

Diagnosis of the Knowledge of Students and Professors About Environmental Education - Case Study.

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Abstract— The objective of this work was to investigate the treatment of the theme Environmental education in a transversal way with the students of the 1st periods of the courses of Buildings and Integrated Sanitation of the IFPE (Federal Institute of Education, Science and Technology of Pernambuco) - Campus Recife, under the perspective of awareness of these students, with mathematics as an important aid tool. The survey took place in July and August 2020, where questionnaires were applied through Google Forms to 80 students. In a second step, another form was sent to the teaching segment, in a total of 50 questionnaires. The questions addressed in the questionnaires to students led to points such as the perception of the existence of environmental problems, also seeking to analyze the degree of understanding of students in relation to mathematics as a support to environmental education. Subsequently, tabulation, statistical treatment and analysis of the data obtained through descriptive statistics were performed. The results revealed that a significant portion of the students came to understand that the environmental issue is not only a matter of nature, but also of society. Although, it should be noted that some of them can better understand what an environmental problem is than fully understand what the environment is. As for the professors, they demonstrated to relate to the current reality of the planet, however, a portion of this segment suggests that the structure of work to approach the theme is not so adequate.

I. INTRODUCTION

When it comes to environmental education, discussions involving topics such as legislation, administration and geography are common. In this context, it makes sense to approach these themes. However, the discussion of this theme, like any other, would not be possible without the aid of mathematics, since it is inserted in all aspects that involve the need to quantify or qualify a result.

Environmental education is present in all schools. In Brazil, the National Environmental Education Policy (PNEA) - Law No. 9,795, of April 27, 1999, defines that environmental education must be present in a continuous, articulated and interdisciplinary way in all modalities of formal and non-formal education [1]. However, some research on environmental education practices in public

schools in the country portrayed the difficulties of professors to insert it in the school context [2].

Agenda 21, in its chapter 36, highlights environmental education as a process that seeks to develop a population that is aware and concerned with the environment and its related problems. A population that has knowledge, attitudes, skills, commitments, and motivations to work individually and collectively, seeking solutions to existing problems and preserving those that still resist and deserve more attention [3].

Also, according to [3], Environmental Education is an educational process, the purpose of which is to develop pedagogical instruments that expand educational practice so that man lives in harmony with the environment.

Based on this, the pedagogical work with Mathematical Modeling is an important instrument for the application of mathematics, in the environmental context, to solve real problems, since it uses the generation and need of data collection, aiming at the simplification of reality situations. Actions aimed at experimentation, visualization, interpretation, and forecasting, if the commitment to explore new things, has the consequence of producing knowledge, because when working with practical projects, we favor the construction of environments in which students are encouraged to do analogies and perform simulations, leading to the design of models that can be useful in representing different situations [4].

In this context, environmental education, and mathematics, in the context of modeling, becomes a strong ally, because through mathematics we can quantify environmental problems, obtaining a clearer view of the phenomena that are occurring in the environment, creating an opportunity to act in the sense to improve or modify some aspects related to the quality of the studied environment [5].

Prospecting (for an aspect of mathematics teaching) the degree of awareness and workability of the theme Environmental Education in the classroom at a federal public institution was the objective of this work.

II. METHODOLOGY

- Place of Study

The surveys were carried out in July and August 2020, at the Federal Institute of Science and Technology Education of Pernambuco IFPE - Campus Recife, but specifically at the Academic Department of Infrastructure and Civil Construction - DAIC (Block F). Campus Recife is in the Cidade Universitária neighborhood, in the city of Recife, Pernambuco, Brazil.

Currently Campus Recife has 7,856 students with active enrollments, distributed in courses of the most diverse modalities of classroom teaching: postgraduate, specialization, bachelor's, and technologist, subsequent, integrated and PROEJA (Youth and Adult Education Program) (IFPE, 2020 - data extracted from the Q-academic registration platform - IFPE's academic and institutional system).

- The Questionnaire:

To develop the research, questionnaires were adapted by the author and applied. There were questionnaires in electronic format, delivered via email for access through a link, generated through the Google Forms tool.

80 (eighty) questionnaires were applied to the student public - corresponding to the total number of students in the 1st period of both courses mentioned above. Of this amount applied, 75 (seventy-five) questionnaires were answered. 50 (fifty) questionnaires were applied to the teaching public, obtaining 44 (forty-four) responses as feedback. They are professors who teach classes to both courses (Sanitation and Buildings), of the most diverse curricular components, under the pedagogical perspective of what is proposed by the various Course Plans of the Institution.

