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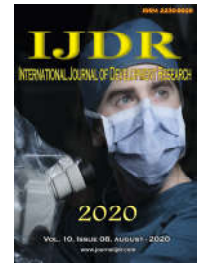
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RESEARCH ARTICLE

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PERCEPTION OF STUDENTS AS TO THE MANAGEMENT OF ELECTROELECTRONIC WASTE IN A HIGHER EDUCATION UNIT

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ABSTRACT

According to data from the United Nations, Brazil is ranked as the largest producer of electronic waste in Latin America, and seventh in the world. With an annual production of 1.5 tons of electronic waste. This fact is due to the dizzying increase in the consumption of electronic technology, as the versions are updated and modernized in a short period of time, driving consumers to purchase new products and erroneously dispose of the old devices that have become obsolete. This speed of consumption associated with the low level of knowledge of the population on the subject, has serious consequences for the ecosystem, as they have numerous harmful substances causing negative impacts on the biosystem and contamination to the population's health. Knowing the perception of environmental issues in different classes of society is an essential step towards implementing programs on environmental education more effectively. Therefore, the research aimed to assess the perception of the disposal of batteries by the academic community in a technological in Recife – Brazil. The research was conducted from June to August 2019 using the students and professors of the tourism technologist course. In total, 115 semi-structured questionnaires with 10 questions related to the topic were applied. The survey of the data was tabulated in descriptive statistics. The interviewees showed that they are aware of the dangers of incorrect electronic waste disposal to the environment and human health, despite the great majority of them discarding their electronic waste incorrectly due to the lack of knowledge of collection points for this material in the environment where they live. Thus, it is verified the importance of an effective action plan on the part of the educational institution, adviser the academic community regarding the correct disposal of batteries.

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INTRODUCTION

Man, to maintain his livelihood has always used raw materials in products that aided his survival. The substitution of manual labor for machinery took place in the 18th century, with the Industrial Revolution favoring an increase in the production of consumption of inputs, goods, and an increase in population, causing damage to the environment (Kumar, 1997). After the substitution of manual labor for the production and consumption of inputs, consequently the discard of these obsolete products, generated negative impacts on the environment. According to Baldé et al. (2017) in its international report prepared jointly with the United Nations University (UNU) in partnership with the International Telecommunication Union (ITU) and the ISWA - International

Solid Waste Association, Brazil generated a total 1.5 million tons of electronic waste in 2016, being the second largest generator of this type of waste in the American continent, behind only the United States, which produced 6.3 million tons of electronic waste in the same period. According to the organization, a large part of this volume is not recycled and has an inappropriate destination, ending up in open air dumps, contaminating the environment and people's health. It is known that the current environmental and socioeconomic context enables revaluation through management, which obtains economic and environmental returns. The rapid consumption of technologies was due to digital marketing caused by electronics companies. It is estimated that according to Datareportal (2019), about 4.388 billion people are

connected to the internet around the world. However, in Brazil approximately 150 million people, about 140 million of whom are active users on social media, the study also states that the Brazilian population spends on average more than 9 (nine) hours of their day connected to these services. Brazil generates about 680,000 tons of electronic waste annually, being characterized as the largest generator of WEEE (Waste Electronic Equipment) among emerging countries according to Pacheco; Fields; Birth (2018). Some of the materials can be recycled and recovered, however, they can harm people if they handle them incorrectly (VAISHNAV; DIWAN, 2013) or affect the environment through contamination of water and groundwater because they contain substances such as lead, cadmium and mercury (ROBINSON, 2009). The influence of consumers to purchase products with high-tech, impels society to dispose of obsolete materials on a large scale. The problem derives from the discarded equipment, as they have heavy metal compositions in contact with soil, water, and air, affect the environmental quality and cause damage to human health, (QUINTANA; BENETTI, 2016). According to Conceição (2018) "the waste from batteries contains high levels of dangerousness which cause eventual changes in the physical structures of the soil". Thus, the danger of improper disposal creates a crisis for the environment, as these materials contain harmful substances and should not be discarded in common places (OLIVEIRA; LIMA, 2016). Thus, the dematerialization process is an alternative to reduce and reuse electronic waste for the production of new useful products over time, establishing the rate of consumption of materials and the technological improvements in their production (Dai; Liu, 2018), and thus to be effective since the Brazilian legislation presents clear and restricted guidelines regarding the handling of batteries (Law 12.305/2010), however few initiatives are implemented regarding the correct disposal of this waste. That said, it is mandatory to set the reverse policy program to manufacturers, importers, distributors, and resellers of batteries of any type. The disposal of this waste is one of the biggest environmental problems today.

