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Environmental education: a comprehensive approach in pre-university education

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ABSTRACT

Introduction: environmental education constitutes a priority within the Cuban educational system, in line with the Sustainable Development Goals of the 2030 Agenda. Its enhancement in pre-university education is essential due to its contribution to the comprehensive formation of students, fostering a holistic vision, critical and creative thinking, and the development of skills for identifying and solving environmental problems in diverse contexts.

Objective: to theoretically substantiate the process of environmental education from a comprehensive approach in pre-university education, grounded in the pillars of curricular sustainability, interdisciplinary integration, pedagogical systematization, and contextualization of content.

Methods: a descriptive study was conducted based on a literature review, from a dialectical-materialist perspective, employing theoretical methods and documentary analysis of guiding documents for pre-university education.

Results: it was found that the coherent articulation of the defined pillars favors a systemic understanding of the environmental education process and contributes to its strengthening within the pre-university curriculum.

Conclusions: the substantiated comprehensive approach enables the formation of responsible, critical, and participatory environmental behavior among students, in accordance with Cuban educational policies and current and future socio-environmental challenges.

Keywords: Environmental Health Education; Students; Thinking.

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INTRODUCTION

Contemporary society faces one of the greatest challenges due to the presence of an environmental, social, cultural, political, and economic crisis, which demands awareness and consciousness to contribute to saving humanity. Hence, there is a need to utilize educational processes that strengthen critical thinking and responsibility to achieve a collective environmental ethic oriented toward sustainable development.

In the opinion of Márquez et al.,⁽¹⁾ there is a growing need to promote educational processes in all contexts and levels of society, through which the appropriation of knowledge, skills, values, and attitudes different from those that have conditioned the exacerbation of contradictions between society and nature is facilitated.

In Cuba, environmental education for the population is a fundamental priority. In the update of the Guidelines for the Economic and Social Policy of the Party and the Revolution for the period 2021-2026, the importance of environmental education for sustainable development is recognized as a key element for achieving the objectives of the 2030 Agenda, signifying in its SDG No. 4 the need to: "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all."⁽¹⁾

The Ministry of Science, Technology, and Environment of Cuba (CITMA) argues that an environmental education adapted to the Cuban context and the concrete conditions of the country must be built, with the objective of achieving sustainable development levels in the shortest possible time.⁽²⁾

Several authors have addressed this process from different conceptions, including Márquez,⁽¹⁾ Borges et al.,⁽⁴⁾ Meneses,⁽⁵⁾ Sixto,⁽⁶⁾ and Castro et al.,⁽⁷⁾ who have established the initial guidelines for the improvement of environmental education at different educational levels, approaching it with varying degrees of depth, and have designed, systematized, and evaluated environmental education experiences from different directions.

Furthermore, in pre-university education, there is evidence of the need to incorporate environmental education into educational and training processes. In this regard, the importance of improving the preparation of teaching staff, professional pedagogical performance, professional development, and the integration of community environmental education processes is recognized.

This leads to the need to develop constructs specifically designed to integrate environmental education in pre-university education, with a comprehensive approach based on the pillars of curricular sustainability, integration, systematization, and contextualization, which overcomes the simplifying paradigm and addresses environmental complexity.

In the Cuban context, education is undergoing a profound process of transformation within the framework of the Third Educational Improvement. This is a continuous process of reform and enhancement of the educational system, seeking to adapt education to the current and future needs of the country.

The school, as an important cultural center of the community and a socializing agent of sustainable practices, is the integrating institution of actions for environmental education in favor of the desired sustainable development and in the formation of social actors, enabling them to become agents of change in their communities and drive local development.

Educational institutions must assume the role of developing ideas and reflections on sustainability by teaching how the problems currently affecting the environment impact society.⁽⁸⁾ In this way, the individual can more consciously and rationally understand the world around them, adopting a new perspective to achieve a more humanized interaction of mankind with their environment.⁽⁹⁾ On the other hand, social responsibility consists of the development of commitment and awareness to contribute to the environmental, social, economic, and cultural environment.

In the context of the Third Educational Improvement in Cuba, the environmental education process has been enriched with theoretical and conceptual approaches, highlighting its relevance within the framework of pre-university education. Nine content components have been determined that contribute to the comprehensive formation of the student, highlighting Environmental Education as a priority with coherent action at all educational levels, in a permanent and continuous manner for the sake of sustainable development.

