

Educational potential of environmental conflict in university education

Potencialidad educativa del conflicto ambiental en la formación universitaria

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Abstract

Introduction: This study assesses the educational potential of environmental conflict from a renewed theoretical perspective on environmental education and training, within the context of social transformations in Cuba.

Objective: The paper aims to characterize the educational potential of environmental conflict in the training of university students to enhance environmental culture.

Method: A qualitative, descriptive study was conducted, based on a participatory action research design. The first phase involved a systematic literature review using theoretical methods (analysis-synthesis, induction-deduction) and documentary analysis of national environmental regulations. The second phase worked with a purposive sample of 48 third-year Computer Engineering students from the University of Camagüey. Data were collected through direct observation in areas near the “Tejas Infinitas” factory, semi-structured interviews with stakeholders, and a survey to explore students’ knowledge and perceptions of environmental conflict. Instruments were validated by expert review, and the ethical principles of informed consent, confidentiality, and anonymity were respected.

Results: Systematizing the categories of conflict and environmental conflict revealed their educational value. The case of the “Tejas Infinitas” factory was identified as a representative environmental conflict, and educational activities were designed integrating the academic, professional, research, and outreach components. Qualitative findings showed progress in understanding environmental conflict, developing critical thinking, and adopting professional practices committed to the environment.

Conclusion: The implemented activities are applicable to the educational subprocesses, contributing to students’ comprehensive development, strengthening environmental culture, and fostering university-community engagement.

Keywords: environmental education, educational potential, environmental conflict, higher education.

Resumen

Introducción: Se valora la potencialidad educativa del conflicto ambiental desde renovados fundamentos teóricos de la formación y la educación ambiental, en un contexto de transformaciones sociales en Cuba.

Objetivo: Caracterizar la potencialidad educativa del conflicto ambiental en la formación de estudiantes universitarios para el desarrollo de la cultura ambiental.

Método: Se desarrolló un estudio cualitativo, descriptivo, sustentado en un diseño de investigación-acción participativa. La primera fase comprendió una revisión sistemática de la literatura mediante los métodos teóricos análisis-síntesis e inductivo-deductivo y el análisis documental de normativas ambientales nacionales. En la segunda fase se trabajó con una muestra intencional de 48 estudiantes de tercer año de Ingeniería Informática de la Universidad de Camagüey. Se aplicaron la observación directa en áreas próximas a la Fábrica “Tejas Infinitas”, una entrevista semiestructurada a actores implicados y una encuesta a los estudiantes para explorar sus conocimientos y percepciones sobre el conflicto ambiental. Los instrumentos fueron validados por criterio de expertos y se respetaron los principios éticos de consentimiento informado, confidencialidad y anonimato.

Resultado: La sistematización de las categorías conflicto y conflicto ambiental permitió develar su valor formativo. Se identificó el caso de la Fábrica “Tejas Infinitas” como un conflicto ambiental representativo y se diseñaron acciones educativas articuladas con los componentes académico, laboral, investigativo y extensionista. Los resultados cualitativos evidenciaron avances en la comprensión del conflicto ambiental, el desarrollo del pensamiento crítico y la apropiación de modos de actuación profesional comprometidos con el entorno.

Conclusión: Las acciones implementadas resultan aplicables a los subprocesos formativos, contribuyen a la formación integral de los estudiantes, al fortalecimiento de la cultura ambiental y al vínculo universidad-comunidad.

Palabras clave: formación ambiental, potencialidad educativa, conflicto ambiental, educación superior.

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Introduction

The contemporary global context, marked by the aftermath of the COVID-19 pandemic and the systemic crisis of capitalism in its multimodal character, reveals environmental problems of great magnitude: climate change, depletion of natural resources, accelerated loss of biodiversity, and environmental degradation (Ministry of Science, Technology and Environment [CITMA], 2021). Added to this is neoliberal globalization, which deepens the concentration of wealth, inequalities, extreme poverty, armed conflicts, and ungovernability. Faced with this reality, the United Nations



(UN) promoted the 2030 Agenda for Sustainable Development and, through the Paris Agreement (United Nations, 2015a and 2015b), established key instruments to confront the climate crisis.

