EDUCATIONAL STRATEGIES FOR TEACHING ENVIRONMENTAL SCIENCE IN ELEMENTARY EDUCATION

ESTRATÉGIAS EDUCATIVAS PARA O ENSINO DE CIÊNCIAS AMBIENTAIS NO ENSINO FUNDAMENTAL

ESTRATEGIAS EDUCATIVAS PARA LA ENSEÑANZA DE LAS CIENCIAS AMBIENTALES EN LA ESCUELA PRIMARIA

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ABSTRACT

This article aims to analyze the educational strategies used in the teaching of Environmental Sciences in Elementary Education, with emphasis on water and sustainability, in the municipality of São Sebastião da Boa Vista, located in the Marajó Archipelago, state of Pará, Brazil. The study is based on the understanding that environmental education is essential for the formation of critical, conscious and participatory individuals committed to the preservation of natural resources. A qualitative methodological approach was adopted, including documentary, bibliographic and field research. Data collection was carried out through the analysis of the Political Pedagogical Project, textbooks, curricular planning and the application of questionnaires with objective and subjective questions to nine teachers of the 5th grade of Elementary School. The results indicate that environmental themes are present in school documents and pedagogical practices, mostly addressed through an interdisciplinary approach. However, weaknesses were identified regarding continuing teacher education, conceptual understanding of Environmental Sciences and knowledge of the 2030 Agenda and the Sustainable Development Goals, especially SDG 6. It is concluded that strengthening contextualized educational strategies, combined with teacher training and diversified methodologies, is essential for consolidating a critical and transformative environmental education in Elementary Education.

Keywords: Environmental Sciences. Elementary Education. Educational Strategies.

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RESUMO
O presente artigo tem como objetivo analisar as estratégias educativas utilizadas no ensino de Ciências Ambientais para alunos do Ensino Fundamental I, com ênfase na temática da água e da sustentabilidade, no município de São Sebastião da Boa Vista, localizado no Arquipélago do Marajó, estado do Pará. A pesquisa fundamenta-se na compreensão de que a educação ambiental constitui um elemento essencial para a formação de sujeitos críticos, conscientes e comprometidos com a preservação dos recursos naturais. A abordagem metodológica adotada foi qualitativa, envolvendo pesquisa documental, bibliográfica e de campo. A coleta de dados ocorreu por meio da análise do Projeto Político Pedagógico, do livro didático, do planejamento curricular e da aplicação de questionários com questões objetivas e subjetivas a nove professores do 5º ano dos anos iniciais do Ensino Fundamental. Os resultados evidenciam que as temáticas ambientais estão presentes nos documentos escolares e nas práticas pedagógicas, sendo trabalhadas, em sua maioria, de forma interdisciplinar. No entanto, identificaram-se fragilidades relacionadas à formação continuada dos docentes, ao domínio conceitual sobre Ciências Ambientais e ao conhecimento acerca da Agenda 2030 e dos Objetivos do Desenvolvimento Sustentável, especialmente o ODS 6. Conclui-se que o fortalecimento de estratégias educativas contextualizadas, aliadas à formação docente e ao uso de metodologias diversificadas, é fundamental para a consolidação de uma educação ambiental crítica e transformadora no Ensino Fundamental.

Palavras-chave: Ciências Ambientais. Ensino Fundamental. Estratégias Educativas.

RESUMEN
Este artículo tiene como objetivo analizar las estrategias educativas utilizadas en la enseñanza de las Ciencias Ambientales en la Educación Primaria, con énfasis en la temática del agua y la sostenibilidad, en el municipio de São Sebastião da Boa Vista, ubicado en el Archipiélago de Marajó, estado de Pará, Brasil. La investigación se basa en la comprensión de que la educación ambiental es fundamental para la formación de sujetos críticos, conscientes y comprometidos con la preservación de los recursos naturales. Se adoptó un enfoque metodológico cualitativo, que incluyó investigación documental, bibliográfica y de campo. La recolección de datos se realizó mediante el análisis del Proyecto Político Pedagógico, libros didácticos, planificación curricular y la aplicación de cuestionarios con preguntas objetivas y subjetivas a nueve docentes del quinto año de la Educación Primaria. Los resultados muestran que los temas ambientales están presentes en los documentos escolares y en las prácticas pedagógicas, siendo trabajados, en su mayoría, de manera interdisciplinaria. No obstante, se identificaron debilidades relacionadas con la formación continua de los docentes, el dominio conceptual sobre las Ciencias Ambientales y el conocimiento de la Agenda 2030 y de los Objetivos de Desarrollo Sostenible, especialmente el ODS 6. Se concluye que el fortalecimiento de estrategias educativas contextualizadas, junto con la formación docente y el uso de metodologías diversificadas, es esencial para consolidar una educación ambiental crítica y transformadora en la Educación Primaria.