The improvement also promotes sustainable practices in schools, such as school gardens, recycling, and energy conservation, which serve as concrete examples for students.⁽¹⁰⁾ "These activities not only contribute to sustainability but also strengthen the connection between theory and practice in environmental education."⁽²⁾

Currently, strengthening environmental education constitutes an objective of Cuban pre-university education. In this sense, this educational level plays a crucial role, as it is the stage where the comprehensive formation of young people who will soon join the social and productive life of the country is consolidated. The graduate is expected to act with feelings of conscious responsibility for the care and conservation of the environment, applying scientific procedures to solve everyday problems in their community.

The potential of the curriculum at this educational level as a vehicle to strengthen environmental education is immense, given that it provides the basic scientific knowledge to understand the interrelationships in natural systems, the impact of human activities, and the foundations for seeking sustainable solutions. Therefore, teaching from a comprehensive approach based on the pillars of curricular sustainability, integration, systematization, and contextualization is necessary.

This research arises from the need to present the referential framework on environmental education for pre-university education, from the perspective of Education for Sustainability. Based on the above, this study proposes to substantiate the process of environmental education in the Cuban pre-university school from a comprehensive approach, based on the pillars of curricular sustainability, integration, systematization, and contextualization, analyzing its importance in effective and transformative environmental formation.

METHODS

A descriptive study was conducted based on a literature review under a dialectical-materialist conception. From a theoretical point of view, historical-logical, analysis and synthesis, and inductive-deductive methods were used, which allowed the analysis of conceptions on the topic from diverse approaches and contexts. At the empirical level, documentary analysis was employed to gather information from the group of guiding documents for pre-university education. The theoretical systematization carried out allowed the description of the evolution and development of the environmental education process and its substantiation from a comprehensive approach based on the pillars of curricular sustainability, integration, systematization, and contextualization.

DEVELOPMENT

Environmental education has undergone a profound process of evolution and improvement, supported by the main theoretical and methodological contributions provided by various international events that have taken place since the mid-1970s to the present.

In Cuba, there is a strong political will to strengthen Environmental Education for Sustainable Development, reflected in several guiding documents of the country's economic and social development that contain the guidelines of Cuban environmental policy.

The current Constitution of the Republic of Cuba, approved in 2019, in its Chapter II (RIGHTS), Article 75, states:⁽¹¹⁾

"All persons have the right to enjoy a healthy and balanced environment. The State protects the environment and the natural resources of the country. It recognizes their close link with the sustainable development of the economy and society to make human life more rational and ensure the survival, well-being, and security of present and future generations."⁽¹¹⁾

National environmental policy and management are strengthened; Law 150 on the System of Natural Resources and the Environment is approved,⁽¹²⁾ establishing the principles and basic norms that regulate the actions of the State, citizens, and society in general to ensure the implementation and functioning of the System of Natural Resources and the Environment, which includes social interactions that strengthen the protection and sustainable use of natural resources and the environment. This demonstrates, as stated by Goicochea,⁽¹³⁾ the aspiration to guarantee the environmental sustainability of development in the nation. In this context, environmental education acquires greater relevance.

In its Chapter IX, Article 148 defines environmental education as:⁽¹⁴⁾

"(...) a continuous and permanent process, it constitutes a dimension of the comprehensive education of all citizens and communities, aimed at knowledge management, the development of habits, skills, capacities, and attitudes in the formation of values, and which, through innovation, promote the adoption of well-founded decisions on new lifestyles and consumption practices, in favor of environmental integrity, compatible with sustainable development."

Law 150 also makes it clear that environmental education has an interdisciplinary and transdisciplinary approach, with the purpose of fostering and increasing the participation, awareness, and environmental culture of the entire society.⁽¹⁴⁾

The creation of the Ministry of Science, Technology, and Environment (CITMA) was of great significance as it achieved a strengthening of the Cuban institutional framework. Considered the guiding document of Cuban environmental policy, its mission is directed at identifying the country's main environmental problems and establishing strategic directions for their solution, within the context of the country's sustainable development. In this sense, the key role of environmental education as an essential tool in preparing the general population to face the current environmental crisis is highlighted.