The questions addressed in the questionnaires to students, led to points such as the perception of the existence of problems related to the environment, also seeking to see the degree of perception of these students in relation to mathematics as a tool and support to environmental education. To do so, evaluate and outline a general profile of this public to the topic discussed.

Likewise, the questionnaire to the teaching public granted and sought to evaluate the theme from an interdisciplinary perspective. In other words, how far professors (after a general outline) have advanced in the classroom about environmental education, based on the pluralism of ideas and pedagogical concepts from different sciences.

Thus, the procedure for carrying out this part of the work was then divided into two parts: first, an email was sent to the email address of each student and each professor, where the intention of this work was exposed, in addition to the links (form Google Forms) of the questionnaire - specific to each class. In the second moment, the tabulation and the due analysis of the data obtained were performed - through descriptive statistics. Thus, allowing the profile of both audiences evaluated.

The research result provides quantitative descriptions of the object of study and addresses associations between

the issues (the theme) and characteristics (social and cultural) of the audiences evaluated.

III. RESULTS AND DISCUSSION

- Students

A preliminary analysis of the data obtained (1st integrated period of the Sanitation and Buildings courses; N = 75 - number of questionnaires answered) made it possible to understand that a higher percentage, despite a not so significant difference, of the interviewees claim to be aware of definitions and issues related to the environment and environmental education. This suggests that these students have, despite starting high school, a relative critical sense about the topic. The observed results, in general, corroborate with [6], who signals that the environment started to be understood by the students, in its totality, under a globalizing perspective, without dissociating nature and society.

On the questions 'do you understand what the environment is' and 'can you understand what environmental problems are?', when compared, it is noticed that the interviewees tend to better identify an environmental problem, than to properly conceptualize what the environment is.

When asked about what they consider to be an environmental problem, given the options provided, almost 90% say that 'Sewage disposal in rivers and canals' is an environmental problem. 81.33% consider 'Emission of gases' as a bad environmental issue, followed by 80% consider 'Urban waste' and 50.67% 'flooding' (Figure 1).

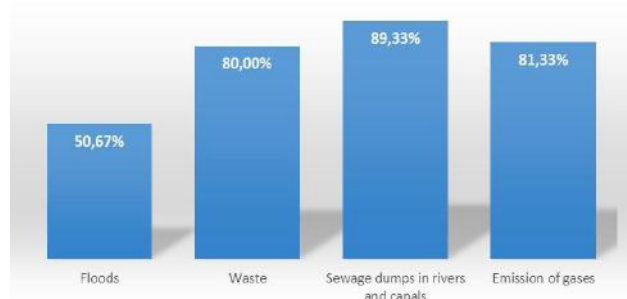


Fig.1: Data obtained on "What do you consider an environmental problem?" - questionnaire sent to students in the 1st period - 2020 (courses on Sanitation and Buildings) - IFPE. Source: The authors (2020).

It is important to note that for none of the options mentioned in the question, unanimity (100%) was reached as an answer, which makes it possible to understand that a relative percentage, however significant, does not have full knowledge about what constitutes an environmental

problem. The National Environmental Education Policy (PNEA) defines that environmental education must be present in the formal and non-formal educational process, having as objectives actions that will improve the quality of life on Earth.

However, when asked if there are environmental problems where they live, the percentage of positive responses is absolutely significant: 90.67% 'Yes. Exists': 6.67% answered that they do not know and 2.67% answered that it does not exist.

The practice of environmental education becomes increasingly necessary, especially in the school environment, as stated by [7]. Therefore, sensitizing children and adolescents, in the stage of cognitive training, is a promising strategy for achieving new results.

When asked who is primarily responsible for the emergence of environmental problems, approximately 75% claim that the Industrial sector is the protagonist, the Government takes second place with 62.67% of the respondents' opinion, and Society and Agriculture follow tied with 46.67% (Figure 2). It is curious to note that, when asked about who is responsible for solving these same issues, the interviewees thought that the Society was first (70.67%), subsequently the Government with 62.67%, followed by Industry and Agriculture, 30.67% and 24% respectively (Figure 3).

