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Primary School Teachers' Awareness and Experiences in Addressing Environmental Challenges in Tanzania: The Case of Dar es Salaam and Kilimanjaro Regions

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Abstract

This study examines the awareness and experiences of primary school teachers in Tanzania concerning environmental changes and challenges. The fundamental research question was to explore the extent to which teachers understand local and global environmental issues and their implications. Using the grounded theory and thematic analysis, interviews with 24 teachers from five schools in the study area revealed that environmental changes are predominantly driven by anthropogenic activities; and are exacerbated by poverty, deforestation, and climate variability. Teachers identified rising temperatures, biodiversity losses, waste mismanagement, and pollution as the key concerns. The findings underscore the necessity for capacity building among educators, reforms in environmental education curricula, and government interventions to combat poverty and promote sustainability. Based on their experience, primary school teachers recommended strengthening environmental education in primary schools, fostering community-led conservation initiatives, and addressing socio-economic barriers to sustainable development. This study contributes to the understanding of the critical role of teachers in addressing Tanzania's environmental challenges, and shaping future generations towards ecological stewardship.

Keywords: *environmental challenges, grounded theory, anthropogenic activities, capacity building*

1. Introduction

The growing concern over environmental issues and their impact on global and local ecosystems is one of the most important phenomena of the last two decades (Marques & Xavier, 2020). Anthropogenic activities—such as urbanization, deforestation, use of agrochemicals, and wetland destruction—have disrupted natural balance and depleted resources, leading to biodiversity loss and ecosystem degradation (Alimbaev et al., 2020). UNESCO (1994) and URT (2019) underscore the fact that unsustainable consumption practices and uncontrolled population growth further exacerbate these challenges. These pressures contribute to worsening human health, food insecurity, increased vulnerability to natural calamities, and the erosion of the ecosystem's cultural and aesthetic values.

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Environmental changes have also been linked to the spread of diseases and extreme weather events, including floods, droughts, and rises in global temperatures. McMichael and Lindgren (2011) point out that altered climate patterns escalate the occurrence of diseases such as malaria and dengue fever in formerly unaffected regions. In response to these challenges, educational policymakers and curriculum developers play a central role in promoting awareness and action (Mutisya & Barker, 2022). The integration of Environmental Education (EE) into curricula has been emphasized in global initiatives, including the foundational document *Our Common Future* (WCED, 1987), which calls for EE at all levels of education.

In Tanzania, environmental issues—such as land degradation, deforestation, water quality decline, and loss of biodiversity—significantly impact both rural and urban communities (URT, 2019). Approximately 41% of Tanzania's land is degraded, with 61% being affected by soil erosion due to unsustainable agricultural practices and deforestation (Kirui, 2016). Climate change further intensifies these challenges, causing temperature fluctuations, decreased rainfall, and extreme weather events (URT, 2019). Urban centres, such as Dar es Salaam, face unique challenges; including waste management crises, rising pollution levels, and inadequate infrastructure, as documented by Membe (2015) and Huisman et al. (2016). Deforestation and biodiversity loss are critical concerns, with Tanzania's forest cover diminishing by 373,000ha annually, thereon threatening species and disrupting ecological balance (URT, 2019). Coastal and marine ecosystems are also under threat from overfishing, coral reef destruction, and pollution (Yanda, 2013). All these environmental issues demand proactive measures to safeguard Tanzania's ecological and socio-economic future.

The role of EE is vital in equipping communities with knowledge and skills to address these challenges. Research by Türkoğlu (2019) underscores the importance of teacher awareness and training in fostering sustainable practices among students. Also, Debrah et al. (2021) caution that deficiencies in teachers' practical experience can thwart students' knowledge of the environment. Despite Tanzania's integration of EE into its formal curricula (MoEC, 1997), studies—such as Kimaryo (2011) and Mwendwa (2017)—highlight gaps in its implementation; and the need for tailored strategies to address local contexts. This study builds on these insights to explore the awareness and experiences of Tanzania's primary school teachers regarding environmental changes and challenges. By focusing on the perspectives of educators, the study sought to identify barriers to effective environmental education; and propose actionable recommendations for fostering sustainability through education and community engagement.

