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Role of Green School in Environmental Conservation and Sustainable Development: A Systematic Review

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Abstract

This paper delves into the critical role of green schools in advancing environmental conservation and sustainable development. Through an extensive review of literature, it examines the evolution of environmental education and the integration of green schools into educational frameworks at national and state levels. By exploring various perspectives, the paper underscores how green schools foster a profound understanding of ecological principles and environmental issues among students. It discusses key components and guidelines for green schools, highlighting their benefits in terms of cost savings, improved learning environments, and enhanced student performance. Additionally, it elucidates how green schools contribute to environmental conservation through sustainable practices like waste management, energy efficiency, and water conservation. The study emphasizes the crucial role of education for sustainable development (ESD) in cultivating environmental awareness and empowering students to become responsible stewards of the environment. Ultimately, the present paper aims to raise awareness of the importance of green schools and inform educational strategies for addressing environmental concerns through sustainable development initiatives in schools. Furthermore, this paper evaluates the alignment of green schools with the Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education) and SDG 13 (Climate Action), demonstrating their impact in fostering a sustainable and resilient future.

Keywords: Sustainable Development, Environmental Education, Green School, Environmental Conservation, Waste Management, SDGs

Introduction

Over the past three decades, the global population has experienced a significant surge, exacerbating the imbalance in urban-rural distribution and placing additional strain on Earth's finite resources. The rapid pace of industrialization and modernization has driven heightened both the level of production and intake of food, accompanied by increased purchasing power and improved literacy rates worldwide. However, this societal shift has also fostered a superficial, cosmetic lifestyle, contributing to escalating pollution levels and posing a grave peril to life on our planet. Consequently, both developed and developing nations are increasingly recognizing the urgent need to address the environmental damage and loss of biodiversity, which, if left unchecked, could have irreversible consequences for the next generations (Reid, 1995; Dalal-Clayton and Bass, 2002). Sustainable development and environmental

education have become top priorities on national and international agendas from the Rio Earth Summit in 1992. The concept of sustainable development, initially articulated by Brundtland in the 1987, report titled as "Our Common Future," explained it as development that satisfies current demands without jeopardising the capacity of future generations to satisfy their own requirements (WCED, 1987). This marked a crucial step in highlighting the significance and applicability of sustainability. Globally, education for sustainable development, or ESD, is acknowledged as a crucial instrument for accomplishing sustainable development. As the environment sustains life on our planet, its degradation has become a pressing concern, necessitating the integration of environmental education (EE) as a lifelong learning tool, starting from childhood. EE can be understood as a process aimed at cultivating communities aware of and engaged with the environment, equipped with the abilities, pledges, attitudes and knowledge to address current challenges and prevent future occurrences (Sonowal, 2009). Environmental issues have intensified due to rapid technological and industrial growth, leading to significant shifts in the environmental landscape. The United Nations Decade of Education for Sustainable Development (UNDESD) underscores the pivotal role of Education for Sustainable Development (ESD) in addressing complex environmental issues and advancing global sustainable development agendas. Initiated by UNESCO from 2005 to 2014, UNDESD aimed to integrate sustainable development principles, values, and practices into all levels of education. ESD equips individuals with the understanding, skills and attitudes necessary to engage with and contribute to sustainability challenges, fostering a holistic understanding and adoption of sustainable practices. While the formal period of UNDESD concluded in 2014, its legacy persists through on-going efforts to mainstream ESD into educational systems and policies worldwide, emphasizing the importance of education as a catalyst for building a more resilient and environmentally sustainable future. In alignment with global sustainability efforts, the United Nations established the Sustainable Development Goals (SDGs) as a framework for addressing critical social, economic, and environmental issues. Green schools align with SDG 4 (Quality Education) by integrating sustainability into curricula, fostering environmental literacy, and promoting experiential learning. They support SDG 13 (Climate Action) through sustainable infrastructure, renewable energy use, and eco-conscious policies that reduce environmental impact. By addressing these goals, green schools cultivate environmentally responsible citizens and contribute to long-term sustainability at local, national, and global levels.

