

Enhancing Environmental Education Through Pre-Service Teacher Training: Strategies, Benefits, and the Role of Educators

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Abstract : Environmental challenges such as climate change, pollution, deforestation, and biodiversity loss pose significant threats to global sustainability. Education plays a critical role in addressing these challenges, with teachers serving as key facilitators in fostering environmental awareness and sustainable behaviors. This paper explores the role of pre-service teacher training in enhancing the effectiveness of environmental education (EE). It examines how well-structured training programs equip future educators with the knowledge, pedagogical skills, and values necessary to deliver impactful EE. The study highlights the benefits of integrating EE into teacher education programs, including improved content knowledge, increased confidence, interdisciplinary teaching strategies, and action-oriented learning approaches. Additionally, it discusses strategies to enhance EE in teacher training, such as hands-on learning experiences, collaboration with environmental organizations, and the integration of sustainability practices. Furthermore, the paper emphasizes the pivotal role of teachers in developing students' environmental responsibility through curriculum integration, critical thinking, eco-friendly role modeling, and community engagement. By effectively preparing teachers through pre-service training, education systems can foster a generation of environmentally conscious individuals who actively contribute to sustainability efforts.

Keywords: Environmental Education (EE), teacher education, pre-service teacher training, environmental awareness, sustainability.

Introduction - Environmental challenges such as climate change, deforestation, pollution, and biodiversity loss pose significant threats to global sustainability. Education is essential in tackling these challenges, with teachers playing a vital role in raising environmental awareness and encouraging sustainable practices. Achieving sustainable development requires a fundamental shift in society's attitude toward nature and the environment, which can be facilitated through moral and ethical education. It is essential to instill and reinforce environmental values in young minds to develop a sense of responsibility toward nature. By imparting knowledge and sensitizing both students and society about environmental issues, teachers contribute to tackling environmental challenges.

Professional development through training is a key strategy to improve the effectiveness of environmental education (EE). Strengthening pre-service and in-service teacher training programs in EE is crucial for preparing educators who can effectively promote environmental literacy and inspire future generations to engage in sustainable practices^{3,4,8}. Studies indicate that many science teachers, who often serve as EE instructors, lack adequate

preparation to teach Education for Sustainable Development (ESD). Their understanding of ESD remains limited, highlighting the need to enhance their capacity to teach environmental concepts effectively⁹. While EE is implemented across all levels of education through structured approaches, few institutions offer specialized EE training alongside general teacher education programs⁵. This gap in teacher training programs, both pre-service and in-service, limits the effectiveness of EE integration in curricula.

Since EE intersects multiple disciplines and levels of study, policymakers and education planners should integrate it as a mandatory component across all educational levels. Teacher training curricula should incorporate EE through both theoretical and practical courses. A structured approach to EE should begin by fostering student awareness of the environment, followed by an understanding of the relationship between humans and nature. Teachers play a crucial role in helping students develop the knowledge and skills needed to address environmental challenges while encouraging participation in environmental protection initiatives. From an early stage,

educators must instill environmental knowledge and cultivate a positive attitude toward conservation and sustainability. There is a growing need to organize and implement educational programs focusing on environmental issues, solutions, and attitudes toward preservation and conservation⁷.

Environmental education training is one of the most commonly attended programs by science teachers and those specializing in environmental studies. Several initiatives have been conducted, including EE training for prospective teachers⁶, EE for sustainability¹¹, and EE integrated into science learning^{10,12}. Such training programs provide teachers with opportunities to utilize natural surroundings as a learning resource, enhancing students' understanding of environmental concepts¹. As mastering subject knowledge and pedagogical skills is essential for achieving Sustainable Development Goals (SDGs), continuous professional development through EE training can significantly contribute to the professionalism of teaching and the advancement of environmental education². This paper highlights the significance of pre-service teacher training in enhancing the effectiveness of environmental education (EE). It explores how equipping future educators with environmental knowledge, attitudes, and skills positively impacts their ability to integrate EE into their teaching practices. Additionally, the paper examines the key benefits of incorporating EE into teacher training programs, emphasizing its role in fostering environmental awareness, critical thinking, and responsible behavior among students. Various strategies for improving EE within teacher training are also discussed, including experiential learning opportunities, interdisciplinary integration, and hands-on activities that bridge theory with practice. Furthermore, the paper underscores the crucial role of teachers in shaping students' environmental consciousness and promoting sustainable practices, ultimately contributing to a more environmentally responsible society.