Such problems have repercussions in Cuba, where the updating of the economic and social model aimed at building a prosperous and sustainable socialism is being carried out, amidst a context marked by the tightening of the economic blockade, the energy crisis, food difficulties, and environmental deterioration. The Constitution of the Republic of Cuba (2019) enshrines the right to a healthy environment that fosters sustainable development and quality of life, under the guarantee of the socialist rule of law State.

In correspondence with the National Economic and Social Development Plan 2030 (Ministry of Economy and Planning, 2019), the country deploys the National Environmental Strategy (CITMA, 2021), the National Environmental Education Program for Sustainable Development 2023-2030 (CITMA, 2023), and the Environmental Strategy of the Ministry of Higher Education (2021). The World Conference on Higher Education (UNESCO, 2022) emphasized that institutions at this level have the mission of producing knowledge through research, training professionals with the necessary competencies for working life, and exercising effective social responsibility. Along these same lines, during the XIV International Congress University 2024, the strategic role of higher education in generating knowledge and promoting the most genuine social interests was ratified (León Díaz & Balbín Aria, 2024).

The environmental training of future graduates falls within these missions. Critical knowledge is required, supported by complex, inclusive, participatory, and innovative thinking, which contributes to solving environmental problems. Study Plans E, conceived from a perspective of continuing education, give special relevance to the political, scientific, cultural, and environmental dimensions, which require adherence to materialist dialectics to understand the contradictions of the current world and project its transformation (Artola Pimentel *et al.*, 2019).

In the training process, it is essential to take advantage of the potential of the academic, professional, research, and outreach components, so that graduates possess a solid scientific, ethical, humanistic, and environmental culture that coherently integrates environmental conflict: its perception, evaluation, and transformation. However, this construct is insufficiently addressed both in research and in the guiding documents of the country's environmental and educational policy. This observation gave rise to the present investigation, framed within the doctoral studies of the main author at the University of Camagüey. Its objective is to characterize the educational potential of environmental conflict in the training of university students for the development of environmental culture.

Methods

The research is based on the dialectical-materialist conception and assumes a qualitative approach, with a participatory action research design, structured in two complementary phases.



First phase: theoretical and documentary review.

The theoretical methods of analysis-synthesis and induction-deduction were used to systematize the categories of environmental conflict, environmental training, and educational potential. Likewise, a documentary analysis of the National Environmental Strategy, the MES Environmental Strategy, Study Plans E, and other regulations was carried out, in order to identify the explicit or implicit treatment of environmental conflict in said documents.

Second phase: obtaining empirical evidence.

A purposive sample of 48 third-year students of the Computer Engineering program, Regular Course modality, from the University of Camagüey, was selected. The inclusion criteria were: being officially enrolled in the third year of the Regular Course -- participating in the activities of the Political Theory subject, whose first topic addresses social conflict-- and expressing their informed consent to participate voluntarily. Those who did not complete all the required requirements were excluded. The sample consisted of 12 women and 36 men, aged between 21 and 22 years.

For data collection, the following empirical methods were applied:

- Direct observation in the areas surrounding the "Tejas Infinitas" Factory, located in the San Rafael neighborhood of the city of Camagüey, using a guide that allowed recording the types of pollution and visible impacts on the environment.
- Semi-structured interview with implicated social actors (neighbors, factory workers, and institutional representatives), aimed at reconstructing the evolution of the problem and the emergence of the conflict.
- Survey applied to students to explore their prior knowledge, interests, and perceptions about environmental conflict, as well as their final assessment of the training process.

The instruments were subjected to content validation by a panel of five experts in environmental education and research methodology. The ethical principles established in the Declaration of Helsinki were respected; written informed consent was requested, the anonymity of the participants and the confidentiality of the data were guaranteed, and the approval of academic and community authorities was obtained.

