ROLE OF EDUCATION IN PROMOTING ENVIRONMENTAL ETHICS

ROL DE LA EDUCACIÓN EN FOMENTAR UNA ÉTICA AMBIENTAL

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Abstract

In a global context marked by a profound environmental crisis, education emerges as a fundamental tool to drive the development of a committed and responsible environmental ethics. This research focuses on analyzing how educational processes can contribute to the formation of values, attitudes, and behaviors oriented towards environmental protection. The central objective of this study was to examine the role of education in building a strong environmental awareness and the adoption of an ethical commitment towards sustainability. The main findings indicate that education plays a key role in various key aspects. Education plays a crucial role in the development of environmental competencies, equipping students with skills such as critical thinking, problem-solving, and responsible decision-making, which are essential for effective environmental action. It establishes a fundamental link between the knowledge of environmental problems and the personal and collective commitment to address them. By acquiring a deeper understanding of the complexity of the environment, students develop a sense of responsibility and an intrinsic motivation to protect the planet. Furthermore, education fosters a systemic and interdisciplinary vision, allowing students to understand the interrelationships between different systems (social, economic, ecological) and their impact on the environment. This holistic perspective is crucial for an integral environmental ethics. In conclusion, education emerges as a fundamental pillar to empower individuals and communities as agents of positive change, capable of assuming an ethical responsibility and acting in favor of the protection of the planet and the construction of a sustainable future.

Keywords: Environmental education, Environmental awareness, Environmental competencies, Ethical commitment, Sustainability, Behavioral change

Resumen

En un contexto global marcado por una profunda crisis ambiental, la educación emerge como una herramienta fundamental para impulsar el desarrollo de una ética ambiental comprometida y responsable. La presente investigación se enfoca en analizar cómo los procesos educativos pueden contribuir a la formación de valores, actitudes y comportamientos orientados a la protección del medio ambiente. El objetivo central de este estudio fue examinar el papel de la educación en la construcción de una conciencia ambiental sólida y en la adopción de un compromiso ético hacia la sostenibilidad. Los principales hallazgos indican que la educación desempeña un rol clave en diversos aspectos clave. La educación juega un papel crucial en el desarrollo de competencias ambientales, dotando a los estudiantes de habilidades como el pensamiento crítico, la resolución de problemas y la toma de decisiones responsables, las cuales son esenciales para una acción ambiental efectiva. Establece un vínculo fundamental entre el conocimiento sobre los problemas ambientales y el compromiso personal y colectivo para abordarlos. Al adquirir una comprensión más profunda de la complejidad del medio ambiente, los estudiantes desarrollan un sentido de responsabilidad y una motivación intrínseca para proteger el planeta. Además, la educación fomenta una visión sistémica e interdisciplinaria, permitiendo a los estudiantes comprender las interrelaciones entre los diferentes sistemas (sociales, económicos, ecológicos) y su impacto en el medio ambiente. Esta perspectiva holística es crucial para una ética ambiental integral. En conclusión, la educación se erige como un pilar fundamental para empoderar a los individuos y las comunidades como agentes de cambio positivo, capaces de asumir una responsabilidad ética y actuar en favor de la protección del planeta y la construcción de un futuro sostenible.

Palabras clave: Educación ambiental, Conciencia ambiental, Competencias ambientales, Compromiso ético, Sostenibilidad, Cambio de comportamiento

Introduction

Over the past three decades, the global environmental crisis has worsened significantly. Problems such as climate change, pollution, biodiversity loss, ecosystem degradation and the depletion of natural resources pose serious threats to the sustainability of the planet (IPCC, 2021; UNEP, 2022). According to data from the United Nations (UN), 75% of the Earth's surface has been modified by human activity and around 66% of the oceans are in a state of degradation (UN, 2022). These alarming figures highlight the urgent need to promote an environmental ethic that guides the relationship between humans and nature.

This paper, inspired by the thought of the Cuban national hero José Martí, who stated that "education is the only way to save the world" (Martí, 1891), and by the words of the revolutionary leader Fidel Castro Ruz, who pointed out that "the fight to save the planet is a task for everyone" (Castro, 1992), considers that education plays a fundamental role in the formation of responsible citizens committed to protecting the environment, within the framework of a culture for nature. Hence the importance of promoting values, attitudes and behaviors that respect the natural environment.

Previous studies have shown that environmental education can increase citizen knowledge, awareness, and participation in protecting the planet (Barraza & Cuarón, 2004; Álvarez-García et al., 2018). However, there are still significant gaps in research on how education can effectively contribute to building a strong and widespread environmental ethic in society.

Based on the above, the research question is: How can education contribute to the promotion of environmental ethics? In this sense, the objective of this research is to analyze the role of education in the promotion of environmental ethics, identifying the most effective pedagogical approaches and educational strategies to promote ecological awareness and responsibility in the population.

The importance of investigating the role of education in fostering environmental ethics lies in the urgent need to address the environmental challenges facing the planet. In a context of climate change, biodiversity loss and pollution, education plays a fundamental role in forming environmentally conscious and responsible individuals. Understanding how education can promote a strong environmental ethic is essential to developing effective strategies that promote sustainability and the conservation of natural resources.

