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Environmental Education, Climate And Sustainability: An Integrative Review

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ABSTRACT: This article aims to analyze the scientific production related to Environmental Education, Climate Environmental Education, and sustainability in articles published by the International Journal of Environmental Resilience Research and Science (IJERRS). This is a qualitative and exploratory research, developed through an integrative literature review. The methodological strategy was based on bibliographic and documentary research, going through the stages of collection, selection, categorization, and critical analysis of the textual corpus. Thirty-two articles were analyzed, comprising the final sample, after applying inclusion and exclusion criteria based on relevance and suitability to the proposed theme. The results reveal a strong convergence between Environmental Education, sustainability, socio-environmental justice, public policies, climate change, and civic education, highlighting the predominance of Critical Environmental Education as the main theoretical framework. The documentary analysis demonstrated that the climate dimension has been gaining prominence in contemporary discussions in the journal, especially in studies focused on climate resilience, citizen science, community participation, and interdisciplinary methodologies, although research directed towards sustainability, school practices, and environmental management still prevails. It is concluded that IJERRS is consolidating itself as an important space for scientific production and dissemination on Environmental Education, contributing to the strengthening of critical, interdisciplinary and transformative approaches aimed at addressing contemporary socio-environmental crises.

KEYWORDS: Climate Environmental Education, Climate Change, Qualitative Research, Climate Resilience, Integrative Review, Sustainability.

I. INTRODUCTION

According to Boff (2014), the contemporary civilizational paradigm is biophysically unsustainable, making the transition toward sustainability an unavoidable path. The continuous degradation of natural resources and energy matrices, driven by an intrinsically exploitative economic logic, has resulted in severe social crises and profound environmental imbalances. This scenario not only threatens the stability of ecosystems but also compromises the viability of future generations' existence.

This unsustainability is corroborated by Carson's insightful analysis (2010), which warns about the proliferation of chemical substances used without proper investigation into their effects on soil, water, and human health. For the author, such negligence regarding the protection of the natural environment — the fundamental basis of life — constitutes a framework of predatory exploitation whose consequences will hardly be redeemed by future generations.

Zonin et al. (2017) argue that the convergence of climate, energy, and social crises reveals the intrinsic fragility of the current development model and calls for an imperative ethical repositioning in human interaction with ecosystems. This multidimensional socio-environmental crisis acts as a catalyst for overcoming obsolete paradigms, raising an ontological questioning concerning the conception of progress and redefining the epistemological constructs that underpin the relationship between humanity and nature.

In this context, given the panorama of the contemporary planetary crisis, sustainability has become the central challenge of civilization. Although it constitutes a polysemic field permeated by theoretical and political fluctuations, its scientific maturation has been driven by empirical evidence of environmental degradation. After five decades of international negotiations with results below expectations, the lack of time to reverse ecological collapse demands that theoretical reflection move toward immediate praxis. In this scenario, the concept of "hope" emerges as the guiding axis for future actions (Zonin et al., 2023).

This dilemma dates back to the 1972 Stockholm Conference, a landmark in which Zonin et al. (2023) identify two fundamental premises: the warning about the planet's imminent collapse — should the post-war development model continue — and the need for a movement of liberation from the constraints of predatory productivism. Although the field has evolved scientifically since then, the bitter perception of current environmental degradation demonstrates that negotiations over the last five decades have been insufficient, making it imperative to transform reflection into active "hopeful action."

In this context, discussions regarding the Environment have evolved over decades, reflecting diverse perspectives associated with different historical moments and ideological approaches. Starting from an initial view that conceived natural resources merely as instruments serving human interests, the debate progressed through schools of thought such as preservationism (which advocates the conservation of nature regardless of economic or utilitarian values) and conservationism (which promotes the rational use and proper management of resources). Currently, sustainable development approaches have consolidated the concept of Sustainability as the guiding principle for actions and public policies (Ferreira; Picanço; Antiqueira, 2021).

It is crucial to recognize that environmental protection is a shared responsibility between the State and society, requiring deep reflection on the challenges inherent in changing perceptions regarding environmental issues. Public participation, a vital element in this process, can only be fully realized when the right to information is guaranteed, allowing all citizens transparent access to environmental data and research. Thus, adopting a sustainable development model offers the opportunity to implement sociopolitical changes that do not compromise the integrity of the ecological and social systems sustaining our communities (Brenzan; Hornung; Oliveira, 2021).

From this perspective, and considering the central role of information, education for citizenship emerges as a fundamental catalyst for reconfiguring forms of participation in safeguarding quality of life. Environmental education, in this scenario, assumes an intrinsically transformative role, especially by focusing on its potential to raise public awareness regarding the imperative preservation of the environment (Brenzan; Hornung; Oliveira, 2021).

Thus, Environmental Education (EE) assumes a central role, acting as a guide for processes and a systematizer of concepts and practices aimed at achieving this purpose. It is a broad-ranging theme, recognized as a cross-cutting axis within the National Curriculum Parameters of Brazilian education, present in environmentalist discourses, political debates, and various manifestations across multiple contexts (Ferreira; Picanço; Antiqueira, 2021).

The International Journal of Environmental Resilience Research and Science (IJERRS), established in 2019 through a strategic cooperation between the State University of Western Paraná (Brazil), the University of York, and the University of Leeds (United Kingdom), has consolidated itself as an important interdisciplinary journal focused on climate resilience and sustainable development. As part of the activities of the Graduate Program in Sustainable Rural Development (PPGDRS) and CEPED-Unioeste, IJERRS promotes scientific dialogue among fields such as Environmental Education, Public Policies, and Climate Justice, prioritizing critical, decolonial, and multi-referential approaches (IJERRS, 2019).

This article aims to analyze the scientific production related to Environmental Education, Climate Education, and Sustainability, specifically in articles submitted to and published by the International Journal of Environmental Resilience Research and Science (IJERRS). The relevance of these themes is evidenced by their multifaceted insertion, encompassing formal education and the broader educational field, driven by the National Environmental Education Policy (PNEA), as well as municipal and state-level initiatives. This demonstrates the importance of integrating environmental education into local and school communities' curricula as a crucial factor for promoting actions and public policies aimed at environmental and climate awareness and the implementation of sustainable practices.

II. SUSTAINABILITY AGENDA

In 1962, Rachel Carson, through her seminal work Silent Spring, denounced the indiscriminate and irresponsible use of synthetic pesticides, particularly dichlorodiphenyltrichloroethane (DDT), and their devastating effects on ecosystems and human health. Carson did not advocate for the complete ban of all pesticides; rather, she strongly criticized the prevailing approach of the time, characterized by a "war against nature." The central concept of Silent Spring served as a metaphor for an imminent future in which the massive poisoning of the environment would lead to the extinction of birds, culminating in a spring devoid of birdsong and marked by absolute silence in nature as a direct consequence of the application of toxic chemical agents (Carson, 2010).

In her work, Carson (2010) warned the scientific community and society about contamination resulting from pesticide use, emphasizing phenomena such as bioaccumulation, in which chemical compounds concentrate in the fatty tissues of organisms, and biomagnification, which describes the increase in chemical concentration as one ascends the food chain. It was observed that birds of prey, such as eagles and hawks, suffered severe damage, including the thinning of eggshells, significantly compromising their reproductive capacity.

In this context, the author established an intrinsic relationship between environmental degradation and public health, suggesting that human exposure to these compounds was directly associated with genetic alterations and cancer incidence. Although the work was vehemently rejected by the chemical industry, which launched attacks and attempts to discredit Carson, the social impact of Silent Spring was profound. This impact culminated in the creation of the Environmental Protection Agency (EPA) in the United

States in 1970 and, subsequently, in the ban on DDT for agricultural use in 1972, a measure later adopted by several other countries, fostering a paradigmatic shift in humanity's relationship with nature (Carson, 2010).

The urgent need to debate environmental issues became evident as several countries had already begun detecting significant environmental changes on a global scale, manifested through phenomena such as the desertification of lakes and rivers, thermal inversions, and heat waves. The perception that the environment was not an inexhaustible source of resources, as previously believed, gradually became consolidated.

In 1968, a group of scientists, later known as the "Club of Rome," met to discuss environmental problems, culminating in the publication of the study The Limits to Growth. This work presented mathematical projections concerning the potential future harmful effects on the environment resulting from uncontrolled population growth, industrialization, pollution, and excessive consumption of natural resources. Although some authors later argued that "these projections proved inaccurate and alarmist," they were crucial in catalyzing behavioral changes and serving as a warning to society (Ribeiro; Gomes Silva, 2019).

