2025 Reflection Article

Inclusión y Desarrollo No 11 2 JANUARY | JUNE

Competencias ambientales: aproximación desde una reflexión conceptual

Enviromental Competencies: Approach from a Conceptual Reflection

Competências Ambientais: abordagem a partir de uma reflexão conceitual

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Para citar este artículo | To cite this article | Para citar este artigo:
Viveros, E.; Mina, D. y García, L. (2024). Environmental Competencies: An Approach from a Conceptual Reflection. *Inclusión y Desarrollo*, *11* (2), pp.96-106

Recibido/Received/Recebido: August 10, 2024
Aceptado/Accepted/Aceito: November 26, 2024
Publicado/Published/Publicado: December 18, 2024

Artículo de reflexión / Reflection Article / Artigo de reflexão
Conflict of interest: The authors have stated that there are no competing interests

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Educación de calidad al alcance de todos

RESUMEN

Este artículo de reflexión se origina a partir de la observación de las afectaciones de los fenómenos medioambientales y comportamentales que afectan los ecosistemas naturales y las poblaciones humanas, la educación ambiental y la ecopedagogía, estableciendo la necesidad de analizar cómo se desarrollan los procesos cognitivos que derivan en la gesta de capacidades y formación de competencias ambientales de los sujetos en formación, lo cual conduce a que desde la escuela se reproduzca una cultura ambiental frente a las problemáticas ambientales a nivel local. Se analizan aspectos conceptuales que exponen la formación y las relaciones entre las capacidades y las competencias. También se hace reflexión frente al rol del docente en los procesos de enseñanza-aprendizaje y apropiación de la didáctica de la educación ambiental desde contextos naturales. Por último, se observan las problemáticas ambientales como puntos focales importantes para que los procesos didácticos y de enseñanza para que la escuela y sus programas de educación ambiental faciliten la formación de competencias ambientales en los estudiantes.

Palabras claves: capacidad, competencia, ambiental, enseñanza, aprendizaje, educación ambiental, problemática

ABSTRACT

This reflection article originates from the observation of the effects of environmental and behavioral phenomena that affect natural ecosystems and human populations, environmental education and ecopedagogy, establishing the need to analyze how cognitive processes develop that lead to the development of capacities and the formation of environmental competencies of the subjects in training, which leads to the reproduction of an environmental culture in schools in response to environmental problems at a local level. Conceptual aspects that expose the formation and the relationships between capacities and competencies are analyzed. There is also a reflection on the role of the teacher in the teaching-learning processes and the appropriation of the didactics of environmental education from natural contexts. Finally, Environmental issues are seen as important focal points for teaching and didactic processes so that the school and its environmental education programs facilitate the development of environmental skills in students.

Keywords: capacity, environmental, competence, teaching, learning, environmental education, problematic.

RESUMO

Este artigo de reflexão tem origem na observação dos efeitos dos fenómenos ambientais e comportamentais que afectam os ecossistemas naturais e as populações humanas, a educação ambiental e a ecopedagogia, estabelecendo a necessidade de analisar como se desenvolvem os processos cognitivos que conduzem à conquista de capacidades e à formação de capacidades ambientais. competências dos sujeitos em formação, o que leva a escola a reproduzir uma cultura ambiental diante dos problemas ambientais em nível local. São analisados aspectos conceituais que expõem a formação e as relações entre capacidades e competências. Há também uma reflexão sobre o papel do professor nos processos de ensino-aprendizagem e apropriação da didática da educação ambiental a partir de contextos naturais. Por fim, os problemas ambientais são observados como pontos focais importantes para os processos didáticos e de ensino para que a escola e seus programas de educação ambiental facilitem a formação de competências ambientais nos alunos.

Palavras-chave: capacidade, competência, ambiental, ensino, aprendizagem, educação ambiental, problemas.

