

# Fostering Environmental Awareness in Science Education: Challenges and Opportunities

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**Abstract-** Undoubtedly, students acquire a multitude of knowledge, both formally and informally, encompassing various aspects, particularly those related to the natural environment. Whether addressing a natural phenomenon i.e. lightning, the water cycle, photosynthesis, or the aurora borealis), a component of the natural world like a rock, a flower, or a glass of water, a socio-scientific matter i.e. genetically modified food, transportation, or overpopulation, and an environmental concern like water pollution, global warming, or acid rain, the natural environment becomes a focal point, either directly or indirectly, in the realm of study. Considering the contested relationship between science education and environmental education, promoting environmental awareness poses a significant challenge for science education. Nonetheless, it is important to recognize that both natural phenomena and entities, on one hand, and socio-scientific issues and problems, on the other, possess the potential to explicitly nurture the relationship between human beings and the natural world. Undoubtedly, the argument against isolated scientific understanding holds merit. It appears that the natural environment serves as a necessary context for such comprehension. This paper proposes a pedagogical strategy that emphasizes keeping the natural environment at the forefront of the teaching-learning process, thereby making the connection between the self and the natural world explicit. This strategy aligns with a suggestion to reevaluate the goals of scientific inquiry, emphasizing issues and problems of living, ultimately enhancing the meaningfulness of school science learning by focusing on the interrelationship between the self, science, and the natural world.

**Keywords:** Photosynthesis, aurora, environment, nature.

## INTRODUCTION

Advancing environmental awareness is deemed a critical objective in contemporary education due to the inherent interdependence between humanity and the natural world. Nature not only defines our existence but also shapes our broader relationship with the world. Therefore, developing environmental awareness is seen as a means to transform our connection with nature, fostering more responsible behavior and instilling respect. Moreover, nurturing this relationship can actively contribute to promoting environmental awareness [1].

While direct, "first-hand" experiences in nature are considered crucial for fostering an emotional bond, it's essential to recognize the significance of indirect learning experiences. The rapid pace of technological development has outpaced our evolutionary adaptation to new environments, particularly impacting young children who grow up in a highly technological environment, often detached from the natural world. Hence, learning experiences and knowledge about nature become imperative, and science education emerges as a key provider of such experiences, capable of raising environmental awareness [2, 3].

Historically, the perceived incompatibility between science, science education, and environmental education was more prevalent when science was indifferent or even hostile to social issues. Similarly, the belief that environmental education was more suited to disciplines other than science was rooted in the past. Postmodern perspectives in science and science education now offer opportunities for students to engage with personal, social, economic, or political issues, making the relationship between science education and environmental education more harmonious. Pursuing the development of environmental awareness through science education is now considered sensible [4-6].

Despite the acknowledged limitations of science education, it has been noted that it offers numerous opportunities for fostering environmental awareness. Over the past two decades, science educators have explicitly or implicitly addressed the need for environmental awareness. While acknowledging the limitations of the School Teaching System (STS) movement in science education, its contribution to incorporating social issues into the science curriculum is recognized [5][7-10]. The recent emphasis on socio-scientific issues (SSI) seems more promising compared to the traditional STS approach, as it empowers students to reflect on the interrelationship between the physical and social world, their own lives, and the moral principles guiding decision-making on socio-scientific issues. While socio-scientific issues are a valuable avenue for raising environmental awareness, science ideas can also contribute. However, a challenge arises in determining whether students perceive the natural world as an object of study in

science education. Despite the potential for science educators and teachers to use issues, problems, and science ideas with environmental dimensions to foster environmental awareness, there are inherent difficulties and obstacles to consider. Using such elements for teaching science does not necessarily guarantee the development of environmental awareness, even when it is an explicit goal [11].

### **The Educational Importance of 'Awareness'**

Undoubtedly, students acquire a multitude of knowledge, both formally and informally, encompassing various aspects, particularly those related to the natural environment. Evaluating students' conceptual representations, presumed to be learned, serves as a gauge of their overall knowledge. This distinction in knowledge lies between information presented through traditional representational pedagogy and that constructed through personal experiences in constructivist pedagogy [12].

Environmental awareness stands in direct correlation with environmental knowledge, attitudes, and actions, with knowledge influencing students' attitudes. Critical thinking also exhibits a connection to environmental awareness. Defining environmental awareness broadly as a combination of knowledge, critical thinking, and attitudes is justified by the transformative nature of awareness itself. Awareness initiates a shift in perception, a prerequisite for attitudinal change, which, in turn, precedes behavioral and actionable change.

Environmental awareness, in this context, refers to understanding the interconnections between issues or problems and human life. Although this knowledge impacts one's life—shaping feelings, thoughts, behaviors, and actions—it is considered a prerequisite for achieving environmental literacy. Environmental literacy involves a nuanced understanding of issues and problems, enabling individuals to evaluate and make informed decisions as responsible citizens [13, 14].

Emphasizing the development of students' environmental awareness gains significance, particularly in light of criticisms against the notion of sustainability or sustainable development. The conventional view of nature as a resource, driven by anthropomorphic and economic motives, is subject to critique. Therefore, fostering an awareness of the intricate relationships between environmental and socio-scientific issues and human life becomes pivotal in addressing these concerns [15].

### **Difficulties and Problems in Raising Environmental Awareness**

Commencing with the acknowledgment that the natural world serves as a subject of study, a crucial inquiry arises regarding the significance attributed to this subject by students. Whether addressing a natural phenomenon i.e. lightning, the water cycle, photosynthesis, or the aurora borealis), a component of the natural world like a rock, a flower, or a glass of water, a socio-scientific matter i.e. genetically modified food, transportation, or overpopulation, and an environmental concern like water pollution, global warming, or acid rain, the natural environment becomes a focal point, either directly or indirectly, in the realm of study. The essential question to consider is whether this subject is prominently featured in the forefront or merely relegated to the background within the teaching-learning process.