The article is structured into five main sections. After this introductory section, the second section explores environmental challenges at the global level;

emphasizing the relationship between environmental change, human activities, and sustainable development. The third section explores the Tanzanian context, examining key environmental challenges such as climate change, deforestation, waste management, and water-related concerns. The fourth section discusses environmental education in Tanzania, focusing on policy and curriculum frameworks, teachers' awareness and experiences, and the role of primary education in advancing environmental sustainability. The fifth section outlines the research methodology and presents the findings and discussion, with particular attention on teachers' perceptions and experiences in both urban and rural settings. Finally, the article summarizes the main findings, suggests policy implications, and gives recommendations to strengthen environmental education and sustainability initiatives in Tanzania.

2. Environmental Challenges and Global Contexts

In the last two decades, the global community has witnessed a dramatic escalation in environmental challenges, characterized by ecosystem degradation, loss of biodiversity, and climatic instability. These challenges are largely driven by anthropogenic activities such as deforestation, wetland destruction, excessive use of agrochemicals, and rapid urbanization (Alimbaev et al., 2020). Simultaneously, unsustainable consumption practices and widening socio-economic inequalities have further exacerbated environmental degradation and resource exhaustion (UNESCO, 1994; URT, 2019). The consequences are evident in the form of increased health challenges, food insecurity, and the vulnerability of both ecosystems and human settlements to natural disasters.

Recent decades have seen the emergence/re-emergence of many vector-borne diseases due to warming temperatures, altered precipitation patterns, and increased frequencies of extreme weather events (Barker & Reisen, 2024). Research by McMichael and Lindgren (2011) demonstrates the direct relationship between climate change and shifting epidemiological patterns, with disease vectors such as malaria mosquitoes and ticks expanding into new altitudes and latitudes. These environmental changes have increased the risk of disease transmission in previously unaffected areas, particularly in highland and temperate zones, thereby intensifying public health vulnerabilities and complicating disease control efforts. Similarly, the World Commission on Environment and Development (WCED, 1987) emphasized the interdependence between environmental stability and sustainable human development. These concerns led to the inclusion of EE within global policy agendas, aiming to shape environmentally conscious and responsible citizens (Glackin & King, 2020).

The integration of EE into formal curricula has become increasingly relevant as societies grapple with rising temperatures, water scarcity, and resource depletion. Marques and Xavier (2020) contend that public awareness of

environmental issues is one of the most visible societal shifts in recent history, as communities begin to understand the complex interplay between human behaviour and environmental health. However, the success of EE depends heavily on effective implementation in local educational contexts, a task that requires investment in teacher development and curriculum reform.

2.1 Environmental Challenges in Tanzania

Tanzania, like many countries in Sub-Saharan Africa, faces a multitude of pressing environmental issues, including land degradation, deforestation, pollution, biodiversity loss, and poor waste management. According to the Third National State of the Environment Report (URT, 2019), land degradation has emerged as the most severe environmental threat, with over 41% of the land affected, and 61% experiencing soil erosion. This degradation—often driven by agricultural expansion, overgrazing, and unsustainable land use—directly affects the livelihoods of millions of Tanzanians who rely on farming as their primary economic activity (Wynants et al., 2021).

Climate variability has increased the frequency and severity of natural disasters in Tanzania, with severe weather causing most disasters between 2000 and 2019. Floods alone have led to hundreds of deaths and displaced thousands; highlighting the country's growing vulnerability to climate change and its socio-economic impacts (Msemo et al., 2021; URT, 2019). Tanzania is currently undergoing a rapid deforestation at the rate of 373,000ha per year; which is driven by population growth, energy demand, infrastructure expansion, and unsustainable farming (URT, 2019). Forest exploitation now exceeds natural regeneration, indicating unsustainable management. This trend threatens biodiversity through habitat loss and poaching (WWF, 2015). Between 2013 and 2023, agricultural land expanded by 39%, and settlements by 686%; further intensifying pressure on forest ecosystems (Lwankomezi & Kaganga, 2024).