Introduction

Environmental education has made significant progress since the first United Nations Conference on the Human Environment held in Stockholm, Sweden, in 1972, further accelerated by the advancements of the 1980s which led to the Rio de Janeiro Earth Summit held in June 1992, where 172 countries and 2,400 representatives of non-governmental organizations participated. This summit highlighted the consequences of technological advancements and the destruction of natural habitats, as well as concerns about poverty and inadequate educational indicators. Gomes and Cárdenas (2023) discuss aspects of the impact of the agreements 30 years after this event, emphasizing the declaration of the local and school Agenda 21. This document commits states to integrate environmental education into their educational systems and school curricula, emphasizing sustainable development of natural resources through training and civic culture (Aguirre et al., 2021).

According to Mora (2020) and Martínez (2010), humanity and its technological development affect the environment in various ways, such as the population growth that runs parallel to productivity and consumerism, alongside the trade agreements of countries that have laid the foundations for a globalized world. This has led to the deterioration of natural ecosystems because it is from these spaces that natural resources are extracted as raw materials that enter the means of production and the market. The costs of this human maneuver are, for example, chemical discharges into rivers and seas, reduction of forests which implies a decrease in animal species populations, air pollution, increase of inorganic solid waste, among other issues affecting cities, towns, and natural ecosystems. For society to become interested in the issues, there must be a transformative environmental education that succeeds in involving the individual, strengthening sensitivity and responsibility, to prevent, mitigate, and solve environmental changes (Fajardo et al., 2024).

According to the United Nations Educational, Scientific and Cultural Organization [UNESCO] (2016), and Nay and Febres (2019), based on international legislations derived from international agreements, environmental education should contribute to schools promoting environmental competencies in society from the levels of early childhood education, primary education, secondary education, university education, and non-formal education. This requires an education that considers new forms of pedagogical thought capable of posing theories and didactics so that, from research and active education, a transformative environmental culture of school and community environments is promoted (Valencia and García-Noguera, 2024).

According to Mora and Guerrero (2022), and Cruz (2022), in Colombia and other Latin American countries, it is essential for educators to consider different approaches to developing competencies in individuals, particularly in environmental education (EE). This need arises from the guidelines of the local and school Agenda 21 from the Rio Summit, which have been integrated into educational systems. Specifically, this integration is reflected in the curriculum linked to interdisciplinarity and transversality. In other words, it leads to the reflection processes in the environmental field and the teaching-learning processes resulting in environmental competencies or performances in individuals in training. This discipline combines theoretical, scientific, and practical elements, necessitating a structure or pedagogy capable of creating experiential spaces that enhance teaching-learning processes. These processes should significantly impact students, resulting in performances that manifest as environmental habits for sustainable development within their school and community life spaces.

In line with the pedagogical exercise that connects the teacher-knowledge-student and the aspects related to the development of environmental competencies in individuals in training, this reflection of authors and their publications aims to answer the question: How are environmental competencies developed?

Ecopedagogy and Competencies

Addressing ecopedagogy as an educational tool requires educators with the ability to facilitate the transmission of knowledge in a subject that is inherently multidisciplinary, involving various fields such as educational theories, and concepts from social and natural sciences. Ruiz et al. (2021), in their review of the contributions of eco-pedagogy in the educational field, indicate that a large portion of the publications observed have a theoretical and critical focus on current educational contexts. Likewise, others present practical experiences in this regard, but do not delve into the problems that this pedagogy aims to solve, which involve cultural changes where scientific and environmental competencies are reflected in the various social contexts represented by the member countries of the United Nations Organization.

Ecopedagogy, as an active branch of environmental education, has an outstanding task regarding the integration of the pedagogical elements that compose it and its operability in educational communities to generate learning that results in environmental competencies that transform culture and the environment. Morales and Mardones (2023) present significant advancements in the educational policies of the states, but are specific about the results involving activities that encompass aspects of environmental competencies, which implies a need to redefine how the school leads to environmental competencies. This multidisciplinary tool must transcend being merely a cognitive stimulus; instead, it should be a collective practice of collaborative learning that influences group consciousness and remains a constant presence in public opinion, that is, in the life of communities (Tapia et al., 2023).