Sustainability emerges as a path perspective to build new forms of production and consumption and, with this, to address the causes and effects of environmental changes (Neves et al. 2015), Thus, the installation of strategic points of great public circulation to be placed selective recipients to the points of voluntary delivery - PEV's, facilitates the final disposal of waste batteries and completes the reverse logistics cycle (Conceição et al. 2018). The State of Pernambuco has become a national reference in the disposal of batteries and portable batteries, being the first to be committed to implementing reverse battery logistics, according to SESC (2018), where they are sent for recycling. Thus, the role of educational institutions in citizen education strengthens the instruments in the environmental management process, including issues of citizenship, communication, responsibility, and support in socioeconomic, cultural, and ideological differences in the treatment of the focus. This study aims to point out a base of information about the profile of academics from the Federal Institute of Education, Science and Technology of Pernambuco - IFPE, Recife campus regarding the perception of the use and disposal of batteries. In addition, the research seeks to assess the perception of the academic community in relation to the current policy for the disposal of electronic waste at the IFPE educational institution, Recife campus, both in relation to the collection and the final destination of these residues.

MATERIALS AND METHODS

Characterization of the study area: The research was carried out from June to August 2019, at the Federal Institute of Education, Science and Technology of Pernambuco (IFPE), Campus Recife. The Institute is about Cidade Universitária, where it has an area of 1.10 km². Currently approximately 6,000 (six thousand) people circulate among students, teachers, professors and technicians, of this total 5,418 thousand students are students of courses in several modalities, such as: Integrated Technician, Subsequent, Superior of Technology, Bachelor and Postgraduate. Among these 822 students, they are linked to Higher Technology courses. The questionnaire was applied specifically to the academic community of the Higher Course in Tourism Management Technology. To structure the questionnaire, the methodology described by Gama et al. (2016) which consisted of ten semi-structured questions in multiple choice and open options. In total, 115 questionnaires were applied, corresponding to 100% of the students and 15% of the professors of the Higher Course in Tourism Management Technology. The following topics were addressed in the questions: Perception of the imminent risks of electronic waste, Environmental issues through the erroneous disposal of waste, Solid waste, Collection of electronic waste. The collected data were tabulated and submitted to descriptive statistics using the statistical software JMP SAS.

RESULTADOS E DISCUSSÃO

The analysis of the data obtained from the application of the questionnaire revealed that 71% of the interviewees were feminine and 29% individuals were male (Figure 1). Moreira (2010) observed a prevalence of female students in the tourism job market. In the universe of students and professors included in the research, only 1/3 of the interviews were male. Partly reflecting what is observed in the professional profile of the available tourism market.

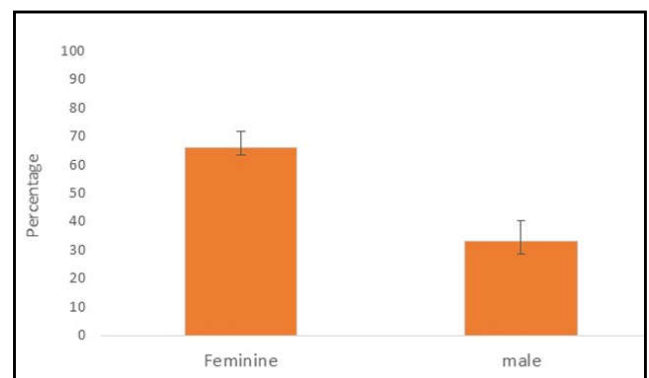


Figure 1: Distribution of respondents by gender.
Source: The authors (2020)

