Resilient Schooling for A Warming World: Sustainable Educational Development Challenges and Opportunities in Kwara State, Nigeria

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Abstract

This paper examines designing resilient schooling for a warming world through sustainable educational development: challenges and opportunities in Kwara state, highlighting key challenges, prospects, and opportunities for creating a climate-resilient education system. Climate change marked by rising temperatures, irregular rainfall, and recurrent that threatens school infrastructure, disrupts learning, and undermines the quality of education. The study reviews the current status of SDE and CCE, revealing persistent barriers such as limited funding, inadequate teacher training, outdated curricula, and weak policy enforcement. Despite these constraints, significant opportunities exist. Nigeria's National Climate Change Policy, the Sustainable Development Goals, renewable-energy initiatives, and international donor programs can support the integration of climate literacy and sustainability principles in lower and upper basic schools. Embedding CCE within SDE was found foster critical thinking, environmental stewardship, and innovative problem-solving skills essential for long-term socio-economic development in Kwara State. The paper recommends curriculum revision to include climate topics, capacity-building programs for teachers, climate-resilient infrastructure investments, robust monitoring and evaluation mechanisms, and partnerships among government agencies, NGOs, and local communities. Implementing these strategies will strengthen Kwara State's education sector as a driver of climate adaptation and sustainable growth, ensuring that future generations are equipped to thrive in a warming world.

Keywords: Sustainable Educational Development, Climate Change Education, Kwara State, Nigeria, climate resilience, sustainability

Introduction

Climate change has become one of the most defining challenges of the 21st century, affecting every sector of human endeavor, including education. Rising global temperatures, unpredictable rainfall patterns, and the increasing frequency of extreme weather events have profound implications for teaching and learning worldwide (UNESCO, 2024). Across Africa, and particularly in Nigeria, these climate-related disruptions are already visible in the form of floods, heatwaves, droughts, and infrastructure damage that undermine access to quality education (Adelekan & Eze, 2023). The urgency of building resilient schooling that is, education systems capable of anticipating, adapting to, and recovering from climate-related shocks has therefore gained unprecedented attention among policymakers, scholars, and practitioners. Nigeria is one of the country's most vulnerable to climate change due to its

diverse ecological zones, heavy reliance on climate-sensitive livelihoods, and rapid population growth (Federal Ministry of Environment [FME], 2022). Within Nigeria, Kwara State occupies a unique ecological position in the Guinea Savannah belt, characterized by a mix of forest and grassland. This geography exposes the state to seasonal flooding, high temperatures, and shifting rainfall patterns that directly affect school operations. For instance, heavy downpours have in recent years damaged school buildings in Ilorin and other local government areas, causing temporary closures and displacing students and teachers (LIDA Network, 2023). Beyond physical infrastructure, climate change influences food security, public health, and household income, all of which indirectly shape school attendance and learning outcomes.

Education is not merely a victim of climate change; it is also a critical driver of climate action and sustainable development. The concept of Sustainable Educational Development (SED) refers to a holistic process of planning, delivering, and continually improving education in ways that meet present learning needs without compromising the ability of future generations to learn and thrive (Education Commission, 2022). SED integrates three key pillars economic viability, social equity, and environmental stewardship into curriculum design, teacher capacity building, infrastructure development, and policy frameworks. When viewed through the lens of climate change, SED requires both mitigation (reducing greenhouse-gas emissions through green campus initiatives and energy efficiency) and adaptation (equipping learners and institutions to cope with climate shocks). Despite the recognition of education as a cornerstone of climate resilience, many Nigerian states, including Kwara, struggle to align their education systems with the realities of a warming world. Existing school infrastructures are often poorly constructed or inadequately maintained, making them vulnerable to flooding and heat stress.