Competencies and their Importance

The human being as a subject in formation is one of the elements within the educational system whose cerebral plasticity provides an opportunity for pedagogical strategies, through various stimuli, to generate changes, outcomes, and transformations in attitudes that are reflected towards the environment. Castellanos and Rojas (2023), and Pimentel et al. (2019) indicate that competence is defined as the set of socio-affective behaviors and cognitive, psychological, sensory, and motor skills that enable an individual to adequately perform a task, function, activity, or duty, and are considered scientific when they allow the person to recognize scientific language, skills for classification, experimentation and teamwork, among other performances.

The report made by the United Nations (2018), fourth goal, item 7, states that by the year 2030 “all students will acquire the necessary theoretical and practical knowledge to promote sustainable development, among other things through education for sustainable development.” This implies that states, by creating the conditions for educational systems to understand the environmental agendas of international summits, specifically the Sustainable Development Goals [SDGs], lead communities to meet their educational goals and reproduce environmental competencies.

Environmental Competencies through an Active Pedagogy

Understanding and reflecting on the ethical aspects of environmental values is fundamental for those in training, both in the classroom and during recess and other areas of their daily lives, to actively and consistently develop and strengthen their human relationships. Through activities that promote cultural awareness and the development of environmental competencies, individuals can have a positive impact on their environment. These activities provide them with the opportunity to express and contribute to environmentally friendly practices, which can include small actions such as propagating and dispersing plants, keeping pets, reusing and recycling solid waste, among others. According to Delgado (2022), it is important to consider educational innovation within a society subject to changes, which in turn implies an intervention that connects and activates the teaching-learning processes of subjects (teacher, student, community), the planning, and the agreements of practical, feasible, and measurable didactic actions from investigative approaches that allow observing the development of these competencies.

For the contemporary challenges of commercially and politically interconnected societies, educational innovation must encompass pedagogical and didactic adaptations to new realities and contexts so that active teaching-learning processes lead to the internalization of sound environmental practices that endure over time to become culture, and likewise, a public policy.

Awareness, a Starting Point for Environmental Competencies

The discussion about values regarding the environment and other living beings that develop within ecosystems lies in recognizing their existence, their role in life, and their biology. In other words, awareness begins with the study of theoretical and practical knowledge of living entities. The individual's reflection once they recognize others promotes sensitivity (what matters); thus, the affirmation of the individual and collective subject is shaped towards the protection of rivers, recycling, and environmental recovery.

Cruz et al. (2023) indicate that starting from environmental ethics and proper awareness, transformations occur in the didactic and pedagogical processes that must ensure that the learner understands and realizes that there are situations and conditions of an unsustainable nature, such as climate change, species reduction, deforestation, slavery, diseases, food crisis, poverty, and immigration. These issues require commitment and participation.

Thus, when didactic strategies facilitate the learner's recognition of environmental reality and its implications, they can lead to the development of environmental competencies within the community and communities, aimed at developing environmental leaders with skills such as teamwork, among others, enabling a transition from helplessness to environmentally friendly action.

How is an environmental competence developed?

