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Green education: Learning about the green transition and sustainable development

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Abstract

In an era of climate change and environmental degradation, the need for a paradigm shift in education has never been more urgent. According to the European Education Area, Green Education, which includes initiatives and policies that integrate education for sustainability and climate change into education and training, has emerged as a critical approach to empowering individuals with the necessary knowledge, skills, and values to address the complex environmental challenges of our time. The aim is to equip learners with the knowledge, skills, and attitudes necessary for a greener and more sustainable future. The evolution of technology and the use of technologically advanced tools help those involved in education: learners, parents, and teachers to develop environmental awareness and improve skills, values, and attitudes related to well-being.

Keywords: Environment; Green Education; Technologies; Green Jobs; Green Skills: Environmental Awareness; VR

1. Introduction

Undoubtedly, excessive and often uncontrolled human activity has caused significant and irreversible environmental periods in modern times. With the advent of the Industrial Revolution and the separation of man from nature, the relationship between culture and environment underwent a profound change that resulted in the reckless exploitation of natural resources and the subsequent environmental degradation (Tsamboukou-Skanavi, 2004).

The world is at a critical juncture. Climate change, resource depletion, biodiversity loss, and a host of other environmental challenges threaten the very fabric of our planet and the well-being of future generations. In the face of these daunting realities, education is emerging not just as a tool for individual advancement, but as a vital tool for social transformation. Green education, also known as environmental education or sustainability education, is not just another subject to be taught. It is a fundamental shift in pedagogy, philosophy, and purpose, aimed at empowering individuals with the knowledge, skills, values, and services they need to navigate the complex environmental landscape and build a sustainable future.

Green education is not just about teaching about the environment, but about empowering individuals to become agents of change. It is about cultivating the knowledge, skills, values, and attitudes needed to create a more sustainable and just world. In the 21st century, green education is not just desirable. It is essential. As environmental challenges continue to mount, the need for a generation of environmentally literate and engaged citizens has never been greater. By embracing green education, we can equip future generations with the tools they need to build a thriving planet for all. It is an investment in our collective future, a commitment to nurturing not just individuals, but the very ecosystems on which our lives depend. The time to act is now, to weave the principles of sustainability into the very fabric of our education systems and to empower the next generation to become stewards of a healthy and vibrant planet. Climate

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change is seen by Europeans as one of the world's most pressing issues. Like all other sectors, education and training need to act to address this global catastrophe.

Countries in the European Union (EU) get assistance from the European Commission in:

- Giving educators and students the information and abilities they need to be sustainable
- Assisting educational and training establishments in incorporating sustainability into their everyday operations, instruction, and learning
- Establishing a common vision and knowledge of green transition education

The transition to a climate-neutral EU will have significant social, economic, and employment impacts. A socially just transformation requires people to have the knowledge, skills, and attitudes to shape and cope with profound change. Education and training systems and institutions can act as catalysts and support a shift towards a more sustainable society (Bianchi et al., 2022).

2. Green education: a multi-faced facet holistic and transformative approach and economic dimensions

2.1. Definition

Green education is a multidisciplinary field that integrates environmental awareness and sustainability into all aspects of learning. It goes beyond simply teaching about the environment. It encourages a deep understanding of the interconnection between human actions and the natural world.

Green education aims to cultivate environmentally responsible citizens who are equipped to make informed decisions and take action to protect the planet, going beyond the traditional boundaries of classroom learning. It is a holistic and interdisciplinary approach that integrates environmental awareness and sustainability into all aspects of the educational experience. Green education goes beyond simply teaching about the environment to promote a deep understanding of the interconnection between human actions and the natural world.

It seeks to cultivate environmentally responsible citizens who are not only aware of environmental issues but are equipped to make informed decisions, engage in critical thinking, and take meaningful action, as Sterling (2001) argues, it is about "developing capacities for sustainable living".

2.2. Green Education: Cultivating a Sustainable Future Through Learning

The world is facing a confluence of environmental crises – climate change, biodiversity loss, resource depletion – that require a fundamental shift in the way we interact with our planet. Education, in this context, is not just a tool for personal development, but a critical tool for social transformation. Green education is a holistic and transformative approach that empowers individuals with the knowledge, skills, values, and factors they need to navigate the complex environmental landscape and build a sustainable future.