Based on the empirical evidence obtained, a set of training actions was designed and implemented that integrated environmental conflict into the academic, professional, research, and outreach components over a period of three months. To assess its partial results, the following indicators were established: cognitive (knowledge about environmental issues and conflict), affective-motivational (interest and satisfaction), and procedural (research skills and use of technological resources).



Results and discussion

1. The environmental problem in university student training: nature-society link

The nature-society relationship constitutes an ontological axis present in all sciences. Throughout history, this relationship has been characterized by profound human dependence on nature, the productive practice that enables social development, and an exploitative sense that has led to successive crises. Critical thinking aimed at transforming this link is therefore essential as a condition for achieving an authentic culture of society and nature. Treacy (2020) updates the Marxist approach to this relationship by integrating, from its episteme, aspects such as environmental crisis and the depredation of the environment.

Within this framework, political ecology emerges, a discipline that incorporates power relations and decision-making into the analysis of the society-environment relationship. One of its central objects is socio-environmental conflict, which includes the study and training of the subjects involved. As García Jiménez (2022) maintains, it is about building a new environmental rationality in which the social subject internalizes events from an interdisciplinary perspective.

Even in Cuban society, where neoliberal logics do not prevail, the environment is also aggressed and a separation occurs between the human and the natural. Hence the need to promote university environmental training that turns the student into a transforming agent, prepared to participate in decision-making and to implement action strategies.

Professional training in Cuban Higher Education is conceived as a comprehensive process that encompasses the instructive, educational, and developmental dimensions (Guerra Suárez & Espindola Artola, 2022). Two guiding ideas support it: the unity between education and instruction and the study-work link. This conception is enriched by the contributions of Montané Caballero and Pacheco Suárez (2024), who consider political ecology as a pedagogical process that can constitute a training alternative in universities.

Environmental training, as an aspect of professional training, has been addressed by various Cuban researchers. Hernández González *et al.* (2021, 2023) incorporate the ethical, psycho-ethical, and spiritual dimensions, while Iribarren *et al.* (2022) understand it as a critical pedagogical process that enables understanding and action on socio-ecological conflicts. Márquez Delgado *et al.* (2021) and Pérez Hernández (2021) provide alternatives focused on sustainability, and Santos Abreu *et al.* (2020) project it from public policy and curricular mainstreaming. These approaches align with the guidelines of UNESCO (2021) on education for sustainable development based on action, resilience, and social transformation.

This research assumes the definition of environmental training as a systematic, reflective, and contextualized process, aimed at developing competencies for practice as an educator and community environmental manager (Socarras Estrada *et al.*, 2025, p. 210). This definition emphasizes the active role that students, regardless of their specialty, must assume in



transforming the environment.

Despite these advances, the National Environmental Strategy and other guiding documents emphasize the environmental problem but omit an approach that explicitly recognizes the existence and educational potential of environmental conflict, which is present in a differentiated way in the Cuban context. Internationally, environmental conflicts have been extensively studied from political ecology by authors such as Luna Nemecio (2021), Munévar-Quintero and Valencia Hernández (2020), Perdomo López and Quirós Espinosa (2022), and Sánchez Vázquez (2022). In the Cuban case, although the country is far from neoliberalism, the prolonged crisis, economic reforms, the emergence of new economic actors, and environmental deterioration generate a scenario in which environmental problems and conflicts are increasingly manifested, demanding an educational response.

II. Epistemic approach to environmental conflict

The current environmental crisis, manifested in climate change, accelerated loss of biodiversity, resource depletion, and widespread degradation, evidences the evolution of numerous problems towards environmental conflicts within the framework of the capitalist systemic crisis (CITMA, 2021). From political ecology, this crisis is also a problem of knowledge and culture, a statement that the authors share.

