting the items that appear on the labels;
- Carry out workshops and differentiated activities with students in order to use the study of industrialized food labels as a didactic strategy;
- To verify how students perceive the relationships between the chemical contents covered in the classroom and their daily lives, mediated by activities with the use of industrialized food labels;

- To evaluate, through questionnaires, whether participation in the project reinforced or added new chemical knowledge, as well as whether it provided reflection on the consumption of processed foods.

4 METHODOLOGY

According to Gil (2007), research is the set of systematic procedures, based on logical reasoning, which aims to find solutions to proposed problems, consisting of some steps, from the presentation of a problem to the discussion of the results.

The research was carried out from the application of the Academic Focus project/UFMA, entitled "**THE USE OF LABELS IN THE TEACHING OF CHEMISTRY:** Exploring and interpreting food labels", in 4 classes of the third year of high school, in the morning shift, of the Benedito Leite Teaching Center", located in the center of São Luís - MA. In all, 82 students participated in the project, most of them up to 18 years old. The field research was carried out from November 18, 2021 to December 9, 2021 and had the participation of scholarship holders and volunteers for its application.

Due to the use of questionnaires with questions that aimed to know the reality of the subjects participating in the research, the data treatment was a qualitative approach and the type of hypothetical-deductive reasoning was the basis to identify the influence of the methodology used as a facilitator of learning.

As instruments for data collection, the questionnaire and direct observation were used, in order to obtain a better appreciation of the results obtained in the development of the project. Data were collected using standardized questionnaires for the correct tabulation of the data. With this resource, it was possible to collect the most important information for the development of the work.

These questionnaires were the methodological tools that guided the research, and their elaboration aimed to discuss issues related to the students' perception of the use of food labels as a facilitator in the learning process, which aims to make it easier to understand in the chemistry discipline.

The research was carried out in five stages. In the first, a diagnostic questionnaire was applied, with the objective of knowing the students' eating habits and the frequency of reading food labels, as well as knowing the way they see and/or relate chemistry in their daily lives.

The second stage consisted of two lectures and dialogues, the first on the importance of chemical knowledge in the reading and analysis of food labels for more conscious food choices, focusing on the chemical knowledge used in the information contained therein.

The second class taught used the contextualization in the teaching of organic functions, commonly found in the chemical composition of food and expressed on food labels, their benefits or consequences on the health of the consumer and their importance in the food industry.

The third stage consisted of the application of a quiz, elaborated on KAHOOT (available on the web and in the play store) and made available to students through a link. The use of the application came in order to investigate whether students were able to be clear about the subjects worked on in the classroom. The questions were chosen and developed in advance by the project team, which took into account the classes taught and the discussions regarding food labeling raised in the classroom.

In the fourth stage, an experimental activity was developed with the students, on the identification of carbohydrates and proteins in some foods, as a way to reinforce that the information contained in the labels is of great importance and that their composition is also presented.

And finally, the fifth and last stage of the project, which consisted of the application of the learning assessment questionnaire, in order to analyze the impacts of the project on the study of chemistry and on the lives of students. The questionnaire was made available in a link (through a web form prepared from Google Forms, a Google application that allows the creation, sharing and availability of a form on the web) and sent to students from 4 classes of the third year of high school, so that the schedules would have enough time for the development of all stages of the project.

To conclude this study, information regarding the results was obtained through the two questionnaires: diagnosis and satisfaction. The first had questions related to the subject of study and the second questions related to the results obtained after the development of the project, as well as observations and analyses of classroom activities.

5 RESULTS AND DISCUSSIONS

In the initial questionnaire, 13 questions were presented with the purpose of knowing the students' eating habits, frequency of reading the labels of foods consumed by them, information they considered relevant on a food label and the understanding of the chemistry contained therein. Of these suggested questions, 5 questions were analyzed, where the answers were very relevant to the proposed methodology suggested in the classroom.