Teacher training colleges rarely incorporate climate change education or Education for Sustainable Development (ESD) into their programs, leaving educators ill-prepared to integrate environmental literacy into daily instruction (Okoli & Yusuf, 2021). Furthermore, funding for climate-resilient infrastructure, curriculum innovation, and community outreach remains limited, even though the Climate Change Act of 2021 provides a policy framework for integrating climate concerns into sectoral plans (Federal Republic of Nigeria, 2021). Without deliberate action, the compounding effects of climate change threaten to widen educational inequalities and derail progress toward Sustainable Development Goal (SDG) 4, which calls for inclusive and equitable quality education for all. Understanding and addressing these challenges in Kwara State is crucial for several reasons. First, Kwara serves as a microcosm of Nigeria's broader climate-education nexus: it encompasses urban centers like Ilorin as well as rural communities dependent on agriculture, offering a representative setting for analyzing diverse impacts. Second, the state's recent experiences with seasonal floods and heatwaves highlight the urgent need for adaptive infrastructure, such as elevated classrooms, climate-smart school design, and improved drainage systems. Third, Kwara's vibrant civil society and active education sector present opportunities for piloting innovative programs such as community-based climate clubs, renewable energy projects in schools, and green curriculum reforms that could serve as models for other regions.

Two theoretical perspectives guide this study. Resilience Theory provides a lens for understanding how social-ecological systems absorb disturbances and reorganize while undergoing change. Applied to education, it emphasizes flexibility, redundancy, and adaptive learning as key attributes of a climate-resilient school system (Folke et al., 2022). Education

for Sustainable Development (ESD) serves as a complementary framework, focusing on the transformation of teaching and learning processes to empower students to contribute to sustainable futures. Together, these theories explain why education must not only withstand climate shocks but also cultivate the competencies and values necessary for long-term sustainability. The overarching objective of this paper is to explore the challenges and opportunities of achieving sustainable educational development in the context of climate change in Kwara State. Specifically, it aimed to:

i. Examine the current state of climate-related risks to education in Kwara State.

ii. Identify institutional, infrastructural, and pedagogical barriers to building climate-resilient schooling.

iii. Highlight prospects and opportunities including policy reforms for advancing sustainable educational development.

Concept of Sustainable Educational Development (SED)

Sustainable Educational Development (SED) refers to a continuous, purposeful process of planning, delivering, and improving education so that present learning needs are met without compromising the ability of future generations to meet their own educational and developmental needs. It embodies the principles of sustainability economic viability, social equity, and environmental stewardship within the entire educational system (UNESCO, 2024). At its core, SED views education not merely as the transmission of knowledge but as a transformative force for creating resilient, equitable societies capable of addressing complex global challenges such as climate change, poverty, and social injustice (Education Commission, 2022). This perspective aligns with the United Nations' Sustainable Development Goal 4 (SDG 4), which calls for inclusive and equitable quality education and the promotion of lifelong learning opportunities for all. Elements of the SED concept include:

1. **Integration of Environmental and Social Sustainability:** SED promotes curricula and school practices that foster environmental literacy, conservation ethics, and social responsibility. Learners are equipped to understand and respond to climate change, biodiversity loss, and other sustainability issues, preparing them to become active agents of positive environmental action (Sterling, 2021).

2. **Equity and Inclusivity:** Sustainable development in education requires equitable access for all, regardless of gender, socio-economic background, or location. This ensures that vulnerable populations often the most affected by environmental challenges receive quality education that enables their full participation in sustainable futures (UNICEF, 2023).

3. **Economic and Institutional Continuity:** SED emphasizes prudent resource management and investment in durable, climate-resilient infrastructure. Schools must be financially and structurally capable of withstanding environmental shocks while maintaining continuous, quality instruction (Adelekan & Eze, 2023).

4. **Lifelong and Transformative Learning:** Education systems are encouraged to promote critical thinking, creativity, and problem-solving skills that support sustainable

livelihoods, green technologies, and adaptation to climate change over the long term (Okoli & Yusuf, 2021).

Significance of Sustainable Educational Development (SED)

Sustainable Educational Development (SED) is pivotal for building education systems that can endure and thrive in the face of environmental, social, and economic challenges particularly in regions vulnerable to climate change like Kwara State, Nigeria. Its significance can be examined across several interrelated dimensions:

1. Climate Resilience and Risk Reduction: SED strengthens the capacity of schools to anticipate, adapt to, and recover from climate-related stocks such as flooding, extreme heat, and storms. By integrating climate-smart infrastructure (e.g., elevated classrooms, rainwater harvesting, and energy-efficient buildings) and disaster-preparedness plans, education systems can maintain continuity of learning even during environmental crises (UNICEF, 2023). For Kwara State, where seasonal floods increasingly damage school facilities, SED provides a pathway to safeguard learning outcomes.