2.2.1. Environmental problems include

- Environmental pollution,
- Climate change,
- The ozone hole,
- Deforestation or deforestation
- Desertification,
- The extinction of biological species,
- Acid rain, etc.

It is widely known that climate change is one of the most characteristic phenomena of the modern world. It is a by-product of the greenhouse effect, which is a natural phenomenon necessary for the maintenance of life on the planet. However, human activities have contributed greatly to the increase of an unbalanced amount of greenhouse gases in the atmosphere, causing the anthropogenic aspect of climate change. Despite doubts about the impact of humans on climate change, there is indisputable scientific evidence that confirms it. The consequences of climate change seem very serious, both for the environment and for people themselves, while they do not escalate in the future as stated in the article: Climate Change 101: How Everyday Activities Contribute to the Ever-Growing Issue (Driga, & Drigas, 2019).

The globalization of environmental issues makes environmental-practical education vital for shaping attitudes, influencing perceptions and encouraging environmentally friendly behavior, in order to raise citizens' awareness of environmental issues, take preventive measures to address them and participate at national and local levels.

The European Union and the OECD have set important axes - goals for the environment and the promotion of sustainability, which include climate change, the circular economy, recycling, energy saving, biodiversity, etc. The OECD suggests promoting green education in various ways, such as:

- Educational programs: Organization of educational programs for students, aiming to raise awareness about sustainable mobility.
- Collaboration with schools: Collaboration with schools to implement actions aimed at the use of public transportation and cycling.
- Creating infrastructure: Creating bicycle and pedestrian-friendly infrastructure to encourage the use of more sustainable means of transportation.

The main axes of Green Education are

- Learning Environments and understanding environmental issues: Creating supportive learning environments that promote practical, interdisciplinary, and locally relevant sustainability education. Students learn about climate change, pollution, biodiversity loss, and other important issues.
- Sustainability Capabilities: Development of environmental problem-solving capabilities and skills that enable learners to contribute to sustainable development and address environmental challenges. Students acquire skills such as data analysis, decision-making, and collaboration to address environmental challenges.
- Educational Policies - Promoting sustainable development: : Supporting Member States to prioritize sustainability in education and training policies and programs. Students learn about the concepts of sustainability and how they can contribute to a more sustainable world.
- Community Participation - Encouraging participation in environmental actions: Active participation of students, teachers, local authorities and organizations in sustainability initiatives. Students participate in volunteer activities, such as beach cleanups, tree planting and other actions that contribute to the protection of the environment.
- Curriculum integration: Integrating sustainability into the curriculum at all levels of education, from primary schools to higher education.

The basic principles that support this green education arise, which are the following

- Interdisciplinarity: Green education draws on various disciplines, including sciences, social studies, economics and ethics, to provide a holistic understanding of environmental issues, recognizing the multifaceted nature of environmental challenges (Orr, 1994). It recognizes that environmental challenges are complex and multifaceted and require perspectives from different sectors to address them effectively.
- Experiential learning: Hands-on experiences in nature, through outdoor learning, field trips, and community projects, foster a sense of connection and stewardship (Sobel, 2004). Green education emphasizes hands-on, real-world experiences that connect students to nature and foster a sense of stewardship. Outdoor learning, field trips, community-based projects, and citizen science initiatives provide opportunities for students to explore ecosystems, observe environmental phenomena, and develop a sense of connection with the natural world.
- Critical Thinking and Problem Solving: Green education encourages students to analyze environmental problems, evaluate possible solutions, develop critical thinking skills, and challenge dominant narratives, developing their informed perspectives (Fien, 2002). It empowers them to question assumptions, challenge dominant narratives, and think creatively about how to address complex environmental challenges, that is, it promotes critical thinking skills.
- Action-oriented learning: Green education empowers students to become agents of change, taking concrete steps to address environmental issues in their communities (Jensen & Schnack, 1997) and beyond. A key tenet of green education is its focus on action. It encourages students to become active agents of change, empowering them to take concrete steps to address environmental issues in their schools, communities, and beyond. This can include anything from organizing recycling campaigns to advocating for environmental policies.
- Systems thinking: Understanding promotes understanding of the interconnectedness of social, economic, and ecological-environmental systems is vital to understanding the impacts of human actions (Meadows et al., 1972). Green education of the interconnectedness of social, economic, and systems. It emphasizes the

importance of considering the ripple effects of human actions and understanding how different systems interact to create challenges and opportunities for sustainability.