Context

The figures of the current global context are overwhelming and speak for themselves about the urgency of addressing the environmental challenges affecting humanity. According to scientific reports and data from organizations Climate change is one of the greatest challenges we face on an international level. For example, the Intergovernmental Panel on Climate Change (IPCC) has warned that if urgent action is not taken to reduce greenhouse gas emissions, we could face catastrophic consequences such as rising global temperatures, rising sea levels, extreme weather events and the loss of vital ecosystems.

Biodiversity loss is another serious problem affecting the planet. According to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), we are witnessing a mass extinction crisis, with a rate of species loss unprecedented in human history. Deforestation, air and water pollution, overexploitation of natural resources and soil degradation are just some of the causes contributing to this crisis.

These alarming figures, shown in Table No. 1, reflect the urgent need to address environmental challenges in a comprehensive and urgent manner. Healthy ecosystems and biodiversity are fundamental to human well-being, food security, water supply and natural disaster mitigation. It is therefore crucial that we take concrete steps at individual, community, national and international levels to protect and preserve our natural environment for future generations. Education plays a crucial role in this process, as it can empower people with the necessary skills to achieve their goals knowledge, skills and values necessary to act responsibly and sustainably in the face of current and future environmental challenges.

Definition and analysis of the concepts of environmental ethics

"Environmental education is the only way to preserve the world that our ancestors left us and the only way to prepare the one that our descendants will inherit." "Defending nature is defending life, and that is man's first ethical obligation."

Jose Marti

Environmental ethics is a field of study that focuses on examining the moral principles and values that govern the relationship between humans and the environment. Within this broad field, different ethical approaches or schools of thought have been developed that analyze this relationship from different perspectives.

One of the main currents is anthropocentric ethics, which considers that the human being is the center and the most important value, and that the environment has value to the extent that it serves human interests and needs (Callicott, 1984; Rolston, 1988). From this view, nature must be preserved and cared for because it is useful and necessary for the survival and well-being of the human species.

TABLE 1. Alarming figures of environmental pollution and its consequences for humanity

Type of Pollution	Alarming figures	Consequences for humanity	Fountain
Pollutionfrom the air	9 out of 10 people in the world breathe polluted air. 7 million premature deaths a year. PM2.5 levels have increased by 15% since 2010.	Respiratory, cardiac and cerebrovascular diseases. Decreased life expectancy. Deterioration in quality of life. Economic impacts due to health costs and loss of productivity.	WHO, 2021; UNEP, 2022
Pollutionfrom the water	2 billion people lack access to safe drinking water. 3.5 billion people lack access to adequate sanitation. 80% of the world's wastewater is discharged untreated.	Diarrheal diseases, cholera, typhus and other waterborne diseases. Pollution of aquatic ecosystems and biodiversity. Shortage of safe drinking water, limiting human development.	UNICEF and WHO, 2021; UN-Water, 2021
Pollutionfrom the ground	One third of the world's soils are degraded. Reduction in productivity and capacity to capture carbon. It affects food security, human health and biodiversity.	Decreased food production. Degradation of terrestrial ecosystems. Contamination of groundwater.	FAO and ITP, 2018; UNEP, 2016
Climate change	The average global temperature has increased by 1 degree Celsius since the pre-industrial era. Extreme weather events are becoming more frequent and intense.	Threats to food security, access to water, biodiversity and infrastructure systems. Rising sea levels, floods and droughts. Natural disasters and population displacement.	IPCC, 2021; WMO, 2021
Loss of biodiversity	One million species of plants and animals are threatened with extinction. This affects ecosystem health, food security and the planet's ability to regulate the climate.	Loss of ecosystem services essential for human life. Deterioration of air and water quality. Vulnerability to the impacts of climate change.	IPBES, 2019

Fountain: Prepared by the authors based on the literature consulted

On the other hand, biocentric ethics proposes a broader vision in which all living beings, regardless of their species, have intrinsic value and deserve moral consideration (Taylor, 1986; Schweitzer, 1949). Under this approach, human actions must respect and preserve life in all its forms, avoiding causing harm or suffering to other organisms.

Finally, it is highlighted that ecocentric ethics goes further and proposes that moral value should extend to ecosystems and the Earth as a whole (Naess, 1973; Callicott, 1989). From this perspective, human beings are an integral part of nature and must act in a way that maintains the health and balance of ecological systems.

These different ethical approaches have concrete implications for the way in which the relationship between human beings and the environment is conceived, and for the actions and policies that must be adopted to protect and care for the planet.

From Table No. 2 different analyses could be performed:

First, environmental ethics has developed around different ethical approaches that address the relationship between humans and the environment. Second, in the case of anthropocentric ethics, based on the usefulness of the environment for humans, biocentric ethics, which recognizes the intrinsic value of all living beings, and ecocentric ethics, which considers ecosystems as entities with their own value, are fundamental perspectives in this field.

Anthropocentric ethics, on the other hand, by focusing on the utility of the environment for humans, emphasizes the importance of considering the benefits and dependence that humans have on natural resources. However, its limitation to the utilitarian value of the environment can lead to excessive exploitation of resources and ignorance of the rights of other species.

Biocentric ethics expands the moral sphere beyond humans, recognizing the intrinsic value of all living beings and advocating the conservation of biodiversity. This perspective promotes the protection of ecosystems and responsibility towards future generations, although it may face challenges in decision-making when human interests and the protection of other species conflict.