Research Questions: This study aims to address the following research questions:

1. How does pre-service teacher training influence the effectiveness of environmental education?
2. What are the key benefits of incorporating environmental education into pre-service teacher training programs?
3. What strategies can be adopted to improve environmental education in teacher training programs?
4. How do teachers contribute to enhancing students' environmental awareness and responsibility?

Research Methodology: This paper is theoretical in nature.

Influence of Pre-Service Teacher Training on the Effectiveness of Environmental Education: Pre-service teacher training is essential in enhancing the impact of environmental education (EE). Well-designed training programs equip future teachers with the necessary knowledge, skills, and attitudes to deliver impactful EE in

classrooms.

Enhancing content knowledge is essential for effective environmental education, as teachers need a strong understanding of environmental concepts, sustainability, and ecological interconnections. Pre-service teacher training programs are instrumental in establishing this foundation by incorporating subjects like environmental science, climate change education, and sustainable development. These programs provide future educators with thorough and precise knowledge, empowering them to teach environmental topics with confidence and clarity. A well-rounded understanding of these concepts allows teachers to present complex environmental issues in an accessible and engaging manner, helping students develop a deeper awareness of sustainability and ecological responsibility.

Developing pedagogical skills is also crucial for effective environmental education, as it enables teachers to create engaging and student-centered learning experiences. Pre-service training equips future educators with interactive teaching strategies such as inquiry-based learning, problem-solving, and experiential education, which encourage students to think critically about environmental issues. Additionally, methods like outdoor education, project-based learning, and interdisciplinary approaches make environmental education more practical and relevant by connecting classroom lessons to real-world environmental challenges. By mastering these teaching strategies, educators can foster deeper student engagement and inspire meaningful discussions on sustainability and ecological responsibility.

Fostering environmental attitudes and values in teachers is essential for promoting a meaningful and impactful approach to environmental education. Educators with strong environmental awareness and a personal commitment to sustainability are more likely to inspire students to develop a sense of responsibility toward the environment. Pre-service training programs that incorporate eco-literacy and value-based learning help cultivate this intrinsic motivation, encouraging teachers to integrate environmental education into their teaching practices. By fostering a deep appreciation for nature and sustainability, these programs empower educators to instill similar values in their students, ultimately contributing to a more environmentally conscious generation.

Building confidence and competence is crucial for pre-service teachers, as many feel unprepared to teach environmental education due to a lack of knowledge or effective teaching methods. Hands-on experiences, micro-teaching, and exposure to real-world environmental challenges help them develop the confidence and skills needed to deliver impactful lessons. Similarly, encouraging interdisciplinary approaches enhances the effectiveness of environmental education by integrating it across subjects such as science, social studies, ethics, and policy

discussions. This interdisciplinary connection enables teachers to present environmental concepts in a more holistic and meaningful way.

Providing access to resources and networks further strengthens pre-service training by introducing educators to environmental organizations, teaching materials, and technological tools that support environmental education. Collaborations with NGOs, environmental agencies, and community-based projects enhance the practical application of environmental education in schools, giving teachers valuable opportunities to engage with real-world environmental issues. Additionally, promoting action-oriented education ensures that environmental learning leads to tangible behavior changes. Training programs that incorporate service-learning projects, eco-clubs, and community engagement activities encourage teachers to design lessons that inspire students to take real-world environmental action.

Despite the benefits of environmental education, many teachers face challenges such as curriculum constraints, lack of administrative support, and inadequate resources. Pre-service training that includes discussions on overcoming these barriers equips future educators with strategies to integrate environmental education effectively, even in challenging circumstances. By addressing these obstacles, training programs empower teachers to become advocates for environmental education, fostering a generation of students who are knowledgeable, engaged, and committed to sustainability.

Key Benefits of Incorporating Environmental Education into Pre-Service Teacher Training Programs:

Incorporating environmental education (EE) into pre-service teacher training programs provides a range of key benefits that enhance both teacher preparedness and student outcomes. Pre-service teachers gain a solid understanding of environmental concepts, sustainability, and ecological issues, allowing them to deliver accurate and well-informed lessons. Training in EE equips educators with effective, student-centered teaching strategies such as inquiry-based learning, experiential education, and project-based approaches, making lessons more engaging and interactive. Many teachers may feel unprepared to teach environmental topics, but pre-service training builds their confidence through hands-on experiences, lesson planning, and practice teaching. Additionally, exposure to EE fosters environmental literacy and a personal commitment to sustainability, encouraging teachers to integrate these values into their lessons and inspire students to adopt eco-friendly behaviors.

