



Water security in the semi-arid region of Paraíba - Experience report of an extension activity

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ABSTRACT

The semi-arid region of Paraíba is a region that has a very long period of drought over the years, generating water scarcity that affects agricultural activity, adding to environmental reactions that reduce the soil's water collection capacity, increased leaching, promotion of the unregulated flow of water recharges, becoming a region with water unfit for consumption by living beings. Inserted in this context, the PET-Chemistry of UFCG, promoted a lecture for high school students from this region, in the city of Cuité, Paraíba. The lecture aimed to expand knowledge to the external school community as a form of extension activity, one of the aspects of the Tutorial Education Program. A questionnaire was applied to the school community to evaluate the effect of carrying out this activity. The adequate information provided to public school students on the subject was important to warn about the effects caused to society, health and the environment through water scarcity in the semi-arid region of Paraíba, and the knowledge acquired becomes a tool to deepen the students' opinion on the problem in question, in addition to awakening the critical sense so that they can act as citizens in the society in which they live.

Keywords: Water, Environmental Education, Chemistry Teaching.

1 INTRODUCTION

Water, the essence of life on the planet, is the most valuable and most wasted compound by man, a contradictory aspect for society. There is a need for conscious use and about the causes of water misuse. A large part of the world's population has access to drinking water, and even so, the duty to keep it in a good state for use without risk to everyone is a problem that society has not yet solved, there is always a minority that still suffers from its lack or the consumption of untreated water. Especially in the Northeast region, in the semi-arid region of Paraíba, for example, a region that suffers from a lack of rain, vegetation, fauna and the people who live in this area, for this reason abandon this region, because the lack of water is a direct threat to everyone. (BRUNI, 1993.)

The Brazilian semi-arid region went through a period of drought between 2012 and 2016, which may reach 2018, depending on the region (VIANNA; GRANDSON; FARIAS, 2023). It is necessary to



define that rainfall is of irregular occurrence in the Brazilian semi-arid region in relation to time and space, and the occurrence of rainfall in average terms is between 200 and 800 mm. This irregular factor generates effects such as water scarcity, affecting agricultural activity, adding to environmental reactions that reduce the soil's water collection capacity, increased leaching, in addition to deregulating the flow of water recharges, which also end up becoming unfit for consumption by living beings. Therefore, these are drastic effects that occur in a way that varies the areas where the semi-arid predominate, therefore, they have the effects of drought, revealing ways that serve for coexistence in the semi-arid and some measures to minimize the punishing effects of water scarcity (CRUZ et al., 2022).

The care to guarantee the population's access to drinking water has as its highlights the correct storage of water, especially so that it is kept away from contaminants and/or physicochemical factors that modify the quality of its potability. As a common way to store water in the semi-arid region, the use and construction of cisterns is commonplace. Lopes et al. (2002) state that water for human consumption and domesticable animals can be stored in these closed reservoirs so that it can be used to capture, preserve and minimize rainwater waste. It is also possible to guarantee and maintain the quality of drinking water and avoid large displacements because it is close to the house. Cisterns are usually made of bricks, blocks, hardware, and masonry. Government work for the semi-arid region of Paraíba is already being developed in order to alleviate such environmental and sanitary problems, the pipa operation is a strategy for the distribution of drinking water in trucks that transport between 5 thousand and 20 thousand liters of water to the most affected regions, the distribution of chlorine is an effective treatment against microorganisms that cause diseases, however it must be limited, the abuse of chlorine in the water can cause problems for the population, about 0.4 mg/L is indicated to maintain a good quality of the water, but this does not always happen which leads to the importance of homemade filters, in which it will filter the water from polluting organisms, definitely a water station would be appropriate to solve all the problems of the semi-arid regions, however, governments must take action to solve the water problem beyond the measures already taken (VIANNA; GRANDSON; FARIAS, 2023).

Another tool used to combat the effects of droughts is the installation of artesian wells. Soares (2013) points out that there are more than 50,000 artesian wells, where around 20,000 are operating and the remaining amount is found inactivated due to the lack of equipment capable of capturing or because it does not have the characteristic of potability for human beings. That is why it is important to know the quality of water to avoid problems in agriculture that cause harmful effects for small farmers and interfere with the quality of life and social life of the population (LIMA et al., 2020).