Water quality reduction and limited access to clean water also remain critical concerns. Less than 50% of the rural population has access to improved water sources; and due to this, among others, around 60–80% of outpatient hospital cases are linked to waterborne illnesses caused by poor sanitation and contaminated water (URT, 2019; Magwe, 2025). Solid waste management (SWM)—encompassing the systematic processes of collection, transportation, treatment, and disposal of solid waste materials—is also a critical concern within urban sustainability. Dar es Salaam generates approximately 9,000 metric tons of solid waste daily, and the city faces severe challenges in managing this volume effectively. Inadequate solid waste management practices—and particularly the reliance on poorly maintained landfills—pose significant environmental and public health risks (Richard & Kimwaga, 2024). The emerging challenge of electronic waste disposal poses an additional threat to environmental and public health (Huisman et al., 2016). Moreover, liquid waste is also a grave matter, especially in urban areas.

2.2 Environmental Education in Tanzania's Policy and Curriculum

In response to environmental challenges, Tanzania has adopted a policy framework that encourages environmental sustainability through formal education. The National Environmental Policy (NEP) of 1997 explicitly highlights the need for a sustainable resource management, and advocates for environmental content to be integrated into formal, non-formal, and informal education (URT, 2004). Following international initiatives, such as the United Nations Conference on Environment and Development (UNCED) of 1992, Tanzania included EE in its formal curricula across all education levels (MoEC, 1997).

Despite these policy efforts, studies have shown that the implementation of EE in schools in Tanzania has been limited in scope and effectiveness. Research by Kimaryo (2011) and Mwendwa (2017) illustrate that EE remains under-prioritized in the classroom due to outdated teaching practices, lack of teacher training, and an exam-oriented education culture. Many schools struggle to translate EE from policy into meaningful pedagogical practice, often resulting in rote learning without fostering critical environmental awareness. Recent evaluations, such as that conducted by Kimaro (2018), highlight the lack of systemic support for EE at the classroom level. Teachers are rarely involved in curriculum development, and are often not equipped with practical skills to link environmental topics to learners' everyday experiences. Furthermore, assessment tools for environmental competencies remain either absent or ineffective, making it difficult to evaluate the impact of EE on learners' behaviour or knowledge acquisition.

2.3 Teachers' Awareness and Experiences on Environmental Change and Challenges

Teachers play a pivotal role in the implementation of environmental education, and their ability to fulfil this role depends on their knowledge, attitude, and experience. Several studies underscore the importance of teacher awareness in shaping student engagement with sustainability. Research by Türkoğlu (2019) and Debrah et al. (2021) show that students' literacy on environmental issues is directly linked to the depth of their teachers' knowledge of environmental matters and practical experiences. In cases where teachers lack awareness or confidence, EE is likely to be marginalized or poorly delivered. In Tanzania, teachers generally acknowledge the existence of concerning environmental issues, particularly climate change. However, their understanding is often superficial, and many struggle to contextualize environmental content in a way that resonates with students' understanding. Kalungwizi et al. (2019) found that teachers face systemic constraints—including the lack of instructional resources, crowded classrooms, and rigid curricula—which limit their ability to engage learners in EE effectively.

Haßler et al. (2024) also report that teachers working in climate-affected areas face additional challenges, including high classroom temperatures and limited infrastructural support. These factors compound the difficulty of teaching EE

meaningfully, particularly in under-resourced schools. Similarly, Otieno (2015) noted that environmental education in East Africa is often treated as an add-on, rather than as a core and integrated part of the learning experience. This marginalization undermines the potential of EE to foster critical thinking and problem-solving among students. Recent contribution by Mugabe et al. (2022) advocates for an integrated approach to EE that incorporates indigenous knowledge and participatory learning. They argue that when EE is grounded in local realities and supported by community engagement, it becomes more relatable and impactful. This model also aligns with Das and Jan's (2025) suggestion that EE must span across generations, and include early childhood education to establish strong foundational attitudes.

2.4 Primary Education as a Foundation for Environmental Sustainability

Primary education plays a critical role in cultivating environmental awareness and responsible behaviours since the early years are widely recognized as a formative period in which lifelong values and attitudes are developed (Davis, 2009; Türkoğlu, 2019). Hence, with a national net enrolment ratio of over 90% between 2016 and 2019 (BEST, 2019), primary schools in Tanzania provide a strategic platform for embedding sustainability values at an early age. However, despite the curricular inclusion of EE, evidence suggests that many students leave primary school with limited environmental understanding. This shortcoming is often a result of insufficiently trained teachers, limited learning resources, and detachment between curriculum content and local environmental realities (Debrah et al., 2021). Without practical and experiential learning opportunities, students may memorize environmental facts but fail to translate this knowledge into action.