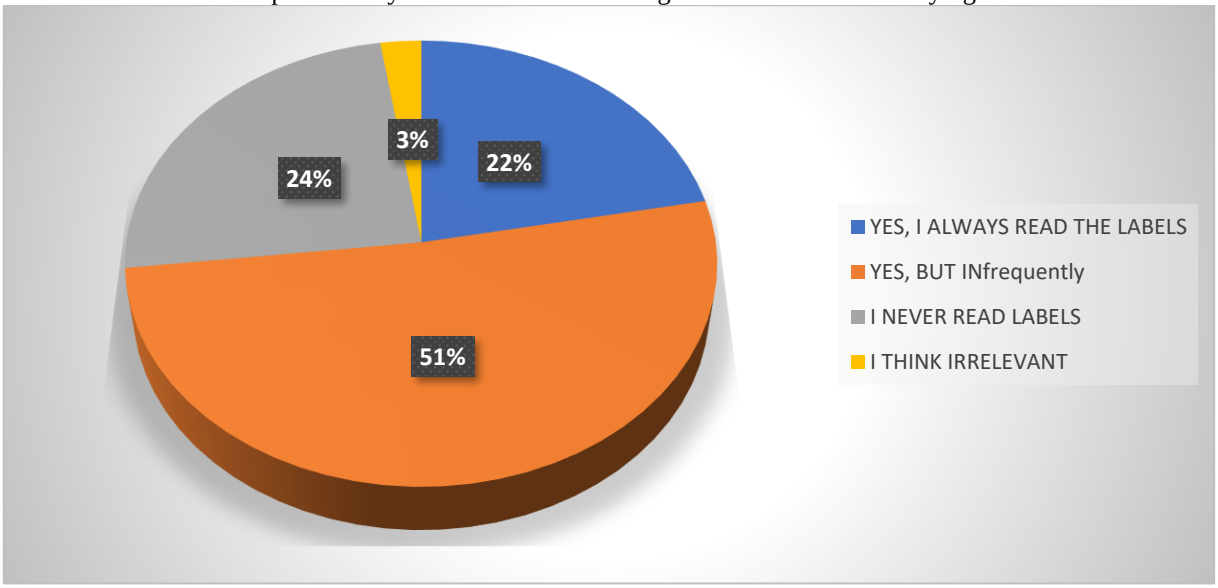
To know the profile of the students, 2 fields were made available for answer: age and gender of the student. Of the total of 82 students, 39% are male and 61% are female. The interviewees were between the ages of 16 and 18.

5.1 ANALYSIS OF THE DIAGNOSTIC QUESTIONNAIRE

From the communicative and enlightening character that the labeling presents, the students were asked about the habit of reading the labels of industrialized foods, and sold in markets and

supermarkets, because the nutritional labeling has the function of guiding consumers as to the composition and characteristics of the products, in addition, it is evident that more and more people are concerned about health, therefore, the label encourages the adoption of healthier eating practices (GONÇALVES, 2012). For this reason, the students were asked about their personal habit of observing or not the labels as part of the choice of food for consumption, the answers are illustrated in graph 1.

Graph 1 - Are you in the habit of looking at food labels before buying?



Source: authors (2022).

Looking at the graph, we can see that a small portion say they have the habit of looking at food labels before buying, about 22% of respondents, while the majority say they look, but not often. Analyzing these data, we can conclude that the vast majority do not have the habit of performing this reading and, consequently, do not evaluate the impacts of these choices made unconsciously.

Several studies have addressed the habit of reading food labels and pointed out why this practice should be adopted by consumers. Silva *et al*. (2019) states that the information contained in food labels is of great importance for the preservation and integrity of food, and consequently provides consumers with the right to analyze the composition of these foods, allowing choices that positively influence or not health. In addition, the labels present in processed foods serve as a communication vehicle between the consumer and the producer, this information serves to guide about what is being consumed, but due to the lack of knowledge on how to use this information, the consumer ends up not attributing importance to this nutritional information (Bendino, 2012).

It is always good to highlight that the labels contain information about the nutritional composition of processed foods, as well as their amounts in grams and percentages. In this way, with the nutritional information, it is possible to check the content of the nutrient in absolute quantity and in its percentage of daily value (described on the label as %DV). And, the lower the value in grams

(g), the lower the amount of the nutrient present in the product. It is important to check the amount of nutrients that are not so healthy (sodium, sugar and fats) and healthy (fiber, vitamins). This information sometimes causes some confusion in those who are going to buy the food, so it is necessary to pay attention to the information when purchasing the products.

The students were then asked about their behavior when they observe on a food label the presence of an item that may be harmful to their health, as shown in graph 2.

Graph 2 - Do you stop buying a food item if you see an item contained in it that could harm your health?

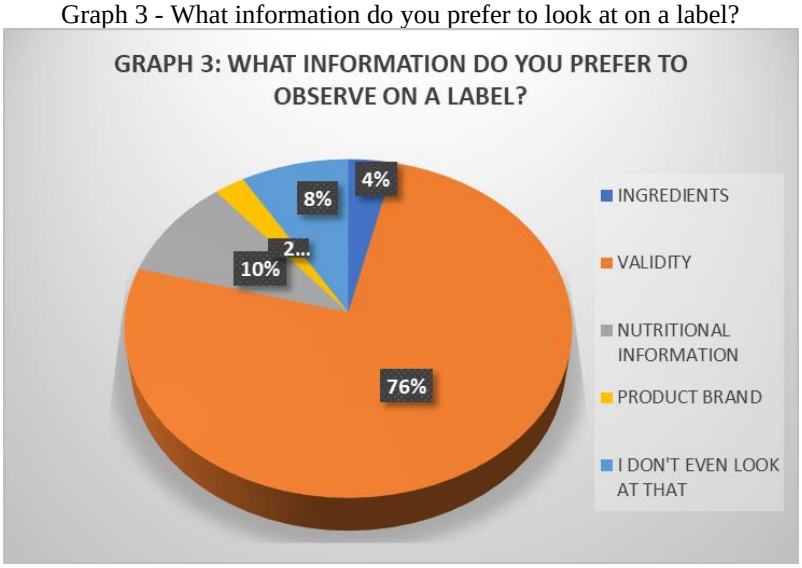
Source: authors (2022).