2. Quality and Inclusive Education: The principles of SED align with Sustainable Development Goal 4 (SDG 4), which calls for inclusive, equitable, and high-quality education. SED emphasizes equal access for marginalized groups girls, rural learners, and children with disabilities ensuring that no learner is left behind despite environmental or economic disruptions (UNESCO, 2024). This inclusivity reduces educational inequalities and promotes social cohesion.

3. Environmental Stewardship and Climate Literacy: SED equips students, teachers, and communities with the knowledge and values needed to understand and address climate change. Through curricula that emphasize environmental science, sustainable resource management, and green technologies, SED fosters a generation of environmentally conscious citizens capable of advocating for sustainable policies and adopting eco-friendly lifestyles (Sterling, 2021). This is critical in Kwara State, where community-based action can mitigate local climate impacts.

4. Economic Sustainability and Workforce Preparation: By embedding skills for green jobs, renewable energy, and sustainable agriculture within educational programs, SED prepares learners for emerging economic opportunities in a low-carbon economy (Education Commission, 2022). This not only reduces unemployment but also drives local economic growth, ensuring that the workforce is equipped for the global shift toward sustainability-focused industries.

5. Policy Integration and Governance Innovation: SED encourages governments to integrate environmental considerations into education policy, budgeting, and planning. Nigeria's Climate Change Act (2021) mandates sector-wide climate action, and SED provides the practical framework for aligning educational policies with this legislation. Strong governance mechanisms support long-term sustainability by promoting cross-sector collaboration and effective resource utilization (Federal Republic of Nigeria, 2021).

6. Community Empowerment and Social Cohesion: Schools designed around SED principles serve as hubs for community education and engagement. Programs such as tree

planting, waste recycling, and climate-awareness campaigns empower local residents to participate in sustainability initiatives, strengthening community resilience and fostering shared responsibility for environmental protection (Adelekan & Eze, 2023).

Concept of Climate Change

Climate change is a long-term alteration in the statistical averages and variability of the Earth's climate system, encompassing temperature, precipitation, wind patterns, humidity, and other atmospheric conditions. It differs fundamentally from short-term weather fluctuations because it represents persistent, measurable trends that typically unfold over decades to centuries. Scientists identify climate change as a consequence of both natural processes and, increasingly, human activities that disrupt the delicate balance of the global climate system (Intergovernmental Panel on Climate Change [IPCC], 2023). At its core, climate change is not merely about rising temperatures; it encompasses complex interactions among the atmosphere, hydrosphere, cryosphere, biosphere, and lithosphere. These interactions determine how energy from the sun is absorbed, stored, and redistributed on Earth. When these processes are disturbed whether by natural events or anthropogenic emissions the climate system responds with shifts that can profoundly influence ecosystems, economies, and human well-being. The concept thus includes both the physical science of greenhouse gases and feedback loops, and the social dimensions of adaptation, vulnerability, and resilience. The recognition of climate change as a global challenge underscores its far-reaching implications. It affects food production, water resources, human health, and economic stability. Because the impacts differ across regions and socio-economic groups, understanding climate change also involves assessing risk distribution, equity issues, and governance structures for mitigation and adaptation. This broad perspective highlights that climate change is not only an environmental phenomenon but also a developmental and humanitarian concern requiring coordinated international and local action (United Nations Development Programme [UNDP], 2023). The dimensions of climate change include:

1. **Natural and Anthropogenic Drivers:** While natural factors such as volcanic eruptions, variations in solar radiation, and oceanic cycles have historically influenced the planet's climate, the contemporary phase of climate change is primarily anthropogenic that is, human-induced. Activities like the burning of fossil fuels, deforestation, and industrial agriculture increase the concentration of greenhouse gases (GHGs) such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). These gases trap heat in the atmosphere, creating the "greenhouse effect" that drives global warming (World Meteorological Organization [WMO], 2022).
2. **Global Manifestations:** The impacts of climate change are diverse and interconnected. They include rising global temperatures, melting ice caps and glaciers, sea-level rise, changes in rainfall patterns, and more frequent and intense extreme weather events heatwaves, droughts, floods, and storms. These changes disrupt ecosystems, biodiversity, food security, and human health (IPCC, 2023).
3. **Regional and Local Context:** In Nigeria, and particularly in Kwara State, climate change manifests through increased temperature extremes, shifting rainy seasons, and recurrent flooding. These phenomena damage infrastructure, reduce agricultural productivity, and heighten the risk of water- and vector-borne diseases. Such localized effects highlight that while climate change is global, its impacts and necessary

adaptation strategies are profoundly regional and community-specific (Federal Ministry of Environment [FME], 2022).

