

ENVIRONMENTAL EDUCATION AND SOLID WASTE IN THE SEMIARID REGION OF PIAUÍ: CONCEPTIONS AND EDUCATIONAL PRACTICES IN THE RURAL ZONE OF THE MUNICIPALITY OF CARAÚBAS DO PIAUÍ.

EDUCAÇÃO AMBIENTAL E RESÍDUOS SÓLIDOS NO SEMIÁRIDOS PIAUIENSE: CONCEPÇÕES E PRÁTICAS EDUCATIVAS NA ZONA RURAL DO MUNICÍPIO DE CARAÚBAS DO PIAUÍ

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RESUMO

O presente artigo tem o intuito de contribuir na discussão sobre práticas em educação ambiental com estudantes de uma escola pública rural, tendo em vista a problemática sobre a degradação ambiental e seus impactos na saúde do planeta e humana. Tem como objetivo inserir práticas de educação ambiental no contexto educacional visando à diminuição da produção de resíduos sólidos. Para isso, foi utilizado um questionário fechado com perguntas sociodemográficas e sobre resíduos sólidos, com o intuito de mensurar os dados. Os resultados apontaram para concepções positivas referentes à diminuição dos resíduos sólidos, porém pouca atuação no cotidiano. O estudo teve como contribuição a demonstração da importância da escola no processo de conscientização ambiental. Assim, conclui-se que a escola pode contribuir de maneira significativa na conscientização ambiental se trabalhada de forma adequada.

Palavras-chave: Concepções Ambientais. Práticas Educativas. Educação Ambiental. Resíduos Sólidos. Escola.

ABSTRACT

This article aims to contribute to the discussion on environmental education practices with students from a rural public school, in view of the problem of environmental degradation and its impacts on the planet and human health. It aims to insert environmental education practices in the educational context aiming at reducing the production of solid waste. For this, a closed questionnaire with socio-demographic and solid waste questions was used, in order to measure the data. The results pointed to positive conceptions regarding the reduction of solid waste, but little performance in daily life. The study contributed to demonstrate the importance of the school in the process of environmental awareness. Thus, it is concluded that the school can make a significant contribution to environmental awareness if worked properly.

Keywords: Environmental Conceptions. Educational Practices. Environmental education. Solid waste. School.

INTRODUCTION

The production of solid waste has been a major global problem, causing various environmental issues and harming human health, making it one of the main concerns of environmentalists worldwide. According to a survey conducted by the Webresol website (2020), each Brazilian citizen produces an average of 800 grams to 1 kg of solid waste per day. As a result, both globally and nationally, there have been several reflections on the harmful effects that waste production is causing to the planet's health.

The consequences of increased waste production have led to global conferences for the formulation of international agreements and national laws that guide industrial sectors and individual citizens to adopt sustainable ways to reduce waste production and/or dispose of what is produced properly (Rial, 2016).

Given this scenario, it is necessary to incorporate habits that reduce the amount of waste produced daily. These habits consist mainly of replacing disposable products, which are produced in large quantities every day and are used only once, such as PET bottles, plastic bags, straws, Styrofoam, etc.

Thus, raising awareness among people about their attitudes towards the environment becomes extremely necessary, lest the depletion of the remaining natural resources occur. In this context, Environmental Education emerges with the main purpose of promoting ecological awareness, that is, behaviors and ways of acting in favor of nature conservation (Ross; Becker, 2012).

Therefore, schools appear as powerful spaces to mediate between society and the environment, providing access to information and expanding knowledge and reflections on the planet and its issues (Sousa, 2018), thus contributing to the formation of conscious and engaged citizens.

In this way, it is believed that the present study can contribute to the increased importance of integrating environmental education into the daily lives of students and their families through schools, with an emphasis on reducing the production of solid waste.

Consequently, it may have benefits such as greater awareness of the responsibility that each individual has towards the environment and more discussions about the role of schools in contributing to the formation of human beings more sensitive to environmental issues.