The lack of well-cared for water can generate several problems for society, one of the main causes is diarrhea, water resources in this region are scarce and cause diseases that can lead to the death of those who consume untreated water, and the lack of sanitary surveillance causes several problems for this region,



such as I - Inadequate water abstraction. II - Contaminated reservoirs, with cracks or crevices. III - Wells without pathogen testing. IV - Inadequate water treatment. V - Distribution of contaminated water, among several other problems that may be generated (CARMO; BEVILACQUA; BASTOS, 2008).

The idea for the lecture was based on high school students from the city of Cuité, a city in the interior of Paraíba, with a distance of approximately 235 km from the capital João Pessoa and some surrounding cities that are served by the Integral Citizen School. The city has two large water reservoirs, popularly known as "Boqueirão do Cais" and the "Retiro Dam" so that the provision of informative content about water and the effects of drought to students are of great importance for the proper use and vital maintenance of water.

The exercise of this extension activity was important, especially to facilitate the transmission of the information learned, both to the school community and to the family circle of the students enrolled in the educational institution. Dias (2018) points out that the initial way for students to take to their families and build together the knowledge acquired on topics such as rural man and the educational vision on the environment as a form of social transformation is above all within the school.

2 OBJECTIVE

To raise awareness among students in the 3rd year of high school in a state public school in the city of Cuité - Paraíba about water as an essential natural resource for human life and water security in the semi-arid region of Paraíba.

3 METHODOLOGY

The work was carried out through an expository lecture at the Journalist José Itamar Cândido da Rocha Technical Integral Citizen State School, with students from the 3rd year of High School from the classes of the technical course of computer science and administration. The students of basic education were under the supervision of teacher Edna, who has a degree in chemistry and is a teacher of the subject at that school. The school is located on the banks of the BR-104 highway in the city of Cuité, in the interior of Paraíba.

The speakers were students of the Chemistry degree course of the Academic Unit of Biology and Chemistry (UABQ) that belongs to the Center for Education and Health (CES), campus of the Federal University of Campina Grande (UFCG). It is worth remembering that the lecturers are members of the Tutorial Education Program (PET) linked to PET-Chemistry. The dissemination took place between social networks and the school activity schedule of the students of the school where the lecture was held. Slides were used to expose the lecture and the theme, and a dialogued approach between the speakers and listeners. At the end, a brief questionnaire was applied on the topic to verify the topic discussed.



Figure 1: Journalist José Itamar Cândido da Rocha Technical Integral Citizen State School



Source: Google Images (2023).

The lecture had as an initiative the expansion of knowledge to the external school community as a form of extension activity, one of the aspects of the Tutorial Education Program. For the lecture, the theme "Water Security in the Semi-arid Paraíba" was chosen to deepen the discussion about the preservation of this natural resource that is scarce in the region.

Figure 2: Lecture on Water Security in the Semi-arid region of Paraíba.



Source: The authors(2023).

Figure 3: Audience of the lecture.



Source: The authors(2023).



4 DEVELOPMENT

The lectures aim to expand people's knowledge, whether they are chemistry students, a high school student or a professional in the sales area, etc., the importance and objective is to pass on information that the listeners probably do not know about a certain topic, in the school environment precisely in high school, lectures are a means of acquiring knowledge that the teacher cannot explore due to the limited time in the classroom. class, according to (LACERDA, 2008). Academic events are important for the academic environment, and promote more than a vision on the topic addressed, managing to transmit information, create interactions between lecturers and listeners, and between the listeners themselves, to a development in scientific communication, this involvement with students, will influence their formation as a person and open doors for their future choices.

According to Possas (2000), he points out that in order for water suitable for human consumption to have the characteristic of being tasteless and the content of salts present is compatible with the cells present in the human body. It is still commonly stated that water is only good when it is drinkable, but in terms of domestic and industrial utility it can be good, without being exclusively potable, an evident example of water that can be considered good for use in daily life, except for human consumption, is that intended for domestic and/or sanitary processes.

In chemical terms, water is made up of two molecules of hydrogen and one molecule of oxygen, in conditions of high purity, it should not have ions or substances dissolved in it. The pH is 7.00 °C at 25 °C.