Ecocentric ethics, by considering ecosystems as entities with their own value, highlights the importance of the integrity of natural systems and promotes a holistic vision of the world. It recognizes the interconnection of

TABLE 2. Comparative status of the different currents that represent environmental ethics

Indicator	Anthropocentric ethics	Biocentric ethics	Ecocentric ethics
Worth of the environment	Utility for humans	Intrinsic value of all living beings	Worth intrinsic of ecosystems
Approach	Human-centered	Focused on all living beings	Focused on ecosystems
Responsibility	Conservation for human benefit	Conservation of biodiversity	Preservation of the biosphere
decision making	Consider human well-being	Consider the well-being of all species	Consider the ecological integrity
Reviews	Ignores the intrinsic value of the environment	You may neglect human needs	Implementation complex practice

Fountain: Prepared by the authors based on the literature consulted.

all elements of the ecosystem and emphasizes human responsibility towards the preservation of the biosphere. However, its practical application can be complex and require a profound re-evaluation of the relationship between humans and nature.

As to which ethical perspective is most appropriate, there is no definitive answer, as each approach has its advantages and disadvantages. The choice of an environmental ethic will depend on the values and principles of each individual or community, as well as the specific circumstances of each environmental situation. It is important to consider that a comprehensive environmental ethic can combine elements of the different perspectives to address environmental challenges in a more complete and balanced way.

Relationships between environmental ethics, sustainability and sustainable development

Environmental ethics, sustainability and sustainable development are closely interrelated. Environmental ethics deals with examining the moral principles and values that govern the relationship between human beings and the environment, which has direct implications for building a more sustainable society (See Table No. 3).

Sustainability (WCED, 1987), on the other hand, is defined as the ability to meet the needs of the present without compromising the ability of future generations to meet their own needs. It involves a balance between economic development, environmental protection, and social well-being. Environmental ethics and sustainability are closely related. Environmental ethics provides the moral framework for sustainable decision-making, while sustainability seeks to put those principles into practice in the real world. Environmental ethics guides the search for sustainable solutions to environmental problems, while sustainability focuses on the implementation of those solutions.

According to Gladwin et al. (1995), sustainability involves "a process of maintaining natural capital without compromising the integrity, stability and beauty of natural systems." From an ethical perspective, this requires recognizing that the environment has an intrinsic value that goes beyond its usefulness to humans. Biocentric and ecocentric ethics, for example, propose expanding the moral circle to include all living beings and ecosystems as a whole (Taylor, 1986; Naess, 1973).

Sustainable development, defined by the World Commission on Environment and Development (1987) as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs", implies an ethical commitment to intergenerational equity and the preservation of natural capital (Dresner, 2008). This means adopting a long-term vision and assuming the moral responsibility of caring for the planet for future generations.

In this sense, environmental ethics is fundamental to underpin and guide actions towards sustainability and sustainable development. Leopold (1966) and Rolston (1988) have argued that building a sound ecological ethic is a prerequisite for achieving the social and environmental transformation necessary for a sustainable future.

TABLE 3. Environmental ethics, sustainability and sustainable development

Indicator	Environmental ethics	Sustainability	Sustainable development
Definition	Set of principles and values that guide the relationship between human beings and the environment.	Ability to meet the needs of the present without compromising the ability of future generations to meet their own needs.	Integrative concept that seeks to reconcile economic growth, environmental protection and social well-being.
Aim	Establish a relationship of respect and responsibility towards the natural world.	Balancing economic development, environmental protection and social well-being.	Achieving a viable future for present and future generations.
Approach	Based on moral values and ethical principles.	Focusing on the planet's carrying capacity and the intergenerational equity.	Seeks a holistic vision that integrates the three pillars: economy, environment and society.
Role in decision making	Provides a moral framework for sustainable decision-making.	It guides the search for solutions that satisfy current needs without compromising the future.	Guide decision making to achieve development that is economically viable, environmentally responsible and socially equitable.
Importance in sustainable development	Fundamental to ensure that development actions do not compromise the well-being of present or future generations, nor the integrity of the planet.	It provides a basis for sustainable decision-making and the implementation of solutions that meet present needs without compromising the future.	Essential to achieving a sustainable future that meets the needs of present and future generations without compromising the health of the planet.
Application examples	Fight against climate change, biodiversity conservation, sustainable use of natural resources.	Implementation of renewable energy, sustainable management of water resources, sustainable agriculture.	UN Sustainable Development Goals (SDGs), Agenda 2030.

Source: Prepared by the authors, based on the literature consulted.

Ultimately, environmental ethics, sustainability and sustainable development are mutually reinforcing. A robust environmental ethic based on respect and responsibility towards nature is crucial to guide decision-making processes and actions towards building more sustainable societies in the long term.

Pedagogical models and educational approaches that promote environmental awareness and responsibility

Environmental education is essential to foster people's awareness and responsibility towards caring for the environment. In this sense, various pedagogical models and educational approaches have proven to be effective in achieving this objective (See Table No. 4).

Various lessons for action can be derived from Table No. 4 :

In the constructivist approach, teachers must design activities that allow students to explore, experiment and reflect on environmental issues, so that they can develop a deep understanding and personal commitment to environmental protection (Piaget, 1976; Vygotsky, 1978; Novo, 2009).