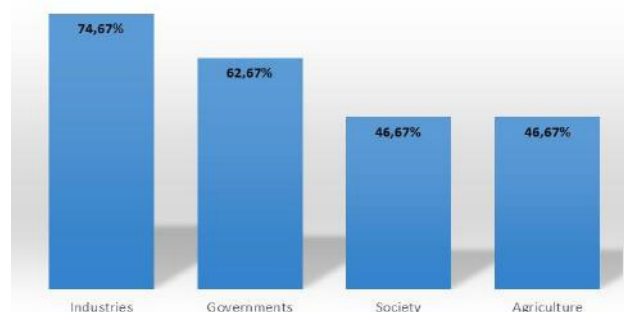


Fig.2: Data obtained: "Who are responsible for the emergence of environmental problems?" - questionnaire sent to students in the 1st period - 2020 (courses on Sanitation and Buildings) - IFPE. Source: The authors (2020).

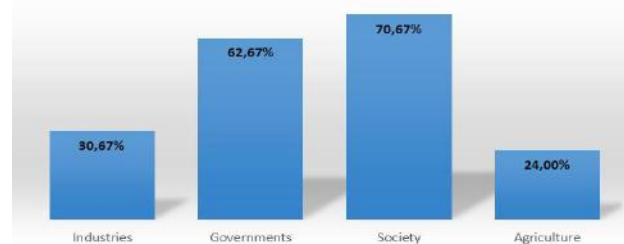


Fig.3: Data obtained: "Who are responsible for solving

these environmental problems?" - questionnaire sent to students in the 1st period - 2020 (courses on Sanitation and Buildings) - IFPE. Source: The authors (2020).

For Environmental Education to be considered, it is necessary to insert it into the educational universe. Thus, when understanding it as education, which is also understood as political action and, therefore, an activity that is not neutral and that reproduce conceptual differences related to Environmental Education with different philosophical-political and pedagogical references, determined almost always by society organization [8].

It is true that the environment is revealed as a privileged field for the educational process. Mathematics being understood as an instrument to understand and modify the reality experienced, as stated by [9].

In this context, the last two questions asked to students contextualize their perspicacity, by associating mathematics as a useful and efficient tool to reduce expenses involving water and electricity. Thus, seeking to mitigate impacts on the environment. Figure 4 shows the percentages obtained as responses.

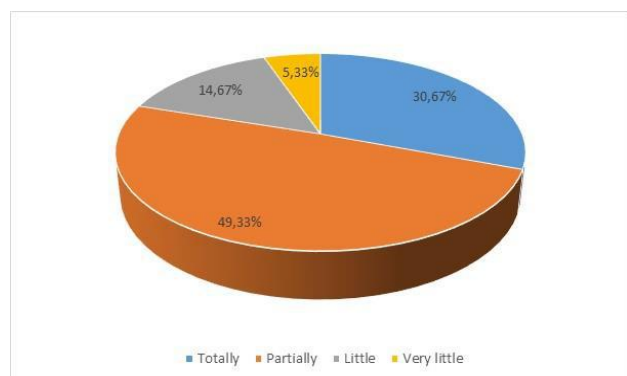


Fig.4: Data obtained: "Does mathematics contribute to solving environmental problems in your home?" - questionnaire sent to students in the 1st period - 2020 (courses on Sanitation and Buildings) - IFPE. Source: The authors (2020).

[10] states that when quantifying an environmental problem using mathematical instruments it is possible to visualize more clearly the phenomenon that is occurring in the environment, in addition to creating an opportunity to act with the intention of improving some aspects.

However, this instrument should not be used in isolation, but as part of the continuous educational process (interdisciplinarity), which results in transformative practices, considering that the classroom must be an

idealized space where one can reflect and build understandings / concepts new and stimulating [11].

Often, school spaces, as well as didactic materials, do not contemplate (in their entirety) the student's reality, that is, they do not offer opportunities that make him perceive the environment in which they are inserted. The absence of these opportunities can make it difficult for these people to perceive and understand the environmental problems that exist and are experienced by each person in their communities. Therefore, school spaces (in an interdisciplinary and continuous way) must provide means for students to become aware, and acquire critical sense, through environmental perception, allowing them to understand the natural environment, and enabling them to change realities.