Palabras clave: Ciencias Ambientales. Educación Primaria. Estrategias Educativas.

1 INTRODUCTION

For decades, the problem of environmental degradation has been discussed, evidenced by processes such as deforestation, global warming, pollution and the depletion of natural resources. Despite the progress of debates and institutional initiatives, it is observed that environmental impacts have intensified over time. Such a scenario results, to a large extent, from the development model adopted by contemporary society, marked by productive practices and consumption patterns that disregard the limits of ecosystems. In this sense, environmental fragility manifests itself as a consequence of the way of life historically constructed by humanity in its relationship with the environment (Moura; Moura; Vieira, 2020).

Even in the face of legal achievements aimed at environmental protection, such as Law No. 13,123/2015, which provides for the conservation and sustainable use of biodiversity (Brasil, 2015), the effects of modern life continue to cause significant damage to nature. Among these impacts are the intensification of climate change, the degradation of natural ecosystems, the contamination of groundwater and the growing scarcity of drinking water, problems that are aggravated as unsustainable practices of exploitation of natural resources are maintained (Cavalcanti, 2004).

Among the various contemporary environmental problems, water assumes a central position, as it is an indispensable resource for the maintenance of life and the balance of ecosystems. However, the way it has been used and disposed of over the last decades reveals a worrying picture, characterized by the pollution of aquatic environments, the inappropriate disposal of waste and the absence of effective basic sanitation policies. This reality compromises the quality of water and directly affects the health of populations, especially those who depend on rivers and streams for supply and daily use.

In the municipality of São Sebastião da Boa Vista, located in the Marajó Archipelago, in the state of Pará, this problem becomes even more evident. Surrounded by an extensive network of rivers, boreholes and islands, the municipality has weaknesses related to basic sanitation and the management of water resources. Situations such as silting of watercourses, inadequate disposal of solid waste, the presence of open cesspools and the proximity of garbage disposal areas to streams and rivers are observed, factors that contribute to water contamination and local environmental degradation.

In this context, the school plays a fundamental role in the formation of critical and conscious subjects, capable of understanding socio-environmental problems and acting responsibly in their territory. Environmental Education, articulated with Environmental Sciences, and guided by the National Policy of Environmental Education, instituted by Law No. 9,795/1999, should permeate all modalities of basic education, promoting awareness,

the construction of values and the development of attitudes aimed at the preservation of the environment (Brasil, 1999).

In view of this reality, the research is guided by the following research question: what are the methodological strategies in Environmental Sciences aimed at raising awareness about sustainable consumption, the reuse of solid waste and the care of household water, rivers and streams, developed with students in the fifth year of the initial years of Elementary School in public schools in the municipality of São Sebastião da Boa Vista, in the state of Pará?

The relevance of this study is justified by the need to understand how socio-environmental themes, especially those related to water and basic sanitation, have been addressed in the school context of the municipality, considering the scenario of environmental vulnerability and the dependence of the local population on water resources. It is expected that the analysis of pedagogical practices will contribute to the strengthening of Environmental Education and to the promotion of sustainable attitudes in the school and community environment.

With the above, the objective of this work was to analyze the methodological strategies in Environmental Sciences used in public schools in the municipality of São Sebastião da Boa Vista, focusing on raising awareness for sustainable consumption, reuse of solid waste and water care, in the fifth year of the early years of Elementary School.