To address these gaps, Glackin and King (2020) propose making EE statutory across all levels of schooling, accompanied by rigorous assessment criteria and teacher support systems. In Tanzania, however, EE is not yet implemented uniformly, and many schools still treat it as peripheral rather than an integral part of the curriculum. Researchers argue that mainstreaming EE into core subjects and daily classroom activities would significantly enhance its visibility and effectiveness. Mugabe et al. (2022) further recommend incorporating culturally embedded knowledge and indigenous ecological practices into EE programmes. This not only validates local knowledge systems, but also strengthens the relevance of environmental content to students' lives. When students see their communities reflected in their learning, they are more likely to internalize and apply environmental principles.

3. Methods and Materials

This study employed a qualitative research design in investigating teachers' awareness and experiences of environmental changes and challenges in Tanzania. A qualitative approach was chosen for its effectiveness in capturing complex, socially constructed realities, and diverse individual perspectives

(Flick, 2023). To generate a theory attached to real-world experiences, the study adopted the grounded theory methodology as articulated by Strauss and Corbin (2015). This approach was particularly suited to uncovering patterns and conceptual insights directly derived from participants' narratives. To ensure a systematic data interpretation, thematic analysis was employed following the framework established by Braun and Clarke (2021). This method enabled a thorough coding, and helped to identify common themes; thereby supporting a clear and detailed analysis of the qualitative data.

The research was conducted in two regions of Tanzania: Dar es Salaam and Kilimanjaro. Dar es Salaam—the nation's largest and most urbanized city with an estimated population of 8.56 million (World Population Review, 2025)—was selected for its urban complexity and acute environmental challenges associated with rapid urbanization. In contrast, Kilimanjaro—renowned for its rich biodiversity and the iconic Mount Kilimanjaro—offered insights into environmental issues in rural contexts, particularly within the Moshi Rural District areas.

A purposive sampling strategy was utilized to recruit 24 teachers (14 male, 10 female) from five schools – three located in Dar es Salaam and two in Kilimanjaro. Participants were selected based on their subject specialization in Geography and Science at upper primary levels (Std. V to VII), as these subjects include significant environmental education components. This sampling strategy ensured the inclusion of educators with a broad range of experiences across both urban and rural settings, thereby enabling a comprehensive exploration of environmental awareness and challenges within Tanzania's educational context.

3.1 Data Collection Methods

Semi-structured interviews served as the primary data collection method. This approach provided flexibility to explore participants' perspectives while ensuring consistency across interviews (Flick, 2023). In-depth interviews were conducted in Kiswahili, the participants' native language, to facilitate comfortable and open discussions. The interviews lasted between 30 and 45 minutes; and were later transcribed and translated into English for analysis. To ensure reliability, interview questions were pre-tested and revised as necessary.

3.2 Data Analysis

Data analysis followed the guidelines of the grounded theory and thematic analysis. Initially, open coding was employed to break down the data into discrete parts, identifying concepts, and assigning codes. Axial coding was subsequently used to group these codes into broader categories, facilitating the emergence of themes (Strauss & Corbin, 2015). Thematic analysis further refined the data by examining patterns and relationships between themes, following Braun and Clarke's (2021) framework. Although the grounded theory formed the

foundation of the analysis, deviations were allowed to accommodate the study's scope and constraints. The researcher opted for a combined approach with thematic analysis due to limitations related to strict adherence to theoretical sampling, as time and financial resources were restrictive. This flexibility of methodology ensured the integrity and depth of the findings.

Ethical approval was obtained prior to the commencement of the study. Participants provided informed consent, and were assured of confidentiality and anonymity through the use of pseudonyms in reporting the data. Interviews were conducted at the school premises to ensure a safe and neutral environment for participants. Time constraint and inadequate financial resources influenced the sampling and data analysis process. Additionally, while the findings were rich and context-specific, they may not have been generalizable to all regions of Tanzania. Future research could expand the scope to include a larger and more diverse sample.