TABLE 4. Pedagogical models and educational approaches that promote environmental awareness and responsibility

Approach	Description	Goals	Strategies	Advantages	Disadvantages
Model of education environmental (Alvarez and Vega, 2009)	• Seeks form citizens with local awareness and planetary for grasp the complexity of the environment and act responsibly in view of issues environmental.	• Citizens with awareness environmental local and global. • Comprehension of the complexity of the environment. • Capacity for act responsibly to environmental problems.	• Implementation of resumes that integrate education environmental in all the areas. • Training of teachers in environmental education. • Participation of the community in educational projects environmental.	• Holistic approach that covers the local dimension and • global. • Promotes the responsibility individual and collective in he careful of the environment. • Allows develop skills for the environmental action.	• Requires a profound change in culture school and the teacher training. • Implementation can be complex and plaintiff of time and resources.
Approach constructivist (Piaget, 1976; Vygotsky, 1978; Novo, 2009)	• Based in the construction of the knowledge to leave of the knowledge previous and the interaction with the around.	• Students that build their own knowledge environmental. • Deep understanding and personal commitment with the protection of the half atmosphere. • Development of critical skills and reflective.	• Activities of exploration, experimentation and reflection about problematic environmental. • Learning collaborative and significant.	• Allows comprehension Deep and contextualized of the issues environmental. • Promotes he learning autonomous and the Responsibility staff. • Develop skills for the resolution of problems and taking of decisions.	• Requires a more preparation and dedication for part of the teacher. • The evaluation of the learning can be more complex.
Learning based on projects (Krajcik& Blumenfeld, 2006; Edelson, 2001)	• It involves that the students work in projects collaborative for identify and resolve issues community environmental.	• Students that identify and resolve environmental problems real. • Development of skills of thought critical, decision making and leadership. • Sense of responsibility towards caring for the environment.	• Projects collaborative oriented to the resolution of issues environmental. • Research and data analysis • Development of products either solutions to environmental problems.	• Allows a practical application of knowledge and skills. • Promotes work in equipment, the communication and collaboration. • Develop a sense of responsibility social and environmental.	• Requires a elderly planning and organization by part of the teacher. • The evaluation of the learning can be more complex.
Education for the development sustainable (UNESCO, 2017, 2014; Tilbury, 2011)	• Integrate the principles of sustainability in all levels and areas of the system educational.	• Trained people to make decisions informed and responsible for of the environment, the society and the economy. • Understanding the interdependence between social systems, economic and environmental. • Active participation in the construction of a sustainable future.	• Curricula that integrate education for he development sustainable in all the areas. • Training of teachers in education for he sustainable evelopment. • Participation of the community in educational projects for he development sustainable.	• Comprehensive approach that covers the social dimensions, economic and environmental. • Promotes he critical thinking, creativity and the innovation for the sustainability. • Prepare to the people for face the challenges of the future.	• Requires a profound change in culture school and the teacher training. • Implementation can be complex and plaintiff of time and resources.

Source: Prepared by the authors based on the literature consulted.

In the project-based learning approach, teachers should guide students in identifying and solving environmental problems in their community, encouraging collaborative work, critical thinking, decision making and leadership (Krajcik & Blumenfeld, 2006; Edelson, 2001).

In the model of education for sustainable development, teachers must promote an integrated vision of human development and environmental sustainability, empowering students to make informed and responsible decisions at local and global levels (UNESCO, 2014, 2017; Tilbury, 2011).

In the service-learning approach, teachers must organize community service activities, such as reforestation campaigns, river clean-ups or community gardens, so that students can apply their knowledge and skills in practice, developing a sense of commitment and empowerment towards environmental protection (Furco & Billig, 2002).

In the experiential education model, teachers must facilitate practical and experiential activities that allow students to interact directly with the environment, acquiring greater knowledge and sensitivity towards environmental problems (Kolb, 1984).

Education: its contribution to the development of environmental awareness

The relationship between education and environmental awareness is fundamental and is supported by several solid arguments. Firstly, education plays a key role in the formation of values and attitudes towards the environment. Through educational processes, a holistic view of environmental issues can be promoted, generating awareness about the importance of protecting and conserving the environment, as highlighted by Álvarez and Vega (2009).

Environmental education enables the development of essential skills for responsible environmental action. Students acquire skills such as critical thinking, problem solving and decision making, which enables them to identify and actively participate in the search for solutions to environmental problems, as noted by Gutiérrez and Pozo (2006).

Another relevant aspect is the link that environmental education establishes between knowledge about environmental problems and personal and collective commitment to address them. By understanding the complexity of the environment, students develop a sense of responsibility and an intrinsic motivation to act in its protection, as suggested by Novo (2009).

An education oriented towards environmental awareness contributes to the development of citizens committed to sustainability. These informed and critical citizens are better prepared to participate in decision-making, exercise leadership and promote changes in their communities, according to UNESCO (2014). Finally, environmental education fosters an interdisciplinary and systemic approach, allowing students to understand the interrelations between different systems and their impact on the environment. This holistic perspective is essential for the development of a comprehensive environmental awareness, as Tilbury (2011) points out.

Strategies and pedagogical approaches to foster environmental ethics in education

Educational strategies that foster environmental awareness in students are based on innovative and participatory pedagogical approaches. One of these strategies is experiential learning, which involves students in practical and experiential activities that allow them to connect with the environment in a direct and meaningful way (Hungerford & Volk, 1985; Tilbury, 2011). This can include field projects, experiments, and awareness campaigns.