In this context, the study aimed to analyze environmental education practices in the educational context aimed at reducing the production of solid waste. And as specific objectives: to understand the conceptions of elementary school students about solid waste; to identify if there are practices aimed at reducing solid waste by students and their families; to characterize how the disposal of solid waste is carried out by students and their families, as a possibility for the insertion of environmental education practices in the school

THEORETICAL FOUNDATION

Environmental Degradation

It is well known that the planet suffers from an environmental crisis, which dates back to the 20th century and persists to this day (Afonso et al., 2014). Along this path, one of the most notable components, concerning severe environmental damage, comes from the lifestyle characterized by consumerism (Andreassa, 2008).

It can be said that environmental degradation arises from various interactions between humans and the environment, in which there are profound transformations of natural environments and even the annihilation of places and biodiversity, due to the indiscriminate use of natural resources (Joly; Queiroz, 2020).

According to Hartung (2018), environmental degradation is the process of ecosystem imbalance that reduces its potential to sustain life and the planet's resources, and it is related to changes in the environment caused by human action.

Thus, it is noted that the acceleration of the planet's imbalance is the result of the evolution of societies and the occupation of various natural spaces, which are transformed by human action and cause different environmental impacts (Freitas, 2012).

Joly and Queiroz (2020) argue that the effects of the biodiversity crisis can be mitigated by addressing the vectors of environmental degradation. Therefore, it is necessary for the population to act in a way that aims at the interest of the environment, in order to reduce or at least not intensify the planetary crisis situation.

Among the vast array of factors impacting environmental degradation is the production of solid waste, known as garbage. Therefore, discussions and actions regarding the production and management of solid waste that can truly reach the population become essential.

Solid Waste: Concept and Legislation

The production and disposal of solid waste worldwide pose serious problems for the planet and humanity, becoming a challenge not only for governments but for society as a whole (Beltrame et al., 2016).

In 2010, the National Solid Waste Policy (PNRS) was created with Law No. 12,305, of August 2, 2010, which seeks to organize and regulate how the country deals with produced waste, demanding transparency from both public and private sectors in the management of these residues (Brazil, 2010).

The law also proposes the practice of sustainable consumption habits, containing instruments that encourage recycling and the reuse of solid waste, as well as

environmentally adequate disposal of waste and even the extinction of open dumps (Brazil, 2010).

Despite the evolution of societies, the model of production and disposal of materials remains the same, following a sequence of extraction-manufacture-disposal. It is no wonder that some theorists attribute to this model the name "the disposable era" (Cardoso, 2004; Ribeiro; Kruglianskas, 2014).

Waste, in this production chain, is the final part of the process, being produced after consumption. Its inadequate disposal and in large composition cause enormous piles of garbage that affect the soil, water, and air, as well as spreading diseases (Cardoso, 2004; Rial, 2016).

One of the possibilities for addressing the increase in solid waste and environmental degradation is environmental education, which contributes to knowledge about new ways of establishing the relationship between humans and the environment, bringing the responsibility of each citizen towards the care and preservation of the planet (Beltrame et al., 2016)

Environmental Education in Schools

Environmental education is a term associated with sustainability, which refers to "concern for the future existence of natural resources to enable the continuation of human life" (Beltrame et al., 2016; Feil; Schreiber, 2017, p. 7).

Conceptually, environmental education concerns a teaching/learning methodology that involves bringing people to take responsibility and participate in environmental issues, so they can actively contribute to addressing and creating solutions, thus becoming transformative agents (Roos; Becker, 2012).

In this sense, authors also point out that only with environmental education will the transition of the consumption model occur because it provides the basis for achieving sustainable development by intending to integrate the political, social, economic, and environmental spheres and placing individuals at the forefront of the environmental degradation movement (Oliveira et al., 2014).

Therefore, the importance of developing practices around environmental education is noted, aiming at quality of life for current and future generations. By introducing environmental education into the school context, an opportunity is provided to address social and educational responsibility from childhood and throughout other stages of development (Tavares, 2013).