2 THEORETICAL FRAMEWORK

The theoretical framework of this study is based on scientific productions, legal documents and educational norms that address Environmental Sciences, Environmental Education and their interfaces with Elementary Education. The discussion includes reflections on the socio-environmental impacts resulting from human action, especially with regard to the degradation of water resources, as well as the role of the school in the formation of critical subjects committed to sustainability. In addition, it dialogues with authors who defend interdisciplinarity, contextualized teaching and the articulation between different types of knowledge as fundamental strategies for the consolidation of pedagogical practices aimed at environmental awareness, in line with current educational and environmental public policies.

2.1 THE IMPACTS OF SOLID WASTE ON THE WATERS OF RIVERS AND STREAMS

Water is an indispensable resource for the survival of all living beings, which is why the growing degradation of rivers and streams arouses concern in the face of the neglect and

lack of awareness of a significant portion of humanity. The improper dumping of solid waste of various natures in watercourses causes contamination, pollution of water resources and, consequently, serious public health problems. This pollution process tends to intensify progressively, accumulating waste on the banks of rivers and configuring one of the most serious environmental problems today (Freitas; Oliveira; Silva, 2017).

In the Brazilian context, the pollution of rivers and streams is frequently reported by the media. However, its impacts are experienced more intensely by riverside populations, who directly depend on these resources for supply, food and transportation. Among the main environmental damages are the silting of watercourses, the death of aquatic animals as a result of the entrapment or ingestion of plastic waste, and the contamination caused by oil spills from vessels. Such human actions cause profound changes in aquatic ecosystems, including the extinction of species of fauna and flora, in addition to compromising the health of the populations living in these areas (Frank; Berbet, 2017).

In the legal sphere, Federal Law No. 12,305/2010 instituted the National Solid Waste Policy, establishing guidelines for the integrated management and proper management of waste, as well as the responsibilities of the government and generators (Brasil, 2010). Despite this normative advance, it is observed that the contamination of aquatic environments by solid waste continues to intensify, evidencing the fragility in the implementation of effective public policies, especially in municipalities that depend heavily on water resources, such as São Sebastião da Boa Vista, the locus of this research.

The reality of the municipality can be observed in the following figures, which show situations of siltation and pollution of rivers and streams, demonstrating the neglect and absence of systematic actions for environmental preservation.

Figure 1

Siltation and pollution of watercourses in the municipality of São Sebastião da Boa Vista, PA

Source: Author of the research.

The images show the high level of environmental degradation of the municipality's

watercourses, a worrying factor, considering that these rivers and streams are the main sources of water supply for the local population. This scenario reinforces the relevance of choosing the municipality of São Sebastião da Boa Vista (PA) as a case study, given the urgency of educational and preventive actions aimed at the conservation of water resources.

Another aspect that aggravates this problem refers to disorderly urban growth, characterized by the construction of residences and stilt houses in inadequate areas, often on streams or on the banks of rivers, without inspection by the public authorities and without compliance with environmental standards. In view of the lack of awareness of both the population and public managers, there is a need to strengthen the teaching of Environmental Sciences in schools, as a strategy to promote awareness, stimulate community participation, and contribute to improving the quality of water used for supply (ANA, 2023).

2.2 ENVIRONMENTAL SCIENCES IN BASIC EDUCATION

Over the last decades, school education has sought to promote the awakening of environmental awareness, integrating different areas of knowledge in the search for solutions to socio-environmental problems. This perspective is based on the interdisciplinary articulation of knowledge, so that educational institutions, guided by an integrative approach, are able to contribute to the reunification of fragmented knowledge (Leff, 2012).

Interdisciplinarity in Environmental Sciences enables the articulation between empirical and scientific knowledge, favoring the construction of a broader and more critical understanding of environmental issues. This integration allows the school community to overcome fragmented or accommodated views of reality, transforming common sense knowledge into investigative, reflective knowledge committed to social transformation (Carvalho, 2009).

The consolidation of Environmental Sciences in the educational field intensified from the 1990s onwards, with the inclusion of the area in the subprograms of the Support Program for Scientific and Technological Development, promoting the integration of different fields of knowledge to understand the impacts of technological advances on the environment (Philippi Jr., 2000). Such a movement contributed to the development of a critical, participatory and sustainability-oriented environmental awareness, aiming at the preservation of natural resources for future generations.