4. **Climate Change vs. Climate Variability:** It is important to distinguish climate variability natural short-term fluctuations such as El Niño from climate change, which signifies long-term trends. While variability may cause year-to-year differences, climate change represents a persistent directional shift in the global climate system (UNFCCC, 2021).
5. **Socioeconomic Implications:** Beyond environmental consequences, climate change poses significant economic and social challenges. It threatens food and water security, increases poverty risk, and exacerbates social inequalities, disproportionately affecting vulnerable populations such as children, women, and rural communities (UNDP, 2023). For education, this means disrupted schooling, damaged infrastructure, and heightened pressure on public resources.

Significance of Climate Change Education (CCE)

Climate Change Education (CCE) is an essential strategy for building awareness, knowledge, skills, and values that enable individuals and communities to address the challenges of a warming planet. Its significance is multidimensional, encompassing environmental, social, economic, and policy-related benefits. Below are key areas that highlight the importance of CCE, with recent scholarly support.

1. Enhancing Awareness and Understanding: CCE equips learners with scientific knowledge about the causes, impacts, and mitigation strategies of climate change. By fostering critical understanding, it helps students, educators, and communities grasp how human activities drive climate change and how local actions connect to global outcomes (Okafor & Akinyemi, 2023). Such awareness is the foundation for meaningful climate action.

2. Promoting Sustainable Lifestyles: Through CCE, individuals learn sustainable practices such as energy conservation, waste reduction, and responsible consumption. Education encourages behavioral changes that reduce greenhouse gas emissions and environmental degradation (UNESCO, 2022). In schools, this can translate into initiatives like tree planting, recycling programs, and renewable energy adoption.

3. Building Adaptive and Resilient Communities: CCE fosters resilience by teaching adaptation strategies such as water conservation, flood management, and climate-smart agriculture. Communities with climate education are better prepared to anticipate and respond to extreme weather events, reducing vulnerability and disaster risks (Adebayo & Musa, 2021).

4. Strengthening Policy and Civic Engagement: Educated citizens are more likely to participate in climate-related policymaking and advocacy. CCE empowers students and communities to engage in environmental governance, lobby for climate-friendly policies, and hold leaders accountable (UNFCCC, 2021). This civic empowerment helps bridge the gap between scientific knowledge and public action.

5. Advancing Economic Opportunities: Climate literacy opens pathways to green jobs and careers in renewable energy, sustainable agriculture, and environmental management. As

nations transition to low-carbon economies, CCE prepares learners for emerging job markets while supporting national development goals (World Bank, 2022).

6. Supporting National and Global Goals: CCE contributes to achieving global frameworks such as the United Nations Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education) and SDG 13 (Climate Action). It ensures that education systems align with international commitments to reduce emissions and enhance climate resilience (UNESCO, 2023).

Amalgamation of Sustainable Educational Development (SDE) with Climate Change Education (CCE)

The integration of Sustainable Educational Development (SDE) and Climate Change Education (CCE) represents a strategic convergence aimed at building a resilient and environmentally conscious society. While SDE focuses on providing equitable, high-quality, and future-oriented education that meets present needs without compromising the ability of future generations to learn and thrive, CCE seeks to instill climate literacy, adaptive skills, and pro-environmental behaviors. Combining these two paradigms creates a transformative educational framework that addresses both developmental and ecological imperatives. SDE and CCE share a commitment to sustainability, equity, and long-term societal well-being. SDE emphasizes access to inclusive, quality education as a driver of sustainable economic, social, and cultural growth (UNESCO, 2023). CCE, on the other hand, focuses on understanding and addressing the causes and impacts of climate change (IPCC, 2023). Their amalgamation ensures that educational development is not only socially and economically sustainable but also environmentally responsible, directly supporting the United Nations Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education) and SDG 13 (Climate Action).