Another effective strategy is problem-based learning, in which students are confronted with real environmental problems, motivating them to investigate, analyze, and propose creative solutions (Krajcik & Blumenfeld, 2006; Álvarez & Vega, 2009; Novo, 2009). This involves identifying relevant environmental problems, investigating their causes and consequences, and developing viable proposals for action.

A relevant strategy is service-learning, in which students participate in community service activities that address environmental issues, such as reforestation campaigns, river clean-ups, or the creation of urban gardens (Celio et al., 2011). By applying their knowledge in practice, students strengthen their sense of responsibility and empowerment towards the protection of the environment (Furco and Billig, 2002).

Furthermore, the use of information and communication technologies (ICT) can enhance environmental learning. Tools such as simulations, educational games, and online collaboration platforms allow students to explore and experiment with environmental issues in an interactive and engaging way (Hwang et al., 2018).

Action education promotes students' active participation in environmental protection initiatives, allowing them to apply their knowledge and skills in practice and develop a sense of responsibility and empowerment (Hungerford & Volk, 1985; Tilbury, 2011; UNESCO, 2017). Some activities may include environmental volunteering, service projects and environmental entrepreneurship.

On the other hand, curricular integration is essential for students to understand the interconnection between the environment and the different disciplines (Krajcik & Blumenfeld, 2006). Finally, teacher training is crucial for teachers to be able to implement these strategies effectively (Álvarez & Vega, 2009).

Role of teachers

Teachers play a fundamental role in the formation of environmental ethics in students. Through their teaching practices, teachers can promote the development of values, attitudes and behaviors that respect the environment.

One of the key aspects is the integration of environmental education in a transversal way in the school curriculum (Tilbury, 1995). Teachers can incorporate topics related to sustainability, conservation of natural resources and ecological responsibility in various subjects, such as natural sciences, geography, economics or ethics. In this way, students can analyze the interrelations between natural, social and economic systems, and develop a holistic vision of environmental care.

Therefore, educators can encourage experiential learning and the development of practical skills through activities such as field trips, action research projects, and environmental volunteer programs (Wals, 2007). These experiences allow students to apply their knowledge in real-life situations, develop a sense of responsibility and commitment to protecting the environment, and acquire leadership and teamwork skills.

On the other hand, teachers can play a key role in promoting environmental values through modeling and critical reflection (Hungerford & Volk, 1990). By demonstrating environmentally friendly attitudes and behaviors in their daily lives, teachers can inspire students to adopt more sustainable lifestyles. Furthermore, by encouraging discussion and analysis of ethical dilemmas related to the environment, teachers can help students develop critical thinking and deeper environmental awareness.

In this sense, the training and professional development of teachers in environmental education and ecological ethics are fundamental (Tilbury & Wortman, 2008). Teacher training programs should address aspects such as the curricular integration of environmental education, the design of meaningful learning activities, and the development of skills for facilitating processes of reflection and ethical decision-making.

Key elements of an ethical environmental education

Environmental education with an ethical focus must go beyond the mere transmission of knowledge about environmental problems. It is essential to promote the development of skills, values and active participation that allow students to take a leading role in building a sustainable future.

In addition to the elements mentioned above, ethical environmental education must include other key components. For example, fostering students' empathy and emotional connection with nature and other forms of life (Chawla & Cushing, 2007). This involves generating meaningful experiences that allow them to appreciate the beauty and fragility of the environment, thus developing a sense of belonging and responsibility towards its care.

It is essential to promote understanding of the interrelationships between social, economic and environmental systems (Tilbury, 1995). This helps students to understand the complexity of environmental issues and to recognise how their individual and collective actions can have impacts at local, national and even global levels.

On the other hand, ethical environmental education should foster the development of agency and empowerment of students (Hsu, 2004). This involves providing them with tools and opportunities to identify problems, propose solutions and actively participate in the transformation of their communities towards sustainability.

A key element is that environmental education is aligned with ethical principles such as justice, equity and solidarity (Sauvé, 1996). This means addressing the social, economic and political dimensions of environmental issues, recognizing how they disproportionately affect the most vulnerable groups in society.

Challenges and opportunities

The implementation of environmental education with an ethical focus faces various challenges, but also presents important opportunities for its strengthening and effectiveness.

A key challenge is to address the lack of resources and training for teachers in environmental education. According to a UNESCO study (2021), many teachers lack the training and teaching materials necessary to effectively integrate environmental education into their teaching practices. To overcome this limitation, it is essential to invest in teacher professional development programs that provide them with the skills to effectively integrate environmental education into their teaching practices conceptual, methodological and pedagogical tools required to promote environmental ethics in the classroom (Tilbury & Wortman, 2008).

Institutional and political barriers can hinder the implementation of environmental education programmes. Various studies have pointed out that a lack of political will, insufficient budget allocation and weak coordination between different levels of government hinder the transversal integration of environmental education in educational systems (Sauvé, 2005). To address these challenges, it is necessary to strengthen the commitment and leadership of educational authorities, as well as to promote regulatory frameworks and public policies that support and facilitate the implementation of environmental education with an ethical approach.