Carson's work directly contributed to the formation of an international public opinion more sensitive to environmental issues during the 1960s and 1970s. The repercussions of her work stimulated environmental movements, scientific debates, and social pressures demanding greater control over pollution, chemical products, and the effects of unchecked economic growth. In this context, the 1972 Stockholm Conference emerged as a response to growing global concern regarding environmental degradation and the limits of the prevailing industrial development model (Ribeiro; Gomes Silva, 2019).

Faced with increasing environmental concern and alarming projections, the United Nations (UN), in collaboration with 113 countries and more than 400 governmental and non-governmental institutions, organized the first World Conference on the Human Environment in Stockholm, Sweden, in 1972. During the conference, issues such as acid rain and air pollution control were intensely debated among participants. A geopolitical tension became apparent, in which developing countries, whose economies were predominantly based on industries with high environmental impact, demonstrated resistance to the debate, while developed countries showed greater openness to discussion (Ribeiro; Gomes Silva, 2019).

The Stockholm Conference consolidated, at the international level, many of the warnings previously raised by Rachel Carson. The event officially recognized that environmental protection should be integrated into economic and social development policies, advocating the need to preserve natural resources and combat various forms of pollution. Furthermore, the conference established fundamental principles of International Environmental Law and created the United Nations Environment Programme (UNEP), institutionalizing the environmental agenda on the global stage (Brazil, 1995).

As corroborated by Ferreira, Picanço, and Antiqueira (2021), discussions regarding the environment evolved significantly over the decades, reflecting the intersection of distinct perspectives with historical moments and varied ideological approaches. Two decades after the landmark United Nations Conference on the Human Environment held in Stockholm (1972), nations gathered in Rio de Janeiro for a highly significant meeting whose primary objective was to consolidate the concept and practices of sustainable development.

The United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro in 1992 and known as Eco-92 or Rio-92, represented one of the major international milestones in consolidating sustainable development as a global guideline. The event brought together representatives from several countries, international organizations, and civil society movements to discuss alternatives capable of reconciling economic growth, environmental protection, and social justice. Among the conference's main outcomes was the creation of Agenda 21, a global action plan aimed at promoting sustainable development in the twenty-first century. Agenda 21 established goals and strategies for governments, institutions, and communities in areas such as poverty reduction, preservation of natural resources, environmental education, changes in consumption patterns, and the strengthening of social participation. Thus, Eco-92 consolidated the understanding that environmental problems have a global dimension and require international cooperation, sustainable planning, and shared responsibility among states and society (United Nations, 1972).

Subsequently, Rio+5, held in June 1997 in New York, functioned as a special session of the United Nations General Assembly intended to review the first five years of Agenda 21 implementation. Unlike the original 1992 conference, the meeting did not seek to establish new agreements but rather to critically analyze the slow progress in achieving the goals established in Rio de Janeiro. The final assessment was marked by pessimism, highlighting the continuation of global environmental degradation, the lack of promised funding from developed countries, and the mismatch between rapid economic globalization and the fragility of international environmental governance (United Nations, 1997).

The Millennium Summit, held in September 2000 at UN headquarters, represented a historic milestone by bringing together the largest concentration of heads of state to establish a global commitment to the challenges of the new century. The main outcome of this meeting was the Millennium Declaration, which consolidated values such as freedom and solidarity and gave rise to the eight Millennium Development Goals (MDGs). These objectives were pioneering in establishing measurable targets and defined deadlines — focused primarily on the year 2015 — aimed mainly at social and subsistence issues, seeking to transform the fight against poverty and inequality into a practical and internationally coordinated agenda (United Nations, 2000).

The Johannesburg Summit, formally known as the World Summit on Sustainable Development (Rio+10), took place in 2002 in South Africa with the mission of revitalizing the environmental agenda a decade after Rio-92. The meeting was remarkable for consolidating the transition from a purely ecological focus to social and economic dimensions, establishing that poverty eradication is an indispensable requirement for environmental protection. The conference's main practical legacy was the Johannesburg Plan of Implementation (JPOI), which structured key goals through the acronym WEHAB, prioritizing five critical areas: Water and sanitation, Energy, Health, Agriculture, and Biodiversity (United Nations, 2002).

The United Nations Conference on Sustainable Development (UNCSD), known as Rio+20, held in Rio de Janeiro in June 2012, marked the twentieth anniversary of the historic Eco-92 with the central objective of renewing global political commitment to sustainable development. Unlike previous meetings focused on new treaties, the conference concentrated on evaluating gaps in the implementation of existing agreements and debating two fundamental themes: the Green Economy, which seeks to align economic growth with environmental preservation and poverty eradication, and the strengthening of the institutional framework for international governance, resulting in the modernization of the United Nations Environment Programme (UNEP) (Brazil, 2012).

Rio+20 resulted in the development of a final document entitled The Future We Want, reaffirming principles of precaution and shared responsibilities while also initiating the process of creating the Sustainable Development Goals (SDGs). These goals were designed to replace the Millennium Goals and laid the foundation for the 2030 Agenda, guiding global policies on clean energy and social inclusion. Furthermore, the conference innovated by mobilizing billions of dollars through voluntary commitments from companies and civil society, expanding the debate beyond the traditional diplomatic sphere (Brazil, 2012).

Since the 1970s, Environmental Education (EE) has been the subject of conceptualization and implementation, becoming integrated into the policies of various nations and receiving support from United Nations (UN) agencies and programs for training and the production of educational and instructional materials. However, the translation of these political guidelines into practice at all educational levels often lacks sufficient relevance and clarity for effective implementation. This gap frequently reduces EE to mere everyday practices of household and institutional waste management, distancing it from a broader and more transformative approach (Brenzan; Hornung; Oliveira, 2021).

Brazil has stood out internationally in the field of Environmental Education, as evidenced in global events such as COP28 in Dubai. Law No. 9,795, enacted in 1999 and now approaching three decades in force, is notably comprehensive in establishing, in Article 3, Environmental Education as a universal right. Its comprehensiveness is reflected in the recognition of both formal and non-formal Environmental Education processes and in the clear definition of the role of each involved agent.

The broader conception established by Law No. 14,393/2022 expands the original scope by incorporating the dimension of sustainability. However, Environmental Education transcends mere instruction; it constitutes an educational process for life. Therefore, it should be oriented toward fostering respect and harmonious coexistence among all living beings and the environment that shelters them, encouraging action and thus consolidating itself as a fundamentally political act (Alves; Carniatto; Kataoka, 2023).

III. METHODOLOGY

This qualitative and exploratory research approach is fundamental for investigations aimed at understanding the depth and complexity of phenomena that have not yet been exhaustively mapped. From this perspective, the focus is not on numerical measurement, but rather on the interpretation of nuances, meanings, and trends present in the discourses of the analyzed authors. The exploratory nature allows the researcher greater flexibility to unveil the object of study — in this case, Environmental and Climate Education in the International Journal of Environmental Resilience Research and Science (IJERRS) – ISSN 2675-3456 — providing an initial and detailed overview that serves as a basis for theoretical strengthening and for identifying new avenues of investigation in the field.

The foundation of this research is supported by bibliographic, documentary, and integrative review methods, which operate complementarily to provide rigor to the theoretical framework and depth to the discussions. The bibliographic research provided the necessary conceptual support, enabling dialogue with renowned authors in the fields of Environmental Education and Sustainability, thereby ensuring the essential theoretical grounding for interpreting the data. This bibliographic survey was crucial for situating the state of the art and contrasting existing theories with the findings of the investigation.

Simultaneously, the documentary method was applied to the analysis of articles published in the IJERRS journal, which served as primary data sources (non-conventional documents). Unlike traditional bibliographic reviews, documentary analysis enabled the investigation of the journal's scientific production as an object of study, allowing the mapping of trends, approaches, and specific gaps within the periodical.

Thus, the integration of these methods enabled the results to go beyond mere description, reaching a level of analytical discussion. The triangulation between theory (bibliography) and the data extracted from the manuscripts (documents) made it possible to develop a critical synthesis, revealing how Climate Education has been institutionalized and identifying the practical and theoretical challenges that still persist within the contemporary scientific production analyzed.