Embedding CCE into the planning and implementation of SDE strengthens the capacity of schools to address climate-related challenges. Curriculum reforms can integrate topics such as renewable energy, climate science, and ecosystem preservation into core subjects like science, social studies, and geography. This alignment ensures that students acquire critical thinking and problem-solving skills relevant to a warming world while advancing the objectives of SDE to prepare learners for future challenges (Okafor & Akinyemi, 2023). Climate change threatens educational infrastructure through flooding, extreme heat, and other hazards. By blending SDE with CCE, schools can adopt climate-smart construction practices such as energy-efficient buildings, rainwater harvesting, and natural ventilation while promoting sustainable resource management. These measures enhance institutional resilience, reduce operational costs, and ensure continuity of learning during climate disruptions (Adebayo & Musa, 2021). SDE encourages lifelong learning as a means of personal and societal growth, while CCE motivates community-based adaptation and mitigation strategies. Their integration creates opportunities for schools to serve as hubs of community climate action, offering workshops on sustainable agriculture, disaster preparedness, and renewable energy. Such outreach strengthens local adaptation strategies and ensures that climate-conscious behaviors extend beyond the classroom into homes and communities (UNESCO, 2022).

The amalgamation also prepares students for emerging green economies by promoting skills in renewable energy technology, environmental management, and sustainable business

practices. This dual focus supports Nigeria's broader development agenda by cultivating a workforce capable of driving low-carbon innovation while meeting the global demand for green jobs (World Bank, 2022). At the policy level, integrating SDE and CCE promotes a holistic approach to educational governance. It requires collaboration between ministries of education, environment, and finance to align curriculum design, teacher training, and infrastructure development with climate adaptation and sustainability goals. This coordinated governance ensures that climate considerations are mainstreamed into every level of educational planning and funding.

Present Status of Sustainable Educational Development (SDE) and Climate Change Education (CCE)

Sustainable Educational Development (SDE) and Climate Change Education (CCE) have become critical priorities in the twenty-first century as nations grapple with the dual challenges of ensuring inclusive, high-quality education and addressing the escalating impacts of climate change. Globally, SDE aims to provide equitable learning opportunities that foster economic growth, social inclusion, and environmental stewardship, while CCE seeks to build climate literacy and adaptive capacities among learners and communities. In recent years, significant strides have been made worldwide to embed sustainability and climate awareness into education systems, though the pace and depth of progress vary across regions, especially in developing contexts like Nigeria and Kwara State. At the international level, the United Nations Sustainable Development Goals (SDGs) have provided a clear framework for advancing SDE and CCE. Goal 4 emphasizes inclusive and equitable quality education, and Goal 13 focuses on urgent action to combat climate change and its impacts. UNESCO's 2022 progress review highlights that many countries have begun aligning their curricula with education for sustainable development (ESD) principles, integrating themes such as environmental stewardship, renewable energy, and disaster preparedness. Similarly, CCE initiatives have gained traction following the Paris Agreement of 2015, which underscores education and public awareness as central to climate action. Nations such as Finland, Germany, and Costa Rica are recognized for embedding sustainability and climate content across all levels of schooling, from early childhood to higher education, and for supporting teacher training programs that cultivate climate competencies (UNESCO, 2023).

In sub-Saharan Africa, SDE and CCE have received increasing attention due to the region's vulnerability to climate change and its youthful population. Regional bodies like the African Union have incorporated climate education into continental frameworks such as the Agenda 2063 and the Continental Education Strategy for Africa. However, progress remains uneven. Many African education systems face structural challenges, including inadequate funding, outdated curricula, limited teacher capacity, and weak infrastructure. These constraints slow the integration of sustainability and climate change themes, despite growing awareness of their importance. Recent studies indicate that while environmental science topics are present in some secondary school curricula across Africa, they often lack the depth, contextualization, and practical application necessary to foster climate resilience (Adebayo & Musa, 2021). In Nigeria, Sustainable Educational Development has been formally recognized as a key driver of national development, but implementation gaps persist. Policies such as the National Policy on Education (2021 revision) and the National Climate Change Policy (2021) provide frameworks for integrating sustainability and climate action into education. Federal initiatives,

including the Green Education Initiative and the School Climate Clubs supported by the Federal Ministry of Environment, reflect efforts to mainstream environmental and climate issues into schools.