It is essential to understand that Environmental Sciences are not configured as an isolated discipline, but as an area of knowledge that articulates several disciplines around a common objective, that is, to understand and face socio-environmental problems. In this sense, education plays a strategic role in promoting dialogue between different fields of

knowledge, encouraging teachers and students, from early childhood education to higher education, to reflect on environmental transformations and seek solutions to contemporary challenges (Floriani, 2000).

2.3 ENVIRONMENTAL EDUCATION IN THE GUIDING LAWS OF BASIC EDUCATION

Environmental Education has been consolidated, over time, as a central theme in educational debates, due to the need to form a more critical, participatory society committed to sustainability. The emergence of environmental movements, especially from the second half of the twentieth century, boosted the insertion of environmental issues in political and educational agendas.

The United Nations Conference on the Human Environment, held in Stockholm in 1972, marked a historic moment by recognizing Environmental Education as a fundamental element in facing the environmental crisis. In Brazil, this perspective was incorporated into the National Curriculum Parameters, which propose the treatment of socio-environmental issues in a transversal way, permeating all areas of knowledge (Brasil, 1997).

The Brazilian legal framework advanced significantly with the enactment of Law No. 6,938/1981, which instituted the National Environmental Policy, and with the Federal Constitution of 1988, which assigned to the public power the duty to promote Environmental Education at all levels of education (Brasil, 2012). Subsequently, Law No. 9,795/1999 established the National Policy on Environmental Education, reaffirming the obligation of its integrated approach to the school curriculum (Brasil, 1999).

The Law of Guidelines and Bases of National Education, Law No. 9,394/1996, reinforces the importance of Environmental Education by evidencing its presence at all levels and modalities of education, even if in a transversal way (Brasil, 1996). In addition, CNE/CP Opinion No. 8/2012 established the National Curriculum Guidelines for Environmental Education, highlighting the need to understand the environmental problem on a local and global scale, in order to promote attitudes of care and preservation.

In the current context, the National Common Curriculum Base defines essential learning for Basic Education, highlighting, among its general competencies, the formation of subjects capable of critically analyzing socio-environmental problems and acting responsibly in their environment (Brasil, 2017). In the state of Pará, Law No. 9,981/2023 stands out, which institutes the Formal Education Policy for the Environment, Sustainability, and Climate, making the inclusion of the Environmental Education curricular component mandatory in the state education network (Pará, 2023).

In this way, Environmental Education presents itself as a fundamental instrument for

students to recognize their insertion in nature and understand their role in the construction of an environmental rationality guided by the preservation of biodiversity and the sustainable use of natural resources (Morin, 1991).

3 METHODOLOGY

This article is part of a master's thesis produced within the scope of the Graduate Program in the National Network for the Teaching of Environmental Sciences (PROFCIAMB), of the class of 2022, defended on March 7, 2024. The research was submitted to the Ethics Council and approved by Opinion No. 6,161,356. It was self-funded, with no conflict of interest.

The present research is characterized by a qualitative approach, since it seeks to understand and interpret the methodological strategies of themes emphasized in the Environmental Sciences developed in the school context, considering the perceptions, pedagogical practices and institutional documents. The qualitative approach allows an in-depth analysis of educational phenomena in their natural environment, enabling the understanding of the meanings attributed by the subjects to the practices developed (Luna, 2011).

As for the objectives, the study is characterized as descriptive and exploratory, since it seeks to understand and describe the pedagogical practices developed in the scope of Environmental Sciences, in articulation with Environmental Education. The investigation emphasizes themes such as sustainable consumption, reuse of solid waste and water care, understanding Environmental Education as a transversal formative dimension and Environmental Sciences as an integrating field of knowledge. Thus, it is analyzed how these approaches materialize in the school daily life of the municipality of São Sebastião da Boa Vista, in the state of Pará.

The study was developed in three public elementary schools located in the urban area of the municipality of São Sebastião da Boa Vista, in the Marajó Archipelago, Pará. Nine teachers who work in the fifth year of the initial years of Elementary School participated in the research, all with higher education and belonging to different areas of knowledge.

Regarding the data collection procedures, documentary research, bibliographic research and field research were used. The documentary research included the analysis of the Pedagogical Political Project of the schools, the lesson plans, the textbooks and the curricular components aligned with the National Common Curricular Base, with the objective of identifying the socio-environmental themes addressed and the methodological strategies proposed. The bibliographic research was carried out from books, scientific articles,

legislation and official documents, providing the theoretical basis necessary for the understanding of the environmental and educational problems investigated.