The investigation was grounded in the Integrative Review method, characterized by its comprehensive nature, as it allows for the simultaneous inclusion of experimental and non-experimental studies. This approach adopts the principles of Evidence-Based Practice (EBP), which are essential for synthesizing the accumulated knowledge concerning the triad of Environmental Education, Climate Education, and Sustainability from multiple sources. Unlike narrative or simple reviews, the integrative modality presupposes methodological rigor that ensures the replicability of the study and the scientific validity of the presented results, enabling a critical and holistic analysis of the documentary corpus.

The integration method comprises six necessary stages:

a) Guiding Question: What is the panorama of the scientific production published by IJERRS regarding Environmental Education, Climate Education, and Sustainability, and what do these studies reveal about current trends in the field?

b) Search or Sampling: The themes of Environmental Education, Climate Education, and Sustainability are extremely relevant within the current global climate emergency scenario.

c) Data Collection: Articles published in the IJERRS journal, selected according to their relevance and thematic focus, were tabulated and presented in the research results.

d) Discussion and Interpretation: These aspects are properly addressed within the results and discussion sections of the research.

e) Knowledge Synthesis: Reserved for the final considerations regarding the theme within the present analysis.

Data Collection: Data collection was conducted through documentary research in the digital repository of the IJERRS journal. The search was structured using the descriptor "Environmental Education," enabling the identification of manuscripts containing the term specifically in the title, abstract, and keywords.

Selection Criteria: The bibliographic survey was conducted through a systematized search within the database of the International Journal of Environmental Resilience Research and Science (IJERRS).

The search strategy was limited to the descriptor "Environmental Education," strictly applied to the fields of title, abstract, and keywords. The temporal scope covered the period between January 1, 2020, and December 31, 2026, using advanced search filters.

The initial universe of 82 publications was submitted to a screening protocol based on thematic adherence and technical accuracy criteria. After this stage, 32 articles met the inclusion requirements for definitive analysis, while the remaining studies were excluded due to inconsistencies with the central scope of the research.

The inclusion criteria comprised manuscripts directly addressing Environmental Education, Climate Emergency, and Sustainability. Priority was given to articles discussing environmental and climate education at local, state, or regional levels. The selection emphasized the relevance of public policies and projects promoting the curricular integration of Environmental Education in connection with local and school communities.

Accordingly, the studies with the greatest adherence to the proposed theme were selected.

Table 1: Selcted Themes

Proposed Theme	Analyzed Topics
Public Policies and Management	Law 9.795/99 – National Environmental Education Policy (PNEA); State and Municipal Plans; Solid Waste Management and Sanitation
Climate Change and Resilience	Climate Emergency; Local Resilience; Climate Environmental Education
Environmental Education in the School Context	Curricular Innovation and Curricular Integration; Specific Pedagogical Practices; Performance Assessment
Sustainability and International Agenda	Agenda 2030 and SDGs; Citizenship and Human Rights
Intersectorality and Diverse Knowledge	Rural and Quilombola Education; University Extension; Ecosocialism

Source: author (2026).

IV. RESULTS AND DISCUSSION

The following table presents the systematization of the articles selected for analysis, highlighting the titles of the studies, their respective objectives, keywords, and main conclusions. The organization of this information provides a panoramic view of the investigated themes, emphasizing the contributions of the studies to the debate on Environmental Education, sustainability, climate resilience, public policies, and the Sustainable Development Goals (SDGs). Furthermore, the synthesis of the studies allows for the identification of theoretical and practical convergences among the research works, as well as the main challenges and potentialities observed in the analysed experiences.

Table 2: **List of Articles Reviewed in IJERRS**

Title	Objective	Keywords	Conclusion
Environmental Education in Paraná Public Policies: A Critical Analysis of Institutional Discourse (2026)	To analyze Environmental Education (EE) in Paraná's educational policies.	Sustainability; territoriality; educational policies.	EE has advanced, but greater institutional articulation is still required.
Environmental Education in Practice: Analysis of the Fingerling Release Project in the Municipality of Nova Santa Rosa/PR, Brazil (2026)	To evaluate a fish restocking project.	Water resources; awareness; public policies.	The project strengthens river preservation and social awareness.
Environmental Education and Climate Resilience: Current Challenges for Achieving the Sustainable Development Goals in Brazil (2025)	To relate education, sustainability, and the 2030 Agenda.	SDGs; resilience; sustainability.	Multisectoral articulation reduces inequalities and strengthens socio-environmental resilience.
Environmental Education and Solid Waste Management: Local Pathways for Mitigation and Adaptation to the Climate Crisis in an Intersectoral Experience (2026)	To report experiences in waste management and health.	Solid waste; intersectorality; sustainability.	Intersectoral projects favor climate adaptation and health promotion.
Risk Perception Among Residents of Foz do Iguaçu: Challenges of Non-Formal Environmental Education for Climate Resilience (2026)	To investigate perceptions of environmental risks.	Environmental risks; non-formal EE.	There is difficulty in associating everyday risks with climate change.
Extension Curriculum Integration and Climate Change: A Challenge for Higher Education Institutions (2026)	To analyze the curricular integration of extension activities in the face of the climate crisis.	University extension; sustainability.	Curricularized extension strengthens citizenship education.
Environmental Education in a Municipality in Western Paraná and Its Practices Involving the SDGs (2025)	To examine EE practices linked to the SDGs.	SDGs; educational practices.	Collective participation strengthened local environmental actions.
Curricular Innovation Through the Integration of Environmental Education: Its Importance for Children's Protagonism (2023)	To understand the relationship between EE and children's protagonism.	Curricular innovation; childhood.	Environmental practices stimulate protagonism and closeness to nature.
Mapping Environmental Actions in State Schools: Implementation of Paraná's Environmental Education Program (2025)	To present the implementation of the Paraná Environmental Education Program (PEEA-PR).	State program; public schools.	The mapping supports strategic EE actions in Paraná.
Environmental Education and Diagnostic Assessment: Results in Natural Sciences in the 3rd Edition of Paraná Test 2023 (2025)	To evaluate student performance in EE.	Diagnostic assessment; Natural Sciences.	Difficulties persist regarding pollution and ecological relationship contents.
Wajãpi Ecological Trail: An Experiential Alternative Applied to Environmental Education in Southern Amapá, Amazon, Brazil (2023)	To propose an ecological trail as an educational practice.	Ecological trail; Amazon.	Environmental trails are effective for ecological awareness.
Environmental Education and the Future: An Essential Commitment to Sustainability (2023)	To discuss the importance of EE from childhood onward.	Sustainability; school; childhood.	Schools play a central role in developing environmental awareness.

The Importance of Environmental Education in Environmental Conservation and Tourism Enhancement in the Riverside Community of Santo Antônio de Leverger - MT (2024)	To assess environmental impacts in a tourist area.	Conservation; tourism; riverside community.	EE is essential in addressing pollution and improper waste disposal.
Environmental Education and Sustainability: Actions in Everyday Life (2023)	To analyze sustainable practices in daily life.	Sustainability; social practices.	There is recognition of environmental impacts related to daily habits.
Socio-Environmental Sustainability: A Discussion on Ecosocialism (2024)	To investigate relations between ecosocialism and EE.	Ecosocialism; environmental crisis.	Structural changes are necessary to confront the environmental crisis.
Training in Environmental Education and Municipal Basic Sanitation (2024)	To report a course on sanitation and EE.	Continuing education; sanitation.	The integration of actors strengthens urban sanitation actions.
Quilombolas of Mata Cavalo: Re-signifying School, Culture, and Nature (2023)	To analyze identity and quilombola education.	Quilombola; territory; identity.	Collective resistance sustains territorial and environmental defense.
Operation Rondon Paraná: A Bridge Between Environmental Education and University Extension (2023)	To promote environmental awareness in schools.	University extension; recycling.	Practical workshops encourage sustainable habit changes.
Environmental Education Through School Gardens: A Case Study of Municipal Schools in Marechal Cândido Rondon - PR (2023)	To investigate the pedagogical use of school gardens.	School garden; pedagogical practices.	The effectiveness of gardens depends on teacher training and continuous maintenance.
Climate Environmental Education and the Contribution of Voluntary Environmental Monitoring (VEM) in Schools and Coastal Communities (2024)	To disseminate voluntary environmental monitoring practices.	Citizen science; climate change.	VEM strengthens community climate resilience.
Environmental Education and Cultural Dialogues: Challenges in the Face of the Impacts of the Covid-19 Pandemic (2020)	To reflect on inequalities aggravated by the pandemic.	Inequality; sustainable practices.	Integrated policies of social and environmental justice are necessary.
Environmental Education in the Face of the Climate Emergency: A Proposal for a Didactic Guide Applied to an Interpretive Trail (2024)	To present a didactic guide for interpretive trails.	Climate emergency; didactic guide.	Critical trails encourage understanding and transformative action.
Foundations of Environmental Education in the Face of Climate Change (2023)	To analyze EE within school curricula.	Curriculum; climate resilience.	EE still requires greater depth and curricular continuity.
The Reflections of the National Environmental Education Policy on the Management of Formal Education (2019)	To analyze the relationship between the National Environmental Education Policy (PNEA) and educational management.	PNEA; educational management.	The effectiveness of the policy depends on continuous application in schools.
Environmental Education in the Context of Inclusive Education (2020)	To analyze EE practices in APAEs (special education institutions).	Inclusion; special education.	Environmental awareness should be integrated into students' daily lives.