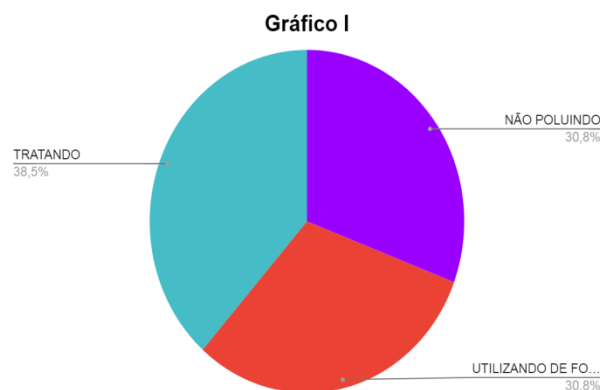
The development of scientific knowledge is necessary in the academic environment, the theme of the lecture involves the semi-arid region of Paraíba, which covers knowledge on the subject of water, water resources, water treatment, environmental problems, among others resulting from the incidence of rainfall, extremely relevant topics that can be worked on during the lecture expanding the students' knowledge about chemistry, the semi-arid region of Paraíba. According to Oliveira et al. (2015), environmental education in schools is an important topic to work on with students, as it brings to light the importance of water resources, and contributes to the formation of citizens focused on seeking to live sustainably with the natural resources of their region. The lecture developed has as a priority the dissemination of knowledge about the semi-arid region of Paraíba and its water resources, so that students can obtain a worked view on human development, environmental issues, developing chemical knowledge, and water resources.

Compared to the countries distributed around the globe, the Brazilian nation has the greatest potential for this water resource. However, the way it is distributed unequally, as one of the reflections of the scarcity of this resource in the Brazilian Northeast, making it an arid region of low rainfall density, but remarkably inhabited and still causing social, environmental and economic imbalance compared to other regions. In the semi-arid region, it is necessary to have harmony between human coexistence and climatic conditions, especially in water rationing techniques since the region is lacking in this resource and rainfall conditions

are unfavorable due to average rainfall below estimates and the rainy season being of short duration and also presenting temperatures and factors that easily favor evaporation. Leading the inhabitants of the locality to resort to means that allow the use of water (BARROS, 2013).

As a way to mitigate the effects of prolonged drought and ensure the population, the construction of dams and weirs is common, so that low levels of rainfall end up making this practice a necessity for people to have access to drinking water (LUCENA et al., 2018).

Graph 1: In your view, how can we guarantee quality water for the population?



SOURCE: The authors(2023).

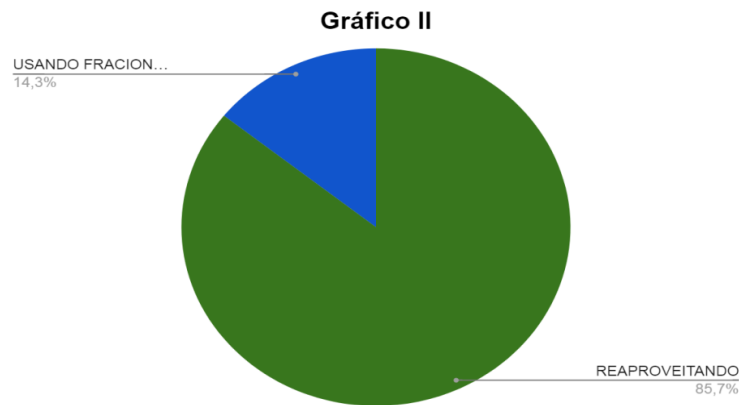
The opinion of the students point out that the way to ensure quality water for the population is that 38.5% is to treat this natural resource, being in line with what Brandão (2011) points out as soon as it becomes a comparative effect, because the population must have in mind to progress through the rational use of the essential substance for life, Because the contamination can make the treatment aimed at eliminating harmful agents for the health of the population more expensive.