According to Graph 2, many respondents, i.e., 40% sometimes stop buying a certain food when they notice the presence of an item that may cause a health problem, followed by 33% who said they stop buying if they make this observation and 27% of the interviewees said they do not stop buying even under these conditions.

Based on the results presented in the second question, it is important to work on this theme in the classroom, in order to show students the consequences of food choices on their health, since a good part of the interviewees cannot reflect on it, that is, they do not even care about what these products have in their composition. In this sense, bringing to the classroom the discussion of the importance of this item is extremely necessary, this will make the student, in his role as a consumer and probable multiplier, exercise vigilance in his acquisitions and consumption, so that he achieves autonomy in the selection of foods with better nutritional value.

The following question deals with the interviewees' knowledge of the information contained in food labels, as shown in Graph 3. It was noted that the vast majority, about 76% of the students interviewed, observe information regarding the expiration date of food, but do not pay attention to important information such as those contained in the nutritional table and ingredients, for example.

Graph 3 - What information do you prefer to look at on a label?



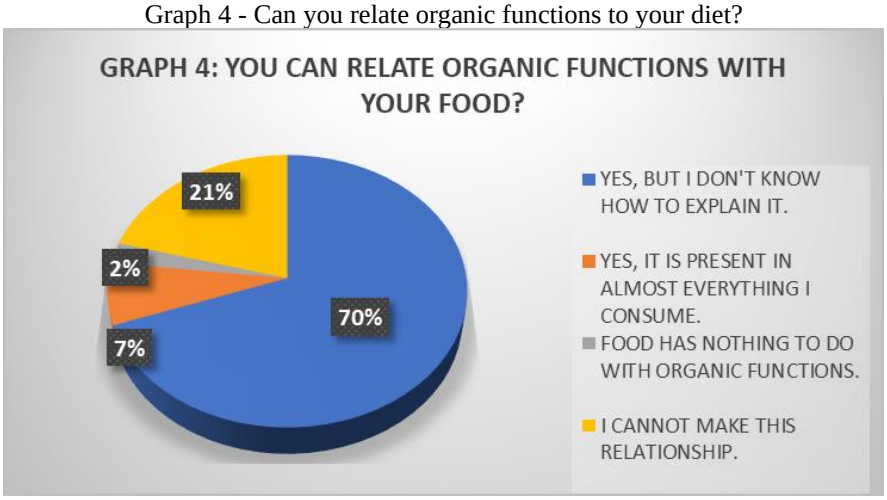
Source: authors (2022).

This result agrees with Cassemiro *et al*. (2006) who reports in his work with a certain group of users of nutritional labeling, that they usually observe and read the labels before buying, because they value the quality of the product, the packaging and the expiration date of the product before purchasing the food. So, according to Marins *et al.* (2008) It is necessary to implement education and communication strategies as a way to encourage consumers to acquire the habit of reading labels. The development of this habit consists mainly in the knowledge of terms considered technical, which can easily be found on the internet and/or worked on in the classroom, with the aim of making the information sufficiently enlightening for students and consumers. That is, to add to the lives of these subjects the access to new information and guidelines to be used according to specific situations, taking into account the cultural and personal interests that will be at stake in different circumstances.

Analyzing a certain lack of knowledge of the students with regard to nutritional information, and the relationship of these substances with chemistry, it is possible to perceive the real need to show in the classroom the importance of this table for the communication between producers and consumers. Since this is a tool that facilitates the knowledge of the composition of the food and can affect consumption choices, reflecting on the health and well-being of the consumer.

The results presented in Graph 4 deal with the relationship between food and chemistry discussed in the 3rd year of high school. The students were asked about the study of chemistry from food labels, in which the content of organic functions can be worked on.

Graph 4 - Can you relate organic functions to your diet?



Source: authors (2022).

Based on graph 4, the majority of students, 70% of the total, are able to relate the content of organic functions to their diet, although they do not know how to clearly explain where they can find them. While 21% manage to make this relationship and stated that it is present in almost everything they consume. And 9% of the students answered that there was no relationship or could not make this relationship. This figure of 70% is quite significant and shows the reflection of the contextualization applied by the teacher in the classroom, but there is little assimilation on the part of the students when the objective is to explain a practical application.

With this, we can perceive the need to teach chemistry with a more contextualized look, therefore, the project brought to the classroom this idea of showing how Chemistry is close to us and is a science that contributes to the improvement of life and well-being. It is only on this basis that knowledge will gain real meaning for the student.

The use of a tool such as the nutritional label brings the student closer to the explanation between food and chemistry, and what substances we consume in our daily lives. It is evident that there is a need to include labels in food and nutrition education initiatives in order to know the information on the labels, in order to empower consumers and strengthen their autonomy to make their food choices (PEREIRA *et al.*, 2017).