Sousa (2018) points out the school as the greatest aid in raising awareness among people about the environment, by promoting dialogue, the construction of values, and principles

that assist in the formation of environmental leadership in students. Additionally, the author also emphasizes the importance of teachers' participation in this process.

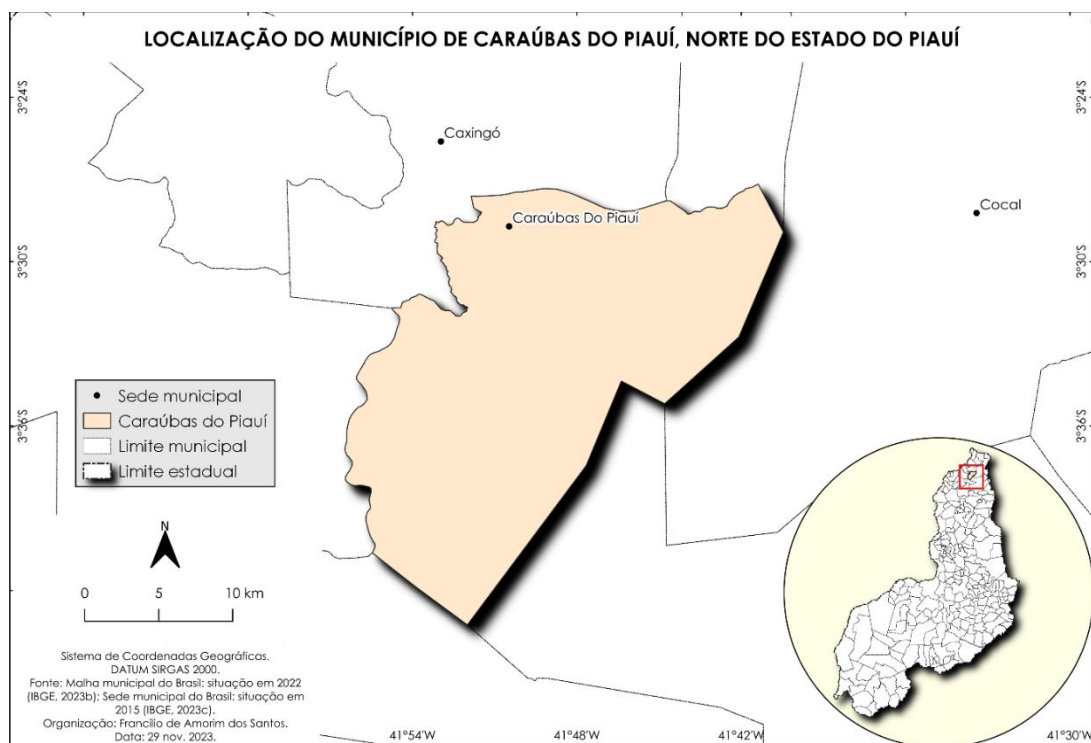
MATERIALS AND METHODS

Study Area

The municipality of Caraúbas do Piauí is located in the north of Piauí, situated in the microregion of the Piauí Coast, covering an area of 468.59 km², with the following municipal boundaries: to the north, the municipalities of Buriti dos Lopes and Caxingó; to the south, Piracuruca and São José do Divino; to the east, Cocal and Piracuruca, and to the west, Caxingó and Joaquim Pires (Figure 1). The headquarters of this municipality is located at the geographical coordinates of 03°28'33"S and 41°50'34"W and is 255 km away from Teresina, the capital of the state of Piauí (Aguiar; Gomes, 2004).

The municipality's name derives from the abundance of the "caraúbas" tree, present in the local vegetation. Caraúbas do Piauí was elevated to the status of municipality and district under the name Caraúbas do Piauí, by State Law No. 4811, dated 12/27/1995, having been separated from Buriti Lopes. Caraúbas do Piauí has a population of 5,630 inhabitants, according to the IBGE Census of 2022, a Gross Domestic Product (GDP) per capita of R\$ 9,359.66, and a Municipal Human Development Index (MHDI) of 0.505 (IBGE, 2023a)

Figure 1 – Location of the municipality of Caraúbas do Piauí, North of the state of Piauí.