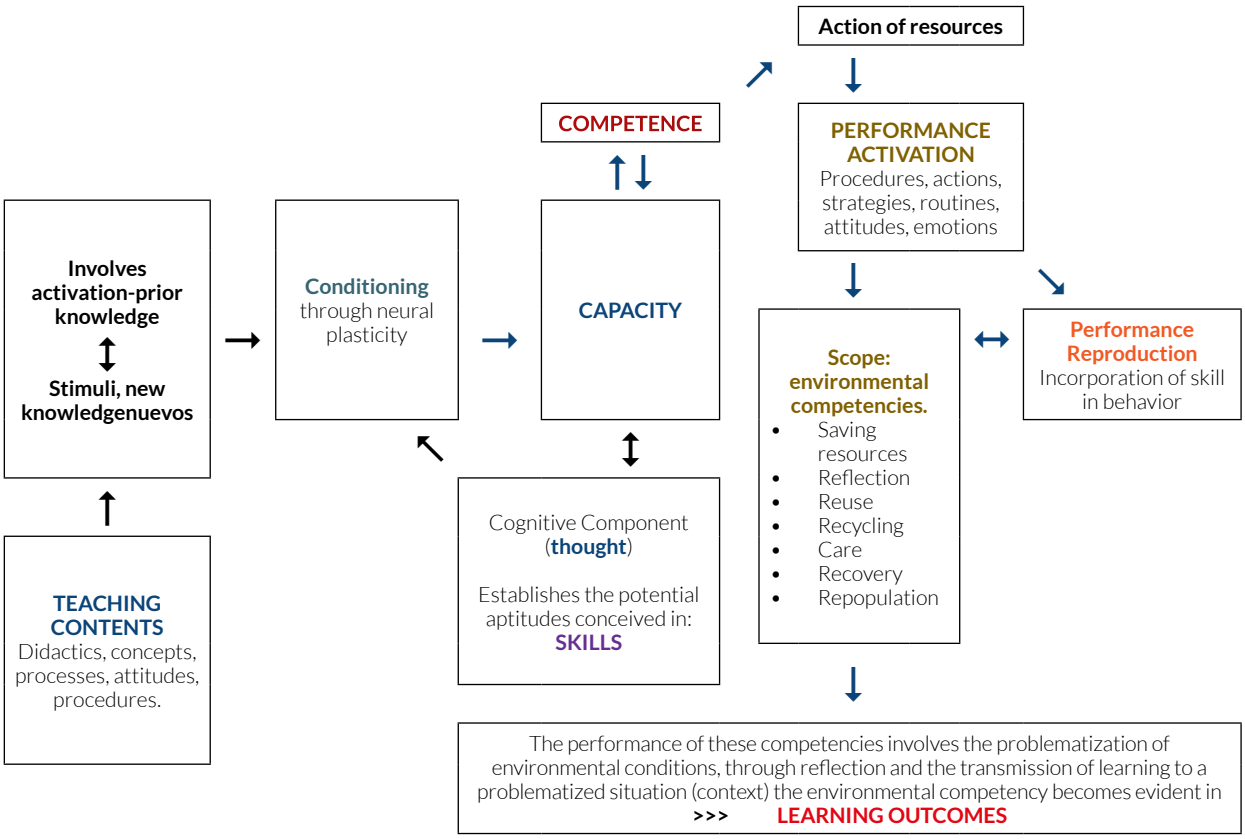
From the environmental perspective, in accordance with international and national legislation, it has been advocated that educational systems and institutions focus on incorporating environmental competencies into the profiles of graduates through curricular adaptations that result in cross-cutting proposals at the secondary and university levels (Castro et al., 2019); (UNESCO, 2016). It is crucial that for the reproduction of behaviors or an environmental culture related to or observed from environmental pedagogy, as a competence in the field, there must be cross-cutting proposals and actions promoted through school organization and educational projects.

Mora and Guerrero (2022), and Gonzales (2021), state that in order to understand how competencies manifest in individuals in training, attitudinal aspects must be taken into consideration, such as: capacity, understood in relation to the cognitive potential that implies learning aptitude; and performance or practice, which is denoted as acquired competence. Likewise, competence will be understood as the projection of a capability, that is, expressing the level of development of the capability, which intrinsically comprises the cognitive, attitudinal, emotional, and procedural components whose mental framework is associated with and refers to knowledge and learning.

The attitudinal nature of competence is demonstrable in action within a specific context, requiring the activation of the neural network (brain plasticity) that encompasses abilities, cognition, knowledge, values, and experiences. Thus, given the previous reflection, there is a sine qua non *relationship* between capacity and competence, where one of the processes cannot exist, function, or express itself without the other, and it is the operability of the capacity that leads to the development of competence.

Capacities are understood as contained elements, psychological potentialities, with a predominance towards possession and thought rather than execution, since when the latter comes into play, it results in the expression of competence or performance. Consequently, internal reflection, the type of thinking that involves capacity, is related to performances that imply competence. This relationship, which in practice is a duality, comprises: perception - interpretation, evaluation - analysis, execution - creation, and decision-making - transformation. In Figure 1, the formation of environmental competence is presented, which in an integral way exposes the capacity-competence relationship that allows the learner to culturally reproduce actions as "learning outcomes," predictable aspects that the student is expected to be able to understand, perform, and demonstrate.