With the application of questionnaire 1, it was possible to make a diagnosis about what most students think about the information on food labels and that most of them could not relate the information that was contained in the labels of the food they consumed on a daily basis with chemistry issues that were discussed in the classroom. Based on this data, it is possible to program activities with these students, using the Labels tool for the teaching of organic chemistry, in addition to awakening a more conscious look when buying a certain industrialized food.

According to Pereira *et al* (2017), labeling used responsibly can be an instrument used to raise awareness, since it is able to provide information that enables consumers to make comparisons between

products and make their food choices, exercising their decision-making autonomy for healthier foods. Because opting for healthier foods implies improving eating habits and opting for more nutritious foods.

5.2 PRESENTATION OF CLASSES ON LABELS AND THEIR RELATIONSHIP WITH CHEMISTRY

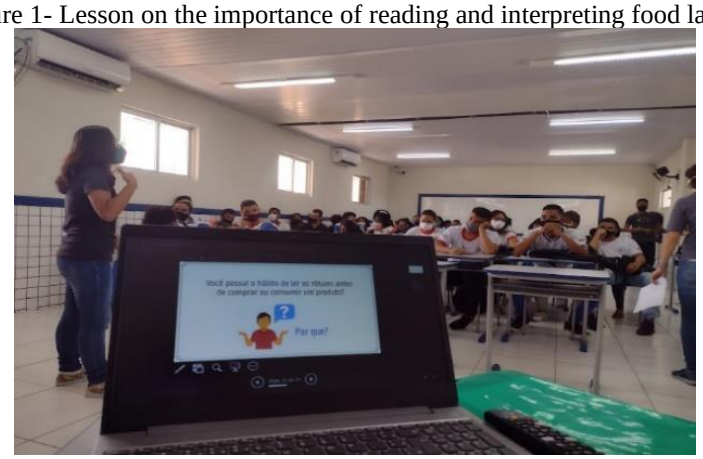
The second stage, called classes 1 and 2, were related to the interpretation and analysis of food labels and the chemistry present therein, focusing on contextualization as a precursor of scientific literacy, since students developed an understanding of science, relating them to problems such as poor diet and the considerable increase in the consumption of processed foods. growing problems today.

According to Suart (2018), the population has an active importance in decision-making and discussions regarding society's problems, in this sense, scientific literacy can be presented as a method of understanding and evaluating the impacts of science on the life of human beings and, consequently, its benefits and possible risks.

In class 1, the need for food labeling and its mandatory information was discussed, as well as how these data should be interpreted, followed by the impacts that the disordered consumption of processed foods can generate on the consumer's health.

Figure 1 illustrates the moment of the presentation of the first class, in one of the classes, which aimed to promote changes in consumption habits in order to show the benefits for everyone's health.

Figure 1- Lesson on the importance of reading and interpreting food labels.



Source: the Author (2021)

This activity encompassed the active participation of students in the search for this knowledge, exposing opinions and information regarding consumption in their daily lives and the importance of conscious food choices, discussing the problem of the project that deals with the real need to observe and interpret the nutritional information contained in the nutritional table, which despite being essential is little used by consumers.

According to MORAN (2021), activities that involve student participation are necessary, since activities without adequate reflection can lead to superficial learning and insufficient development of the skills and competencies expected at each stage of curriculum application.

In class 2, a more investigative and contextualized approach was used, using the systematization, organization and discussion of the theme in order to seek new meanings for the study of chemistry. Using the students' previous knowledge regarding the content of "organic functions" studied before the application of the project, the scholarship holders acted as mediators in the classroom, putting this content in confrontation with the experiences of common sense.

In practice, the students were encouraged to look for the presence of organic functions in the chemical composition of the foods they frequently consumed and, together with the scholarship holders, discuss the possible impacts of some of these compounds on health. The students were also presented with the need to analyze food labels to assist in this impasse.

At the end of this activity, it was possible to observe a more critical position in relation to food, confirmed from observations of the discussions in the classroom, and from the statements exposed in relation to different points, such as: the differences between ingredients that had or did not have some nutritional value, the exaggerated use of food additives, among other statements.

Despite the active participation of the students, it is not possible to say in fact that the project changed the way of seeing and/or choosing food, however, it was possible to observe that the contextualization of the subject made the study of chemistry more interesting, since the students were more motivated in the search for chemical knowledge by understanding that it is possible to solve problems that directly impact everyone's lives.

Figure 3 illustrates the moment of the presentation of the class on the organic functions present in food.

Figure 2 - Lesson on organic functions present in food.

Source: the Author (2021)

Thus, it can be inferred that the classes carried out from contextualization, investigation and dialogue contribute significantly to the development of skills related to scientific literacy, by considering situations in which students can solve problems, and propose solutions for them, which contributes to their cognitive and conceptual development.