The main results of the data survey indicated that 91% of the interviewees had knowledge prior to the study, about the potential environmental contamination power of electronic waste (Figure 2). This observed trend was demonstrated by being in an excellent educational institution, where there is free access to information, the target audience becomes active and aware of the different themes. The observed results corroborate with Butzke et al. (2017) where they reported the strategies and learning in the teaching environment favorable to the construction of new ideas. Environmental perception includes understanding the interrelationships between the

environment and individuals, that is, how society perceives its surroundings, expressing its opinions and expectations. Responses related to the themes "Perception of imminent risks, erroneous disposal and electronic waste" presented greater trends in knowledge by respondents. However, the answers refer to problems such as the management and disposal of electronic waste. In the students' perception of the imminent risks to the environment due to incorrect disposal 91% of the interviewees reported the problem due to the release of heavy metals by the disposal of batteries (Figure 2).

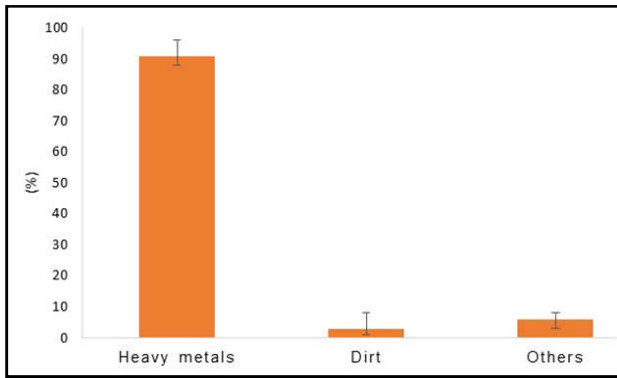


Figure 2: Perception regarding the type of environmental risk of improper disposal of batteries by students at a federal technological education institution. Source: The authors (2020).

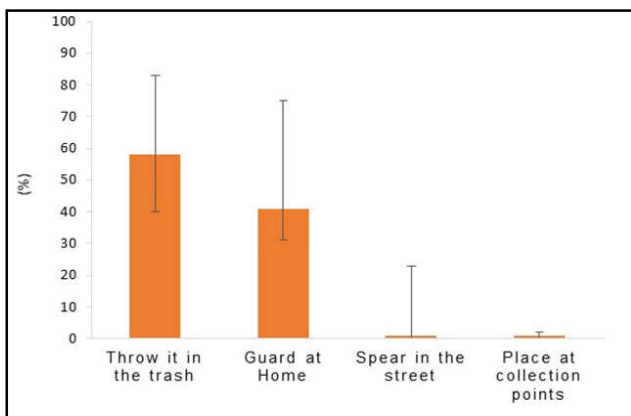


Figure 3. Forms of electronic waste disposal used by the academic community of a public technological education institution in the city of Recife, state of Pernambuco - Brazil. Source: The authors (2020).

When asked if they know any point of collection of electronics, 66% of respondents said they had no knowledge. Regarding the place of electronic waste disposal, 58% of the participants reported that they were disposed of in general use dumps (Figure 3). With regard to the fact that the electronics stores are responsible for the collection of electronic waste, as provided by CONAMA in Resolution 401/08, 34% of the interviewees answered they were aware of collection points and mentioned some located in stores, supermarkets, banks and universities. Similar results were observed by Carvalho et al. (2016), where they observed the interviewees' knowledge of collection points for electronic waste, however, they do not usually separate recyclable electronic waste from ordinary waste, using the trash in their home as the main disposal destination. Results establish a correlation between the study by Conceição et al. (2018), which certifies common waste disposal being more convenient and easier to access, demonstrating that the understanding of this theme is minimal

to students. Being the best way to reduce these negative impacts, it is to promote the awareness of people in order to avoid the erroneous discards, the forms of packaging, transportation in inappropriate places, because the refusals of these materials carried out in improper ways, cause innumerable problems to the environment. as for human health (RIBEIRO et al., 2016).