The field research was conducted through the application of questionnaires with objective and subjective questions to the participating teachers, in order to obtain information about the pedagogical practices developed, the perception of teachers about Environmental Education and the challenges faced in addressing Environmental Science themes. The use of the questionnaire enabled the collection of data in a systematic way, favoring the analysis of the conceptions and experiences of the subjects involved (Luna, 2011).

The data obtained were evaluated through qualitative analysis, seeking to identify emerging thematic categories related to methodological strategies, pedagogical approaches and the insertion of Environmental Education in the school context. The interpretation of the data was carried out in the light of the theoretical framework adopted, allowing the establishment of relationships between the practices observed, the documents analyzed and the contributions of the scientific literature.

Finally, it is emphasized that the research respected ethical principles, ensuring the confidentiality of information and the confidentiality of the participants, as well as the use of data exclusively for academic and scientific purposes.

4 RESULTS AND DISCUSSIONS

The diagnostic analysis of the perception of the nine teachers participating in the research evidenced relevant aspects about the teaching of Environmental Sciences in the school context investigated. When questioned about their knowledge related to this area, six teachers stated that they had knowledge, while three indicated that they knew only partially. Although the majority answered affirmatively, it is observed that a significant portion does not have full mastery of the theme, which is a worrying fact, considering the centrality of Environmental Sciences in the formation of critical and conscious subjects.

This result signals weaknesses in the initial and continuing education of teachers, since Law No. 9,795/1999 establishes, in its Article 11, that the environmental dimension must be part of teacher training curricula at all levels and modalities of education (Brasil, 1999). This finding reinforces the need for investments in public policies for continuing education, capable of strengthening the theoretical and methodological knowledge of educators, enabling contextualized and socially committed pedagogical practices. According to Freire (1996), the teacher needs to create conditions for the student to build his own knowledge, in a dialogical process that allows him to intervene critically in the social reality.

Regarding the themes addressed with the students, in the Environmental Sciences classes, there was unanimity among the participants regarding the insertion of contents such as water resources, biodiversity, solid waste and pollution. This data reveals that environmental problems are present in the daily school life, which is positive, since such issues are part of the reality experienced by students. However, more than the simple approach to the themes, it is essential that these contents be worked on in a critical and reflective way, promoting environmental awareness and understanding of the relationships between society and nature (Carvalho, 2009).

When asked about the relevance of working with environmental issues in schools, the teachers highlighted awareness, awareness and the formation of responsible citizens as the main objectives. These perceptions dialogue with the conception of critical environmental education, which understands the school as a privileged space for the construction of values, attitudes and practices aimed at sustainability. In this sense, Floriani (2000) emphasizes that interdisciplinarity and the valorization of different types of knowledge are essential for a broad understanding of contemporary socio-environmental problems.

With regard to the documents and institutional resources that guide the teaching of Environmental Sciences, the results indicated that the themes are present in the Political-Pedagogical Project, in textbooks, in curriculum planning and in interdisciplinary projects. This finding demonstrates alignment with the National Common Curriculum Base, which assigns to education systems the responsibility of adapting content to the reality of students (Brasil, 2017). However, the presence in the documents does not guarantee, by itself, the effectiveness of transformative pedagogical practices, and it is necessary that such orientations materialize in the school routine.

The theme of water stood out as central to teaching practices, being considered relevant by all participants. Teachers associated its importance with the preservation, conscious consumption and survival of life. This understanding shows an adequate perception of the value of this natural resource, especially in a municipality marked by direct dependence on rivers and streams. However, despite the recognition of the relevance of the theme, some of the teachers stated that they felt only partially prepared to address it, pointing out the lack of specific training and didactic resources as the main difficulties.

This reality reinforces the need for training actions that enable teachers to understand the complexity of water-related issues, going beyond a simplified approach. Although basic knowledge about the importance of water is widely disseminated, critically discussing the causes of water resource degradation requires theoretical and methodological preparation. According to Leff (2012), overcoming the environmental crisis necessarily involves

overcoming the crisis of knowledge, which demands an education based on interdisciplinarity and dialogue of knowledge.