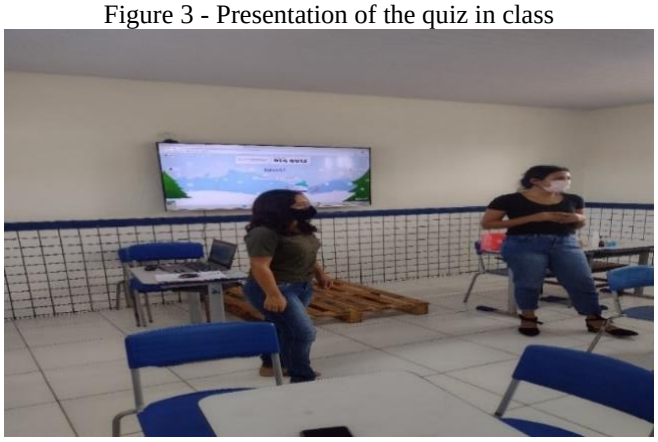
5.3 WORKSHOPS APPLIED TO STUDENTS FOR LEARNING

5.3.1 Momento Quiz

After the presentation of the chemistry contents, using the food labels, the process of applying the quiz in the classroom was initiated, this option arose from its dynamic character in the teaching/learning process. This tool emerged as a new possibility to make teaching more pleasurable and uncomplicated, for both student and teacher.

Figure 3 illustrates the moment of the presentation of the quiz in the classroom. This activity was carried out in teams and answered through cell phones. The results of each team were projected on a TV, for everyone's knowledge.

Figure 3 - Presentation of the quiz in class



Source: the Author (2021)

By appropriating this instrument in the construction of learning, the students externalized their thoughts and ideas about the content that was being studied and in this way the class became much more spontaneous. Thus, all students were able to actively participate in the construction of chemical knowledge and analyze what could be done, improved and corrected in the question of food and health.

We noticed that the students themselves felt like critical subjects and capable of solving quiz problems with the most diverse levels of difficulty. This is due to the dynamizing function of this activity and the initial activities.

Based on the observations made during the application of this activity, it was evident the interest in studying chemistry using resources available in the student's daily life, which, despite the facilities they present, are resources still little used in the classroom.

Figure 4 illustrates the moment of the students' participation in the quiz, a question-and-answer activity.

Figure 4 - Student participation in the quiz.

Source: the Author (2021)

The results of this activity evidenced the need to bring to the classroom attractions that motivate students in the teaching and learning process. Since the interest and curiosity in learning something new using this tool was noticeable, which was verified by the number of interactions in the classroom.

5.3.2 Chemical Experiments to Observe Substances from Labels

It is important to consider that in order to facilitate the teaching and learning process, the teacher must plan his activities thinking about how to awaken in the students the interest in studying a certain subject and thus promote meaningful learning. Experimental classes by themselves are instruments that arouse the attention of the students, when combined with contextualization, they prove to be a great motivating instrument in the educational process.

This activity aimed to facilitate the teaching and learning process, providing students with an understanding of the relationship between chemistry and society, bringing to the classroom this action that involves everyday matters, more specifically, such as the verification of the chemical composition of the food frequently consumed by them. From this stage of the project, it was possible to analyze the presence of some components listed on food labels, and confirmed through experiments, to show students that it is possible through investigative experimentation and chemistry to analyze what is exposed on the labels.

According to Silva (2016), experimentation is important in the educational process, and when it is presented as an investigative process, it becomes a rich teaching tool, which enables the creation of situations that motivate students.

Figure 5 illustrates the moment of the development of the experimental activity, investigation and identification of the presence of carbohydrates and proteins in some foods.

Figure 5 (a) - Development of the experimental activity. (b) - materials and reagents used during the experimental workshop

Source: the Author (2021)

With the experiments, it was possible to verify the presence of carbohydrates in samples of milk, bread and biscuits, as a way to prove what was described on the labels of these foods and also to verify the presence of the chemical in our daily lives.

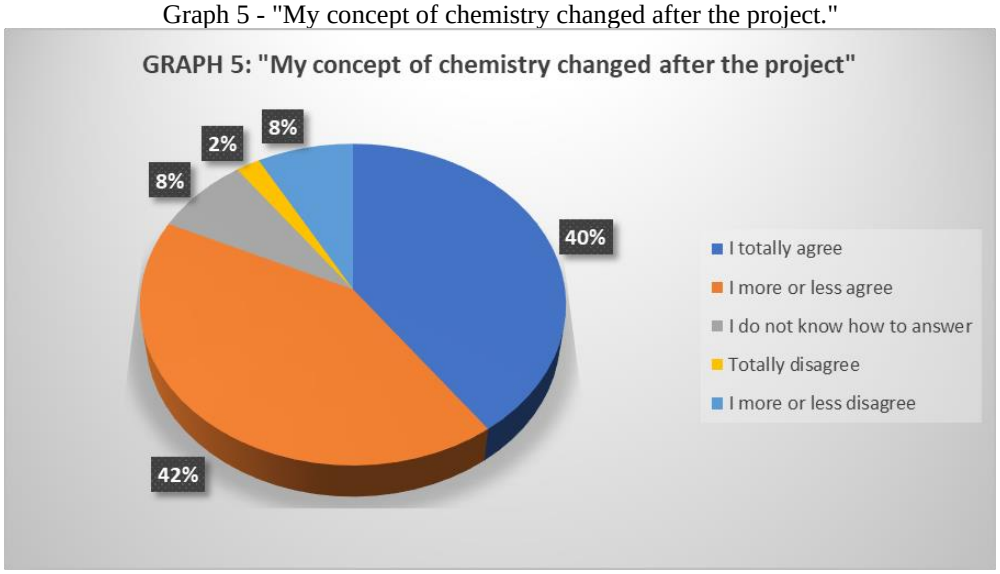
The use of the experimental class in this project was an important instrument in the teaching process, as it aroused the students' interest in the subject under study, which was noticeable with the interactions and questions during its realization. The benefits of experimental activities can be seen in the works of several authors, who highlight experimental practical activities as being important for dynamic and attractive teaching (TEOTONIO *et al*. 2019; SILVA 2017; DA SILVA, 2011).