Environmental conflict has been approached from multiple disciplines. At the conceptual level, the Dictionary of the Royal Spanish Academy assimilates conflict to combat, struggle, confrontation, or problem (Royal Spanish Academy, n.d.), which reflects the proximity between both categories. However, the scientific literature establishes substantial differences. Munévar-Quintero and Valencia Hernández (2020) define social conflict as a situation of opposition, confrontation, or divergence between people or groups, originating from incompatible interests, values, or objectives. When this opposition revolves around access, use, distribution of natural resources, or the effects of pollution, it is an environmental conflict.

Luna Nemecio (2021) studies the water conflict in Mexico and contributes to the conception of socioformation and sustainable development (Luna-Nemecio *et al.*, 2020). Sánchez Vázquez (2022), for his part, maintains that the analysis of environmental conflicts constitutes a consolidated, although still emerging, field that requires integrating political ecology and peace and conflict studies with the influence of Marxism.

This research assumes environmental conflict from a dialectical materialist conception as a type of social conflict. The distinguishing element that separates it from the mere environmental problem is the existence of manifest tensions between the subjects, actors, or social groups involved. While the environmental problem is defined by the objective impact on the environment, the conflict emerges when this impact generates disputes, controversies, or antagonisms in the public sphere. Sánchez Vázquez (2022) adds that these conflicts constitute



threats to well-being and security, particularly in the Global South, where they are associated with extractive projects, power inequalities, and violence.

The causes of environmental conflicts, according to Sánchez Vázquez (2022), include resource exploitation leading to dispossession, divergent valuations of nature, and institutional and governance factors. Perdomo López and Quirós Espinosa (2022) classify the actors into main and secondary, according to their participation in the generation, reception, and regulation of the damage, a criterion very useful for identifying barriers and facilitators in the solution.

The characteristics of environmental conflict reinforce its educational value. Induced by environmental degradation, it is at the same time political, social, economic, and territorial (Perdomo López & Quirós Espinosa, 2022). Sánchez Vázquez (2022) highlights its temporal dimension, the environmental damage it produces, and the reactions it generates in other actors. The authors of this work add that the impact of the conflict on subjects can promote the development of an environmental political culture, conditioned by class position, the damage suffered, and the role of the institutionality or civil society in each phase of the conflict.

An example in the Cuban context is that caused by the "Tejas Infinitas" Factory, located in the San Rafael neighborhood of the city of Camagüey. Initially, the environmental problem consisted of the emission of toxic gases, soot, and polluting particles during tile production, which affected air quality and the health of neighbors. The subsequent construction of housing less than 120 meters from the plant, without an environmental license or impact studies, aggravated the situation. The problem evolved into an environmental conflict when complaints, protests, public denunciations, and demands for institutional intervention arose, confronting the interests of the company, workers, residents, CITMA, and the local government. The case was documented in the newspaper *Juventud Rebelde*, and resulted in Sentence 140/2011 of the Provincial People's Court of Camagüey, which recognized the impact and the need to apply the precautionary principle.

The analysis of this conflict shows how, by overcoming the dimension of the problem, a clearer perception of the categories of space and time in environmental matters is facilitated, the social essence of the environmental crisis is reflected, and an eminently transdisciplinary scenario is configured. Despite this richness, Cuban guiding documents and study plans do not organically incorporate environmental conflict. Perdomo López and Quirós Espinosa (2022) already warned that Cuban publications on social conflicts are scarce, and even more limited is their integration into the training process. This gap opens the possibility of developing the educational potential of environmental conflict from an innovative position, integrating the environmental, evaluative, and pedagogical aspects.

Regarding the category of educational potential, the theoretical review shows two tendencies: one focused on the internal aspects of the subject (cognitive, socio-affective, motivational) and another on the external aspects of the pedagogical context. Current education emphasizes the training of critical and autonomous subjects, capable of transforming their reality (Vargas



Betancourth, 2022), and highlights the importance of placing the world --and not just the individual-- at the center of the educational process (Biesta, 2023). For the purposes of this study, educational potential is assumed as the set of intrinsic formative possibilities offered by both the teaching content and the pedagogical situation in which it unfolds (Lugo Márquez & Mena Lorenzo, 2016). From this perspective, environmental conflict constitutes content with a high formative load, as it allows articulating disciplinary knowledge, developing critical thinking, and promoting a socio-environmental ethic.