Curricular Sustainability

For Environmental Education to transcend occasional discourse and consolidate as a genuine formative pillar, it is imperative to address the concept of curricular sustainability.

It is necessary to briefly analyze the antecedents that date back to the last decades of the 20th century, emerging as a response to the growing global awareness of the environmental crisis, reflected in international summits such as the one in Stockholm, where the topic is warned as a foundational moment and marked the beginning of a series of intergovernmental meetings.⁽¹⁵⁾ Authors such as Sauvé⁽¹⁶⁾ highlight that this event laid the foundations for environmental education as a tool for sustainability.

It is in the celebrated Brundtland Report that sustainable development is defined as: "Sustainable development is development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs." This interpretation is three-dimensional. It aggregates the economic and social dimensions in the concept of development, and the third is sustainability.⁽¹⁷⁾ In 1992, twenty years after Stockholm, the United Nations Conference on Environment and Development was held in Rio de Janeiro, marking a turning point. It highlighted the role of environmental education in promoting sustainable development and laid the foundations for implementing strategies through Agenda 21 that balance economic, social, and, primarily, environmental aspects worldwide.⁽¹⁸⁾

International meetings have been fundamental in this process, providing a theoretical and practical framework for environmental education, which has evolved from an approach focused on ecological awareness to a transformative approach that integrates sustainability, environmental justice, and global action.

Incorporating sustainability into the educational curriculum becomes an imperative need. This approach not only enriches the academic training of students but also equips them with the necessary tools to become agents of change in their communities. By integrating sustainable principles into teaching, critical awareness is fostered, and new generations are prepared to face future challenges, promoting more responsible and equitable development.⁽¹⁹⁾

Authors such as Higuera et al.,⁽¹⁹⁾ affirm that curricular sustainability is a response to the environmental crisis caused by human activities in recent years. It is based on three dimensions: economic, social, and environmental.

In the opinion of Higuera et al.,⁽¹⁹⁾ "curricular sustainabilization is an educational approach that seeks to integrate the principles of sustainability into all aspects of the teaching and learning process."

Curricular sustainability is not limited to adding ecological content, but rather implies rethinking methodologies, learning objectives, and the very culture of the educational center, in order to form conscious, responsible citizens capable of facing the complex socio-environmental challenges of the 21st century.

For Higuera et al.,⁽¹⁹⁾ sustainability in education promotes an innovation agenda that invites us to rethink the way we live and work. By integrating sustainable practices in classrooms, a space is created where students can develop key skills to become agents of change. Thus, a more equitable and responsible future is built, where human development and planetary conservation go hand in hand.

This approach seeks to integrate environmental principles in a transversal, continuous, and critical manner into the design of pre-university study plans, overcoming the fragmented vision that reduces it to a mere complementary activity. Mochizuki and Fadeeva,⁽²⁰⁾ confirm that, in general, education is taken as an important tool for transformation to achieve sustainability.

Despite the fact that in the normative documents of pre-university education, environmental education is declared as a transversal axis and as a content component in its curricular conception, its concretization in pedagogical practice is irregular and not always enduring. Its treatment usually depends on the individual will of the teacher rather than on a solid institutional curricular strategy.

Curricular sustainability in pre-university education requires that environmental education cease to be sporadic content and become a guiding principle of the institutional and group educational project, ensuring its continuous and progressive presence in all grades and subjects, and the joint action of all agents and agencies involved in the educational process, while also taking advantage of the potential offered by the new forms of work of the Third Improvement. Without this sustainability, isolated efforts lack the necessary impact to generate permanent changes in student attitudes.

Interdisciplinary Integration

Curricular sustainability finds its mechanism of action and its maximum expression in the integration process. This integration must be twofold: horizontal, among the different disciplines, so that the environmental perspective is not the exclusive heritage of the natural sciences, but is also enriched by the humanities, arts, and social sciences; and vertical, throughout the entire pre-university educational trajectory, to ensure a coherent and cumulative progression of learning.

The effective integration of sustainability into the curriculum inherently requires adopting an interdisciplinary approach. This interdisciplinarity breaks down the silos of knowledge, allowing the student to analyze an environmental problem from multiple scientific, ethical, economic, and social perspectives and to understand its systemic complexity.