Source: Prepared by the authors (2023).

Procedural Methodology

This is a descriptive and quantitative study. Descriptive, as it aims to describe the characteristics related to environmental issues of a particular sample and its relationships (Gil, 2008). Quantitative, since the study seeks to analyze data from a questionnaire with closed-ended questions about environmental issues. Fonseca (2002) explains this type of research:

Quantitative research focuses on objectivity. Influenced by positivism, it considers that reality can only be understood based on the analysis of raw data collected with the help of standardized and neutral instruments. Quantitative research uses mathematical language to describe the causes of a phenomenon, the relationships between variables, etc. (Fonseca, 2002, p. 20).

The research involved the participation of 20 (twenty) elementary school students from a Rural Public School in the municipality of Caraúbas do Piauí, in the state of Piauí. Due to the Covid-19 pandemic, all research procedures were conducted remotely through digital information and communication technologies.

First, a mini-lecture on solid waste was given to the students, followed by a workshop to teach them how to reuse objects that could potentially become waste. It is estimated that both actions took about an hour to complete.

Subsequently, the students were explained the study's objectives, emphasizing the voluntary nature of participation. Afterward, the participants were invited to respond to an online questionnaire about solid waste and socio-demographic characteristics.

The mini-lecture and workshop were conducted through the Google Meet tool, while the questionnaire was administered through the Google Forms tool. The questionnaire had two parts: one with socio-demographic questions to characterize the sample, aiming to obtain information about Gender; Age; Education; Income; Household composition and Environment, and the other with specific questions about students' perceptions and practices regarding solid waste.

The solid waste questionnaire was divided into five subtopics to better understand the results, namely: environmental education practices at school; students' perceptions of solid waste and environmental concern; practices for reducing solid waste by students and their families; reused products by students and their families; solid waste disposal by students and their families.

The data resulting from the questionnaire were organized through a descriptive (exploratory) analysis aiming at the measurement and classification of quantitative

variables, performed using statistical methods, which aim to classify and specify the characteristics studied (Marconi; Lakatos, 2003). The statistical data were produced by Google Forms itself, and the variables were presented in tables and graphs for better visualization of the results

RESULTS AND DISCUSSION

Results of the Socio-demographic Questionnaire

The results obtained from the socio-demographic questionnaire (Table 1) indicated that the sample is mostly composed of females. It is believed that this result highlights the more active and direct involvement of women in household activities, placing them more prominently in environmental issues (Lima; Torres; Filho, 2017; Tramontina; Carniatto, 2019).

Regarding education level (Table 1), there was an equal distribution of students across the grades comprising Elementary School. In this aspect, this variable did not show much influence in this research, however, studies have shown that higher levels of education are associated with greater likelihood of pro-environmental attitudes (Tramontina; Carniatto, 2019).

Regarding age (Table 1), the sample consisted of adolescents, with the majority being between thirteen and fourteen years old. This variable has been described diversely in the literature. Some studies suggest that age has little influence on environmental concern, while others observe that older individuals tend to be more involved in environmental issues (Silva, 2014; Beuron et al., 2016).

Table 1 - Sociodemographic data of elementary school students at a public school in the rural area of the municipality of Caraúbas do Piauí.

Variable	Result	%
Sex	Feminine	90
Age	13 and 14 years old	65
School grade	6º, 7º, 8º e 9º	25
Income	Less than 1 salary	55
Home	Own home	90
Reside	With the parents	65

Source: Prepared by the authors (2020).