Fostering collaboration between different social actors, such as non-governmental organizations, local communities and the private sector, can be a key opportunity to promote effective environmental education (Wals & Lenglet, 2016).

By establishing strategic alliances, these actors can contribute resources, knowledge and experiences that enrich educational programs and strengthen their impact on the formation of citizens committed to caring for the environment.

Leveraging information and communication technologies (ICTs) can be an opportunity to strengthen environmental education. According to an OECD study (2019), the use of digital tools, such as online learning platforms, augmented reality and educational games, can facilitate access to teaching resources, promote interactivity and collaborative learning, and expand the reach of environmental education programs, especially in contexts with limited resources.

Impact assessment

Evaluating the impact of environmental education on the formation of environmental ethics is essential to understanding its effectiveness and improving educational programs. Key elements to consider include:

Development of evaluation instruments and methodologies

Several studies have proposed the use of surveys, interviews, observations, and analysis of student work as tools to evaluate the impact of environmental education (Hungerford & Volk, 1990; Hsu, 2004). These methodologies allow for the collection of information on changes in students' knowledge, attitudes, skills, and behaviors.

Analysis of changes in attitudes, knowledge and behaviors

Research has shown that environmental education can lead to positive changes in students, such as increased knowledge about environmental issues, more favorable attitudes toward environmental protection, and the adoption of more sustainable behaviors (Chawla & Cushing, 2007; Wals, 2007). Analyzing these changes over time is necessary to understand the impact of educational programs.

Identifying success factors

On the other hand, it has been pointed out that the success of environmental education programs depends on factors such as teacher commitment and training, curricular integration, community participation and institutional support (Tilbury & Wortman, 2008; Sauvé, 1996). Understanding these factors allows for the design and implementation of more effective programs.

Examples of good practices in environmental education

The programs "Guardianes del Bosque" in Colombia and "Cultivando Valores" in Mexico share characteristics and factors that contribute to their success in promoting environmental education with an ethical focus. Both programs are characterized by their participatory and experiential methodology, which involves students in practical and reflective activities on environmental conservation. In addition, they stand out for their ethical approach, which promotes values such as responsibility, respect and sustainability.

These programs are also closely linked to the local context, adapting to the specific needs of the communities where they are implemented, and foster collaborative work between students, teachers, parents and the community at large. To ensure their success, the commitment of the educational community, institutional support, the availability of adequate resources and periodic evaluations to adjust and improve the programs are essential.

In order to generalize these experiences, it is suggested that programs be adapted to different contexts, that the exchange of experiences between successful programs be encouraged, that quality educational materials be developed, that teachers be trained in environmental education, and that research be conducted to evaluate the effectiveness of the programs. In short, environmental education with an ethical approach can be a powerful tool to promote responsible environmental awareness in students and contribute to the construction of a more just and sustainable society.

Future of environmental education

The future of environmental education depends on several key factors. First, the implementation of sound public policies and the commitment of governments at all levels are essential to ensure the sustainability and strengthening of environmental education. This involves allocating sufficient resources, establishing appropriate regulatory frameworks and promoting the integration of environmental education into educational systems.

The role of teachers is also a key to the success of environmental education. It is therefore essential to provide solid initial and ongoing training for teachers, so that they can effectively integrate this approach into their teaching practices and foster the development of environmental awareness in students. From this perspective, environmental education must adapt to the changes and challenges of today's world, incorporating innovative and diverse pedagogical strategies, such as problem-based learning, service-learning, experiential education, and the use of information and communication technologies.

Environmental education should not be limited to schools, but should actively involve local communities. Promoting community participation and empowerment in environmental education processes will allow for greater impact and a sense of co-responsibility in protecting the environment.

Research in the field of environmental education is essential to better understand the challenges and the most effective strategies. This involves promoting interdisciplinary research, the systematization of experiences and the dissemination of good practices, which will contribute to the strengthening and evolution of environmental education.

Strategies to strengthen environmental education and adapt it to the needs of the present and the future

The global environmental crisis and the urgent need to build a sustainable and fair future have highlighted the importance of strengthening environmental education. In this regard, some strategies are proposed to adapt it to the needs of the present and the future.

Integrate environmental education at all educational levels

It is crucial that environmental education be integrated into all educational levels, from early childhood education to higher education, in order to develop in students a deep understanding of the interconnection between the environment and the different areas of knowledge.

Implement innovative and participatory methodologies

Environmental education should adopt innovative and participatory methodologies that actively involve students, such as experiential learning, problem-based learning, project-based learning and the use of information and communication technologies (ICT).

Encourage critical thinking

Environmental education must go beyond the transmission of knowledge and focus on the development of skills such as critical thinking, problem solving, effective communication and responsible decision making.

Linking environmental education to local and global challenges

It is important that environmental education is linked to real environmental problems faced by local and global communities, allowing students to understand the relevance of environmental education in their daily lives and motivating them to actively participate in the search for solutions.

Promote community participation and intersectoral collaboration

Environmental education requires the active participation of the entire community, including students, teachers, families, civil organizations, businesses and governments. Intersectoral collaboration is essential to create synergies and amplify the impact of environmental education.

Emphasize the importance of environmental justice and equity

Environmental education must address the social, economic and environmental dimensions of sustainability, promoting environmental justice and equity to ensure that all individuals have access to a healthy environment and can participate fairly in decision-making that affects the planet.