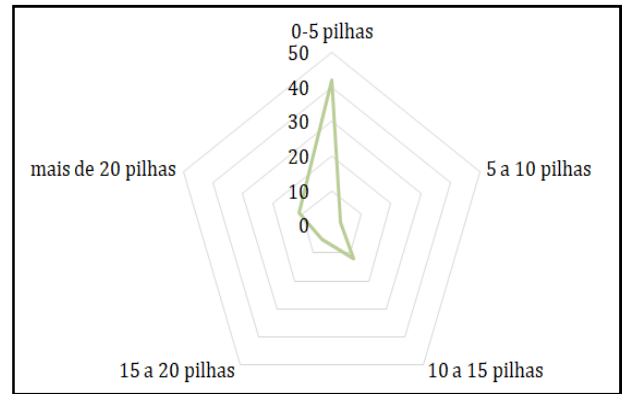


Figure 4. Battery consumption reported by the academic community of a public technological education institution in the city of Recife, state of Pernambuco - Brazil. Source: The authors (2020). I CHANGED THE FIGURE

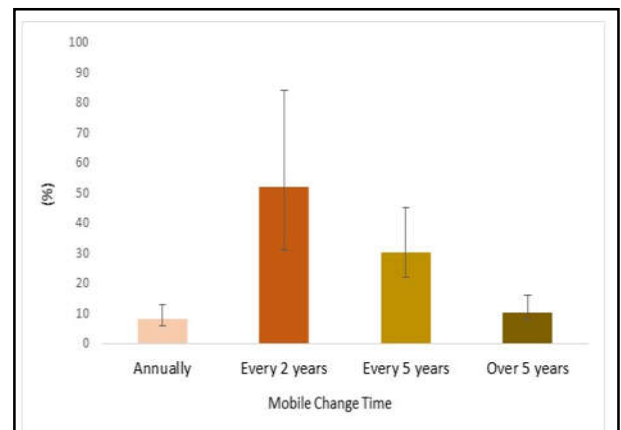


Figure 5. Average frequency of cell phone changes reported by the academic community of a public technological education institution in the city of Recife, state of Pernambuco - Brazil. Source: The authors (2020).

Regarding the amount of batteries discarded annually, the results were quite diverse. On average, 42% of the interviewees responded that they consume up to 5 batteries per year, 30% consume up to 10 batteries, 12% consume up to 15 and 5% consume up to 20 batteries per year and 11% more than 20 batteries per year (Figure 4). In general, the largest portion of the interviewees mentioned will have an annual consumption of up to 10 batteries a year (42%). According to Dacoregio (2018) the excessive consumption of batteries is generated by the convenience and portability to the use of electronic devices used in everyday life, they have not lost their place in the market because they are of cheaper economic access to the population. Regarding the frequency of changing cell phones, 52% of respondents answered to change cell phones every two years, 30% change them every five years, 8% of respondents change cell phones annually and 10% over five years (Figure 5). The results corroborate with those observed by Almeida et al. (2019), where the authors report that modern society motivates consumers so that they always

stay updated, thus buying new, cutting-edge products. This fact takes the name of consumerism, which is causally related to the increase in the production of electronic waste. When asked about the destination of old cell phones, 61% of the students interviewed answered to keep them at home. This observed trend may be related to the lack of information on proper disposal, as well as the scarcity of effective projects in the environmental education of electronic waste.