- Values-based education: Green education is not value-neutral. Promoting values such as environmental stewardship, social justice, intergenerational equity, and respect for all forms of life guide students' relationship with the environment (Huckle & Sterling, 1996). It encourages students to reflect on their values and how they inform their relationship with the environment.

2.3. European framework of competencies for sustainability

With the European Green Deal and the goal of becoming climate-neutral by 2050, the European Union (EU) is working to bring about the fundamental reforms that our economy and society need. The EU coordinates efforts across a number of policy domains, including energy, the environment, transportation, and agriculture, in an effort to achieve a just and inclusive green transition. Like other sectors, education and training must critically evaluate how its operations, processes, and practices are tackling the ecological and climatic challenges. Of utmost importance is how it is preparing students for the future ("Learning for the green transition and sustainable development," 2024).

A number of significant EU policies, including the Green Deal, the EU Biodiversity Strategy for 2030, the EU Skills Agenda3, and the Council Resolution on the European Education Area, emphasize the value of education and training in empowering and involving people for environmental sustainability and improving the skills and competencies needed for the green transition.

The European framework states that students of all ages should learn four categories of sustainability-related abilities. Three sub-components make up each competency.

- Integrating sustainability values assessing sustainability support for justice promotion of nature
- Embracing complexity in sustainability
    - Systems thinking
    - Critical thinking
    - Problem framing
- Action for sustainability
    - Political agency
    - Collective action
    - Individual initiative
- We envision sustainable futures
    - Future education
    - Adaptability
    - Investigative thinking

A set of knowledge, abilities, and attitudes that students must develop for a sustainable future are also included in the Green Competencies framework, which is a bundle that encompasses Green Education. The European Education Area defines green competencies. These skills are intended to assist people in developing agency, becoming critical and systemic thinkers, and supporting sustainable development.

2.3.1. The basic Green Capabilities are the following

- Social-emotional competence: Understanding and managing emotions, empathy and cooperation.
- Cognitive ability: Critical thinking, problem-solving, and decision-making skills.
- Metacognitive Ability: Reflection on one's own thinking and learning processes.
- Functional ability: Application of knowledge and skills in real-world situations.
- Physical Ability: Understanding natural systems and the impacts of human activities on the environment.
- Political Competence: Participation in civic activities and understanding of governance structures.
- Economic competence: Understanding economic systems and their impacts on sustainability.

From elementary school to college, as well as in both formal and informal learning settings, these abilities are meant to be included into all tiers of education and training.

2.4. Benefits of green education in transformation societies

The impact of green education extends beyond environmental awareness, offering a multitude of benefits. The benefits of green education extend far beyond simply increasing environmental awareness.

It offers many benefits for individuals, communities, and society, such as

- Improved environmental awareness and literacy: Green education equips students with a deep understanding of environmental issues, their causes, and their consequences. It enhances environmental literacy, enabling individuals to critically evaluate information and make informed decisions about environmental issues. Learners gain a deep understanding of environmental issues, enabling informed decision-making (Hungerford & Volk, 1990).
- Developing Key Skills: Green education cultivates a range of key skills, such as critical thinking, problem-solving, creativity, collaboration, communication, and leadership. These skills are not only critical to addressing environmental challenges but are also highly valued in the 21st-century workforce. The necessary skills of critical thinking, problem-solving, creativity, collaboration, and communication are honed and are vital for both environmental action and 21st century careers (UNESCO, 2017).
- Increased citizen participation - Civic engagement: Green education promotes active civic engagement, encouraging participation in democratic processes, advocacy for environmental protection (Westheimer & Kahne, 2004), and collaborative work to create sustainable communities. Green education empowers students to become active and engaged citizens. In environmental management.
- Promoting sustainable behaviors: By fostering a deep understanding of environmental issues and promoting the values of environmental stewardship, green education encourages individuals to adopt more sustainable lifestyles. (Stern, 2000). This may include reducing consumption, conserving resources, and making environmentally conscious choices in their daily lives.
- Improved well-being: Connecting with nature through green education contributes to physical and mental health (Louv, 2005). Studies have shown that spending time in nature has many benefits for physical and mental health. Green education, with its emphasis on outdoor learning and connecting with nature, can contribute to improved well-being for both students and teachers.
- Social Justice and Equity: Addressing environmental injustices and empowering marginalized communities is central to green education (Agyeman, 2013). Environmental issues disproportionately affect marginalized communities. Green education can play a critical role in raising awareness about environmental injustices and empowering individuals to advocate for just and sustainable solutions.
- Environmental awareness: Green education raises awareness about environmental issues and their impacts on human society and the planet.
- Sustainability Literacy: Green education equips students with the knowledge and skills to understand and promote sustainable practices.
- Personal Responsibility: Green education installs a sense of personal responsibility for environmental protection and sustainable living.
- Economic Opportunities: The transition to a green economy is creating new job opportunities in a variety of sectors, from renewable energy to sustainable agriculture. Green education can prepare students for these emerging careers and contribute to a more sustainable and prosperous economy.