Placing the natural environment in the foreground signifies that, irrespective of the teaching strategy employed or the concept introduced, the natural environment is consistently "present" throughout the teaching/learning journey. This implies that both the term "nature" and the appreciation of the natural environment in a broader sense—appreciating its beauty and the extraordinary power inherent in natural phenomena—are pervasive during the learning process. While this alignment is more straightforward when a concept is directly tied to a natural phenomenon e.g., the water cycle, challenges arise when there is no direct connection e.g., electric current. Nevertheless, irrespective of this level of difficulty, the promotion of environmental awareness remains unattainable if the natural environment remains in the background. This issue is critical and extends beyond phenomena and issues implicitly tied to the environment, encompassing those with explicit environmental dimensions. Four specific reasons emerge to elucidate the challenges and issues encountered in bringing and maintaining the natural world at the forefront of the teaching-learning process [12].

When discussing the utilization of the natural environment as a subject of study, delineating its position as foreground or background echoes the various dimensions of environmental education, namely "education about the environment" (i.e., understanding how natural systems function), "education in the environment" (i.e., direct experiences in the environment fostering emotional involvement), and "education for the environment" (i.e., the political dimension and actions required to instigate change) [16].

### **The purpose for studying science**

Merely justifying science through scientists' efforts to explore and comprehend the world, or relying on the various rationales presented by science educators, seems insufficient in providing students with a purpose for studying the natural world. While coherent justifications for science learning have been articulated, it is essential to differentiate between a rationale proposed by a philosopher, science educator, or science teacher and a personal purpose [12].

Within the realm of school science education, the perspective that "Without hope, there is no incentive for learning, for the impulse to learn presupposes confidence in the possibility of improving one's existence" is crucial. It sheds light on the intricate relationship between purpose and learning. Such learning cannot solely result from the empirical treatment of nature or the general study of science. Instead, it arises from the awareness that such treatment and study have the potential to enhance human life and our own existence. This realization becomes evident when there is a curricular and instructional emphasis on addressing issues and problems, as well as on those science ideas that foster a sense of connection with the natural world. This leads to the exploration of opportunities for the development of environmental awareness within science education [9].

Considering the contested relationship between science education and environmental education, promoting environmental awareness poses a significant challenge for science education. Nonetheless, it is important to recognize that both natural phenomena and entities, on one hand, and socio-scientific issues and problems, on the other, possess the potential to explicitly nurture the relationship between human beings and the natural world. A fruitful approach involves distinguishing between learning about science ideas and understanding socio-scientific issues and problems, being aware of their personal and broader significance. This approach is considered instrumental in cultivating a sense of connection with the natural world and creating opportunities for the development of environmental awareness [3].

### **Awareness of the significance of science ideas**

Undoubtedly, the argument against isolated scientific understanding holds merit. It appears that the natural environment serves as a necessary context for such comprehension. For instance, concepts like conservation and recycling can be grasped through various natural processes and phenomena, such as the water cycle. However, the question arises as to whether this context alone is sufficient to foster the development of environmental awareness. While essential, an environmental context falls short if environmental awareness is the ultimate objective. True environmental awareness requires an understanding of the significance of certain scientific facts and ideas.

Environmental awareness presupposes recognizing the personal and broader importance of facts such as the finite nature of Earth's water and air. Knowing that the water we drink and the air we breathe have existed for an extended period is more likely to cultivate environmental awareness than merely applying conservation and recycling concepts across various contexts. Similarly, understanding the critical role of plants, as the life-sustaining organisms on the planet, is more likely to promote environmental awareness than merely having knowledge about the process of photosynthesis.

Evidently, awareness of the significance of specific science facts and ideas arises from recognizing the explicit connection between oneself and the environment—a connection vital for the development of environmental awareness. Major scientific ideas, representing the most compelling and crucial contributions of science, offer a broader perspective, integrating science concepts with real-life experiences tied to environmental consequences. Given their capacity to bridge the cognitive and affective domains, the potential of these big ideas in fostering environmental awareness should be seriously considered. It is crucial to ensure that the integration of science concepts with real environmental experiences explicitly highlights the connection between self and nature [7].

### **Conclusion**

The pressing need to incorporate environmental education comprehensively into the formal education system, spanning across the entire school curriculum, cannot be fully addressed without effective strategies that elevate environmental awareness. Despite facing challenges, there are potential avenues, particularly within science education, for nurturing environmental awareness, and additional possibilities may also exist. This paper proposes a pedagogical strategy that emphasizes keeping the natural environment at the forefront of the teaching-learning process, thereby making the connection between the self and the natural world explicit. This strategy aligns with a suggestion to reevaluate the goals of scientific inquiry, emphasizing issues and problems of living, ultimately enhancing the meaningfulness of school science learning by focusing on the interrelationship between the self, science, and the natural world.

Environmental awareness is considered a prerequisite for environmental literacy, which involves a contextualized and comprehensive understanding of issues and problems, enabling individuals to evaluate and make informed decisions as responsible citizens. The significance of aiding students in developing their environmental awareness, by highlighting the relationship between environmental and socio-scientific issues and problems and human life, becomes especially crucial in light of criticisms surrounding the concept of sustainability or sustainable development. This critique questions the conventional view of nature as a mere resource, exposing anthropomorphic and economic motives.

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