Some tertiary institutions have launched programs in environmental management and renewable energy technology, signaling a gradual shift toward green education. Nonetheless, challenges remain formidable. Chronic underfunding of the education sector, estimated at below the UNESCO-recommended 15–20% of the national budget, constrains the development of climate-resilient infrastructure and the recruitment and training of teachers skilled in sustainability topics (World Bank, 2022). Within Kwara State, the present status of SDE and CCE mirrors these national trends but also reflects local dynamics. Kwara, located in Nigeria's North-Central region, faces climate-related hazards such as flooding, unpredictable rainfall patterns, and rising temperatures, which threaten agriculture, health, and infrastructure. These realities underscore the urgency of integrating climate education into the state's educational development strategies. The Kwara State Ministry of Education has made incremental efforts to promote environmental awareness through extracurricular activities such as tree planting campaigns, sanitation drives, and school-based environmental clubs. Some secondary schools have incorporated climate-related themes into science and geography subjects, while tertiary institutions like the University of Ilorin and Kwara State University have introduced courses and research programs in environmental management and sustainable development. Despite these initiatives, the integration of SDE and CCE in Kwara remains at a nascent stage.

Curriculum content addressing climate change is often theoretical, with limited emphasis on practical skills such as renewable energy use, waste management, or disaster risk reduction. Many teachers lack the specialized training needed to deliver climate-focused education effectively, and professional development opportunities in this area remain scarce. Infrastructural deficits ranging from poorly ventilated classrooms to inadequate water and sanitation facilities further challenge the realization of a sustainable learning environment, particularly as rising temperatures and flooding events disrupt school operations. A study by Okafor and Akinyemi (2023) found that fewer than 40% of surveyed secondary schools in North-Central Nigeria, including Kwara, had explicit programs or policies on climate change education, reflecting a gap between policy aspirations and on-the-ground practice.

Financial constraints and governance issues also limit progress. While the state government has expressed commitment to improving education quality, budget allocations for climate-resilient infrastructure, renewable energy installations, and teacher training remain insufficient. Many schools rely on outdated energy sources and lack facilities for rainwater harvesting or climate-smart agriculture demonstrations, missing opportunities to model sustainability for students and communities. Moreover, coordination between the education and environment ministries is often weak, leading to fragmented implementation of climate education policies. Nevertheless, there are promising developments that point toward a more integrated approach. Non-governmental organizations (NGOs) and international partners have begun supporting climate education projects in the state.

Programs led by groups such as the Nigerian Conservation Foundation and international partners like UNICEF have introduced school-based workshops on waste management, climate adaptation, and renewable energy. Community-based adaptation initiatives, including climate-smart farming programs, are increasingly linked with local schools, providing practical

learning opportunities and strengthening the connection between education and community resilience. Public awareness of climate issues is also growing, driven by more frequent extreme weather events and their visible impacts on livelihoods. Parents, educators, and local leaders are beginning to recognize the importance of climate education for protecting future generations and sustaining economic development. This heightened awareness creates an enabling environment for policy reforms and resource mobilization. Digital technology, including online learning platforms and mobile apps, is being explored as a means to expand climate literacy, especially in urban areas where internet access is improving.

Challenges of Sustainable Educational Development (SDE) and Climate Change Education (CCE) in Kwara State, Nigeria

The drive to integrate Sustainable Educational Development (SDE) and Climate Change Education (CCE) in Kwara State faces numerous interconnected challenges that slow progress and limit impact. These obstacles stem from structural, economic, socio-cultural, and policy-related factors, which together hinder the creation of a climate-resilient and sustainability-oriented education system.

1. Inadequate Funding and Resource Allocation: One of the most persistent challenges is the chronic underfunding of the education sector. Nigeria's budgetary allocation to education remains below the UNESCO benchmark of 15–20% of total national spending, and Kwara State reflects this national trend (World Bank, 2022). Insufficient funding limits the construction of climate-resilient classrooms, provision of renewable energy facilities, development of modern learning materials, and implementation of teacher-training programs on sustainability and climate change.

2. Outdated and Overloaded Curriculum: The current curriculum in most Kwara State schools offers only superficial coverage of climate-related issues. Environmental topics are scattered across science and geography subjects without a cohesive framework for sustainability education (Okafor & Akinyemi, 2023). The lack of practical, hands-on learning such as renewable energy demonstrations or climate-smart agriculture prevents students from acquiring real-world adaptation and mitigation skills.

3. Limited Teacher Capacity and Professional Development: Many educators lack the specialized knowledge and pedagogical skills necessary to deliver SDE and CCE effectively. Opportunities for professional development in these areas remain scarce, and teacher training institutions have yet to fully integrate climate change modules into their programs (Adebayo & Musa, 2021). This knowledge gap diminishes teachers' confidence and effectiveness in promoting sustainability concepts.