The above main axes lead to

- Creating a sustainable society,
- Reducing the environmental footprint, long-term goals
- Protection of biodiversity,
- Tackling climate change
- Development of environmental awareness,
- Behavioral change
- Encouragement of participation in actions for short-term environmental goals.

2.5. Green education application

2.5.1. The role of teachers and parents

The role of the teacher is crucial to the success of green education as they can demonstrate their role model for the importance of environmental responsibility, encourage critical thinking, create a positive learning environment, and collaborate with the community to implement environmental actions. The Role of parents is also important in supporting their children's education by using sustainable habits at home and sharing them with their children, encouraging children to explore nature and ask questions, participating in environmental actions, such as beach cleanups, tree planting, and collaborating with the school. Green education with direct access to nature (gardening, hiking, and bird watching), sensory experience, practical learning, social interaction, a sense of success in activities

important for sustainability, and adaptation of activities according to the needs and capabilities of each individual, so that they can participate

- Improved mental health: Reduction of anxiety, depression, and aggression.
- Increased concentration and attention.
- Improvement of motor skills.
- Development of creativity and imagination.
- Strengthening environmental awareness.
- Increased self-esteem and autonomy.

Green education, as a field of awareness and active participation of all citizens, must be accessible to all, regardless of their particular characteristics (vulnerable educational groups, People with Disabilities (PWDs), and students with learning difficulties require special attention and adaptation of educational actions. Green education, which integrates environmental principles and practices into the educational process, can offer significant benefits to people with disabilities and learning difficulties. This approach not only promotes environmental awareness but also contributes to personal development and improvement of quality of life, development of social skills and social inclusion, increase of self-confidence, and improvement of learning skills of these individuals.

2.5.2. Implementing Green Education: Strategies and Best Practices

Green education can be integrated into various educational settings, from early childhood education to higher education and beyond. Effectively integrating green education requires a multifaceted approach.

- Curriculum Integration of Environmental Issues: Integrating environmental issues and concepts into existing curricula across all subjects (Bonnett, 2002). Environmental issues and concepts should be integrated into the curriculum, not just limited to science subjects. Mathematics, language arts, history, art, and other subjects can all provide opportunities to explore environmental issues from different perspectives.
- Outdoor learning - Outdoor Learning Utilizing natural spaces as classrooms for experiential learning (Malone & Tranter, 2003) to provide hands-on experiences with nature. Using outdoor spaces as classrooms is essential to providing hands-on, experiential learning opportunities. School gardens, nature trails, and local parks can become valuable learning environments.
- Inquiry-Based Learning: Encouraging student-led investigations of environmental problems (NRC, 2012). Encouraging students to ask questions, investigate environmental problems, and develop their solutions is a powerful way to strengthen critical thinking and problem-solving skills.
- Project-based learning: Engaging students in real-world projects that address community environmental challenges (Larmer et al., 2015) can be a highly effective way to promote action-oriented learning and civic participation.
- Service-Learning: Combining classroom learning with community service on environmental issues (Bringle & Hatcher, 2011) provides students with opportunities to apply their knowledge and skills to address real-world environmental issues. Involve students in community-based projects that address environmental issues. Sustainability Initiatives Implementing Sustainable Practices within Educational Institutions (Walshe, 2006). Implementing sustainable practices in schools and educational institutions, such as reducing waste, conserving energy, and promoting recycling, can provide students with real-world examples of sustainability in action.
- Teacher Education and Professional Development Teacher Education: Equipping Teachers with the Knowledge and Skills for Effective Green Education (Tilbury, 2011). Providing teachers with the knowledge, skills and resources they need to effectively integrate green education into their teaching is crucial to its success.
- Community Partnerships: Partnering with environmental organizations and agencies (Orr, 2011). Partnering with environmental organizations, community groups, and government agencies can provide valuable resources and support for green education initiatives.
- Sustainability initiatives: Implementing sustainable practices in schools and educational institutions, such as reducing waste, saving energy, and promoting recycling.
- Partnerships: Partner with environmental organizations, community groups, and government agencies to provide resources and support for green education initiatives.
- Assessment: To track advancement and pinpoint areas for development, it is crucial to create suitable techniques for evaluating student learning in green education.