- PROFESSORS

According to [12], the Tbilisi Intergovernmental Conference on Environmental Education (1977) proposed as one of the basic principles of Environmental Education: applying an interdisciplinary approach, taking advantage of the specific content of each discipline, so that a global and balanced perspective is acquired. Due to the nature of the environment, given its multiple interactions, the issue of Environmental Education could not be dealt with in a single discipline. An important contribution in this aspect is contemplated in the National Curriculum Parameters through the transversality of the themes, whose environment is one of them.

With the intention of exploring what the evaluated teaching public thinks about the theme discussed above, the first statement of applied research dealt with the pluralism of pedagogical ideas and concepts, where the interviewees had to position themselves whether they agree or disagree, being for both positions (totally or partially). Among the professors evaluated, the theme of Environmental Education should be treated from an interdisciplinary perspective. Despite expressive unanimity, 15% say they partially agree. What may still be associated with little discussion and little incentive, on the part of the Institution's pedagogical management, for the professors to approach the theme in the classroom in a holistic way, exploring all possible teaching possibilities.

When asked if they have already had opportunities to participate in any event (activities, projects, etc.) related to the environmental theme (Figure 5), almost 50% claim to have participated less than 10 (ten) times; 22.73% claim to have participated more than 10 (ten) times; soon after, 18.18% said they had never participated in any event on this theme, and 13.64% participated only 1 (one) time.

Education needs to be practiced interdisciplinarily, however, it is known that the school system as it stands

does not favor working together. The school, the Institution are compartmentalized. According to [12], “universities are divided into departments, knowledge is divided into disciplines, and so on. We share everything and lose track of the whole”. In all areas of education, the interrelationship between different subjects favors enrichment when addressing the theme.

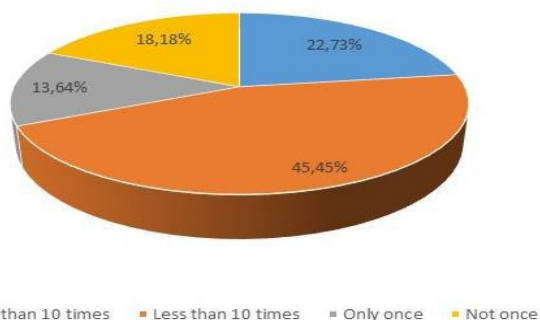


Fig.5: Data obtained: “Have you had the opportunity to participate in any activity and / or project related to the Environment theme?” - questionnaire sent to professors related to the Sanitation and Buildings courses - IFPE.

Source: The authors (2020).

[13] warns that it is necessary for the school to be prepared to incorporate the environmental theme in a coherent way, without falling into the trappings of fads, as the development of activities related to environmental issues is a requirement for the school to fulfill its function Social.

In this regard, the work also sought to understand in which activities the professors participated most, related to the environmental theme. The survey provided four options for professors to identify themselves, making it possible for the interviewee to select all the themes (if any) proposed in the question. Activities related to Sustainability had the highest percentage (72.97%), among the others: Recycling (54.05%), Environmental Preservation (48.65%) and Conscious Consumption (40.54%).

The National Environmental Education Policy, established in Law 9795/99, bases environmental education as an essential and permanent component of national education, and must be present (in an articulated way) at all levels and modalities of the educational process, in a formal and non-formal, which should be developed as an integrated, continuous educational practice involving all professors [14].

[14] in the proposition of Law 9795/99, the environmental dimension must be included in professor

training curricula, at all levels and in all disciplines, and in postgraduate courses, extension courses and in areas focused on the methodological aspect environmental education, when necessary, the creation of specific discipline is allowed. It also adds that active professors should receive complementary training in their areas of activity, with the purpose of adequately meeting the principles and objectives of the National Environmental Education Policy (PNEA).

In 2012, the National Curricular Guidelines for Environmental Education (DCNEA) were established to reaffirm the relevance and mandatory nature of Environmental Education in basic and higher education, in addition to highlighting its interdisciplinary approach (BRASIL, 1999).

According to [15], environmental educators do not say the same thing, much less have the same objectives in dealing with the environmental issue, as they are based on different worldviews. Therefore, as stated by [16] there is no consensus between the fundamentals of Environmental Education, as it is constituted from multiple worldviews.

The proposal of the National Curriculum Parameters (PCN) is to incorporate, through conventional disciplines, the transversal themes to establish a relationship with reality and allow the possibility of pedagogical work that involves political-social engagement with knowledge and training aimed at citizenship [17].