EE training also promotes an interdisciplinary approach, allowing teachers to incorporate sustainability topics across various subjects such as science, social studies, ethics, and policy discussions. Pre-service training connects future educators to environmental organizations, teaching materials, and digital tools, providing resources

that enhance the learning environment. Furthermore, EE training encourages action-oriented education by involving students in real-world projects, eco-clubs, and community engagement activities that inspire them to take environmental action. Teachers are also prepared to overcome barriers, such as curriculum limitations and lack of resources, by gaining strategies to integrate EE effectively despite challenges. Finally, teachers trained in EE are more likely to inspire students to develop critical thinking skills, environmental responsibility, and sustainable habits, creating a lasting impact on student engagement and contributing to a more environmentally conscious future generation.

Strategies to Improve Environmental Education in Teacher Training Programs:

Enhancing the integration and effectiveness of environmental education (EE) in teacher training programs requires strategic approaches. Incorporating experiential learning opportunities—such as field trips, outdoor classrooms, and community-based projects—helps pre-service teachers bridge theoretical knowledge with practical applications, strengthening their ability to teach environmental concepts effectively. Additionally, embedding EE across various disciplines, including social studies, ethics, and the arts, fosters a holistic understanding of environmental issues. This interdisciplinary approach encourages educators to view EE as a fundamental, cross-cutting theme that enriches the overall curriculum.

Training programs should also focus on specific pedagogical strategies for teaching EE, such as project-based learning, inquiry-based learning, and problem-solving approaches, which foster critical thinking and action-oriented learning. Emphasizing eco-literacy and sustainability practices allows future teachers to model sustainable behaviors in their classrooms, promoting values like energy conservation, waste reduction, and green technologies. Collaborations with environmental organizations and NGOs can provide teachers with valuable resources, guest speakers, and service-learning opportunities that enhance the environmental education experience.

Incorporating technology and digital tools, such as environmental apps and virtual field trips, can make EE more engaging and interactive. Teacher training programs should also offer continuous professional development opportunities, including workshops and conferences, to keep educators up-to-date on the latest environmental issues and teaching strategies. Encouraging reflective practices helps teachers connect their personal environmental values to their teaching, fostering a deeper commitment to sustainability. Additionally, fostering collaboration and networking with fellow educators, environmental experts, and community leaders provides teachers with fresh ideas and resources to enhance their teaching. Lastly, creating a school culture of sustainability

within teacher training programs by adopting eco-friendly practices reinforces the importance of environmental stewardship. By adopting these strategies, teacher training programs can better prepare future educators to teach environmental education in innovative and impactful ways.

The Role of Teachers in Enhancing Students' Environmental Awareness and Responsibility: Teachers play a critical role in fostering environmental awareness and responsibility among students by shaping how they perceive and interact with the environment. They contribute in several impactful ways. By incorporating environmental education into the curriculum, teachers embed topics such as ecosystems, human impact, and sustainability across subjects like science, social studies, and language arts, helping students understand the interconnectedness of the world around them. This integration highlights the urgency and relevance of environmental issues in students' daily lives. Teachers also model sustainable practices, demonstrating eco-friendly behaviors like waste reduction, energy conservation, and recycling. When students see their teacher's practicing sustainability, they are more likely to adopt similar habits.

Through promoting critical thinking and problem-solving skills, teachers encourage students to engage with real-world environmental challenges, empowering them to explore solutions and develop a deeper understanding of sustainability. Teachers also facilitate environmental action and engagement by organizing initiatives like eco-clubs and service-learning projects, motivating students to take responsibility for positive change in their communities. By creating spaces for open discussions on environmental topics, teachers help students develop a sense of environmental justice, raising awareness about issues like climate change and pollution.

Teachers who connect students to the outdoors, through field trips to parks or reserves, help them develop a deeper appreciation for nature and an understanding of the importance of protecting natural resources. Instilling values of sustainability in their lessons, teachers foster a sense of responsibility and stewardship, teaching students the long-term benefits of making environmentally conscious choices. Finally, by empowering students to become advocates for environmental causes, teachers provide the knowledge and skills needed to participate in campaigns and raise awareness. Through these efforts, teachers not only educate students about environmental issues but also inspire them to act with care and responsibility, contributing to the development of environmentally conscious citizens.

Conclusion: Incorporating environmental education into pre-service teacher training programs is essential for equipping future educators with the knowledge, skills, and values necessary to address the environmental challenges of the 21st century. By enhancing content knowledge, developing pedagogical skills, fostering environmental attitudes, and providing hands-on learning experiences, pre-

service training programs can empower teachers to deliver impactful environmental education in the classroom. Teachers, in turn, play a critical role in shaping students' environmental awareness and responsibility, contributing to the development of a sustainable, environmentally conscious society.

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