Education is evolving towards green environmental conservation from the standpoint of sustainable development. Moreover, there's a growing emphasis on green environmental protection education. Contrasted with traditional education, green schools represent a novel educational model integrating the principles of sustainable development and ecological environmental preservation, fostering an interconnected understanding of people, nature, and society. In order to effectively address sustainability challenges, it is imperative that students possess the necessary skills and competencies that facilitate thinking critically, figuring out solutions and reflexivity as well.(Tarrant and Thiele, 2016). This approach is instrumental in nurturing students who embody values of harmonious coexistence between humanity and the environment. Green environmental protection education seamlessly incorporates the concept of sustainable development, facilitating its comprehensive integration into educational frameworks. By fully integrating green education into teaching and learning practices, we can propel the widespread advancement of environmentally conscious education.

Objectives

The study aims to acknowledge the significance and prevalence of the green school concept in promoting environmental conservation and sustainable development.

Research Methodology

The present study utilized a literature review approach, examining literature of different time. These sources included academic books, scholarly journals, and research findings related to environmental education, green school, Education for Sustainable Development (ESD) and environmental conservation through it. Through an in-depth analysis of the literature, various insights, perspectives, and findings were gathered. Subsequently, these findings were utilized to inform the development of specific areas of interest to be further investigated in a subsequent study focusing on the practical application of green schools and environmental education using the ESD approach.

Evolution of Environmental Education

From a worldwide perspective, the evolution of higher education has become a focal point (Disterheft et al., 2012). This evolution has been particularly pronounced in developed nations, leading to the cultivation of proficient and knowledgeable human capital. The inception of sustainability in higher education dates back to the Stockholm Declaration of 1972, marking the initial conference that underscored the interconnectedness of humanity and the environment. It was emphasized that integrating environmental awareness into education is vital for cultivating responsible behaviour among both young individuals and adults. The declaration aimed to explore avenues through which universities, their administrators, educators, researchers and students could mobilize their resources to address the imperative of balancing human endeavours for economic and technological advancement with the imperative of environmental conservation (Sohn, 1973). This, in turn, is seen as crucial for fostering environmental conservation efforts and ultimately advancing human development goals.

The Tbilisi Declaration of 1977 highlighted the necessity of environmental education (EE) across all age groups to cultivate a holistic understanding of the world's biological, socio-economic, and cultural aspects, aiming to empower learners with the knowledge, values, skills, and behaviours essential for environmental improvement. Subsequent declarations, like the Thessaloniki Declaration, fused EE with the concept of sustainable development, stressing its role in fostering both environmental consciousness and sustainability. By 1990, more than 300 universities across 40 nations had endorsed the Talloires Declaration, a 10-point action plan aimed at integrating sustainability and environmental literacy into teaching, research, and operational practices within colleges and universities (UNESCO, 1990). The Rio Summit in 1992, encapsulated in Agenda 21, underscored the interdependence of environmental, economic, and social development, asserting education as critical for promoting sustainable development and public participation in decision-making. Consequently, these universities initiated voluntary and committed initiatives to embed sustainability within their institutional frameworks, establishing clear policies, objectives, and targets, along with strategic planning and timelines to realize a sustainable campus (United Nations, 1993). In the 21st century, sustainable development prioritizes localized goals and collective resource management, with Agenda 21 targeting increased community awareness and involvement in environmental and societal advancement. EE and ESD align closely with the United Nations Sustainable Development Goals (SDGs), a set of global targets aimed at addressing pressing social, economic, and environmental challenges by 2030. Education, particularly through EE

and ESD, is identified as a key enabler for achieving these goals. By integrating SDGs into educational curricula and promoting action-oriented learning experiences, EE and ESD contribute directly to progress across multiple SDG targets, such as quality education (SDG 4), climate action (SDG 13), and life on land (SDG 15).

Over time, the discussion surrounding Environmental Education (EE) has increasingly recognized the significance of Education for Sustainable Development (ESD), providing valuable perspectives on crafting comprehensive curricula at both national and state levels. Positioned as a cornerstone of sustainability and considering the interconnectedness of the Global Goals, EE has emerged as a crucial element in progress towards achieving them.