4. Poor Infrastructure and Environmental Vulnerability: A significant number of schools in Kwara State operate in buildings that are poorly ventilated, prone to flooding, and without reliable electricity or clean water. Extreme weather events such as heat waves and torrential rains disrupt learning and damage school facilities. Without investment in climate-resilient infrastructure, schools themselves become vulnerable to the very challenges SDE and CCE aim to address.

5. Weak Policy Implementation and Governance: While Nigeria's National Climate Change Policy (2021) and National Policy on Education (2021) provide frameworks for integrating climate and sustainability education, implementation at the state and local levels is inconsistent. Poor coordination between the ministries of education and environment leads to fragmented programming and a lack of accountability (UNESCO, 2023). Policy directives often fail to translate into tangible action in classrooms.

6. Low Public Awareness and Community Engagement: Although climate impacts are increasingly visible, many parents and community leaders still prioritize immediate economic concerns over long-term sustainability. Misconceptions about climate science and a lack of awareness about the benefits of CCE hinder community support. Without grassroots understanding and participation, school-based climate initiatives struggle to gain traction.

Opportunities for Advancing Sustainable Educational Development (SDE) and Climate Change Education (CCE) in Kwara State, Nigeria

Despite the challenges, there are significant opportunities to expand and strengthen Sustainable Educational Development and Climate Change Education in Kwara State. These opportunities arise from growing global attention to climate action, national policy support, technological advances, and the increasing recognition of education as a key driver of sustainable development.

1. Policy and International Framework Support: The United Nations Sustainable Development Goals (SDGs) particularly SDG 4 (Quality Education) and SDG 13 (Climate Action) provide a strong global framework for promoting SDE and CCE. Nigeria's National Climate Change Policy (2021) and the National Policy on Education (2021) already endorse environmental sustainability and climate action in education. Kwara State can leverage these frameworks to access federal funding, technical assistance, and partnerships for curriculum reform and teacher training (UNESCO, 2023).

2. Integration of Climate Education into Curriculum Reform: The ongoing review of Nigeria's curriculum presents an opportunity to embed comprehensive climate change modules across subjects such as science, geography, and civic education. Integrating practical, hands-on learning experiences like renewable energy projects, waste management programs, and climate-smart agriculture can make learning more engaging and relevant for students (Okafor & Akinyemi, 2023).

3. Capacity Building for Teachers and School Leaders: Training teachers to become climate education champions offers a sustainable way to scale CCE. Workshops, short courses, and professional certifications supported by universities, NGOs, and development agencies can improve educators' climate literacy and pedagogy. Tertiary institutions in Kwara, including the University of Ilorin and Kwara State University, can lead in designing teacher-training programs focused on sustainability (Adebayo & Musa, 2021).

4. Adoption of Green and Climate-Resilient Infrastructure: New school construction and renovation projects present opportunities to introduce climate-resilient designs such as solar-powered classrooms, natural ventilation, rainwater harvesting systems, and energy-efficient lighting. Demonstrating green infrastructure in schools not only reduces operational costs but

also serves as a practical teaching tool for students and surrounding communities (World Bank, 2022).

5. Use of Digital Technology and E-Learning: The rapid growth of digital technology and mobile connectivity in Nigeria can expand access to climate information and interactive learning resources. Online platforms, mobile apps, and virtual classrooms can deliver climate change education to remote and rural areas, bridging the urban–rural knowledge gap and enabling innovative teaching methods (UNDP, 2023).

6. Public–Private Partnerships and NGO Engagement: Collaboration with private companies, NGOs, and international development partners offers financial and technical support for SDE and CCE initiatives. Organizations such as UNICEF, the Nigerian Conservation Foundation, and international climate funds can provide grants, training, and materials for school-based projects like tree planting, renewable energy installations, and environmental clubs.

Conclusion

This paper has shown that climate change poses significant challenges to development in Kwara State, with direct impacts on agriculture, infrastructure, health, and education. However, integrating Sustainable Educational Development (SED) with Climate Change Education (CCE) provides a pathway to resilience and long-term sustainability. Through climate-responsive curricula, teacher training, and community-based initiatives, schools can serve as platforms for building awareness, fostering innovation, and preparing learners with skills for adaptation and green opportunities. Beyond reducing vulnerabilities, SED and CCE create prospects for renewable energy adoption, sustainable livelihoods, and stronger environmental stewardship. Concisely, investing in climate-smart education not only addresses immediate risks but also positions Kwara State to seize opportunities for sustainable growth in a warming world.