4. Results and Discussion

4.1 Teachers' Perceptions on the Environment and Climate Change

The findings from the interviews revealed a high level of awareness among both rural and urban teachers regarding the impacts of climate change. Teachers consistently described climate change to include changes in rainfall patterns, prolonged droughts, rising temperatures, and increased flooding. In particular, rural teachers, linked these changes to declining agricultural productivity and threats to livelihoods. One of the teachers made the following comment: "We are seeing longer droughts and inconsistent rains that harm our crops. This has reduced harvests and made life difficult for farmers." Another teacher emphasized the unpredictability of rainfall: "Rainfall patterns have changed. It is either too much rain that causes floods, or none at all for months; which affects both livestock and farming."

Teachers frequently attributed these changes to human activities such as deforestation, overgrazing, and the burning of fossil fuels. This perception aligns with global and regional studies identifying anthropogenic greenhouse gas emissions as the primary drivers of climate change (IPCC, 2021; Afrobarometer, 2024; World Bank, 2024). The teachers' observations also resonated with research documenting climate-induced stress on agriculture and rural livelihoods in Tanzania (World Bank, 2024). However, while the teachers demonstrated a strong understanding of human-induced causes of climate change, their awareness of natural factors—such as volcanic activity or solar variations—was limited. This gap mirrored findings by Umar and Ozohu (2015), who noted that climate change knowledge among educators often emphasized human causes while overlooking natural processes. These results highlight the need for more comprehensive education on climate in teacher training programmes.

4.2 Teachers' Experiences on Waste Management and Urban Pollution

Teachers living in urban areas identified waste management and pollution as the major environmental challenges in their communities. The participants expressed dissatisfaction with inadequate waste collection systems, poor urban planning, and the widespread dumping of plastic and industrial waste. One teacher said:

> "*Our streets are full of uncollected waste, especially plastics. People dump rubbish anywhere because there are no garbage bins. Such litter causes blockages during the rains, and leads to flooding.*"

Another teacher linked waste pollution directly to health risks by saying:

> "*In the city, pollution is a big concern. Plastic and industrial waste are dumped into rivers, and we see its impact on our children's health.*"

These findings are consistent with studies showing that rapid urbanization in cities such as Dar es Salaam has led to increased waste generation that far exceeds existing waste management capacities (Mapunda et al., 2023; TIC, 2024). The health concerns raised by the teachers—including waterborne diseases and sanitation-related illnesses—align with research documenting recurrent cholera outbreaks as linked to poor waste management in urban Tanzania. The teachers' accounts underscore the fact that waste management is not only an environmental issue, but also a critical public health concern. This calls for integrated waste management policies that combine infrastructure development, enforcement, and community participation (URT, 2023).

4.3 Teachers' Experiences on Deforestation and Soil Erosion in Rural Areas

Teachers living in rural areas demonstrated strong awareness of deforestation and soil erosion as interconnected challenges. They highlighted how tree cutting for charcoal production and land clearing for agriculture weakened soils and reduced crop yields. One teacher gave the following comment*: "People cut trees to make charcoal and clear land for farming. Over time, the soil becomes very weak, and we lose crops due to erosion.*" Another teacher emphasized the economic dimension of the problem: "*There is no alternative source of energy. Charcoal is cheaper, and people here are struggling to survive. Trees are their only option as a source of energy.*"

These findings align closely with national and global studies that identify agricultural expansion, fuelwood collection, and charcoal production as the major drivers of deforestation in Tanzania (URT, 2017; Mapunda et al., 2023; Masolele, 2024). Teachers' emphasis on poverty reflects broader evidence that environmental degradation and poverty reinforce each other, particularly in rural contexts where livelihood options are limited (Povertyevidence.org, 2024; World Bank, 2025). The findings suggest that conservation efforts that fail to address economic realities are unlikely to succeed. As the literature indicates, sustainable livelihood alternatives and access to affordable energy sources are essential for reducing pressure on forests and soils (URT, 2023).

4.4 Teachers' Experiences on Water Pollution and Scarcity

Across both rural and urban contexts, teachers identified water pollution and scarcity as growing concerns to livelihood. They linked water contamination to the runoff of agricultural chemicals, industrial discharge, and poor sanitation practices. These perceptions are consistent with studies documenting declining water quality in Tanzania due to untreated waste and agricultural chemicals (Oluseyi, 2022; URT, 2023). The teachers also noted the consequences of water scarcity to agriculture and public health, reinforcing evidence that climate variability and pollution intensify water insecurity. These findings highlight the need for stronger regulation of industrial waste, improved sanitation infrastructure, and climate-resilient water management strategies.