Strengthening teacher training in environmental education

It is essential to strengthen the initial and ongoing training of teachers in environmental education, providing them with the tools, knowledge and skills necessary to integrate the environmental approach into their teaching practices and foster responsible environmental awareness in their students.

Investing in research and development in environmental education

It is necessary to invest in research and development in environmental education to generate scientific knowledge and evidence to support the implementation of effective practices, improving the quality of environmental education and adapting it to the changing needs of the context.

General conclusions

Environmental education plays a relevant role in building a sustainable and fair future. By strengthening environmental education and adapting it to the needs of the present and the future, new generations can be empowered to be agents of positive change.

Empowering students through environmental education enables them to develop a deep understanding of the complexity of environmental issues. By acquiring solid knowledge about the interconnections between natural, social, and economic systems, students can analyze the underlying causes of environmental challenges from a holistic perspective.

In addition, environmental education fosters critical skills in students for making responsible decisions. By developing critical thinking, problem-solving, and communication skills, students can evaluate various options and their implications, and make informed and ethical decisions in favor of protecting the environment.

Environmental education inspires students to act in a way that is committed to sustainability. By linking learning content to real environmental issues affecting their communities, students are motivated to actively participate in conservation, restoration and promotion of sustainable practices.

In this way, the new generations become agents of positive change, capable of leading transformations in their

environments, promoting innovative and replicable solutions that contribute to building a more sustainable and fair future for all.

Environmental education is therefore a powerful tool to empower students, provide them with knowledge, skills and values, and motivate them to take a leading role in solving environmental challenges. By strengthening and adapting environmental education to current and future needs, the foundations are laid for a more conscious, responsible society committed to protecting the planet.

References

Álvarez, C. E., & Vega, N. (2009 a). Educación ambiental: Fundamentos, metodologías y propuestas de acción. Bogotá: Corporación para el Desarrollo Sostenible (CORPOCDES).

Álvarez, P., & Vega, P. (2009 b). Actitudes ambientales y conductas sostenibles. Implicaciones para la educación ambiental. Revista de Psicodidáctica, 14(2), 245-260.

Álvarez-García, O., Sureda-Negre, J., & Comas-Forgas, R. (2018). Measuring teachers' attitudes towards environmental education: Validating the 2-MEV scale in the Spanish context. PloS one, 13(9), e0202301.

Barraza, L., & Cuarón, A. D. (2004). How values in education affect children's environmental knowledge. Journal of Biological Education, 39(1), 18-23.

Callicott, J. B. (1984). Non-anthropocentric value theory and environmental ethics. American Philosophical Quarterly, 21(4), 299-309.

Callicott, J. B. (1989). In defense of the land ethic: Essays in environmental philosophy. SUNY Press.

Castro, F. (1992). Discurso en la Cumbre de la Tierra. Río de Janeiro, Brasil.

Celio, C. I., Durlak, J., & Dymnicki, A. (2011). A meta-analysis of the impact of service-learning on students. Journal of Experiential Education, 34(2), 164-181.

Chawla, L., & Cushing, D. F. (2007). Education for strategic environmental behavior. Environmental Education Research, 13(4), 437-452. https://doi.org/10.1080/13504620701581539

Dresner, S. (2008). The Principles of Sustainability. Routledge.

Edelson, D. C. (2001). Learning-for-use: A framework for the design of technology-supported inquiry activities. Journal of Research in Science Teaching, 38(3), 355-385. https://doi.org/10.1002/1098-2736(200103)38:3<355::AID-TEA1010>3.0.CO;2-M

Erdogan, M. (2015). The effect of summer environmental education program (SEEP) on elementary school students' environmental literacy. International Journal of Environmental and Science Education, 10(2), 165-181.

FAO e ITP. (2018). Estado mundial de los recursos del suelo. Organización de las Naciones Unidas para la Alimentación y la Agricultura y el Grupo de Expertos Técnicos Intergubernamentales sobre los Recursos del Suelo.

FAO. (2021). La contaminación del suelo . Organización de las Naciones Unidas para la Alimentación y la Agricultura.

Furco, A., & Billig, S. H. (2002). Service-Learning: The Essence of the Pedagogy. IAP.

Gladwin, T. N., Kennelly, J. J., & Krause, T. S. (1995). Shifting paradigms for sustainable development: Implications for management theory and research. Academy of Management Review, 20(4), 874-907.

Gutiérrez, J. M., & Pozo, T. (2006). Modelos teóricos contemporáneos y marcos de fundamentación de la educación ambiental para el desarrollo sostenible. Revista Iberoamericana de Educación, 41, 21-68.

Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn? Educational Psychology Review, 16(3), 235-266.

Hsu, S. J. (2004). The effects of an environmental education program on responsible environmental behavior and associated environmental literacy variables in Taiwanese college students. The Journal of Environmental Education, 35(2), 37-48. https://doi.org/10.3200/JOEE.35.2.37-48

Hungerford, H. R., & Volk, T. L. (1985). Teaching for an ecological future: Basic steps for environmental education. Washington, DC: National Educational Press.

Hungerford, H. R., & Volk, T. L. (1990). Changing learner behavior through environmental education. The Journal of Environmental Education, 21(3), 8-21. https://doi.org/10.1080/00958964.1990.10753743

Hwang, G. J., Fu, Q. K., & Yin, C. (2018). Effects of the tablet-based thematic learning model on students' learning performance and cognitive load - An empirical investigation. Computers & Education, 123, 182-190.