Suggestions

1. Integrate climate change education into school curricula and community outreach to improve public understanding and adaptive capacity.
2. Develop and enforce climate-responsive policies that promote renewable energy, sustainable agriculture, and resilient infrastructure at both state and local levels.
3. Train educators, local leaders, and community members in climate adaptation techniques and early-warning systems to reduce vulnerability.
4. Foster collaboration among government agencies, NGOs, and international partners to access technical support and climate finance for mitigation and adaptation projects.

References

Adebayo, R. A., & Musa, O. T. (2021). Community-based climate change education as a tool for disaster risk reduction in Nigeria. *African Journal of Environmental Education, 18*(2), 55–68.

Adelekan, I., & Eze, B. (2023). Climate change impacts on education in Nigeria: Emerging risks and policy responses. *African Journal of Environmental Management, 14*(2), 45–59.

Akinyemi, O., & Lawal, T. (2023). Integrating climate literacy into Nigeria's basic education curriculum: Pathways to sustainable development. *International Journal of Sustainability Education, 18*(2), 45–59.

Education Commission. (2022). *Education for climate action*. https://educationcommission.org/education-for-climate-action

Federal Ministry of Environment (FME). (2022). *Nigeria's National Climate Change Report 2022*. Abuja: Author.

Federal Republic of Nigeria. (2021). *Climate Change Act, 2021*. https://faolex.fao.org/docs/pdf/NIG208055.pdf

Folke, C., et al. (2022). Resilience theory and social-ecological systems: An update. *Ecology and Society, 27*(1), 1–12.

Intergovernmental Panel on Climate Change (IPCC). (2022). *Climate change 2022: Impacts, adaptation and vulnerability*. Cambridge University Press.

Intergovernmental Panel on Climate Change (IPCC). (2023). *Climate Change 2023: Synthesis Report*. Geneva: IPCC.

LIDA Network. (2023). Climate change and education disruption in Kwara communities. Retrieved from https://lidanetwork.org

Okafor, C. J., & Akinyemi, F. O. (2023). Integrating climate change education into secondary school curricula in Nigeria. *International Journal of Environmental Studies, 80*(4), 567–583.

Okoli, J., & Yusuf, A. (2021). Teacher preparedness for climate change education in Nigerian secondary schools. *International Journal of Sustainability in Education, 16*(4), 233–247.

Olorunfemi, A., Adeoti, K., & Ibrahim, S. (2024). Climate change education and the quest for sustainable schooling in North Central Nigeria. *African Journal of Environmental Studies, 12*(1), 33–50.

Sterling, S. (2021). *Educating for the future: Principles of sustainable education*. Routledge.

UNESCO. (2023). *Education for sustainable development and climate action: Progress report 2020–2023*. United Nations Educational, Scientific and Cultural Organization.

UNESCO. (2023). *Transforming education for sustainable futures*. Paris: UNESCO.

UNESCO. (2024). *Education for sustainable development: Key messages*. Paris: UNESCO.

UNICEF. (2023). *Climate-resilient education systems: A framework for action*. New York: UNICEF.

United Nations Development Programme (UNDP). (2023). *Climate action and digital learning for Africa*. New York: UNDP.

United Nations Development Programme (UNDP). (2023). *Climate change and human development report*. New York: UNDP.

United Nations Educational, Scientific and Cultural Organization (UNESCO). (2022). *Education for sustainable development and climate action: Progress review*. Paris: UNESCO.

United Nations Educational, Scientific and Cultural Organization (UNESCO). (2023). *SDG 4 and climate education progress report*. Paris: UNESCO.

United Nations Educational, Scientific and Cultural Organization (UNESCO). (2023). *Transforming education for sustainable futures*. Paris: UNESCO.

United Nations Framework Convention on Climate Change (UNFCCC). (2021). *What is climate change?* https://unfccc.int

United Nations Framework Convention on Climate Change (UNFCCC). (2021). *Action for climate empowerment: Guidelines and recommendations*. Bonn: UNFCCC.

World Bank. (2022). *Green jobs and the future of work: Pathways for youth empowerment*. Washington, DC: World Bank.

World Meteorological Organization (WMO). (2022). *State of the global climate 2022*. Geneva: WMO.