Elsewhere, it was shown that 30.8% referred to not polluting as a way of maintaining the quality of this resource. It should be noted that the introduction into the environment of non-existent substances or in very low quantities, based mainly on human action, and thus this activity is a reflection of environmental pollution. Therefore, the effects of pollution cause perceptible physical changes in the environment, impacting the fauna and flora and deregulating the life of the species existing there. Thus, such harmful effects cause environmental imbalances (SODRÉ, 2012)

The remaining 30.8% of the students stated that the use of safe sources is another effective alternative for access to drinking water for all. As is well known, the semi-arid region lacks this resource. Razzolini and Günther (2008) emphasize that in needy areas and regions that are excluded from quality basic services, they become aggravating factors for the quality of life, especially as a result of the lack of safe sources of water, and that, in the midst of this, leads the population to consume this resource, often with questionable hygienic quality and that do not even understand the basic human needs in their daily lives.



Graph 2: Do you usually follow news about the topic on social media (internet, television, etc.)? If so, what steps can we take to avoid wasting water?



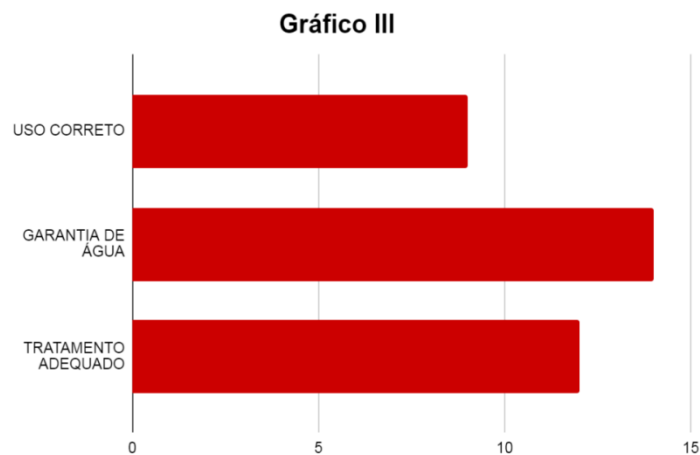
SOURCE: The authors(2023).

The students point out that the reuse of water is one of the solutions to reduce the waste of water, 85.7%, believe that this is a method that will work against waste, according to (MOTA, 2002), the reuse of water brings to the population a great importance, due to waste the lack of water will certainly harm the semi-arid, However, ways of reuse generate greater availability for this region and can bring economic development since it can be used in agriculture, to water plants, or places such as a garden in a municipal square, so it is necessary to have a reservoir for water already used as well as a treatment before its reuse. However, the students' thinking on how to avoid waste is right, it is not something unachievable, it is a sustainable idea, it is enough to have an initiative from governments to avoid such waste and the population.

The fractional use of water is a way to avoid waste, 14.3% of the students pointed out that this is the most correct way to take it, the fractionation of water can be taken as a form of excess loss since the population will not use more than it allows but the population may not like the amount of water made available for the use of certain situations, generating a problem in the environment in which this method is applied.



Chart 3: What do you mean by water security?



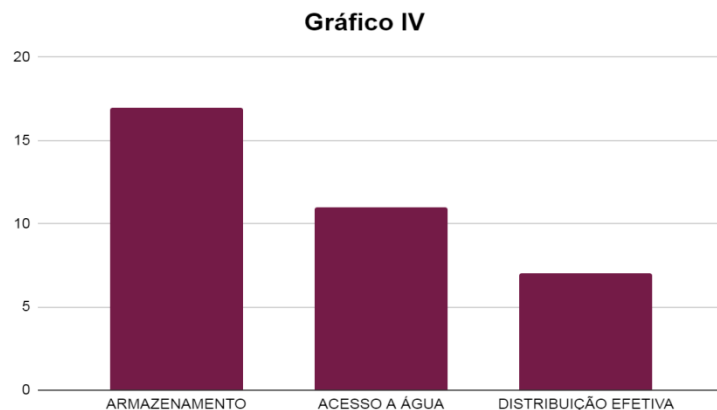
SOURCE: The authors(2023).

The guarantee of water, affirmed by approximately 15 students, comes to light especially in recent news pointed out by the Amendment Project to the Constitution No. 04/2018, approved in the plenary of the Federal Senate on 03/31/2021, aims for the population to have an essential right to the guarantee of drinking water, showing that everyone's awareness of a resource that is essential for human survival and dependent living beings.