Figure 1. *Development of Environmental Competencies in the Subject*



Note: Description of the development of environmental competencies in the subject. Source: Prepare by the authors (2024), based on Mora and Guerrero (2022).

In the environmental field, this relationship can be expressed through the application of educational content that involves environmental references (living beings, objects, natural resources, issues, reflections, intervention actions) organized with ideological, physical, and digital resources capable of being cognitive stimuli for the different intelligences of students in training. This generates or establishes a "thought" in the student, a capacity that has the potential to be executed, exercised, and become part of the culture when reproduced given an opportunity or need. In this way, when the action occurs, the performance of the capacity indicates the environmental competence specified in actions of environmental reflection, resource conservation, recycling, reuse, environmental care or recovery, and reproduction - repopulation of living beings.

Evidence of Environmental Competence

It is fundamental that the training and intervention processes generate products, whether material or immaterial, that denote and evidence environmental competence. This means that it should be perceptible in the values and behaviors of the students, as well as in the environmental state of the school or community setting. Velásquez et al. (2020) and Rodríguez (2012), through review and reflection, argue that the school as a teaching-learning space should provide students with elements that stimulate the development of meaningful life skills and competencies. This implies that learning is acquired when cognitive stimuli are applied through the implementation of effective didactic strategies under a learning theory. This suggests that environmental competencies should be approached from the domains of knowledge (knowing, doing, and being), given that the neural network of the individual integrates knowledge into actions. In other words, it demonstrates a performance that reflects values and motivations projected in the care and protection of the environment.

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The reflection of this aspect lies in the demonstration of environmental competence. For this purpose, the educational system from the school level instills in students' behaviors that will succeed when they become part of the individual's culture and the social collective to which they belong (Insuasty et al., 2022) and thus, this set of knowledge and their environmental culture are the evidence. The same occurs when the environment expresses environmentally acceptable conditions consistent with the efforts of environmental education embedded in the educational system.

Role of the Teacher in Environmental Competencies

This actor and their role as a "teacher" is a fundamental aspect for the student to acquire the knowledge and skills that lead to competencies. They must be the first to be competent in the environmental field, also from an attitudinal perspective. The university education of teachers must also integrate environmental education across study programs, ensuring that teaching-learning processes are effective. Traversa and Gonzales (2022) and Nesmith et al. (2016), they explain how research processes in teacher education are fundamental for developing and strengthening their environmental competencies. In this case, research experience in topics such as wetlands, conservation biology, and water reuse enhances educators' skills, attitudes, and self-efficacy. In this way, a stimulated teacher can develop and stimulate environmental competencies in their students.

It is important for didactics to progress beyond lectures, which, in the case of natural sciences and environmental education, can encounter institutional limitations in curricular adaptations. This leads to the transmission of a dogmatic view of science that does not take advantage of the natural environment as a teaching-learning space, which helps to strengthen the scientific and environmental competencies that students need to develop. Hernández et al (2020) indicate the necessity for a didactic approach that incorporates the natural environment (outside the classroom) as a learning opportunity, so that individuals in training have the chance to directly experience and interact with the surrounding environment and the natural processes operating within it. This approach strengthens knowledge and the apprehension of conceptual, attitudinal, and procedural content.

Environmental Issues and the Teaching-Learning Process

In environmental education, real or virtual scenarios that are part of the context can focus on a focal point, which can be an issue such as climate change or a solution within the environmental field like forest repopulation. In this way, the focal point attains significant importance, becoming a theme in the school, a content that encompasses conceptual, attitudinal, and procedural aspects to enhance the emergence of students' environmental competencies in the teaching-learning process.