Interdisciplinary integration processes suppose a more organic relationship between subjects, where each of them contributes conceptual schemes, integration methods, and ways to analyze problems through close and coordinated cooperation.⁽²¹⁾

In pre-university education, disciplinary fragmentation persists in the different subjects of the curriculum when addressing environmental education. Environmental content is addressed in a compartmentalized manner, without students achieving a holistic vision of the problems.

The integration approach proposes overcoming this barrier through the design of "interdisciplinary nodes" based on real environmental problems in the community. For example, in the area of natural sciences, the study of the pollution of a local river can integrate chemical concepts (analysis of contaminants), biological concepts (effects on aquatic ecosystems), and geographical concepts (location, causes, and socioeconomic consequences), but it can also be supported by nodes in the exact and humanistic sciences.

This approach, supported by authors such as Salazar-Alcívar and Alcívar Cordova,⁽²¹⁾ favors critical and complex thinking, which is essential for understanding environmental reality.

In the view of Covas,⁽²²⁾ the incorporation of this interdisciplinary approach into educational practice must be carried out gradually, (...) in order to achieve an adequate organization of teaching, which contributes to students understanding the complex structure of the environment, as it results from the interaction of its physical, biological, social, and cultural aspects, as well as providing a clear awareness of the political, economic, and ecological interdependence of the an interconnected world.

However, for this collaboration between disciplines not to be sporadic or anecdotal, systematization is fundamental. Systematization provides coherence and sequentiality to this integrative effort, establishing clear learning objectives, collaborative methodologies, and common evaluation criteria throughout the entire educational trajectory.

Thus, interdisciplinarity becomes the vehicle of integration, and systematization becomes the organizing principle that guarantees its efficacy and permanence, profoundly and durably transforming the students' worldview.

Systematization

Systematization, from a scientific-pedagogical approach, refers to the design and application of a curriculum as a complex system whose components (objectives, content, methodologies, and evaluation) are interconnected in a coherent and sequential manner to achieve a higher formative goal.⁽²³⁾

From the perspective of General Systems Theory applied to education, the curriculum is not a mere sum of isolated parts, but an organized whole where the alteration of one element affects the whole.

In the context of environmental education, this implies that sustainability must cease to be an accessory module and become a guiding principle that logically and progressively permeates all stages and areas of knowledge, ensuring that each learning experience builds upon the previous one and prepares for the next.

A systematic general approach therefore requires strategic planning that transcends the individual initiative of the teacher. This is concretized in the definition of a curricular spiral, a key concept in pedagogy that proposes reintroducing central themes, such as sustainability, at levels of increasing depth and complexity throughout the educational levels.⁽²⁴⁾

Likewise, it requires continuous evaluation mechanisms that measure not only the acquisition of knowledge, but also the development of socio-ecological competencies and the internalization of values. Without this systematization, environmental efforts in the school run the risk of being fragmentary, ephemeral, and, ultimately, ineffective in generating the paradigm shift that the environmental crisis demands.⁽²⁴⁾

It was found that environmental education activities frequently lack a logical and progressive sequence. Their planning is, in many cases, reactive and associated with anniversaries, which limits their effectiveness.

Systematization implies conceiving the process in a structured manner, from the identification of needs to the evaluation of impacts, ensuring that each activity is built upon previous learning. This requires conscious methodological work that continuously plans, executes, and controls environmental actions, integrating all educational actors.

A systematic process avoids improvisation and ensures that environmental education is a common thread throughout the entire pre-university formation.

Contextualization

The effectiveness of this comprehensive approach based on systematic integration and interdisciplinarity culminates and acquires its true meaning through contextualization. This principle ensures that curricular sustainability is not an abstract theoretical framework, but is anchored in the immediate reality of the student.⁽²⁵⁾

The Ministry of Science, Technology, and Environment of Cuba (CITMA) pronounces that an Environmental Education adapted to the Cuban context and the concrete conditions of the country must be built, with the objective of achieving sustainable development levels in the shortest possible time, based on the unique potential offered by our socioeconomic model and the advanced nature of the Cuban educational system.⁽³⁾

The instruments applied revealed a scarce link between scientific content and local environmental problems. Students show difficulties in relating the abstract knowledge acquired in the classroom to their immediate environment. Pre-university education lacks the implementation of environmental projects that manage to promote environmental education from the educational institution, involving all agents and agencies that intervene in the process, thus achieving the sensitization, awareness, and commitment of everyone for a common good.