Around ten students who emphasize the importance of the correct use of water, leads us to question how we are using these resources. Still in opinion, along with other authors, it is always necessary to point out that the main problem of the semi-arid Northeast is the scarcity of water, which hinders the development of society and the economy of farmers, because the amount of water that is made available has a reduced value due to the rainy season and the moment of aridity. On the other hand, even if there are places where precipitation is at margins of 800 mm, there are places in this region that do not exceed 200 mm. Therefore, the temporal moment and the lack of social sensitivity due to the lack of knowledge of what is known about sustainability and the deficiency of public policies present difficult points for human development (SILVA et al., 2006).

Affirmed by approximately thirteen students showing that adequate treatment is a characteristic of water security, so the quality of the water that human beings consume must be strictly controlled, becoming a goal of government officials due to their concern (ABREU et al., 2000). An alternative for water treatment is presented by Santos et al. (2015), who used in their research the use of Moringa as an easy-to-use and cost-effective technique, having as one of its characteristics a good function in purification. It is also pointed out that one can live with the drought and the effects caused in the region with the use of easy techniques.

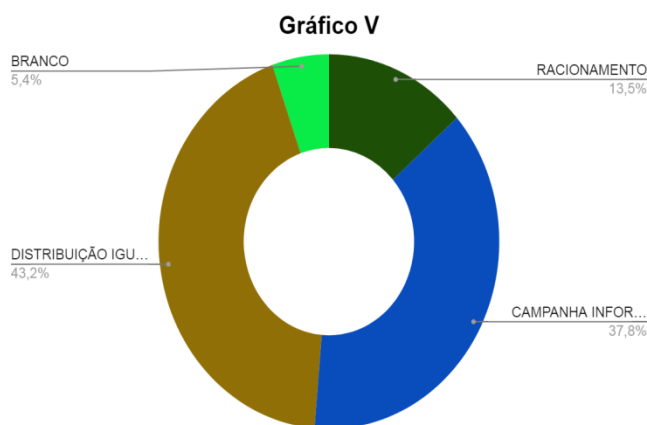
Graph 4: What is the main challenge for us to face the drought?



SOURCE: The authors(2023).

Drought is really a difficulty that most affects the semi-arid regions of Paraíba during the research the answers obtained from 16 students is that storage is the main challenge to face drought, approximately 11 answered that the problem is access to water and seven students answered that effective distribution is the problem. Everyone is correct, there are several problems that have not really been solved against the drought, the government creates several programs to alleviate the difficulties but still, there is a lack of good storage in homes, or in cities, and distribution is still flawed because not everyone has access to water in their homes, often having to travel to have access to drinking water, With this, it is correct to say that problems still exist and that the system is not yet perfect, but there are already projects to fight more and more with the drought, and access to water in the most distant regions is increasingly present.

Figure 5: What government measures are taking to combat drought?



SOURCE: The authors(2023).

The egalitarian distribution pointed out by 43.2% of those who answered the questionnaire comes to the fore as a measure for government action in the fight against drought. It is also a historical factor shown

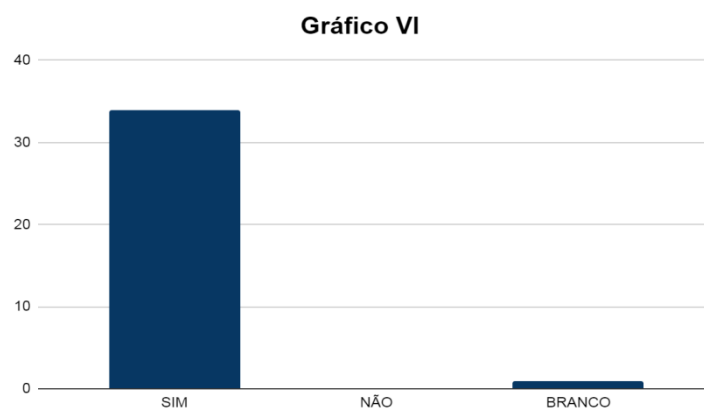


by Silveira and Cordeiro (2010) that, because the lack of rainfall is a natural condition, Brazilian public policies presented by the government only as emergency actions and had as tools such as the operation of water tanks, the construction of dams and in some periods what became known as "Emergency Fronts" as a social program to combat the drought period. Information campaigns are good tools to make society aware of the problem, as the knowledge generated can become useful in the fight against water waste. 37.8% of the students chose as an option the use of campaigns in order to transmit important information, showing that the joint work between the social spheres and the community is valid to work towards water guarantee and security for the population.