III. Training actions from the components of the university process and main results

With the aim of contributing to the formation of environmental culture, professional modes of action, and ethical values, a set of actions was designed that integrated environmental conflict into the training subprocesses, taking as its axis the subject Political Theory and the university-community link. The implementation of these actions involved close collaboration between teachers and students, in which shared responsibility was a dynamic factor (Espindola Artola *et al.*, 2020).

The actions are based on the following theoretical-methodological assumptions:

- Environmental conflict is a type of social conflict in which subjects express antagonisms from their class or group positions.
- It manifests itself in a given civil society, originated by the appropriation of natural resources or the effects of pollution.
- Its solution process contributes to transforming the environmental culture of those involved and promoting a more responsible mode of action.
- It requires a deep diagnosis of causes, structure, participating subjects, characteristics, and phases, as well as methods of mediation and transformation.

Below are examples of actions for each training component:

- Academic component: environmental conflict was introduced as content of topic 1 ("Social conflict") of the subject. Independent study tasks were designed that involved the identification of environmental problems in the National Environmental Strategy, their contrast with the local reality, and the analysis of their possible transformation into conflicts. The students built definitions of environmental conflict using artificial intelligence tools, which favored conceptual appropriation.
- Professional and research component: a participatory environmental diagnosis was carried out in the San Rafael community, supported by observation, survey, and interview. The community impact was assessed and an awareness workshop was organized with factory workers, using ICT. As an evaluative closure, the students prepared research papers and dissertations.
- University outreach component: students participated in socio-community projects aimed



at the prevention, mediation, and transformation of environmental conflicts. Awareness meetings with neighbors and artistic-cultural activities that represented conflicts, their causes, and possible transformative solutions were promoted.

The intervention was developed over three months, with the approval of directors and the acceptance of the neighbors. The year's pedagogical collective and the main teacher supported the actions, led by the teacher of the aforementioned subject.

With the application of the instruments as part of the participatory environmental diagnosis and the initial exploration carried out with students, it was found that:

Table 1.
Summary of survey results by indicators

Indicator	Criterion	Categories / Levels	Students	(%)
Cognitive	Knowledge and conceptual differentiation	Sufficient prior knowledge	14	29,1
		Notable shortcomings (do not differentiate problem from conflict)	34	70,8
Affective-motivational	Interest in environmental topics	High interest and satisfaction	40	83,3
		Moderate interest	5	10,4
		No interest	3	6,2
Procedural	Research skills and use of ICT	High level of development	38	79,1
		Medium level	7	14,5
		Low level / very poor	3	6,2

Source. Own elaboration based on the research conducted.

29.1% of the students had some prior knowledge about environmental issues and environmental conflicts, obtained from readings and audiovisual materials observed on the subject. While 70.8% showed great shortcomings in this regard, not finding differences between environmental problem and conflict.

Regarding the affective-motivational indicator, 40 students, representing 83.3%, showed interest in deepening topics related to the environment, its care, protection, and transformation, when it is agressed and impacts on life and people's well-being are produced. The same percentage ensures that they would feel satisfied studying and inquiring about the topic. While 10.4% (5) showed moderate interest and 6.2% (3) showed no interest at all. On the other hand, expectations regarding the subject Political Theory, 93.7% (45), were not positive, expressing that previously received content related to these topics was worked on in a very theoretical way, without the due link with practice.

Regarding the procedural indicator, the development of research skills and information search using technological resources was identified in 79.1% of the students (38). The positive influence of motivation for the career they study and the activities they have carried out as part of the curriculum is noted. On the other hand, 14.5% (7) show some of the aforementioned skills and in 6.2% (3), the development achieved is very poor, due to not having motivation towards scientific activity.