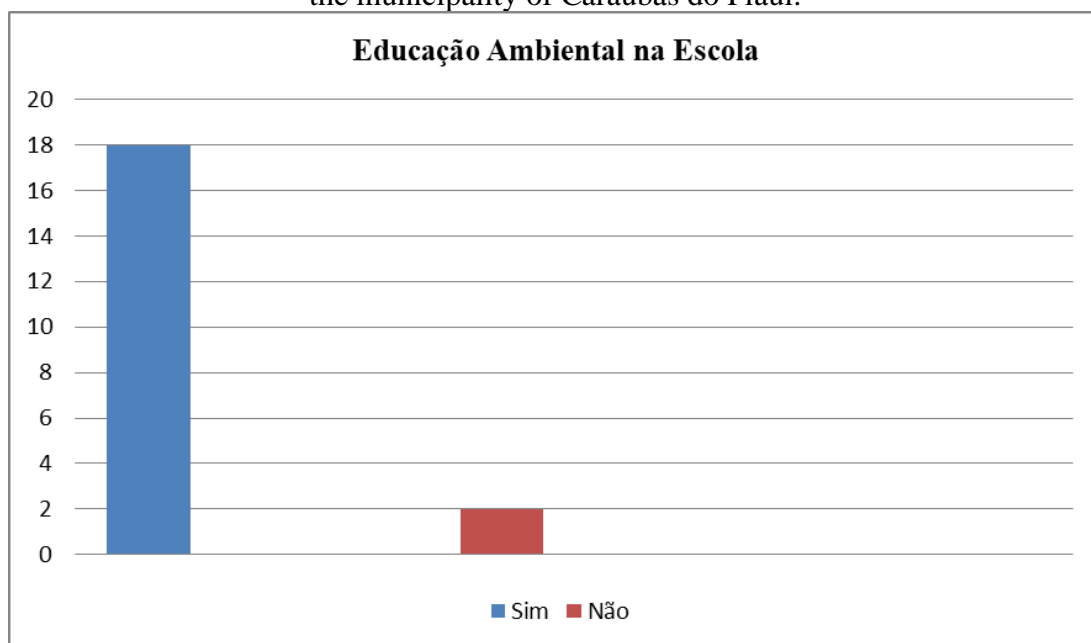
The data on participants' and their families' income (Table 1) showed that the majority live on less than one minimum wage. What the literature suggests about this variable is that individuals with lower incomes tend to change their environmental habits more slowly than those with higher incomes (Bacha; Schaun, 2011).

Solid waste questionnaire results

The first question asked about environmental education practices at school. The vast majority of students (90%) responded that there are environmental education practices in their school, as can be seen in Figure 1 below:

The second question asked about students' conceptions of solid waste and environmental concerns. The results showed that students' conceptions about reducing solid waste are positive (Table 2). It can be inferred that this result is related to the students' response that there are practices in environmental education at their school (Figure 2).

Figure 2 – Environmental Education Practices at the Public School in the Rural Zone, in the municipality of Caraúbas do Piauí.



Source: Prepared by the authors (2020).

In another study involving students from elementary and high school levels in the public education system, where the school also engages in environmental education, it was observed that there is an awareness of environmental issues among the students (Araújo; Silva; Santos, 2017). However, in a research study involving elementary school students aged between 10 and 14 years old from a state school, it was found that the students demonstrated many misconceptions about solid waste and lacked interest in this topic (Nicolosi; Barboza, 2013).

It can also be inferred that environmental education in schools has influenced the result regarding students' environmental concern and their awareness of the harmful effects of unsustainable habits, as the majority reported being concerned about environmental issues, as shown in Table 2

Table 2 - Conceptions about solid waste and environmental concerns of elementary school students at the Public School in the Rural Zone of Caraúbas do Piauí.

Question	Yes	In part	No
Do you know what solid waste is?	95%	-	5%
Are you concerned about environmental issues and are you aware of the damage caused by solid waste to nature?	85%	10%	5%
Do you think that switching from disposable materials to permanent materials would help reduce the amount of waste you and your family produce?	85%	-	15%
Do you think that reusing and recycling solid waste are also options for reducing the amount of waste in nature?	95%	-	5%

Source: Prepared by the authors (2020).