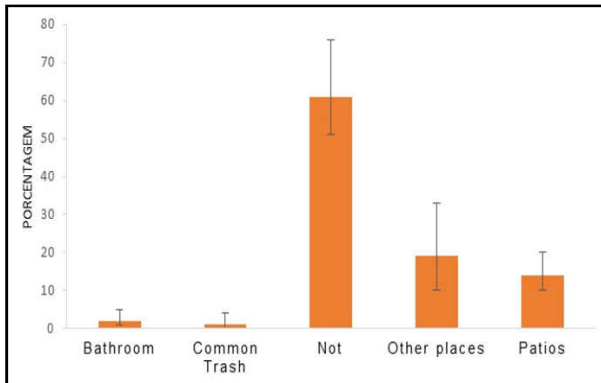


Figure 6. Perception of the places where they observed the disposal of batteries within the teaching unit reported by the academic community of a public technological education institution in the city of Recife, state of Pernambuco - Brazil.
Source: The authors (2020).

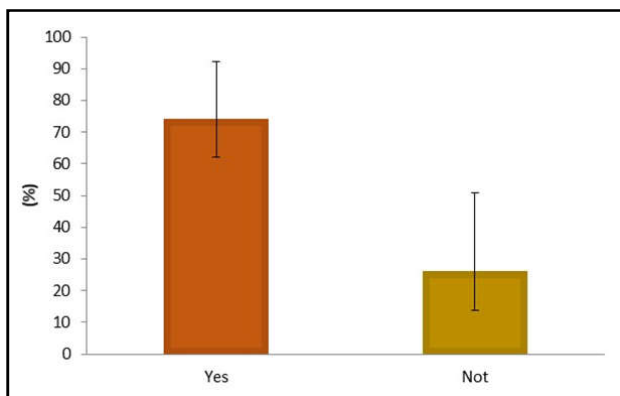


Figure 7. Interest in participating in an electronic waste training program by the academic community of a public technological education institution in the city of Recife, state of Pernambuco - Brazil.

As an initiative for the management of electronic waste, Silva & Borges (2018) implemented an intervention project in a public school in Uberlândia, Minas Gerais, developed in the neighborhood where the school is located, observing the “involvement of the community in the collection practices and the development of appropriate disposal habits”. According to its results, it is possible to promote the dissemination and repercussion of the research with the knowledge of information from the academic community on the correct disposal of batteries and the locations where there are collection points declared by some interviewees, for example. Regarding the question “Have you found batteries or batteries discarded in inappropriate places within your educational institution?”, 61% answered that they had not found batteries and batteries in improper places within the institution, however 39% of the interviewees answered yes, of these 42% said they had found batteries and batteries among common dumps; 7% of respondents found batteries in bathrooms and 4% in the

yard; 47% highlighted the option other places (Figure 6). The situation of electrical and electronic waste within the educational institution, traced through the questionnaires, shows that there is a significant amount of material being discarded without any kind of separation and proper destination. In this way, actions for the correct destination of the electronic waste can be outlined, as well as educational actions.

Such work must be done jointly, including academic, administrative, operational society and students. In response to the last question: “Would you like to participate in an awareness program regarding the correct disposal of batteries and / or batteries in the educational institution?”, 74.14% of the interviewed students answered yes; while 25.86% of respondents showed no interest in participating in waste management programs (Figure 7). The creation of internal policies in educational institutions aims to demonstrate education and environmental awareness as an important tool in combating the damage caused to the environment and to global society, as understood by Passos (2018). This is an ally in the insertion of students in sustainable themes, such as: electronic waste, the imminent risks caused by their inadequate disposal and the damage caused to the ecosystem and human health. Law 9,795/99, regulates, provides, and institutes on the National Environmental Education Policy, in which it defines the concept and principles to be followed for essential and healthy quality of life and sustainability. In this way, environmental education becomes a strong important tool to raise society's awareness of the issue of the use and proper disposal of electronic waste.

Final Considerations

The academic community of the studied educational institution is aware of the dangers of incorrect electronic waste disposal to the environment and human health, although the vast majority of them dispose of their electronic waste incorrectly due to the lack of knowledge of collection points for this material in the environment where they live, demonstrating the need for an environmental education program and collection of electronic waste within the campus. An important part of the academic community of the educational institution was open to the participation of training programs for electronic waste. Therefore, it is recommended to implement training programs on environmental management in teaching units, allowing this body to be a multiplier instrument for the importance of managing these electronic wastes.

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