Concept of the green school

Numerous studies acknowledge that the term "green school" holds diverse interpretations among different individuals, yet all share a genuine dedication to sustainability (Loubser, 2014). As per the Center for Green Schools, "green schools" are characterized as educational facilities designed to cultivate a healthy learning environment while advocating for energy and resource preservation, leading to cost savings (Meiboudi et al., 2016). Conversely, "Green school" as stated by Earthman is a structure engineered to conserve energy and water, created using environmentally conscious building supplies (Earthman, 2009). However, this definition merely scratches the surface of the comprehensive nature of a green school. The terminology surrounding environmentally conscious schools varies among scholars. Some scholars like Earthman (2009) and Kensler (2012) use "high-performance schools" to highlight their superior functionality, while others, such as Peacock (2004), prefer "sustainable schools" to emphasize their broader commitment to sustainability. Additionally, "Eco-schools" is used by scholars like John, Mei, & Guang (2013), Kensler (2012) and Meiboudi et al. (2016). Peacock 2004, emphasizes that sustainable schools encompass not only design but also the daily practices of their occupants. In essence, a green school is a building where occupants actively participate in sustainable development, striving to achieve zero-waste practices and promote environmental responsibility within the school community. Gough mentions different names of the green school movements in more than 20 countries.

In a debate with Olson and Kellum (2003), Gary Bailey, Vice President of Innovative Design, that schools designed with sustainability or green principles can enhance the quality of educational settings. The concept of sustainable development underscores the importance of meeting present needs without jeopardizing the ability of future generations to meet their own. A sustainable school not only adopts the principles of sustainability but also serves as an educational instrument for promoting sustainability.

Green School Guidelines

Gordon (2010) points out that the Leadership in Energy and Environmental Design (LEED) evaluation process was originally created to encompass all types of architectures by the U.S. Green Building Council (USGBC). LEED has identified seven categories in the project checklist which includes green or sustainable spaces, water conservation, energy and atmosphere, assets and supplies, indoor environmental quality, creative design and regional importance. Conversely, the green school guidelines, pioneered by the Collaborative for High Performance Schools (CHPS) in California in 1999, were specifically tailored for educational institutions. CHPS defines green schools by 13 attributes, emphasizing health, comfort, and energy efficiency. The standards for attaining green schools cover seven main categories: Leadership, Education, and Invention; Sustainable Spaces; Water Efficiency;

Energy Efficiency; Climate Impact; Materials and Waste Management; and Indoor Air Quality. These guidelines underscore the holistic approach required to create environmentally sustainable and conducive learning environments.

The Green School attribute for Health and Learning report by the U.S. National Academy of Sciences (NRC, 2006) outlines guidelines aimed at achieving the objectives of green schools. These guidelines encompass more than just building design and engineering standards; they also encompass land use considerations and specific goals such as:

- Locating schools near public transportation to decrease pollution.
- Utilizing green sites to minimize environmental impact and maximize natural light.
- Student-centre learning, where the teacher serves as a facilitator by enabling students to engage actively and take responsibility for their learning process.
- Conserving water through efficient irrigation and plumbing systems.
- Optimizing energy systems to decrease fossil fuel consumption and promote renewable resources.
- Selecting eco-friendly materials.
- Ensuring a comfortable indoor environment with high-quality air, lighting, and acoustics.
- Encouraging education that uplifts ideals in order to boost critical thinking and problem-solving skills, as well as involvement and accountability in making choices.

Green School Benefits

Kats (2005) highlights that green schools offer substantial financial benefits, estimated to be twenty times bigger than typical conventional institution. These schools provide a cost-effective means to improve education, cut expenses along with increase competitiveness. Benefits include savings in energy, emissions reduction, water management, and promoting healthier indoor environments, ultimately freeing up funds for additional resources like teachers and equipment (Ramli et al., 2010). Green building is less expensive than people think, according to a poll conducted by Turner Construction Company, one of the nation's top builders. However, people's ignorance about green building is still a big obstacle to its acceptance. The 2005 Turner Green Building Survey highlighted three categories of benefits for green school design: financial, environmental, and societal. Like Kats et al. (2005), it found that green institutions consume about 33% fewer energy compared to conventional ones, achieved through improvements in lighting and insulation (Ramli et al., 2010). In addition to lower operating costs, green schools offer the advantage of a healthier environment, contributing to improved Assessment outcomes, student concentration, and persistence. Furthermore, they improve the effectiveness of teachers and reduce absence from school for both pupils and educators (Douglas, 2010). Green schools offer a multitude of benefits, including cost savings in construction, reduced pollution, lowered equipment and servicing costs for water delivery and wastewater treatment, improve teacher-student health by enhancing school acoustics, steady interior temperatures, and internal quality of air and directly contribute to student performance improvements. Moreover, green schools serve as educational tools, demonstrating practical ways to address global warming by fostering more productive, prosperous and cost-effective settings to learning for students, faculty and parents (Ramli et al., 2010).