[18] states that the basic text in offers more concrete elements for application to different areas of knowledge, does not point out possibilities on how to work on the theme, does not demonstrate the interfaces of Environmental Education with the disciplines, does not present concrete situations of action, does not it indicate and nor guides educational and cultural activities that imply effective changes in the environment.

Faced with this discussion, the research sought to discover which tools are used by professors to deal with the theme in the classroom. Data obtained according to Figure 6.

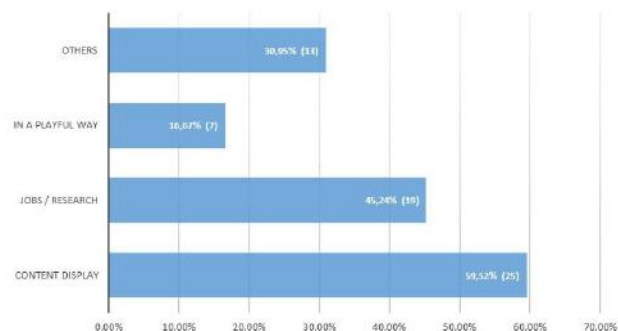


Fig.6: Data obtained: “Dear professor, if the topic is addressed in the classroom, in what way (s) do you expose

it?" - questionnaire sent to professors related to the Sanitation and Buildings courses - IFPE. Source: The authors (2020).

In the school context, the challenge is also to find ways that awaken in the student public the desire to conserve and protect the environment, as well as participate in relationships that can benefit the recovery of degraded environments and the protection of natural resources. One way is to use innovative methodologies in the teaching-learning process.

Currently, the process of knowledge development involves the transition from concrete to abstract and back to concrete, forming a cycle. Mediation in this process is carried out by abstractions, where thought moves away from concreteness as a necessary condition to approach it, to act on it [19].

Therefore, it is important to develop practices to promote concrete awareness of the environment from an early age. The school has a fundamental role in the development of quality Environmental Education, recognizing the environment as a heritage of all.

Programs such as Eco-92, Agenda Rio + 20, and now Agenda 2030 are promoted by the United Nations (UN), and promote (on a global scale) debates and shared social governance actions for sustainable development. In this perspective, in the teaching-learning process, each being must be aware of their rights and duties.

Educators must be involved in the construction of knowledge, being essential for the formation of citizenship since Environmental Education is a pedagogical practice. Since this practice is not carried out in isolation, as stated by [6], but in the relations of the school environment, in the interaction between the different actors, conducted with zeal and excellence.

Based on the principle that the school should contribute to the formation of citizens who are sensitive and aware of the environmental cause, teaching should be organized in a way that creates opportunities and allows the student (the student public) to use knowledge actively about the environment, through participation in activities within the school and in its communities.

IV. CONCLUSION

The research developed aimed to investigate, and to counter - when necessary, the degree of involvement of the teaching and student audiences, both related to the 1st

integrated periods of the Building and Sanitation courses (entry 2020.1) - Campus Recife - IFPE, with issues related to the Education theme Environmental versus Mathematical Modeling. As well as it highlighted and sought to understand important factors (mainly political and sociocultural) that define profiles of both audiences interviewed.

It can be said that the educational process is always under construction, gradually overcoming errors and adding efforts to assume a more effective attitude, with regard to the teaching-learning dichotomy. In view of the data obtained as responses to the applied questionnaires, the critical perspective on Environmental Education, with regard to the student audience, is positively reasonable. What is consistent to affirm that the school (preferably in an interdisciplinary way) has an important role to be fulfilled: to enable these students to have a full, holistic, and solid understanding of all aspects of this theme.

In this way, the formation of critical, conscious and reflective subjects (citizens) on the environment theme, will certainly provide possible changes to the current development paradigm that has aggravated the environmental problem.

Regarding the teaching public, it appears that they are (in general) sensitive to the theme. Positioning themselves willing to work on the theme of Environmental Education in an interdisciplinary way, although they recognize that there are obstacles that seriously hamper the cross-sectional discussion on the subject. Perhaps the result of a possible mismatch between theories, methodologies, pedagogies and applicability.

It was also found that one of the great challenges for the insertion of Environmental Education in schools is precisely the lack of a greater incentive, and constant training for this teaching public, about environmental issues. It should be noted that schools, in general, have not adapted (sufficiently) to develop interdisciplinary projects as suggested by law 9795/99 - the National Environmental Education Plan (PNEA).

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