Environmental Education and Climate Resilience: Contemporary Challenges of the Water Crisis in a Rural School (2023)	To reflect on educational practices facing the water crisis.	Rural school; water crisis.	Integration between local knowledge and sustainability is fundamental.
The Relationship Between Legislation, Environmental Education, and Problems Faced in Solid Waste Management by Rural Communities (2020)	To discuss environmental legislation and rural solid waste.	Environmental legislation; solid waste.	Social participation is essential for effective policies.
Environmental Education as a Human Right: Initial Discussions (2020)	To discuss EE from the perspective of Human Rights.	Human rights; citizenship.	EE is a fundamental instrument for forming the ecological subject.
Manual of Sustainable Tips: A Study on Education and Environmental Perception (2020)	To evaluate a sustainability manual and environmental perception.	Environmental perception; habit change.	Accessible teaching materials broaden environmental awareness.
What Is Still Missing When We Talk About Climate Environmental Education? (2023)	To reflect on climate change education.	Complexity; ethics; climate.	Climate education requires an ethical and interdisciplinary approach.

Source: Prepared by the Authors (2026).

PUBLIC POLICIES AND MANAGEMENT

Cotica and Carniatto (2021) discuss the relationship between the National Solid Waste Policy (PNRS) and the National Environmental Education Policy (PNEA), highlighting how both complement each other in promoting sustainable practices and raising awareness within rural communities. Grounded in authors such as Jacobi, Carvalho, Tristão, Zakrzevski, and Rodrigues et al., the article emphasizes a critical and interdisciplinary perspective of Environmental Education, linked to the social realities of rural areas. The study revealed that inadequate disposal of solid waste in rural regions frequently occurs due to the absence of public collection services and the lack of sustainable practices, resulting in waste burning, burial, and disposal near rivers and springs.

The results indicate that Environmental Education constitutes an essential element for promoting practices of reduction, reuse, and recycling of solid waste in rural communities. The article also identifies structural difficulties faced by rural schools, such as limited resources, lack of adequate teaching materials, and the disconnect between public policies and local realities. Thus, the authors conclude that Environmental Education in rural settings must be directly linked to the concrete needs of communities, strengthening sustainable practices, collective participation, and critical awareness regarding the environmental impacts caused by solid waste (Cotica & Carniatto, 2021).

Silva and Loureiro (2021) seek to understand the impacts of the PNEA on educational management, highlighting the need to incorporate environmental themes continuously, interdisciplinarily, and participatively within the school context. Grounded in authors such as Leff, Libâneo, Paro, and Sorrentino, the article articulates democratic management, interdisciplinarity, and Critical Environmental Education, reinforcing that Environmental Education should be understood as an essential and permanent component of national education, integrated transversally into school curricula.

The findings indicate that Environmental Education is still developed in a limited manner in schools, often restricted to isolated activities on commemorative dates and concentrated in disciplines such as Science and Biology. The study highlights challenges related to teachers' continuing education, curricular fragmentation, and the absence of systematic monitoring of environmental actions within schools. Thus, the authors conclude that the effectiveness of the PNEA depends on strengthening democratic management, collective participation, and the permanent integration of Environmental Education into curricula and pedagogical practices. Furthermore, the article reinforces the transformative potential of Environmental Education for citizenship formation and for building a more sustainable society (Silva & Loureiro, 2021).

The institutionalization of Environmental Education in Brazil is a continuous process, marked by the existence of a robust legal framework, such as the National Environmental Education Policy (PNEA – Law No. 9.795/1999), which defines it as an essential and permanent component of national education. However, the implementation of these policies still faces significant challenges. Studies such as that of Spada, Inácio, and Zarnott (2026) on public policies in Paraná reveal that, although there is formal and legal recognition of Environmental Education, concrete implementation mechanisms are often insufficient. Similarly, Silva and Loureiro (2021) point out that the application of the PNEA in school management is frequently fragmented and restricted to occasional activities, such as commemorative dates, and concentrated in specific disciplines like Science and Biology. This

suggests a gap between normative planning and everyday pedagogical practice, indicating the need for greater integration and transversality of Environmental Education within curricula and political-pedagogical projects in educational institutions.

A significant trend observed in the literature is the predominance of Critical Environmental Education (CEE) as a theoretical framework. Authors such as Loureiro, Layrargues, Lima, and Paulo Freire are frequently mobilized to support studies that seek to transcend merely conservationist and behavioral perspectives of Environmental Education. CEE is understood as a social practice aimed at transforming the structures that produce socio-environmental inequalities, emphasizing social justice, emancipation, and the political and territorial dimensions of Environmental Education. This critical approach is fundamental for the formation of citizens capable of understanding the complex interrelations between society, consumption, and the environment, and of acting in the construction of sustainable solutions (Spada, Inácio, & Zarnott, 2026).

The study by Cansian and Carniatto (2026) analyzed the implementation of the projects "Clean City, Everyone's Duty" (2013–2021) and "Clean City, Zero Mosquito" (2019–2024), developed in the municipality of Campina da Lagoa – PR, demonstrating how the integration of education, health, social assistance, and environmental sectors contributed to expanding community participation in selective waste collection and mitigating environmental impacts. The theoretical framework is grounded in Critical Environmental Education, engaging with authors such as Paulo Freire, Enrique Leff, Loureiro, Carniatto, and Jacobi, understanding Environmental Education as an emancipatory process aimed at collective knowledge construction and social transformation. Furthermore, the study relates Environmental Education to climate resilience and the 2030 Agenda, especially Sustainable Development Goals (SDGs) 11, 12, and 13.

Quantitative data regarding recyclable waste sent to the Campina da Lagoa Recyclable Waste Collectors Association (ACARECAL) between 2013 and 2024 were collected. The results indicate significant growth in the amount of recyclable waste delivered to the association, increasing from 30,560 kg in 2013 to 230,532 kg in 2024, representing an increase of more than 650%. This progress was associated with the continuity of educational actions, the sectorization of selective collection, and community mobilization promoted through workshops, educational campaigns, competitions, parades, and teacher training. The study also estimates that these actions contributed to preventing approximately 2,500 tons of CO_2 equivalent during the analyzed period, reinforcing the role of Environmental Education in mitigating the climate crisis (Cansian & Carniatto, 2026).

Cansian and Carniatto (2026) argue that public policies based on intersectorality, social participation, and Critical Environmental Education strengthen local sustainability and environmental governance, demonstrating that small municipalities can develop effective practices for climate mitigation and solid waste management through the articulation of education, community mobilization, and administrative continuity.

Bittencourt (2025) investigated the implementation of the Environmental Education Program in the state of Paraná (PEEA-PR), in accordance with State Decree No. 11.300/2022, aiming to identify Environmental Education actions already developed within schools in order to strengthen existing public policies related to sustainability. Through a questionnaire administered to 2,100 state schools between October and December 2022, 969 valid responses were obtained, representing 22% of Paraná's state schools.

The results demonstrate a predominance of Environmental Education actions related to waste separation, recycling, school gardens, and tree planting. Among the most frequent initiatives were waste separation (23.32%), school/community gardens (20.61%), recycling (13.89%), and the planting of native and fruit trees (13.80%). The study concludes that schools already show mobilization around Environmental Education; however, challenges remain regarding the expansion of community participation, curricular integration, and the strengthening of permanent sustainability practices. In this sense, the author reinforces the importance of public policies and teacher training in consolidating Critical Environmental Education within Paraná's state school network (Bittencourt, 2025).