Green School and Environmental Conservation

Human existence and the environment are inextricably linked. Since numerous damages to the environment are occurring as a result of human activity, environmental issues are currently of global

concern. Since all countries need to have access to sufficient natural resources in good quality, balanced ecosystems, and preserved plant and animal variety, the environment is one of the most concerning topics of the twenty-first century (Suryani et al., 2019). The indicator "naturally green" is closely associated with the Gross National Happiness (GNH) pillar of "conservation of environment." This pillar emphasizes nurturing, conserving, and responsibly utilizing the Earth's resources while promoting harmony between nature and humanity, with a focus on future generations, animals, plants, and their habitats. Similarly, the "naturally green" indicator encourages learning and appreciation of nature, advocating for waste-free and green school environments through activities such as planting and maintaining green spaces. By integrating environmental education into learning experiences, students are taught to respect and preserve the natural world, aligning with the GNH philosophy of environmental conservation (Drakpa et al., 2013). In this context, Aronson and O'Leary (1982-1983) discovered that signage encouraging water conservation, when displayed inside shower rooms, led to a decrease in water usage. Similarly, Aesotte et al. (2006) discovered that their college campus's energy-efficiency efforts were successfully prompted by short hints posted on light switches and laptop computers.

Key components of energy conservation within LEED standards include improved commissioning and energy management, enhanced energy efficiency, performance measurement, and integration of on-site renewable energy sources. School architects must prioritize energy efficiency, resource conservation, and user comfort, employing strategies such as solar heating, maximizing natural light, utilizing high-performance windows and insulation, and implementing ground-source geo-exchange systems for heating and cooling. Schools that have effectively integrated environmental education exhibit certain attributes, such as practicing water and energy conservation and reducing waste sent to landfills (Zhao, He and Meng, 2015). The concept of zero net energy construction, which aims for buildings with no net energy consumption or carbon emissions, is gaining traction, achieved through on-site solar and wind energy generation. Meanwhile, the availability of fresh water for human consumption is becoming increasingly limited, especially in the face of rapid population growth, which intensifies the demand for this essential resource. Green schools as well as green buildings emerge as crucial solutions to address this challenge by prioritizing water conservation and safeguarding its quality in terms of air and environment as a whole. Furthermore, green buildings embrace advanced technologies like rainwater harvesting and greywater recycling. Rainwater harvesting promotes collection and storage of rainwater for different uses, including irrigation and toilet flushing and greywater recycling involves treating wastewater from sources like sinks, showers to make it suitable for non-potable uses such as watering plants and flushing, cleaning toilets. Moreover, these practices not only conserve water but also alleviate the burden on traditional freshwater sources. In addition to being sustainable and green, many environmental conservation initiatives also result in significant financial savings (Gordon, 2010).

Significance and Prevalence of Green Schools

Green schools are transforming education by integrating sustainability into learning environments, promoting environmental stewardship, and fostering sustainable development. Their prevalence is increasing as governments, educational institutions, and communities recognize the benefits of resource-efficient buildings, renewable energy use, and sustainable waste management. Beyond infrastructure, green schools shape students' environmental attitudes, instilling a commitment to conservation and equipping them with problem-solving and critical-thinking skills related to sustainability challenges.

The impact of green schools extends beyond the classroom, influencing societal change by nurturing environmentally conscious citizens from an early age. Studies show that students in green schools exhibit higher environmental literacy and improved academic performance, benefiting from healthier indoor air quality, natural lighting, and access to green spaces that enhance mental well-being.
The global movement towards green schools is gaining momentum, supported by initiatives like LEED certification and the Eco-Schools program, which encourage sustainable practices and curricula. By adopting green principles, schools contribute to environmental conservation and prepare students to become proactive change agents in tackling sustainability challenges. As their adoption continues to expand, green schools play a crucial role in advancing global sustainability goals, ensuring future generations possess the knowledge and skills necessary to protect the planet and promote long-term environmental resilience.