Emphasized by 13.5% who showed that a government alternative would be water rationing, it can become a hard point in relation to its realization and that this action can become another problem that would come to be debated about rights and freedoms. As a counterpoint, the educational training of the population can be an effective measure to combat the effects of drought compared to rationing.

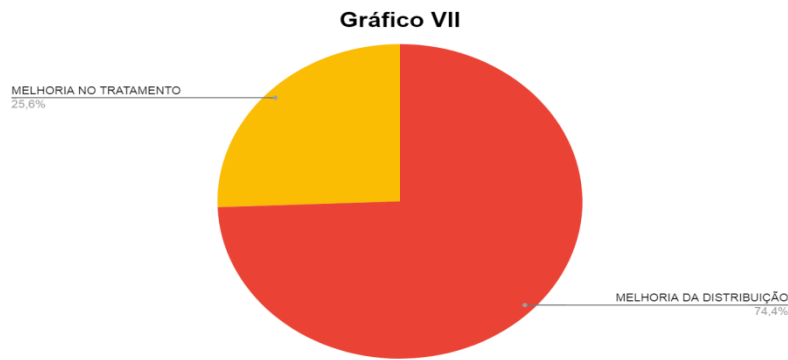
According to Zorzi, Turatti and Mazzarino (2016), the consumption of drinking water is the right of every citizen, the government invests millions in various areas in the country, water treatment and its distribution is the government's obligation, but there are still regions that have difficult availability of adequate water. Among the students who answered the questionnaire, approximately 34 students stated that they have access to quality water in their homes, and approximately one person answered blank, so the survey points out that the vast majority of students have access to drinking water in their homes.

Graph 6: Do you have access to water of adequate quality for human consumption?



SOURCE: The authors(2023).

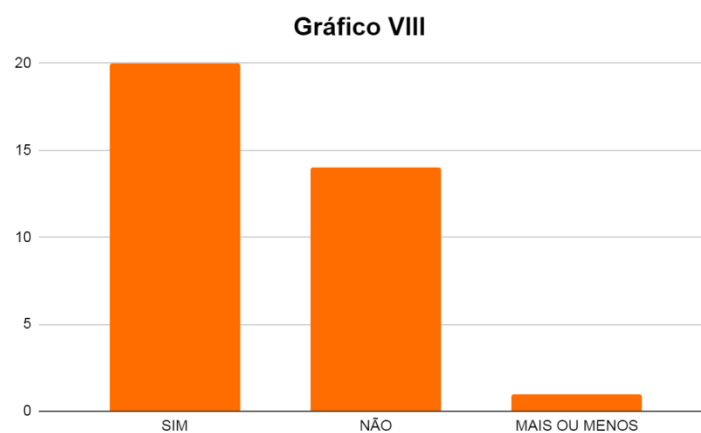
Figure 7: What kind of changes could the government make to improve water quality in your city?



SOURCE: The authors(2023).

The distribution of water is done by a responsible company in each city, it must be well stored avoiding possible contamination, and it must be treated within the control standards, 74.4% of the students who answered the questionnaire say that a better distribution of water is the way that the government has to provide for a better quality of water in their cities, and 25.6% answered that governments should improve treatment, a well-known distribution proposal is Operation Pipa, in which the government distributes water to less rainy regions, (VIANNA; GRANDSON; FARIAS, 2023). The pipeline distribution construction is an interesting proposal to take water to these regions that suffer the most from rainwater, in addition to taking the water it can still be treated at the distributor itself, it is a solution to solve the problem of drought, but it requires a very large investment in water infrastructure, depending only on the government to carry out these works.

Graph 8: In your opinion, is your school's water of good quality?



SOURCE: The authors(2023).