The data regarding students' environmental concern from this research diverges from the results of another study where a majority of students were aware of their habits regarding the environment but believed that they did not impact the environment (Siqueira; Vargas; Soares, 2016). On the other hand, in a study involving university students, a new variable was demonstrated, as the students showed concern and awareness of the problems caused by waste, coupled with a certain type of initiative in wanting to think of solutions to the issue (Rocha; Santos; Navarro, 2012).

Thus, it is evident that the school, by using environmental education, can contribute to raising awareness about environmental issues, but attention should be paid to how the topics are being discussed to achieve a sense of self-responsibility among students in caring for the environment.

The third question inquired about practices aimed at reducing solid waste by students and their families. Regarding practices aimed at reducing waste, the results showed that the majority partially consider choosing more sustainable products but do not opt for more durable products, although they do reuse PET bottles (Table 3). In this aspect, there is a gap in sustainable actions.

Table 3 - Practices to reduce solid waste carried out by elementary school students at the Public School in the Rural Zone of Caraúbas do Piauí.

Question	Yes	In part	No
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When you and your family go shopping, are you concerned about choosing products that are less harmful to the environment?	20%	60%	20%
Have you and your family already replaced, for example, plastic bags with ecobags, plastic straws with metal straws, etc.?	40%	-	60%
Do you and your family usually reuse any type of material that would otherwise go to waste?	85%	10%	5%

Source: Prepared by the authors (2020).

The result regarding the choice of products and substitution is consistent with other studies, which suggest that when students choose products to buy, they consider factors unrelated to environmental impact (Silva, 2012; Siqueira; Vargas; Soares, 2016). In another study with 1st-year high school students, it was demonstrated that students' perceptions are restricted and naive, formulated by simplistic and previous knowledge. Most students do not separate or treat waste and do not possess environmental awareness (Santos, 2020). Another research study found that students lacked waste separation practices and were unaware of the environmental damage caused, also linked to low knowledge about solid waste (Souza, 2016).

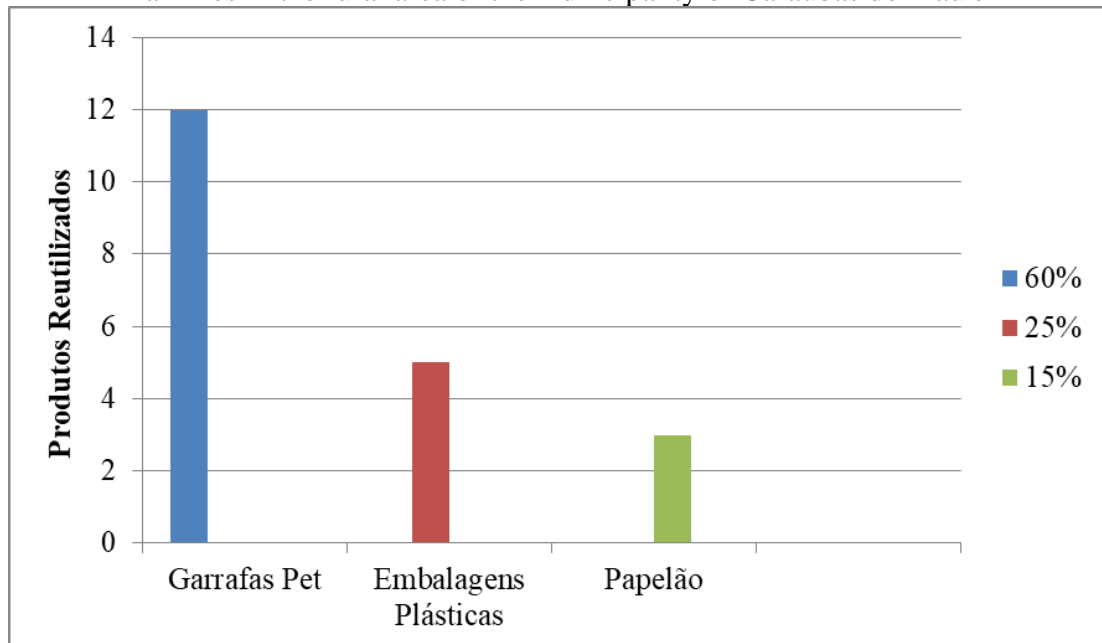
Thus, it is noticeable that even with positive knowledge and perceptions about sustainability practices, it is not guaranteed that people will actively participate in environmental issues. However, it is important to emphasize that knowledge remains an important variable in environmental education practices.