Green School and their Sustainable Practices: an Approach to Sustainable Development

Currently, "sustainable development" stands as a crucial agenda on both global and national levels (Lehtoranta et al., 2011). The thought of "sustainable development" was first articulated in the Brundtland Report of 1987, describing it as development that serves current needs without threatening the potential of future generations to satisfy their own (World Commission on Environment and Development, 1987). These initiatives are driven by various stakeholders across different contexts and perspectives, which involves leveraging the knowledge within university communities to address present and future ecological and social challenges. Investing in education is a commitment aimed at enhancing the economic prosperity of families and communities, thereby positioning the educational journey as a cornerstone for both economic and industrial advancement (Simanjuntak, 2017). Velaquez et al. (2006) characterize a "sustainable university" as an institution that actively encurages the minimization of adverse effects on the economy, society, environment, and wellness impacts on regional or global scales. Sanusi and Doost (2008) add that Education for Sustainable Development cultivates knowledge, values, and skills, fostering individual and collective improvements in quality of life on both local and global scales. While studies generally agree that different people would understand the term "green school" differently, Loubser (2014) notes that all of them have a core commitment to sustainable practices. A green school environment not only serves to reduce utility expenses but also fosters healthier and more productive classrooms by mitigating the risks associated with environmental pollution. As articulated by Gordon (2010), a green school represents a tangible outcome of a collaborative method encompassing organizing, creating and construction, with a focus on the efficiency throughout its whole fifty- to sixty-year lifespan. By prioritizing elements such as optimizing natural light, conserving water and energy, and harmonizing the building's design with its natural surroundings, the aim is to minimize the environmental footprint of the structure (Allen, 2007). Kopec (2009) reiterated the significance of thoughtful spatial planning in creating a secure, healthy, and enjoyable learning environment, underscoring the importance of nurturing a green ethos within school settings.
Seen through the prism of the Sustainable Development Goals (SDGs) established by the United Nations, green school initiative holds significant importance in fostering desirable personal attributes to enhance knowledge, societal norms and ethical standards. Within the school environment, this program facilitates robust collaboration among students, educators, school administrators and other stakeholders. It plays a pivotal role in raising awareness within the school community about environmental issues, fostering a sense of individual responsibility towards environmental conservation and sustainable

development. The green school program serves as a platform for students to actively engage in environmental protecting activities, including waste reduction (e.g., plastic waste), energy conservation, water preservation and the promotion of healthy lifestyles. Ultimately, the green school program aims to imbue students with a deep understanding of environmental values and practices, empowering them to become proactive agents of change oriented towards green sustainability (Barr, 2011).

Green schools and waste management

Green school practices encompasses a holistic approach that integrates waste reduction, reuse, recycling, and energy recovery practices. Insufficient waste disposal methods pose a significant challenge in developing nations, a concern underscored as a major impediment to sustainability during the 1992 UN Conference on Environment and Development (UNCED). Consequently, placing proper waste management as a top priority becomes imperative to safeguard both the environment and human health. Sustainable waste management emerges to be a pivotal tactic in reducing the detrimental influence of waste accumulation and preserving ecological balance. Recognized as an effective approach, it not only mitigates environmental degradation but also yields economic benefits by reducing expenses associated with waste collection, transportation, and processing. Sustainable waste management encompasses a multifaceted approach, involving endeavors to minimize waste generation, reutilize items still functional (reusing), recycle materials, and harness waste as energy sources through processes like waste-to-energy conversion (Gusti, 2016). Furthermore, green school sustains the technique of converting waste into energy sources, known as waste-to-energy (WTE) technology and presents an innovative a way to handle waste that cannot be recycled by producing renewable energy.

Solid waste management (SWM) presents a formidable environmental challenge, directly impacting air, water, soil, and public health. The escalating global waste production further complicates efforts towards effective waste management. Increasingly acknowledged as a "basic human right," there is mounting pressure to enhance SWM, particularly in urban areas of developing nations experiencing rapid rural-to-urban migration. This imperative aligns with a multitude of Sustainable Development Goals (SDGs), with at least 12 of the 17 SDGs directly impacted. The surge in waste generation exacerbates issues such as landfill shortages and escalating management costs. SWM and the principles of the circular economy emerge as pivotal concepts within the framework of the 2030 Agenda, particularly pertinent to SDGs aimed at fostering sustainable cities and communities, promoting appropriate manufacturing and usage practices, along with conserving life below water (Debrah, Vidal and Dinis, 2021). Katzev and Mishima (1992) conducted a study showing that paper recycling can be increased as a result of recycling signage placed near garbage containers at college and university mail rooms.