IPBES. (2019). Evaluación mundial de la diversidad biológica y los servicios de los ecosistemas . Panel Intergubernamental sobre Biodiversidad y Servicios Ecosistémicos.

IPCC. (2021). Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press.

IPCC. (2021). Contribución del Grupo de Trabajo I al Sexto Informe de Evaluación del Panel Intergubernamental sobre Cambio Climático. Panel Intergubernamental sobre Cambio Climático.

Kolb, D. A. (1984). Experiential learning: Experience as the source of learning and development. Englewood Cliffs, NJ: Prentice-Hall.

Krajcik, J. S., & Blumenfeld, P. C. (2006). Project-Based Learning. En R. K. Sawyer (Ed.), The Cambridge Handbook of the Learning Sciences (pp. 317-334). Cambridge University Press.

Leopold, A. (1966). *A Sand County Almanac*. Ballantine Books. https://www.amazon.com/aldo-leopold-sand-county-almanac/s?k=aldo+leopold+sand+county+almanac

Martí, J. (1891). Nuestra América. Caracas, Venezuela: Biblioteca Ayacucho. 2001 (Trabajo original publicado en 1891)

Naess, A. (1973). The shallow and the deep, long-range ecology movement. A summary. Inquiry, 16(1-4), 95-100.

Novo, M. (2009). Educación ambiental: Para qué y cómo. Madrid: Santillana.

OCDE. (2019). Educación y competencias ambientales: Hacia una sociedad sostenible. Recuperado de https://www.oecd.org/education/environmental-education-and-skills.htm

OMS. (2021). *La calidad del aire y la salud*. Organización Mundial de la Salud.

OMS. (2022). *Contaminación del aire y salud*. Organización Mundial de la Salud

ONU. (2022). UN Decade on Ecosystem Restoration. https://www.decadeonrestoration.org/

ONU-Agua. (2021). *El agua y el cambio climático*. Organización de las Naciones Unidas para el Agua.

Parhizkar, H., & Pourbeigipour, H. (2017). The effect of problem-based learning on environmental attitude of students. Journal of Environmental Education, 48(6), 356-366.

Passmore, J. (1974). *Man's Responsibility for Nature*. Scribner. https://books.google.com/books/about/Man_s_Responsibility_for_Nature.html?id=mWMLAQAAIAAJ

Piaget, J. (1976). La inteligencia en el desarrollo del niño. Buenos Aires: Paidós.

PNUMA. (2016). Planeta saludable, gente sana. Programa de las Naciones Unidas para el Medio Ambiente.

Rolston, H. (1988). Environmental ethics: Duties to and values in the natural world. Temple University Press.

Sauvé, L. (1996). Environmental education and sustainable development: A further appraisal. Canadian Journal of Environmental Education, 1, 7-34.

Sauvé, L. (2005). Currents in environmental education: Mapping a complex and evolving pedagogical field. Canadian Journal of Environmental Education, 10(1), 11-37.

Schweitzer, A. (1949). Out of my life and thought: An autobiography. Holt.

Taylor, P. W. (1979). *Respect for Nature: A Theory of Environmental Ethics*. Princeton University Press. https://press.princeton.edu/books/paperback/9780691150246/respect-for-nature

Taylor, P. W. (1986). Respect for nature: A theory of environmental ethics. Princeton University Press.

Tilbury, D. (1995). Environmental education for sustainability: Defining the new focus of environmental education in the 1990s. Environmental Education Research, 1(2), 195-212. https://doi.org/10.1080/1350462950010206

Tilbury, D. (2011). Education for Sustainable Development: An Expert Review of Processes and Learning. UNESCO.

Tilbury, D. (2011). Education for sustainable development: Opening new horizons. London: Sterling Publishing.

Tilbury, D., & Wortman, D. (2008). How is community education contributing to sustainability in practice? Applied Environmental Education and Communication, 7(3), 83-93. https://doi.org/10.1080/15330150802502171

UNEP. (2022). Global Environment Outlook 6. https://www.unep.org/resources/global-environment-outlook-6

UNESCO. (2014). Roadmap for Implementing the Global Action Programme on Education for Sustainable Development. Paris: UNESCO.

UNESCO. (2017). Educación para el desarrollo sostenible: Transformar nuestro mundo. París: UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000252423

UNESCO. (2021). Educación para el desarrollo sostenible: Hacia la acción. Recuperado de https://unesdoc.unesco.org/ark:/48223/pf0000377362

Vygotsky, L. S. (1978). Pensamiento y lenguaje. Barcelona: Ediciones Teorema.

Wals, A. E. (2007). Social learning towards a sustainable world: Principles, perspectives, and praxis. Wageningen Academic Publishers.

Wals, A. E., & Lenglet, F. (2016). Sustainability citizens: Collaborative and disruptive social learning. In R. Horne, J. Fien, B. Beza, & A. Nelson (Eds.), Sustainability Citizenship in Cities: Theory and Practice (pp. 52- 66). Routledge.

WCED. (1987). *Our Common Future: Report of the World Commission on Environment and Development*. Oxford University Press.

World Commission on Environment and Development (1987). Our Common Future. Oxford University Press.