4.5 Limited Attention to Biodiversity and Marine Issues

Despite Tanzania's rich ecological diversity, the teachers rarely mentioned biodiversity loss and marine ecosystem degradation. This limited attention contrasts sharply with the literature, which identifies Tanzania as home to several global biodiversity hotspots facing threats from agricultural expansion, overgrazing, invasive species, and fuelwood extraction (CBD, n.d.; Forest Beekeeping, 2023; Congress.gov, 2024). Similarly, while marine ecosystems are critical for coastal livelihoods, issues such as overfishing, coral reef destruction, and illegal fishing practices received little emphasis in the teachers' responses. This gap mirrors findings that environmental education often prioritizes visible and local problems, while overlooking less immediately observable ecological processes (Mongabay, 2025; *Daily News*, 2025). The absence of these issues in the teachers' narratives points to the need for broader ecological content in EE.

4.6 Role of Environmental Education and the Knowledge Gap

The teachers strongly emphasized the role of EE in addressing environmental challenges; arguing that it could raise awareness, shape attitudes, and promote sustainable practices. This view supports studies highlighting the transformative potential of EE when integrated into school curricula (Marques & Xavier, 2023; Glackin & King, 2023). The teachers also acknowledged that poverty constrains the effectiveness of EE as communities often prioritize immediate survival over long-term environmental sustainability. This is consistent with URT (2023), which emphasized that EE must be complemented by economic empowerment initiatives. Yet, despite their general awareness, the teachers exhibited notable knowledge gaps in areas such as ozone depletion, electronic waste management, and complex environmental systems. These gaps reflect findings by Türkoğlu (2023) and Kimaryo (2022), who argue that continuous professional development is essential for equipping teachers with the depth of knowledge required to effectively deliver EE.

4.7 Synthesis of Comparative Urban-Rural Insights on Environment Management

Overall, the findings reveal clear contextual differences between urban and rural teachers' perspectives. Urban teachers focused primarily on waste management,

pollution, and public health risks linked to infrastructure deficits and industrial activities; while rural teachers emphasized deforestation, soil erosion, and climate impacts driven by economic necessity and reliance on natural resources. These distinctions reflect how environmental challenges are shaped by geographical and socio-economic contexts. The findings support calls in the literature for context-specific environmental policies and education strategies that respond to local realities, rather than applying uniform solutions (Mutisya & Barker, 2022). Understanding these differentiated perspectives is essential for designing effective interventions that resonate with teachers and the communities they serve.

5. Conclusion

This study confirms that teachers play a vital role in addressing environmental challenges in Tanzania, with strong awareness of issues that directly affect their communities. Climate change, deforestation, soil erosion, waste management, and water pollution were the most prominent concerns, with clear differences between rural and urban contexts. Rural teachers focused on climate impacts, deforestation, and land degradation linked to livelihoods and energy needs; while urban teachers emphasized waste management, pollution, and related public health risks. Despite this practical awareness, notable knowledge gaps remain, particularly around biodiversity, marine ecosystems, and less visible environmental processes. Environmental education is widely regarded by teachers as essential for promoting sustainable practices, but its impact is constrained by poverty and limited economic alternatives, especially in rural areas. The findings highlight the need for stronger, context-specific EE supported by continuous professional development for teachers, and aligned with broader economic and policy measures. Strengthening teachers' knowledge and addressing underlying socio-economic constraints are essential for translating environmental awareness into sustained action, thereby advancing Tanzania's sustainable development efforts.

6. Policy Recommendations

To improve environmental literacy in Tanzania, teacher training should focus on contemporary issues such as climate change, pollution, and biodiversity loss. Training programmes must use practical and context-specific examples to support effective classroom teaching. Environmental education should be fully integrated into both primary and secondary curricula, in line with international standards, to develop sustainability skills from an early age. Schools should also introduce modules on clean energy to reduce dependence on fuelwood and mitigate deforestation. Education on waste management should be strengthened, particularly in urban areas, with schools serving as centres for raising awareness on proper disposal and recycling practices. Environmental education policies should include financial incentives for schools adopting sustainable practices. Also, water resource management and biodiversity conservation should be incorporated into national education policies. These efforts require adequate funding, clear curriculum design, and strong monitoring systems to ensure effective implementation.

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