Around 20 students from the school pointed out that the water offered is of good quality, in this way, it is known that in a good part of the opinion they agree with the quality and demonstrates that the school

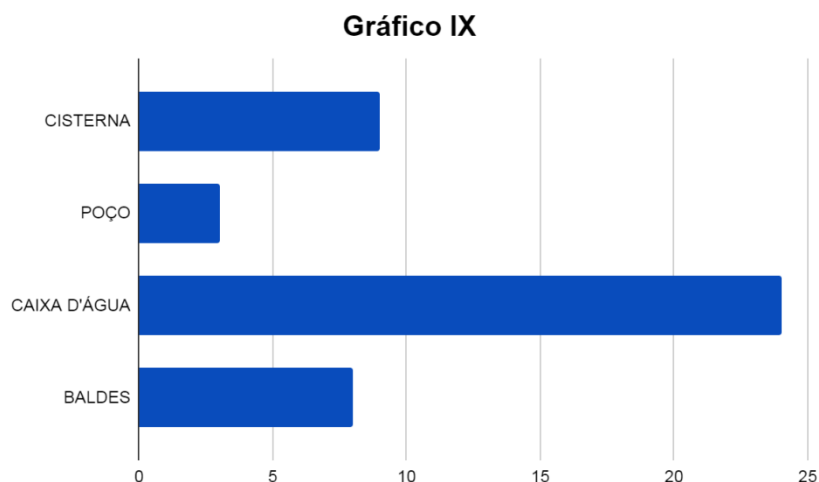


management and the school community care about the students and the offer of this component in optimal potability is allied to the improvement of school life and the health of students.

About fourteen students who answered negatively about water quality, it is necessary to investigate quantitatively to know which factors influenced the choice and look for some solution to contribute positively to those who expressed negative quality. A single student replied that his opinion is not defined as YES or NO.

Proper storage for water is one of the main problems that society faces, since a possible contaminated storage will bring people possible diseases, the use of contaminated water can lead to infection, gastrointestinal discomfort, among other diseases, about 8 students answered that there are cisterns in their home, three students answered that they have a well, Seven students answered that they have buckets as a form of storage and about twenty-four students have water storage as a water tank.

Graph 9: Is there any kind of water storage in your home? If so, how is it stored?



SOURCE: The authors(2023).

Poor storage can and will cause diseases, the characteristics of inadequate storage are those with possible cracks, dirt, open, unsupervised, unmaintained, among others, diseases are diverse, such as cholera, hepatitis, amoebic dysentery (BRITO; AMORIM; LEITE, 2007). These diseases are addressed in the table below.



Table 1: Main diseases caused by incorrect use of water

Diarrhea	Dengue fever	Cholera	Kidney problems
Hepatitis	Leptospirosis	Amebbias	Botulism
Typhoid	Salmonella	Digestive problems	Intestinal problems

SOURCE: The authors(2023).

The students' opinion and information about diseases lead to the fact that the knowledge passed on to them about what contaminated water can cause to health is extremely important, taking into account that the correct use can contribute beneficially and help in the mitigation of diseases.

5 FINAL THOUGHTS

The training for public school students on the subject was important to inform and warn about the effects caused on society, health and the environment, reflecting on the scarcity of water in the semi-arid region of Paraíba, and the knowledge acquired becomes a tool to deepen the students' opinion on the problem in question.

The use of lectures as a method allowed the teaching to be conveyed to the school community and strengthened the extension link between PET - Chemistry and the high school students of the State School Cidadã Integral Técnica Jornalista José Itamar Cândido da Rocha, in addition to enabling their integration in their academic training. The students' opinion was essential for verifying knowledge and instrumentalization to mitigate the effects of drought in the region at a social level, as well as being a way to disperse the community on the topic discussed and that will enable improvement in training on environmental education in the city where the lecture was held. It is still possible to conclude that the formative lecture becomes beneficial to work and computerize the theme, deepening it in a short period of time.

With everything, it was possible to observe that the theme addressed was acquired by the students through their interactions during the lecture, and also by participating by answering the questionnaire, which is of great importance both personally and collectively, since it addresses a reality in which some people are living and that arouses commotion, generating interest not only for the theme but also to solve this problem. Thus inspiring students so that in the future they are more careful with the water they use, and have a conduct that makes it possible to solve problems regarding water.



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