2.6. The role of technology in green education

Technology can play an important role in enhancing green education, offering multiple solutions:

- Virtual Field Trips: Virtual reality and augmented reality can offer students experiences of different ecosystems and environmental challenges, even if they cannot physically visit them.
- Data collection and analysis: Citizen science initiatives and online platforms can allow students to collect and analyze environmental data, contributing to real-world research and conservation efforts.
- Online learning resources: A wealth of online resources, including videos, articles, and interactive simulations, can provide students with access to information about environmental issues and sustainability.
- Communication and Collaboration: Online platforms can facilitate communication and collaboration between students, educators, and environmental organizations around the world.

2.7. Greensigns

The Net Media Laboratory ITP NCSR Laboratory Demokritos participates in and develops green education programs such as Greensigns (Figure 1). This project promotes Green Education by raising awareness among students from vulnerable social groups, people with disabilities, and students with learning and hearing difficulties about the environment and sustainability and encouraging them to act as responsible citizens. It also helps them acquire, develop, and improve skills such as critical thinking, problem-solving, collaboration, and creativity. The Greensigns project, an Erasmus+ project, is becoming viable via the cooperation of the following partners:

- National Center for Scientific Research "Demokritos" (Coordinator), Greece
- Associazioni Unite dei Sordi della Regione Umbria (Partner 2), Italy
- CY - A & A Emphasys Interactive Solutions Ltd (Partner 3), Cyprus
- Fundacion GFM Renovables (Partner 4), Spain
- Special High School and Lyceum S.E. for the Deaf and Hard of Hearing of Thessaloniki (Partner 5), Greece
- Asociatia Nationala a Profesorilor pentru Elevi cu Deficiente de Auz Virgil Florea (Partner 6), Romania.

Figure 1 Greensigns logo. This publication has been developed with the financial support from the European Commission in the framework of Erasmus+ programme. The information and views set out in this publication are those of the authors. The European Commission and the Hellenic National agency may not be held responsible for the use, which may be made of the information contained herein. Project number agreement: 2023-2-EL02-KA220-YOU-000181130

The Greensigns project is pioneering the design of Green Sign Language in Greek, Italian, Cypriot, Spanish and Romanian Sign Language. Greensigns project recognizes the need to upgrade the quality, innovation, and validation of youth work practices related to green postings and digital transformation while ensuring accessible jobs for all young people regardless of their abilities. It addresses the emerging demands or pressing needs of young people (DHH) to acquire green employment security skills and understand issues related to the act of transition, promoting inclusion and diversity in youth work. While in the past the laboratory has developed activities through other programs that were completed within three years, with great success, in the implementation of their educational goals. The broader objective of these projects was to raise public awareness of everyday activities that negatively affect the environment, as well as to create trained scientists who will contribute to the development of environmentally friendly and sustainable agriculture and will be directly excluded from the labor market. The primary sector, plant and animal

production, is highly dependent on climatic conditions and will bear the brunt of this change. Therefore, adjustments are required in the way we practice agriculture. Adjustments that will allow the continuation of the production of quality food of animal and plant origin and that will allow the survival of the human race.

2.8. The future of green education

2.8.1. Challenges and Opportunities: Navigating the Path Forward

Despite its growing recognition, green education still faces several challenges:

- Resource constraints: Funding constraints can hinder program implementation.
- Lack of resources: Many schools and educational institutions lack the necessary resources to effectively implement green education programs. This can include funding for materials, teacher training, and outdoor learning facilities.
- Curriculum pressures: Overcrowded curricula may limit the integration of green education. Curriculum constraints: Overcrowded curricula and standardized testing requirements may make it difficult for teachers to integrate green education into their teaching.
- Resistance to Change: Some teachers may resist new pedagogical approaches. Resistance to Change: Some teachers and administrators may resist adopting new pedagogical approaches and incorporating environmental issues into their teaching.
- Assessment Challenges: Assessing complex skills and values in green education can be difficult: Appropriate methods for assessing student learning in green education can be challenging, as it often involves assessing complex skills and values.