5.4 LEARNING ASSESSMENT QUESTIONNAIRE

At the end of the project's application, the students were asked to answer the satisfaction questionnaire, in which the respondents' participation was voluntary and anonymous, according to their expressed willingness to participate. The students were previously explained the importance of filling out and returning it. The scholarship holders and volunteers of the project made themselves available to the students for any clarifications during the period of application of the questionnaire. This data collection began after the end of the project application as a means of evaluating the results of the activities.

To understand the need to innovate in the classroom, the first question dealt with knowing the possible impacts of the project on the students' relationship with chemistry, for which they were asked to attribute their level of agreement in relation to the change in the concept of chemistry.

Graph 5 - "My concept of chemistry changed after the project."



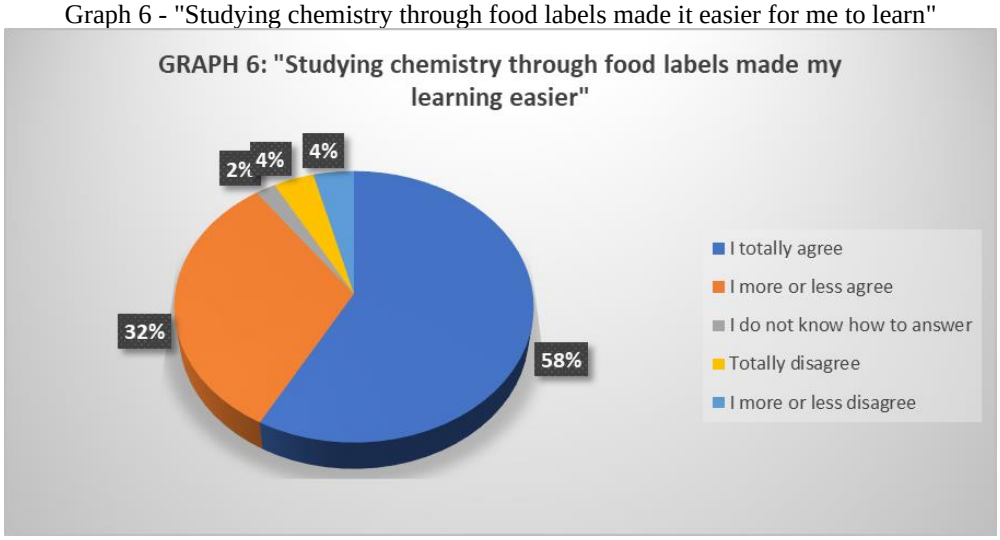
Source: authors (2022).

As noted in the previous graph, the majority totally or partially agree with the statement and only 18% of respondents said they did not agree or did not know how to answer.

The results showed the importance of applying new methodologies in the classroom, in order to attract the attention of students during the school year. To this end, as Brighenti *et al*. (2015) It is important for teachers to constantly improve their methodologies in order to meet the new needs of each audience.

In the second question, the students were asked to rate their level of agreement in relation to learning chemistry through food labels.

Graph 6 - "Studying chemistry through food labels made it easier for me to learn"



Source: authors (2022).

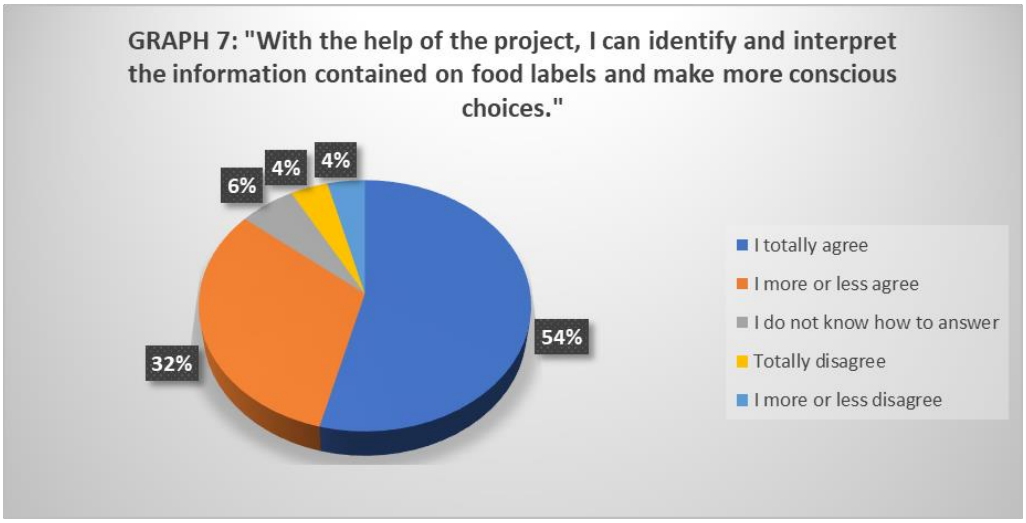
Based on graph 6, the majority of the students, 90% of the total, evaluated that it was easier to study chemistry using food labels.