Assessing waste generation in schools reveals the impact of students and staff on waste production and recycling practices. Educators use this data to implement targeted strategies for waste reduction and recycling. Educational initiatives engage students in sustainability through curriculum integration, hands-on activities, and awareness campaigns. Students, as environmental stewards, influence family behaviors, fostering a culture of sustainability beyond school. These efforts promote waste reduction, recycling, and a more sustainable future for communities (Rada et al., 2016).

The Green School Movement and Its Challenges

The Green School Movement is a global initiative promoting sustainable education through environmentally friendly infrastructure, curricula, and community engagement. These schools aim to

reduce ecological impact, enhance student well-being, and instill environmental responsibility. However, the movement faces key challenges in policy implementation, infrastructure development, and community participation.

- **Policy Implementation**

Government policies are critical in supporting green schools, but inconsistent regulations, lack of financial incentives, and bureaucratic barriers slow progress. Many regions lack clear sustainability policies or fail to enforce existing ones, making it difficult for schools to implement eco-friendly initiatives. Funding shortages further hinder efforts, preventing schools from integrating sustainability into curricula or upgrading infrastructure with energy-efficient technologies.

- **Infrastructure Development**

Green schools require investment in sustainable materials, energy-efficient buildings, and renewable energy systems. However, high initial costs and limited technical expertise pose challenges, particularly in developing countries. Older schools struggle with retrofitting existing buildings to meet sustainability standards, often relying on external support from governments, non-profits, or private partnerships to implement these changes.

- **Community Participation**

Community engagement is essential for sustaining green schools, yet many communities lack awareness or prioritize traditional educational goals over sustainability. Schools need collaboration with local businesses, parents, and organizations to secure resources and implement sustainability projects. Without strong community buy-in, maintaining and expanding green initiatives becomes difficult.

Conclusion

In conclusion, the escalating global population coupled with rapid industrialization has heightened the urgency for environmental conservation and sustainable development. Environmental education, particularly through the idea of green schools, has appeared as a pivotal tool in addressing these challenges. Based on literature review, it is widely acknowledged that research about the implementation of green schooling technique as environmental education in schools is not an easy task for achieving sustainable development. One of the significant advancements in this study is the recognition of green schools as integral components of national and state-level curriculum by incorporating principles of sustainability into education systems. Green schools typically focus on enhancing students' understanding of ecological principles, environmental issues and their interconnections with society. Through hands-on learning experiences, students develop a deeper appreciation for the natural world and gain the knowledge and skills needed to become responsible stewards of the environment. Ultimately, the importance of green schools extends beyond their physical infrastructure to encompass their function as hubs for environmental education and sustainability endeavours. Both green schools and Education for Sustainable Development (ESD) are instrumental in influencing people's behaviour by fostering awareness, knowledge, and skills among students. These educational approaches aim to empower individuals to become critical thinkers and decision-makers capable of addressing environmental challenges within their communities. The study concludes that green schools play a vital role in advancing environmental conservation and sustainable development by integrating Education for Sustainable Development (ESD) into learning frameworks, aligning with key Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education) and SDG 13 (Climate Action). The study may help to identify the importance of green schools in today’s context and formulate educational strategies

for schools in the region, specifically addressing prevalent environmental concerns through environmental conservation and sustainable development. These strategies aim to effectively integrate environmental education into the curriculum, fostering awareness and action among students towards environmental stewardship. However, their widespread implementation faces challenges, including policy inconsistencies, financial constraints, and limited community participation. Addressing these barriers requires strong policy support, financial incentives, and stakeholder collaboration. Green schools not only benefit students but also cultivate environmentally responsible citizens who contribute to broader societal change. Therefore, greater governmental and institutional commitment is essential to scaling up green school initiatives and integrating sustainability into mainstream education policies.

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