CLIMATE CHANGE AND RESILIENCE

Carniatto et al. (2023) highlight Environmental Education as a formal and non-formal educational process committed to sustainability, interdisciplinarity, and social cooperation. Grounded in authors such as Artaxo, Barbieri, Silva, and Colombo, the article discusses the relationship between human actions, greenhouse gas emissions, deforestation, and global warming, demonstrating that climate change represents a significant threat to contemporary society. In this context, the authors argue that Environmental Education enables a broad understanding of the environmental and social problems related to the climate crisis, strengthening educational practices aimed at sustainability and climate resilience.

The results demonstrate that Environmental Education is present in school and university curricula in the state of Paraná, although still in a superficial and discontinuous manner. Although there are specific disciplines and interdisciplinary approaches related to environmental themes, the study points to limitations regarding the depth and continuity of educational practices in the face of the urgency of contemporary climate issues. Thus, the authors conclude that strengthening critical and transversal Environmental Education at all levels of education is essential for forming conscious, resilient citizens committed to building sustainable solutions to climate change (Carniatto et al., 2023).

Alves, Carniatto, and Kataoka (2023), in a critical analysis of Alfredo Pena-Vega's work, argue that understanding climate change constitutes an ethical commitment between generations and requires profound transformations in ways of thinking, acting, and

educating. Based on Edgar Morin's theory of complexity and discussions on Climate Environmental Education and intergenerational justice, the article reinforces that Environmental Education must go beyond fragmented approaches, promoting critical, ethical, and civic education in the face of the climate emergency.

The study also highlights youth protagonism through initiatives such as the Global Youth Climate Pact project, which seeks to engage young people in global climate debates. The findings indicate that Climate Environmental Education should promote intergenerational dialogue, combat climate denialism, and encourage active youth participation in climate-related decision-making. Furthermore, the authors emphasize that young people demonstrate a high level of awareness regarding global environmental problems, such as biodiversity loss and the degradation of water, soil, and agriculture. Therefore, confronting the climate emergency requires a paradigmatic shift in education based on complexity, cooperation, and social protagonism, especially among younger generations (Alves, Carniatto, & Kataoka, 2023).

The study by Pedrini and Pereira Junior (2024) demonstrates concern regarding the impacts of global climate change and the need for pedagogical strategies focused on critical environmental awareness in the face of the contemporary climate crisis. The authors argue that climate injustice must be addressed through critical educational practices capable of problematizing the causes and consequences of socio-environmental issues while promoting social participation and collective transformation.

The authors proposed a methodology based on interpretive trails and extracurricular classes, integrating biodiversity, local culture, environmental perception, and climate emergency. This approach values experiential and interdisciplinary methodologies, bringing students closer to concrete environmental issues and overcoming practices restricted to the traditional classroom space. In addition, the study engages with references from Critical Environmental Education, climate justice, and political ecology, articulating the discussion with educational and environmental public policies, such as the National Environmental Education Policy (PNEA), the National Common Curricular Base (BNCC), and the National Climate Change Adaptation Plan. Thus, the article reinforces the importance of territorialized and critical pedagogical practices in the formation of conscious individuals committed to confronting the climate emergency (Pedrini & Pereira Junior, 2024).

Matarezi (2024) presents Voluntary Environmental Monitoring (VEM) as a methodological strategy aimed at the prevention, mitigation, and adaptation to climate change, articulating Environmental Education, citizen science, community participation, and critical socio-environmental education. Grounded in Critical Environmental Education, complexity, and cultural transformation, the article highlights that Climate Environmental Education enables an integrated understanding of socio-environmental and political relations, promoting awareness, mobilization, and social participation in addressing the climate emergency.

The study also values community participation and citizen science through the "Clube Olho Vivo" program, developed in schools and coastal communities in Santa Catarina and Paraná, involving students, teachers, and residents in the continuous collection of environmental data. This approach connects learning to the realities experienced by coastal communities and strengthens social protagonism in the face of environmental challenges. Furthermore, the article engages with international documents and climate public policies, such as IPCC reports and the Climate Environmental Education Guidelines of FunBEA, emphasizing the vulnerability of coastal populations to climate change and socio-environmental inequalities (Matarezi, 2024).

The study by Ferreira Neta, Ribeiro, and Neves (2026) analyzed the environmental perception of residents of Foz do Iguaçu regarding climate change, emphasizing that "the challenges of climate change require profound transformations in society's behavior." In this context, the authors reaffirm an important approach to Climate Environmental Education focused on risk perception and the construction of more resilient societies, reinforcing the importance of non-formal Environmental Education as an instrument of mediation between society, territory, and the climate emergency.

According to the authors, the population's socio-environmental understanding and perception are fundamental for planning public policies and municipal Environmental Education programs that contextualize local vulnerabilities. The research involved the application of 249 questionnaires in 2024 concerning perceptions of risks related to the body, climate, and territory. The data demonstrated a predominance of concerns related to the body, especially dengue fever, followed by climatic phenomena such as heat waves, storms, and hail. Risks linked to territory, such as deforestation, inadequate infrastructure, and pollution, showed lower levels of perception among residents (Ferreira Neta, Ribeiro, & Neves, 2026).

The authors concluded that most of the population perceives the environmental impacts experienced in daily life but has difficulty relating them to territorial and climatic problems. This reinforces the need to implement municipal Environmental Education programs focused on developing climate resilience by articulating socio-environmental perception, civic participation, and a systemic understanding of the relationships between body, climate, and territory (Ferreira Neta, Ribeiro, & Neves, 2026).

ENVIRONMENTAL EDUCATION IN THE SCHOOL CONTEXT

The study by Pereira, Picanço, and Antiqueira (2021) analyzes Environmental Education practices developed in APAEs (Associations of Parents and Friends of Exceptional Children) in the municipalities of Imbituva, Irati, and Ponta Grossa/PR, highlighting the importance of continuous environmental awareness integrated into students' daily lives. Grounded in the Federal Constitution, the National Environmental Education Policy (Law No. 9.795/1999), the National Guidelines for Special Education, and authors such as Freire, Borges, and Japiassu, the article argues that Environmental Education should be present at all levels

and modalities of education, including Special Education, in an interdisciplinary and inclusive manner. The authors emphasize that Environmental Education contributes to the development of citizenship, social inclusion, and environmental awareness.

The results demonstrate broad teacher participation in projects related to recycling, composting, school gardens, afforestation, and the rational use of water and electricity. The study highlights practical experiences such as paper recycling, vegetable cultivation, seedling production, and organic gardens involving students, families, and the school community. Furthermore, high levels of student interest in environmental activities were identified, despite difficulties related to teacher training and the need for continuity of the projects. The article concludes that Environmental Education within the context of Inclusive Education promotes social participation, environmental awareness, and the strengthening of citizenship, contributing to the formation of more conscious, participatory individuals committed to environmental preservation (Pereira, Picanço, & Antiqueira, 2021).

Rosa, Carniatto, and Cruz (2021) present the experience of the Leopoldo Jacomel Municipal Rural School, located in the Matulão community in Tijucas do Sul/PR, during a water supply crisis, highlighting the mobilization of the school community as a fundamental element in solving the problem and strengthening local socio-environmental identity. Grounded in authors such as Tozoni-Reis, Caldart, and Souza, the article relates Critical Environmental Education, interdisciplinarity, and Rural Education, arguing that these dimensions work together in promoting sustainability, collective participation, and the valorization of peasant identity.

The results demonstrate strong engagement among the school, families, and residents in seeking solutions to the water crisis through organizing events, fundraising, and collective efforts to replace damaged pipes and restore water supply. In addition, students participated in interdisciplinary activities such as the production of models, texts, poetry, graphs, and debates on environmental preservation and sustainability. The article concludes that the connection between school and community strengthens social participation, rural identity, and the construction of sustainable practices, presenting Environmental Education as an essential tool for developing critical awareness, climate resilience, and social transformation in rural communities (Rosa, Carniatto, & Cruz, 2021).

The implementation of Environmental Education depends on the adoption of innovative pedagogical practices and active methodologies that promote student engagement and experiential learning. Several articles highlight the effectiveness of practical and interdisciplinary approaches. Soares, Silva, and Sato (2024) reported the experience of school gardens as living laboratories, integrating different disciplines and promoting student protagonism, healthy eating, and sustainability, connecting with SDG 2 “Zero Hunger” and SDG 4 “Quality Education.”