Regarding the interdisciplinary approach, the data indicated that the theme of water is mostly worked on in an integrated way between disciplines such as Natural Sciences, Geography and Portuguese Language, or even in all curricular components. This practice favors the systemic understanding of environmental problems, contributing to the articulation between human needs, social practices and natural dynamics, as highlighted by Floriani (2000).

As for the methodological strategies and didactic resources used, it was observed the predominance of the textbook, combined with dialogued expository classes, videos, posters and conversation circles. Although such strategies are relevant, the low use of alternative resources, such as didactic games and reusable materials, which have great pedagogical potential in the teaching of Environmental Sciences, is noteworthy. The dialogued expository class, widely cited, proves to be positive by promoting interaction and valuing students' previous knowledge, contributing to the formation of a learning community, as pointed out by Moreira and Santos (2020).

Regarding the teachers' knowledge about the Sustainable Development Goals, the results showed that only four participants stated that they knew them, while the others reported lack of knowledge or superficial knowledge. This data is worrying, considering that the 2030 Agenda and the SDGs are important references for the promotion of sustainable development at the global and national levels. The lack of knowledge about SDG 6, specifically related to water and basic sanitation, reinforces the need for greater dissemination and training on this topic in the school context, in view of the problems related to water supply in the municipality of São Sebastião da Boa Vista, Pará.

In view of this scenario, it is evident that the school, as a space for citizenship education, needs to take a more active role in the socialization of knowledge related to sustainability and the global commitments assumed by the country. According to Freire (1996), it is up to the teacher to promote an education that enables students to critically understand their role in society, contributing to the construction of environmental knowledge committed to the transformation of reality (Leff, 2012).

5 CONCLUSION

The present study made it possible to analyze the perceptions and pedagogical practices of basic education teachers about the teaching of Environmental Sciences, with emphasis on the theme of water and sustainability, in the context of the municipality of São

Sebastião da Boa Vista, in the Marajó archipelago (PA). The investigation showed that, although teachers recognize the relevance of environmental issues and address them in the classroom, there are still weaknesses related to specific training, conceptual mastery and the use of diversified methodologies and didactic resources.

The results showed that environmental themes are present in school documents and pedagogical planning, in line with the National Common Curriculum Base and with the current legislation. However, it was found that the implementation of these guidelines occurs, in many cases, in a limited way, lacking greater theoretical depth, interdisciplinarity and contextualization with the local socio-environmental reality, especially with regard to the problem of water resources.

It was observed that the theme of water is widely recognized by teachers as essential to life and sustainability, being worked on in an interdisciplinary way. However, a significant part of the teachers reported insecurity or partial preparation to address the complexity of problems related to water quality, basic sanitation and environmental degradation. This reality highlights the need for continuous investments in teacher training, since continuing education is fundamental for professional qualification and for strengthening pedagogical security in the sharing of curricular knowledge. In this sense, it is understood that "the school space can recover its public and democratic dimension, becoming an environment of integral education for all" (Betiate; Derisso, 2025, p. 12), contributing to the consolidation of a critical, reflective, and transformative environmental education.

Another relevant aspect refers to the misinformation, on the part of some teachers, about the 2030 Agenda and the Sustainable Development Goals, especially SDG 6, which deals with drinking water and sanitation. This data points to the urgency of institutional actions that promote the socialization of these global references in the school environment, understanding the school as a strategic space for the construction of an environmental awareness committed to sustainable development.

In view of the above, it is concluded that the teaching of Environmental Sciences, when articulated with the local reality, interdisciplinarity and dialogue between different knowledges, has great potential to contribute to the formation of critical, conscious and participatory subjects. Thus, it is essential that the government, educational institutions and education professionals act in an integrated manner, promoting continuing education policies, encouraging the use of innovative methodologies and valuing pedagogical practices that encourage the care, preservation and sustainable use of natural resources.

Finally, it is highlighted that this research has limitations related to the number of participants and the spatial cut adopted, which does not invalidate its results, but points to

the need for future studies that expand the investigated universe, deepen the analysis of pedagogical practices and explore educational strategies aimed at sustainability in riverside and Amazonian contexts.

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