During the application in the classroom, it was noticeable how much this activity attracted the students' attention to the subject, which is usually judged as difficult to understand, but in the course of the project it became attractive, applicable and simple for the students. Of the total number of interviewees, 10% did not know how to answer or disagreed with the statement, which also denotes the need to seek other methodologies that also cover this audience, since in the classroom all students have the same level of importance.

The third question was elaborated in order to identify the level of understanding of the subjects studied, of application and of the possible social impacts of the project in the lives of the participants, in this sense, the students should attribute their level of agreement in relation to the impacts of the project on food choices and on the interpretation of labels.

As shown in Graph 5, the majority of students totally or partially agreed with the statement, 86% of the total number of interviewees, a very expressive number.

Graph 7 - "With the help of the project, I can identify and interpret the information contained on food labels and make more informed choices."



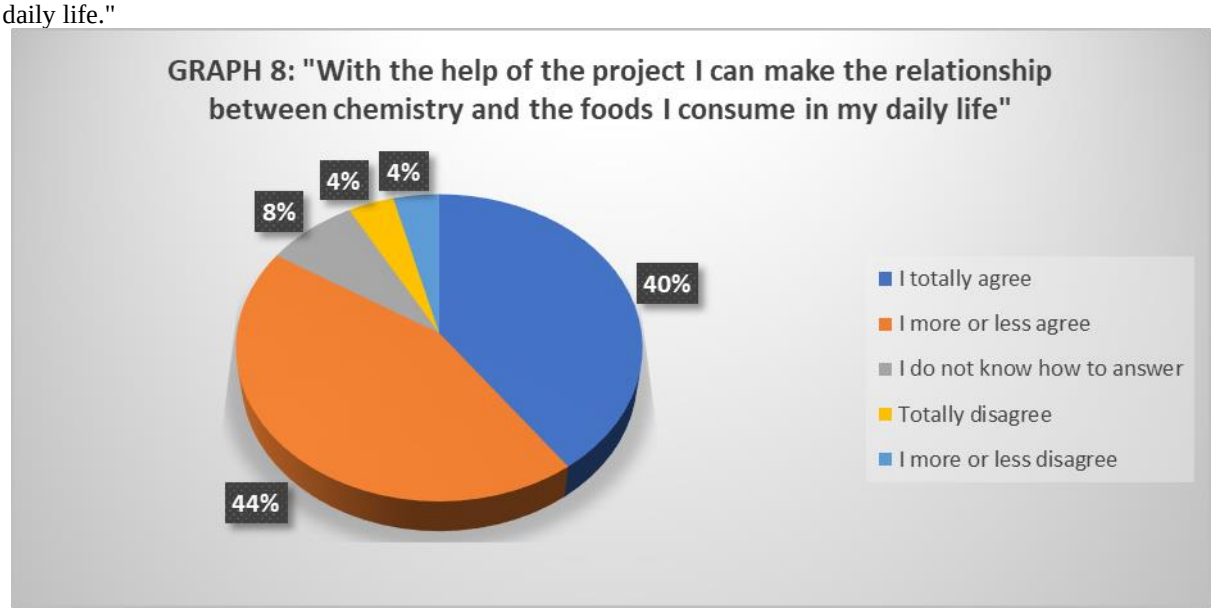
Source: authors (2022).

Finding, therefore, that contextualization is essential for a more meaningful teaching and learning process, which brings chemistry closer to the students' reality, proposing solutions to everyday issues and showing their applicability in practice.

The fourth question sought to evaluate the contributions of the project in the chemical learning of the participants, verifying whether through the activities the students developed knowledge regarding the chemical composition of food and the presence of what is seen in the classroom in their daily lives.

To this end, the students were asked to evaluate the statement in graph 8 with their level of agreement.

Graph 8 - "With the help of the project, I am able to make the relationship between chemistry and the food I consume in my daily life."