In this regard, a study with 6th-grade elementary school students showed a change in students' behavior regarding waste separation at home through the Problem-Solving Methodology, which focuses on changing attitudes practically by thinking about solutions to the problem, emphasizing the knowledge that the student already possesses on the subject (Fiurini; Klein, 2016).

Therefore, it may be pertinent to bring this discussion to the school setting and rethink new ways to introduce environmental education in schools, so that students are encouraged to reflect on their own actions and not just pass on knowledge, leading to the possibility of generating new knowledge about the subject based on students' own experiences and understanding of the issue.

The fourth question inquired about the products reused by students and their families. The data on material reuse (Figure 3) in this study showed that the majority of students and their families engage in recycling.

Figure 3 – Products reused by elementary school and public school students and their families in the rural area of the municipality of Caraúbas do Piauí.



Source: Prepared by the authors (2020).

The result regarding recycling in this research diverges compared to other studies, which showed that less than half of the students engage in recycling and call for greater promotion of the practice (Silva, 2012; Siqueira; Vargas; Soares, 2016). In another study with elementary school students, 77.8% of the students described that they do not know what waste is, but 55.5% know what reuse and recycling are (Santos; Freitas, 2015). At this point, it can be reflected that recycling and reuse relate to the context in which people are embedded, considering the purpose that recycling and reuse can serve in a person's life.

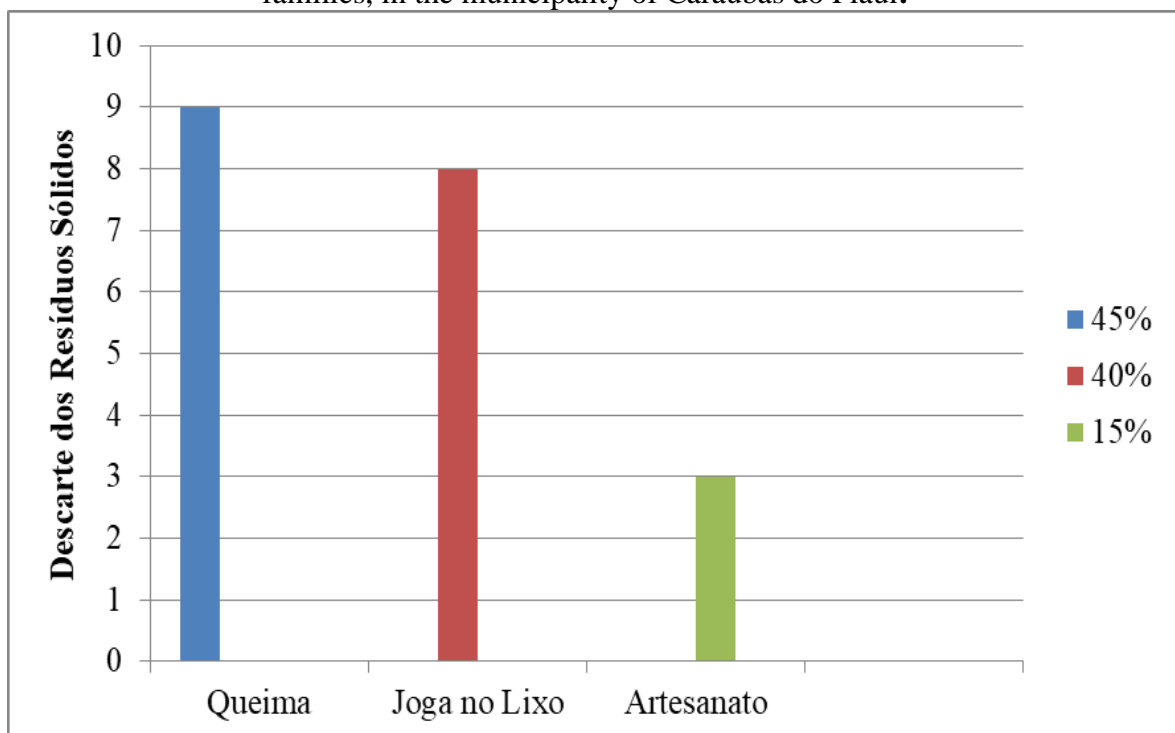
Furthermore, concerning the results of the present research, it is necessary to consider that being aware of the harmful effects of increased solid waste production does not guarantee that active practice on the issue will occur. Studies indicate that numerous variables are involved in pro-environmental behavior, "which can be a conscious and intentional action or not" (Pato; Tamayo, 2006, p. 290). Therefore, there is no rigid definition of what constitutes more sustainable behavior due to its complexity. Thus, once again, it is noted that solely working with environmental education through information dissemination is not the most suitable approach.