The results presented allow identifying potentialities regarding the motivational-affective and procedural indicators, given essentially in the interest in the topic and the development of research skills in a large part of the students; however, expectations need to be reversed, as well as the cognitive indicator due to insufficient prior knowledge about the environmental topic and conflict.

Regarding the participatory environmental diagnosis, the results obtained are summarized below: 100% of the students organized in teams participated in the tour of the areas surrounding the factory, applying interviews to actors and community neighbors. These activities were accompanied by tasks oriented from the academic and professional-research components. The revealed findings were socialized in a workshop that constituted an object of evaluation in the subject, in which the deepening of the definitions of environmental problem and conflict, characteristics and causes that make them different, was verified.

Table 2.
Summary of qualitative findings from the participatory workshop

Aspect analyzed	Main finding	Frequency/Observation
Corroboration of the conflict	Empirical verification of the existence of the conflict and tensions between actors (management vs. community)	Unanimous (48 students)
Discursive contradiction of the management	Awareness of environmental damage, but subordination of this to productive interests	Evidenced in interviews and debates



Omission in the guiding documents	Absence of the category "environmental conflict" in national and educational policies	Identified by 100% of participants
Satisfaction with the methodology	Positive assessment of the connection between Political Theory, computer applications, and real-world issues	39 students (81.25 %)

Source. Own elaboration based on the research conducted.

The students corroborated the existence of the environmental conflict, the positions of the directors, focused on production, regardless of the fact that they are aware of the damage caused to the community. The neighbors expressed their dissatisfaction and confidence in the legal solution to this conflict. For the students, it was a contradiction that the documents referring to environmental policy and Higher Education do not include environmental conflict. The evaluative results obtained from the application of the training actions are summarized in the following regularities:

- The incorporation of environmental conflict from the academic perspective and the handling of official documentation allowed students to verify the absence of this category in the guiding documents, generating a critical debate on the limitations of the current environmental policy.
- The participatory diagnosis confirmed that the "Tejas Infinitas" case constitutes a genuine environmental conflict, evidencing that the lack of territorial planning, the omission of environmental licenses, and weak citizen participation caused the problem to escalate into a socio-environmental dispute.
- The independent study activities, combined with the use of technological resources, aroused notable interest in the topic, increasing motivation towards a subject that was previously perceived as excessively theoretical.
- The integration of investigative methods and computer applications contributed to the development of professional skills, while direct interaction with the conflict and the community stimulated environmental sensitivity, critical thinking, and the adoption of modes of action committed to the environment.
- Both in the students and in the community actors, a more reflective and participatory environmental culture began to be fostered, expressed in the assessments collected in the surveys and in the testimonies of the neighbors during the meetings.

These findings coincide with the approaches of Iribarren *et al.* (2022) regarding the pedagogical power of environmental conflict and confirm the need for the university professor to have didactic-methodological preparation that allows them to lead training processes of this nature (Guerra Suárez & Espindola Artola, 2022).



Conclusions

The epistemological systematization carried out reveals that environmental conflict holds significant educational potential for the environmental training of university students, a potential that has not been sufficiently recognized in research, strategies, or Cuban environmental legislation.

The inclusion of the category of environmental conflict in regulations and guiding documents is imperative, so that its formative value is regulated and harnessed from public policy.

The implementation of training actions articulated with the academic, professional, research, and outreach components, based on the subject Theory and Contemporary Political Processes, proved to be an effective way to raise the environmental culture of students, teachers, and citizens. The proposal offers tools that stimulate participation, strengthen institutional management, and consolidate the university-community link, in correspondence with the current demands of the improvement of Cuban Higher Education.

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Declaration of author responsibility:

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Jesús Tovar Mendoza. Was in charge of guiding the sociological approach of the research and contributed to the improvement of the scientific text.

Modesta López Mejías. Was in charge of the methodological review of the research and the guidance of the pedagogical approach.

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