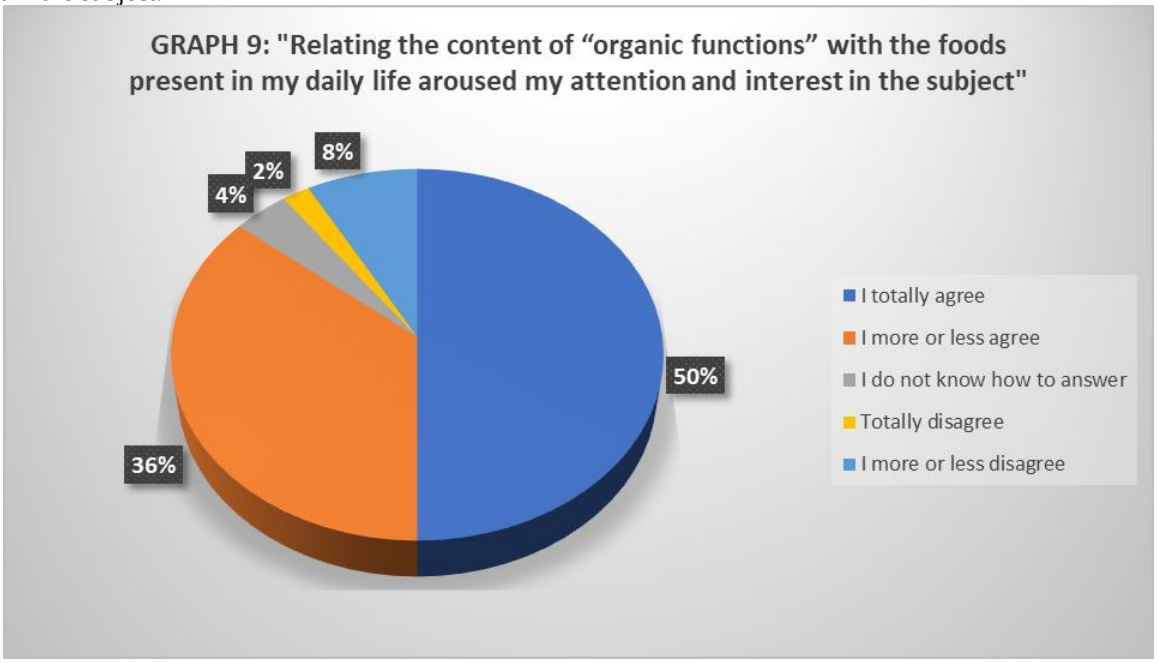


Source: authors (2022).

Regarding the data obtained and shown in graph 8, it can be inferred that the vast majority of the students understood the relationship between chemistry and their diet, totally or partially agreeing that the project facilitated this association. According to LEITE *et al*. (2015) can arouse the interest of students, since by exploring its importance in everyday life in the classroom, students feel motivated in their study, thus providing an understanding of the subject.

In the fifth question of the satisfaction questionnaire, we sought to evaluate the class taught during the project, on "organic functions" showing their presence and functions in food. In the weeks leading up to the project, the subject in question was already being worked on in the classroom, in its conventional way, but with the project it was possible to show the students the approximation of what was being studied with food and the impacts of some of these foods on health. In order to understand the level of satisfaction of the students, they were asked to attribute their level of agreement with the statement in graph 9.

Graph 9 - "Relating the content of "organic functions" with the foods present in my daily life aroused my attention and interest in the subject."



Source: authors (2022).

Of the total number of respondents, 86% totally or partially agreed that the methodology applied in the classroom aroused greater interest in the subject. This is since learning is favored when it directly affects the lives of students. In addition, showing them that chemical knowledge can help in problem solving and skill development with direct impacts on everyone's health and well-being benefits the teaching and learning process.

For PAZINATO *et al.* (2014) Teaching is favored when the methodologies are focused on the personal development of students, allowing them to use chemistry in the interpretation of everyday situations.

6 CONCLUSION

Approaching concepts of organic chemistry in the reading of food labels was significant and motivating for the understanding of these concepts, since it narrowed the relationship between chemistry learned at school and its applicability in the students' reality. In this sense, the use of methodologies that highlight contextualization, such as the one shown in the project, is an important strategy to improve the understanding of the discipline.

Through the diagnostic questionnaire, it was possible to verify that it is necessary to raise awareness among students for a healthy diet. It is known that inadequate food consumption with the ingestion of ultra-processed foods of poor nutritional value is a reality in the lives of children and adolescents. These dietary choices are risk factors for the early onset of obesity and other chronic diseases such as diabetes during the adult life of these young people.

It is undeniable that dealing with healthy eating with a diversity of students with different socioeconomic realities is a very complex topic in the sense that some families do not have the purchasing power to choose healthier food options. Due to lack of information, however, it is not perceived that it is possible to replace some types of food with cheaper ones with better nutritional value. Thus, the objective of applying the methodology to inform about the need to read food labels to know what is being consumed and what needs to be changed in their daily diet was achieved with merit according to the evaluation responses.

Another important point of the research is that it allowed students to investigate information contained in food labels from the perspective of Organic Chemistry and infer about substances that are good or not for health. That is, the students were contributing autonomously to the process of knowledge construction. As advocated by many scholars in the field of education, education should be liberating and enable the student to actively participate in the teaching-learning process.

Finally, the present work fulfilled its purpose of teaching the discipline of Chemistry in a contextualized way, adding the chemical contents to a theme of paramount importance in the lives of students, which is the choice of healthy food products through the reading of food labels.

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