Regarding PET bottles being the most reused product by students and their families, Massukado (2004) and Oliveira (2014) state that PET bottles are one of the components most commonly found in household waste, and recycling them can indicate a certain level of environmental consciousness.

The fifth question inquired about the disposal of solid waste by students and their families. The result regarding waste disposal showed that 45% burn their waste, and 40% dispose of it in the trash for collection (Figure 4). These data reveal an interesting relationship highlighted in the literature, indicating differences in the disposal of solid waste between urban and rural areas.

In urban areas, most of the population disposes of their waste for collection, i.e., they throw it in the trash (Lima; Torres; Oliveira Filho, 2017). However, in rural areas, there is a deficit in household collection coverage (SNIS, 2019), which contradicts the data obtained from the questionnaires, where burning waste is relatively more prevalent than disposing of it for household collection

Figure 4 - Disposal of solid waste carried out by students at a Public School and their families, in the municipality of Caraúbas do Piauí.



Fonte: Elaborado pelos autores (2020).

Studies confirm that the habit of burning garbage is indeed prevalent in rural contexts, both burning and disposal along watercourses (Pedroso, 2010; Roversi, 2013). Additionally, selective collection itself is neglected by the population, along with a precariousness of sustainable disposal.

Thus, it is notable that, whether in rural or urban areas, it becomes necessary to insert environmental education aimed at acting on solid waste, both in its reduction and in its proper and healthy disposal, considering that the data from this research indicated burning as the most used means of waste disposal in an urban setting.

FINAL REMARKS

The study aimed to incorporate environmental education practices in schools aimed at reducing solid waste and identifying students' conceptions and practices regarding waste. Thus, it can be concluded that the study achieved its objectives. The results obtained demonstrated differences between students' conceptions about waste reduction and more conscious practices regarding the issue.

Thus, it was noticed that, despite knowledge and conceptions being inclined to benefit the environment, there is still no leadership in practice in this regard. This new information has led to reflections on the need to think about various ways to use environmental education in schools to enable greater sensitization by students, since knowledge alone has proved insufficient to generate more conscious actions.

In terms of actions that truly contribute to waste reduction, the recycling of PET bottles appeared as a sustainable action by students and their families. However, PET bottles are commonly used as containers for water, liquids, and various types of grains, such as beans, by the rural population, being a habit linked to economy and practicality rather than directly to awareness of the environmental impact. Thus, future research should explore further the factors influencing PET bottle recycling.

Waste disposal presented an interesting fact about a relative majority of the population burning waste instead of depositing it in the trash, a fact explained by the habit people have acquired over time when there was no waste collection, and today, even with the collection service in that community, most people still prefer to burn it rather than disposing of it in a more adequate manner. In this sense, it is necessary to sensitize them about disposing of waste properly and to alert them that burning is also a harmful action to environmental and human health

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