In this context, Soares, Silva, and Sato (2024) demonstrate that the quilombola school goes beyond the traditional teaching function, becoming a space for cultural strengthening, political mobilization, and environmental preservation, highlighting the struggle for the preservation of nature and the definitive achievement of identity and territory. The local school works with practical Environmental Education projects such as community gardens, African dances, quilombola agriculture, and the appreciation of traditional local knowledge, strengthening students’ sense of belonging and cultural identity (Soares, Silva, & Sato, 2024).

Addressing the climate crisis requires Environmental Education (EE) to transcend traditional conservationism. According to the authors, the critical approach to EE provides the theoretical and practical support necessary to combat climate injustice, positioning pedagogy as a strategic tool for raising awareness and addressing contemporary global impacts. This statement reinforces the value of experiential and interdisciplinary methodologies as instruments for strengthening Environmental Education in the school context, since addressing Climate Environmental Education exclusively within classroom walls becomes overly abstract. Therefore, contact with territorialized pedagogical practices capable of bringing students closer to more complex environmental issues is essential (Pedrini & Pereira Junior, 2024).

Regarding the valorization of active methodologies and experiential practices within Environmental Education, Santos et al. (2023) demonstrate that ecological trails can be used as pedagogical instruments for socio-environmental awareness, according to the local experience of Vale do Jari, Amapá. According to the authors, concern about the environmental crisis requires reconnecting humans with the environment in which they live, reinforcing the importance of practical experiences in the teaching-learning process while valuing cultural and territorial elements such as local knowledge and community identity. The results were positive in demonstrating effective awareness regarding socio-environmental causes (Santos et al., 2023).

For Weirich et al. (2026), Environmental Education constitutes a political and ethical process of social transformation grounded in sustainability and environmental awareness. In this sense, the project entitled “Joint Environmental Education and Restocking Action of Native Fish Species in Arroio Guaçu and Jaguarundi” demonstrates that practical Environmental Education actions contribute to a culture of socio-environmental preservation and strengthen students’ awareness regarding ecosystem protection, native species, water resources, and solid waste separation practices. This reinforces the role of Environmental Education as an instrument of social transformation, civic participation, and sustainability promotion.

The curricular integration of extension activities and climate change still represents a challenge for consolidating sustainability, Environmental Education, and the social commitment of Higher Education Institutions (HEIs). Tegoni, Oliveira, and De Grandi (2026) highlight that climate change constitutes one of the greatest challenges of the 21st century, requiring profound

transformations in educational processes and institutional practices. In this context, university extension emerges as an instrument capable of bringing universities and society closer together in constructing responses to the climate crisis. According to the authors, curricular integration should not be understood merely as legal compliance, but as an epistemological and pedagogical reconfiguration of the educational process.

The results show that 79% of Brazilian Higher Education Institutions have already implemented the curricularization of extension activities; however, only 51% have effectively incorporated climate-related themes into their extension projects. The study points out that federal public universities present the highest rates of integration of climate issues, whereas private institutions demonstrate greater structural and pedagogical fragilities in this process. Among the main challenges identified are curricular fragmentation, insufficient specific teacher training, and weak articulation among teaching, research, and extension (Tegoni, Oliveira, & De Grandi, 2026).

The authors concluded that the curricularization of extension activities has transformative potential to strengthen Critical Environmental Education and contribute to addressing climate change, provided that it is associated with institutional sustainability policies, continuing education, and interdisciplinary planning. The authors further argue that universities must assume an active role in promoting climate justice and citizenship education, consolidating university extension as a strategic space for social and environmental transformation (Tegoni, Oliveira, & De Grandi, 2026).

Regarding the importance of integrating Environmental Education into curricula, Benvindo and Serpa (2023) highlight that the absence of environmental practices in the curriculum contributes to distancing children from nature, compromising child development and the formation of environmental awareness. Grounded in authors such as Tiriba, Bissaco, Demoly, Santos, and Barros, the study addresses concepts such as biophilia, the "unwalling" of childhood, and experiential learning, arguing that Environmental Education should be integrated into school routines in an interdisciplinary and practical manner.

The results demonstrate that experiential environmental activities favor children's protagonism, stimulate meaningful learning, and strengthen sustainability values, while also criticizing the traditional school model centered on content transmission and disconnected from experiences with nature. The article concludes that integrating Environmental Education into school curricula can transform educational processes, making them more participatory, critical, and connected to children's experiences. It also reinforces the need for adequate teacher training and curricular changes aimed at bringing students closer to nature (Benvindo & Serpa, 2023).

The study by Silva and Bittencourt (2025) analyzed students' performance in Environmental Education-related content included in the Science and Biology components of the Paraná Test 2023, arguing that the results can support more effective pedagogical actions aimed at students' critical and socio-environmental education. According to the authors, Environmental Education requires a transversal, continuous, and interdisciplinary approach to environmental themes.

The results demonstrate better student performance in content related to environmental health, especially topics involving diseases transmitted through contaminated water, air, and soil. In contrast, content related to pollution, ecological relationships, environmental impacts, and biogeochemical cycles presented low rates of correct answers, revealing weaknesses in the learning process. In Biology, themes related to environmental disturbances and the impacts of human activities also showed significant difficulties. The article concludes that Environmental Education still requires greater pedagogical depth in schools, especially in content demanding a systemic understanding of ecological and environmental relationships. Thus, the authors advocate strengthening interdisciplinary practices and using diagnostic assessments as fundamental instruments for improving teaching and promoting critical, reflective, and sustainability-oriented environmental education (Silva & Bittencourt, 2025).

The study by Reinher, Ruscheinsky, and Duarte (2024) understands Environmental Education as an instrument of social mobilization and civic participation in the face of urban socio-environmental challenges. The proposal integrated students, public institutions, and social movements around the theme of basic sanitation, reinforcing the collective, interdisciplinary, and participatory character of Environmental Education. Grounded in Critical Environmental Education and curricular environmentalization, the authors advocate constructing knowledge aimed at social, cultural, and political mobilization, strengthening society's participation in the search for sustainable solutions.

The activities developed involved continuing teacher education, debates on solid waste, hydrographic basins, curricular environmentalization, and public policies, promoting social learning processes based on dialogue and the collective construction of knowledge. The study demonstrates that the articulation between Environmental Education, community participation, and public policies contributes to strengthening sustainable practices and expanding socio-environmental awareness. Furthermore, it highlights the importance of the National Environmental Education Policy and Municipal Basic Sanitation Plans as essential instruments for promoting more sustainable and socially participatory cities (Reinher, Ruscheinsky, & Duarte, 2024).

The study by Ekert, Mokfa, and Teixeira (2023) understands Environmental Education as a process of constructing social values, knowledge, and competencies aimed at environmental preservation, highlighting the school environment and extension activities as strategic spaces for strengthening environmental awareness. Grounded in Critical Environmental Education and sustainable development, the article argues that education, citizenship, and sustainability are interdependent elements capable of forming

conscious, critical, and participatory individuals. Furthermore, the authors value university extension as an instrument of social transformation, understood as an interdisciplinary, educational, cultural, scientific, and political process.

The results demonstrated increased environmental awareness and active student participation, especially in activities related to recycling and environmental preservation. The study also revealed weaknesses regarding knowledge about solid waste and proper material disposal, indicating limitations still present in formal Brazilian Environmental Education. In this context, the article reinforces the importance of integration between university, school, and community to strengthen Environmental Education, citizenship, and sustainable development, consolidating university extension as an important tool for socio-environmental transformation (Ekert, Mokfa, & Teixeira, 2023).

Rodrigues et al. (2022) demonstrated that environmental preservation is indispensable for maintaining life, highlighting Environmental Education as a fundamental strategy for raising awareness about sustainability and natural resources. Grounded in Critical Environmental Education, sustainability, and citizenship education, the article engages with authors such as Capra, Boff, and Gadotti, reinforcing the role of schools as spaces for knowledge construction and the formation of individuals committed to contemporary socio-environmental challenges. In this context, school gardens are understood as living pedagogical spaces capable of promoting practical and interdisciplinary classes related to healthy eating, environmental care, and sustainability.

The results demonstrate strong student participation in planting, irrigation, maintenance, and harvesting activities in school gardens, strengthening student protagonism and learning through practical experience and direct contact with soil and organic food. The study also demonstrates that school gardens promote the dissemination of sustainable habits within family environments and contribute to integrating Environmental Education into different areas of knowledge, such as Science, Geography, History, Mathematics, Arts, and Portuguese Language. Furthermore, the research relates school gardens to the Sustainable Development Goals (SDGs), especially SDG 2 (Zero Hunger) and SDG 4 (Quality Education), demonstrating their contribution to the construction of ecological values, a culture of care, and sustainability. This reinforces the importance of active methodologies and concrete experiences in school routines for forming critical, conscious individuals committed to caring for the planet (Rodrigues et al., 2022).