Pre-university education needs to implement environmental education strategies through environmental projects, which constitute didactic-methodological tools designed to identify the most pressing environmental problems in relation to their institutional, local, and community environment.⁽²⁶⁾ Their objective is to create and foster educational proposals that adapt to the realities of the context, while improving educational and investigative processes.

School environmental projects are based on community work. Thus, students become active subjects who, through research, can promote environmental education and culture in their educational community and transcend to the family sphere.⁽²⁷⁾

In the view of Higuera,⁽¹⁹⁾ it is decisive to focus attention on practical tasks and personal experiences within the school, family, and community environments. By connecting theoretical concepts with everyday situations, greater relevance and applicability of knowledge about sustainability is achieved. This comprehensive approach not only educates but also empowers people to become agents of change in their communities.

Contextualization implies diagnosing and utilizing the local socio-ecological environment as the main learning scenario. In this way, interdisciplinarity ceases to be an academic exercise and becomes a practical necessity that allows analyzing and acting on a concrete problem, while systematization ensures that this link with the context is not an isolated event, but a common thread throughout the curriculum.

Thus, a meaningful environmental education is forged, where students not only learn about sustainability, but experience and construct it in a relevant way for their own world. It generates a sense of belonging, responsibility, and empowerment in students, transforming them from passive subjects into agents of change within their communities.

Integral Discussion

The discussion of the results leads to the conclusion that these four pillars are not independent, but function synergistically. Curricular sustainability provides the framework of permanence; integration offers the methodology to address complexity; systematization guarantees order and depth; and contextualization provides meaning and relevance to learning. The absence of one of them weakens the entire system. This comprehensive approach aligns with the demands of the Third Improvement and with the critical perspectives of authors such as Novo⁽²⁸⁾ and López Cañizares,⁽²⁹⁾ who advocate for an environmental education that overcomes the simplifying paradigm and focuses on the management of solutions.

The implementation of environmental education with a comprehensive approach in the pre-university stage rests on the consolidation of authentic curricular sustainability. This purpose is materialized through the deep and organic integration of environmental principles, which in turn is sustained by a deliberate interdisciplinarity that allows addressing the complexity of socio-ecological challenges from multiple angles.

For this approach to transcend the declarative and be effective, it requires a systematization that guarantees coherence, sequentiality, and continuity throughout the entire formation.

Finally, it is contextualization that gives meaning and relevance to this framework, anchoring learning in the immediate reality of the students and transforming the classroom and the community into spaces for inquiry and action. In this way, the curriculum stands not only as a transmitter of knowledge, but as a transformative formative project, capable of fostering the critical and responsible citizenship that the future demands.

CONCLUSIONS

The theoretical analysis carried out allowed us to conclude that the improvement of environmental education in the Cuban pre-university school requires a comprehensive approach sustained in the coherent articulation of curricular sustainability, interdisciplinary integration, systematization, and contextualization. Curricular sustainability ensures that environmental education is a permanent and transversal axis, overcoming its sporadic treatment. Integration allows students to build a holistic vision of socio-environmental problems. Systematization guarantees a logical and progressive sequence of activities, avoiding improvisation and process fragility. Finally, contextualization links scientific knowledge with the student's immediate reality, fostering meaningful learning and responsible action. The effective implementation of this comprehensive approach has the potential to transform educational practice, forming critical, participatory, and sustainability-committed citizens, in correspondence with Cuban educational policies and contemporary global challenges. As a projection, the need to continue research that monitors the application of this approach and deepens teacher preparation strategies for its materialization is identified.

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Conflict of Interest

The authors declare that there is no conflict of interest.

Authorship Contribution

AÁL: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Validation, Visualization, Writing – original draft, Writing – review and editing.

LIT: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Validation, Visualization, Writing – original draft, Writing – review and editing.

ÁCL: Conceptualization, Data curation, Investigation, Supervision, Validation, Writing – original draft, Writing – review and editing.

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