However, the opportunities are many:

- Growing public awareness: Growing environmental concern is fueling the demand for green education.
- Technological developments: Virtual reality, data analysis tools, and online resources enhance learning.
- Policy support: Governments are increasingly recognizing the importance of environmental education.

2.8.2. Green Education in the 21st Century: A Call to Action

Green education is not just about environmental knowledge. It is about empowering individuals to become agents of change. As David Orr (1994) so eloquently put it, “The crisis is not just environmental; it is also a crisis of character, vision, and intelligence.” Green education seeks to cultivate these qualities, raising a generation equipped to build a sustainable and just world. It is an investment in our collective future, a commitment to nurture not only individuals but the very ecosystems that sustain us. The time to act is now, to weave the principles of sustainability into the fabric of education, enabling future generations to become stewards of a thriving planet.

As environmental challenges continue to escalate, green education will play an increasingly critical role in shaping a sustainable future. By empowering individuals with the knowledge, skills, and values needed to address environmental issues, green education can help create a world where both humanity and the planet thrive.

3. Conclusion

Green education is not just an educational approach. It is a call to action. It is a recognition that environmental stewardship is not just the responsibility of a few, but a shared imperative for all. By embracing green education, we can cultivate a generation of environmental stewards who are equipped to create a more sustainable and just world for all.

Despite these challenges, the future of green education is bright. Growing public awareness of environmental issues, coupled with growing recognition of the importance of sustainability, is creating a growing demand for green education programs. Technological advances are also creating new opportunities for students to engage in environmental learning. A wide range of initiatives and actions on the environment and sustainability are taking place in education and training across Europe. They reflect progress and growing public interest, but more needs to be done to make learning for sustainability a systemic feature of education policy and practice in the EU. Supporting the green and digital transitions is a priority area for EU policy cooperation in the field of education.

The learning and instruction required for individual, social, and environmental well-being both now and in the future is the focus of environmental sustainability education and training. It may be thought of as a broad heading that

encompasses all subjects and disciplines. To get from awareness to individual and group action and empowerment, learners must understand how economic, social, and ecological systems are interconnected. The development of practical skills (applied learning), empathy, solidarity, concern for the environment (socio-emotional learning), knowledge, comprehension, and critical thinking (cognitive learning) are all necessary to achieve this.

Global change, sustainability, active citizenship, and environmental preservation are promoted by a wide range of educational and training strands and movements. This encompasses education for sustainable development, global education, peace education, climate change education, sustainability education, and environmental education. A vision of education and learning that is transformational, embraces change and fosters sustainability unites all these movements and ideas. Additionally, they all acknowledge how intertwined social, economic, and environmental concerns are. To support the objectives and aspirations of the European Green Deal, the European Commission's work on learning for environmental sustainability builds on existing movements and gives environmental issues fresh attention ("Learning for the green transition and sustainable development," 2024).

It is essential to highlight the vital role that digital technologies play in advancing education [25-30] and green education. ICTs broaden access to environmental learning, introduce innovative approaches to teacher training in sustainability, strengthen long-term knowledge retention, encourage collaboration on eco-projects, foster transparency through shared environmental initiatives, support learner-centered sustainability strategies, and stimulate the development of creative teaching methods. They also accelerate the spread and depth of environmental knowledge. Tools such as VR, mobile technologies, AI, and immersive environments [31-43] provide educators and learners with new ways to represent and engage with sustainable concepts.

ICTs significantly enhance the effectiveness and reach of green education. Mobile technologies allow environmental learning to take place anytime and anywhere, while a wide range of digital applications act as key facilitators in delivering sustainability-focused content. Incorporating AI, STEM education, and robotics into green learning environments promotes innovation, adaptability, and improved educational outcomes. Meanwhile, educational games turn the leading process into an engaging, multisensory experience that makes environmental topics more accessible and enjoyable. Additionally, blending ICTs with approaches like metacognition, mindfulness, meditation and emotional intelligence [44-51] puts personal and emotional growth at the heart of educational practices. This integration enriches sustainability education by encouraging deeper reflection, empathy, and commitment to environmental values.

Compliance with ethical standards

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Disclosure of conflict of interest

The Authors proclaim no conflict of interest.

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