SUSTAINABILITY AND THE INTERNATIONAL AGENDA

Ferreira, Picanço, and Antiqueira (2021) argue that a balanced environment must be understood as a fundamental human right and, consequently, that Environmental Education should also be recognized as an essential element of human dignity. Grounded in authors such as Reigota, Grün, Carvalho, Dimenstein, and Bonotto, the article discusses citizenship, sustainability, and the formation of the ecological subject, criticizing the capitalist and anthropocentric logic that reduces nature to the condition of a commodity. In this context, Environmental Education is presented as a political, critical, and emancipatory practice aimed at constructing a more ethical and sustainable relationship between society and the environment.

According to the authors, although legal guarantees related to the environment and Environmental Education exist, weaknesses in the effective implementation of public policies still persist. The study concludes that access to Environmental Education should be recognized as a fundamental human right, as it contributes to citizenship formation, the development of environmental awareness, and the defense of life and human dignity. Thus, the authors reinforce that strengthening Environmental Education means expanding practices of sustainability, citizenship, and socio-environmental justice (Ferreira, Picanço, & Antiqueira, 2021).

Fausto's study (2025) analyzed the interrelationships between education, sustainability, and food security from the perspective of the 2030 Agenda and the Sustainable Development Goals (SDGs). According to the author, "hunger is not merely characterized by the absence of food, but as a complex challenge involving education, health, sustainability, and social justice." The study also highlights that the climate emergency intensifies social vulnerabilities, especially among peripheral, rural, Indigenous, and riverside populations. The article explores studies related to SDGs 2, 3, 4, 6, 11, 12, 13, 15, and 16, introducing the concept of "Integrated Education for Sustainability" across four dimensions: human development and social agency; socio-institutional resilience; sustainability of productive systems; and multilateral knowledge transfer.

For Fausto (2025), the implementation of the SDGs depends on the integration of public policies, democratic governance, Environmental Education, and the strengthening of resilient communities. Regarding the Brazilian context, the study demonstrates that the country possesses a robust legal framework in the areas of food security and income distribution through programs such as the National School Feeding Program (PNAE), the Food Acquisition Program (PAA), Bolsa Família, and the National Food and Nutritional Security System. Finally, the author concludes that strengthening Critical Environmental Education, social participation, and democratic governance constitutes central elements for the effectiveness of the SDGs and for building resilient, sustainable, and socially inclusive communities in Brazil (Fausto, 2025).

Brenzan, Hornung, and Oliveira (2021) analyzed Environmental Education practices developed in the municipality of Nova Aurora, Paraná State, in 2017 and 2019, involving schools, municipal departments, cooperatives, and local organizations. The study highlights the transformative role of Environmental Education in stimulating public awareness and commitment to socio-environmental preservation. The research demonstrated the importance of collective and interinstitutional actions for promoting

sustainability within the municipal context, reinforcing the participatory and transdisciplinary role of Environmental Education aimed at solving concrete environmental problems.

The results revealed social mobilization promoted by projects focused on spring protection, fish release programs, community gardens, recycling, waste reuse, and food waste reduction, highlighting the role of Environmental Education in transforming community practices and strengthening local sustainability. Among the initiatives developed, the "Clean Plate/Zero Waste" project achieved expressive results, reducing food waste by approximately 30% in participating schools. The findings demonstrate that Environmental Education actions contributed to expanding the population's socio-environmental awareness and enabled the applicability of 15 of the 17 Sustainable Development Goals (SDGs) within the municipality. Thus, the article reinforces that the articulation between schools, public authorities, cooperatives, and the community constitutes a fundamental element for consolidating sustainable practices and strengthening the implementation of the 2030 Agenda at the local level (Brenzan, Hornung, & Oliveira, 2021).

Souza (2023) emphasizes that Environmental Education during childhood is fundamental for developing sustainable awareness, arguing that children should learn from an early age to value and protect the environment through educational practices and activities involving recyclable materials. The article is grounded in school-based Environmental Education, sustainability, and citizenship education, emphasizing the need to integrate Environmental Education into all levels of education, as established by Law No. 9.795/1999. In this sense, the author argues that Environmental Education must go beyond theoretical teaching, promoting ecological awareness capable of encouraging sustainable and responsible practices.

The study also relates Environmental Education to contemporary environmental challenges, addressing themes such as climate change, biodiversity loss, water scarcity, and pollution, reinforcing the role of schools in preparing students to confront these issues. Among the highlighted strategies are school gardens, selective waste collection, recycling projects, and outdoor activities, considered important for bringing students closer to everyday environmental issues. The results demonstrate that formal Environmental Education is an instrument of social transformation and sustainability promotion, reinforcing the importance of interdisciplinary and participatory pedagogical practices capable of preparing future generations to understand and confront socio-environmental challenges critically and responsibly (Souza, 2023).

Costella et al. (2024) investigated environmental actions carried out by young people and adults in everyday life, seeking to understand how individual behaviors can contribute to sustainable development. The authors highlight that multiplying examples of good environmental practices among adults can strengthen young people's environmental awareness and contribute to the sustainability of the planet. The article is grounded in discussions on sustainability, formal and informal Environmental Education, and behavioral change, arguing that individuals learn not only through theoretical guidance but also through observing everyday examples. Furthermore, the study relates Environmental Education to climate emergencies, biodiversity loss, and environmental degradation, reinforcing the need for sustainable daily practices.

The results indicated that adults demonstrate greater commitment to sustainable actions compared to young people, especially regarding proper waste disposal, water conservation, and environmental preservation practices. The study also reveals limitations in formal Environmental Education, since many young people showed low engagement in everyday environmental practices despite exposure to environmental discussions within schools. Therefore, the article reinforces the importance of integrating formal and informal Environmental Education, valuing daily examples, community participation, and collective responsibility as fundamental elements for constructing sustainable practices and confronting contemporary environmental crises (Costella et al., 2024).

Guilherme and Carvalho (2023), based on the social and economic impacts aggravated by the Covid-19 pandemic, discuss the need for educational practices aimed at environmental awareness, citizenship, and the reduction of social inequalities. The authors emphasize that the pandemic intensified social, economic, and environmental vulnerabilities, highlighting the relationship between health crises, sustainability, and social justice. The article strongly articulates with the Sustainable Development Goals (SDGs), especially SDGs 4, 10, 13, and 16, arguing that Environmental Education must assume a formative role directed toward social transformation, inclusion, and the construction of sustainable practices capable of addressing contemporary socio-environmental challenges.

Another relevant aspect concerns the presence of intercultural philosophy and the ethics of alterity as theoretical foundations of the discussion, broadening the understanding of Environmental Education beyond traditional ecological practices. The study engages with the intercultural perspective by advocating the recognition of cultural diversity, citizenship, and social responsibility as essential elements for constructing more just and sustainable societies (Guilherme & Carvalho, 2023).

INTERSECTORALITY AND DIVERSE KNOWLEDGE

Araújo, Ramirez, and Giani (2021) developed the manual "104 Tips for You to Save the Planet", composed of simple and accessible guidelines focused on sustainability and environmental preservation. The authors emphasize that a large portion of the population still lacks the habit of adopting sustainable practices, highlighting the need to expand environmental awareness

initiatives. According to the authors, Environmental Education is a tool for social transformation, the development of critical thinking, and the sensitization of society to environmental issues.

The results demonstrated that participants considered the tips presented in the manual easy to understand and apply, recognizing the importance of changing everyday habits in favor of sustainability. Furthermore, all participants believed that the material could contribute to raising awareness among other people regarding sustainable practices and environmental preservation. Thus, the study concludes that simple Environmental Education actions have the potential to stimulate critical reflection, promote behavioral changes, and strengthen sustainable practices in everyday life (Araújo, Ramirez, & Giani, 2021).

The study by Santos et al. (2023) was motivated by concerns regarding the contemporary environmental crisis and the need to reconnect individuals with the environment in which they live, proposing the ecological trail as a pedagogical instrument for socio-environmental awareness in the Jari Valley, southern Amapá. Grounded in Critical Environmental Education, the article highlights that direct contact with nature favors environmental interpretation and understanding, strengthening meaningful experiences within the teaching-learning process. Furthermore, the research values the cultural and territorial aspects of the Amazon, incorporating references to the Wajãpi Indigenous peoples and Amazonian biodiversity.