Gavilanes and Tipan (2021) point out that an environmental issue or focal point always involves a component of resilience and socio-environmental factors. Therefore, it is important for schools to become the primary transmitters of data that highlight the focal point, as presented in Table 1, as well as in the formation of ecological habits for reproduction by the student population. These habits add to the pro-environmental values and behaviors imparted at home, which converge in the environmental culture. The aforementioned implies that the teacher's role is to guide students in recognizing the theme or focal point so that they form their own understanding within their neural framework, that is, establish a capacity subject to becoming or deriving into an environmental competence.

Table 1. *Environmental themes as focal points in education*

Focal Point	Contents	Procedures
Climate Change	Greenhouse effect, droughts and extreme rains, mitigation of climate change	Analysis of climate impacts, web-based climate modeling, climate variable measurements, emergency prevention.
Reuse and Recycling	Recycling of solid and organic waste, reuse of solid and liquid waste.	Handicraft-making. Reutilization of plastic and metal materials, water reuse, compost formation .
Reproduction and Repopulation	Especies amenazadas, Endangered species, reproduction of plants and animals, reforestation (planting), reproduction and release of animals.	Plant care, soil preparation for planting, plant care, animal husbandry for animal breeding.
Environmental recovery	Soil contamination, erosion, degradation of terrestrial and aquatic ecosystems, health impacts from pollution, conservation of ecosystems.	Environmental recovery of soils and water sources, elimination of contamination hotspots.
Consumerism	Exploitation of terrestrial and marine ecosystems.	Reflections, environmental ethics, environmental dialogues.
Sustainable Development	Strategies for sustainable development, rational use of natural resources, resource prospecting, renewable resources, production of clean energy.	Planeación para desarrollo Planning for sustainable development, technologies for clean energy..

Note: Description of environmental themes. Source: Prepared by the authors.

Thus, the effectiveness of environmental education in fostering environmental competencies within the student body greatly depends on the school's establishment of coherence between the focal points of the global, regional, and local contexts, and the institutional curriculum, which implies that it should be adapted according to the needs for educational improvement. These actions can enhance students' perception and motivation regarding the topics and content to achieve the desired impact. Aparicio and Domínguez (2023) and Hernández and Camarena (2023) present and conclude that to construct the formation, the theoretical identity of environmental education, the educational system that derives in the school must promote curricular adaptations that guide the human intentionality of the educational triangle (teacher – knowledge – student), so that the actors engage in pertinent reflections on "knowledge." This involves serious classroom discussions of topics, appropriation of projects and research, student empowerment, research workshops, discussion forums, in-depth exploration of topics, practical activities with recyclable materials, intervention in resource utilization, landscape care and recovery, among other actions. In this way, competencies can be developed by combining the teacher's expertise with the student's motivation and availability to facilitate environmental education.

Conclusions

The consequences of human development, with the exacerbation of environmental issues such as climate change, pollution, and ecosystem degradation, are a concern for environmental education and its variants like ecopedagogy. This is so that environmental competencies are reproduced from the school, leading to an environmental culture that involves the entire society in solutions. The reflection on the highlighted aspects allows us to conclude that strengthening the teaching-learning processes in the environmental field through curriculum adaptations pertinent to the educational and community context are actions that enhance the teaching practice, ensuring effectiveness in the development of students' environmental competencies.

The development of environmental competencies starts from the premise that the school and its curricular adaptations in teaching content relevant to global and local contexts facilitate individuals in training (neuronal network) to gather cognitive elements that are reflected in the capacity or potentiality connected to competence. By activating procedural actions, attitudinal approaches, and routines evident in ecological and scientific language, observation, reflection, and intervention in the environment, these competencies become apparent in both the "being" and "doing" of environmental competencies.

The role of the teacher is fundamental to the teaching-learning processes of environmental education in the development of students' environmental competencies. This depends on their training and research experience in the environmental field, which allows them to use a didactic approach that involves the school context and natural spaces as elements that stimulate students' knowledge and competencies. It is fundamental for the educator to bring environmental issues into focus, making them a reality within the educational context of teaching. This enables students to grasp the knowledge involved in these issues, thereby facilitating the development of environmental competencies.

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