The results demonstrated strong participant engagement and increased environmental awareness, involving approximately 360 students from different educational institutions throughout 2023. The activities developed contributed to bringing students closer to the ecological functions of the Amazon ecosystem through practical and contextualized experiences. The study concludes that the ecological trail constitutes an effective active methodology for promoting socio-environmental awareness and engagement, reinforcing the importance of participatory, territorialized, and locally connected educational practices in the formation of critical individuals committed to environmental preservation (Santos et al., 2023).

Pinto and Manfrin (2024) analyzed the relationship between Environmental Education, natural resource conservation, and the appreciation of sustainable tourism in a riverside Pantanal community in the state of Mato Grosso. The study highlights Environmental Education as an important instrument for social awareness, directly influencing environmental conservation and the promotion of sustainable practices. Grounded in the National Environmental Education Policy (Law No. 9.795/1999) and state legislation, the article reinforces that Environmental Education should occur in both formal and informal settings, enabling individuals to identify environmental problems, critically reflect upon them, and seek environmentally appropriate solutions. In addition, the research relates Environmental Education to climate change, sustainable tourism, and the conservation of Pantanal biodiversity.

The results revealed several negative environmental impacts in the tourist sites analyzed, such as irregular solid waste disposal, graffiti, lack of adequate infrastructure, discharge of effluents, erosion, deforestation of riparian vegetation, and water pollution. The study demonstrates that these problems compromise both environmental conservation and the tourism potential of the region, affecting the aesthetic quality of the spaces and contributing to the decline in visitors. In this context, the authors emphasize that the absence of effective Environmental Education actions and adequate infrastructure contributes to environmental degradation. The article concludes that educational practices focused on environmental awareness can significantly contribute to the preservation of natural resources and the appreciation of sustainable tourism in Santo Antônio de Leverger – MT, reinforcing the role of Environmental Education as an instrument of social transformation and environmental conservation (Pinto & Manfrin, 2024).

The study by Maillard and Carniatto (2024) understands ecosocialism as a perspective capable of integrating ecological and social issues, seeking to simultaneously confront environmental degradation and structural inequalities. Grounded in Critical and Transformative Environmental Education, the article articulates transformative Environmental Education, social justice, and criticism of the capitalist system. The authors argue that the ecosocialist perspective is particularly aligned with Transformative Environmental Education, as it recognizes the need for structural changes in society in order to achieve sustainability.

Politically oriented Environmental Education is capable of promoting ecological awareness, critical participation, and social transformation in the face of contemporary environmental challenges. In this sense, the article concludes that the environmental crisis cannot be addressed solely through individual behavioral changes, but also requires profound transformations in forms of production, consumption, and social organization, bringing Environmental Education closer to emancipatory and ecosocialist perspectives (Maillard & Carniatto, 2024).

The study by Soares, Silva, and Sato (2024) demonstrates that the quilombola school goes beyond the traditional educational function, constituting a space for cultural strengthening, political mobilization, and environmental preservation. The authors highlight that the quilombola community struggles for the preservation of nature, cultural identity, and territory, evidencing the relationship between culture, environment, and resistance. Grounded in Critical Environmental Education and popular education, the article relates structural racism, social inequality, and environmental conflicts, broadening the understanding of Environmental Education by incorporating debates on territory, environmental justice, and cultural resistance.

The results show that the school develops projects related to community gardens, Afro-Brazilian dances, quilombola agriculture, and the appreciation of traditional knowledge, strengthening students' sense of belonging and cultural identity. The study also points to significant impacts of the COVID-19 pandemic and changes in secondary education, especially regarding school dropout

rates, difficulties in internet access, and food insecurity. Despite these challenges, cultural and environmental projects proved fundamental for strengthening community bonds and encouraging students to remain in school. Thus, the article reinforces the importance of valuing traditional communities and Environmental Education as instruments of resistance, cultural identity, and social transformation (Soares, Silva, & Sato, 2024).

FINAL CONSIDERATIONS

The discussions presented demonstrate that the scientific production of IJERRS has been consolidating a critical, interdisciplinary, and transformative approach to Environmental Education, articulating public policies, educational management, climate change, sustainability, socio-environmental justice, and the appreciation of diverse forms of knowledge. It is evident that Environmental Education has moved beyond conservationist and behaviorist perspectives, assuming a political, participatory, and emancipatory character, mainly grounded in Critical Environmental Education, climate justice, and citizenship education. The studies analyzed demonstrate that Environmental Education is understood as an essential instrument for strengthening citizenship, social participation, and the construction of more sustainable and resilient societies in the face of contemporary socio-environmental crises.

Within the axis of public policies and management, the articles reveal important advances in the institutional recognition of Environmental Education, especially following the National Environmental Education Policy (PNEA) and state and municipal programs. However, challenges persist regarding curricular fragmentation, the superficiality of pedagogical actions, insufficient teacher training, and the gap between public policies and the reality of school communities, particularly in rural areas. The studies reinforce that the effectiveness of Environmental Education depends on its transversal integration into curricula, democratic management, the continuity of educational actions, and collective participation among schools, universities, communities, and public authorities. Experiences such as selective waste collection programs in Campina da Lagoa demonstrate that public policies articulated with Critical Environmental Education can generate concrete impacts on climate mitigation, solid waste management, and community mobilization.

In the field of climate change and resilience, the scientific production analyzed reveals growing concern regarding the climate emergency and the need to strengthen a critical and territorialized Climate Environmental Education. The studies demonstrate that the climate crisis requires participatory, interdisciplinary, and experiential methodologies capable of bringing students and communities closer to concrete environmental issues. Initiatives related to voluntary environmental monitoring, interpretative trails, citizen science, and socio-environmental perception stand out, highlighting the potential of Environmental Education to promote awareness, social participation, and the formation of resilient individuals in the face of climate change. Furthermore, the studies reinforce the importance of youth protagonism, climate justice, and the integration between scientific knowledge, local knowledge, and climate public policies.

Research focused on Environmental Education within the school context demonstrates a strong appreciation for active methodologies, interdisciplinarity, and experiential learning. School gardens, ecological trails, recycling projects, community actions, and university extension activities emerge as relevant strategies for strengthening environmental awareness, healthy eating, territorial belonging, and collective participation. The studies also highlight the importance of social inclusion and the appreciation of cultural and territorial specificities, as observed in APAEs, rural schools, and quilombola communities, reaffirming that Environmental Education must be connected to local realities and the concrete needs of populations.

Regarding sustainability and the international agenda, there is a strong articulation between Environmental Education, the 2030 Agenda, and the Sustainable Development Goals (SDGs). The articles demonstrate that themes such as food security, social justice, inequality reduction, sustainable consumption, and climate change have increasingly been incorporated into Environmental Education discussions, broadening its ethical, political, and social dimensions. Environmental Education is presented as a fundamental human right and as an indispensable element for the construction of sustainable, inclusive, and democratic societies. In addition, the studies reinforce the need for integration between public policies, participatory governance, and the strengthening of local communities in order to achieve global sustainability goals.

Finally, the discussions on intersectorality and diverse forms of knowledge highlight the growing appreciation of traditional cultures, popular knowledge, quilombola, riverside, and Amazonian communities, as well as community and intercultural practices within the field of Environmental Education. The scientific production of IJERRS demonstrates that contemporary Environmental Education must engage with different forms of knowledge, recognizing the relationships between territory, cultural identity, social inequality, and environmental preservation. Thus, the studies analyzed reaffirm that Environmental Education plays a strategic role in confronting contemporary environmental and social crises, contributing to the formation of critical, conscious, and socially engaged individuals committed to socio-environmental justice, sustainability, and social transformation.

Declaration on the Use of Generative AI: During the preparation of this article, Artificial Intelligence tools, particularly ChatGPT and Gemini, were used as auxiliary support for text restructuring, improving the cohesion and coherence of paragraphs, and carrying out preliminary translations. The use of these tools occurred exclusively as technical support for academic writing

and did not replace the authors' critical analysis, data interpretation, literature selection, or intellectual development of the content. All information, interpretations, and conclusions presented were reviewed and validated by the authors, ensuring scientific rigour, academic responsibility, and fidelity to the discussions developed throughout the study.

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