

Climate Change Education in Nigeria: The Role of Curriculum Review

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Abstract This article discusses Nigeria's Response to Climate Change (NRCC) project and policies. Climate change and related environmental issues are seen as an important aspect of education for Nigerian students. The impact of climate change on education is examined here in terms of children's poor school performance and its contribution to poverty. Through knowledge students can measure equally with students from other nations while also contributing to the management of climate change. Students can participate in educating the citizenry on climate change in their various localities. The article insists on the importance of curriculum review so as to present the science of climate change to learners who will in turn disseminate what they have learned to others. How Kenya, Tanzania and Uganda are solving their climate change challenges is also discussed. Some recommendations are made in terms of making the teaching of climate change explicit in the curricula and moving beyond a basic understanding of how the climate system works. In conclusion, the article emphasizes the importance of periodical curriculum change in order to be abreast of the latest developments in climate change. This article is addressed to education managers, planners, curriculum reviewers and policy makers in Nigeria.

Keywords Climate Change, Technology, Education, Curriculum, Students, Curriculum Review

1. Introduction

Many environmental issues are subject to verifiable interpretations; climate change is one of them. Illness is often explained in terms of climate change, especially at the beginning of rainy season and dry season. Most of the time, there is no firm scientific basis behind subjective interpretation. It is interesting to know that the word 'climate' is the average weather pattern of a place. It includes the following: patterns of temperature, precipitation (snow or rain), humidity, wind and seasons. Climate patterns play a fundamental role in shaping natural ecosystems, and the human economies and cultures that depend on them. Our climate is rapidly changing with disruptive impacts and that change is progressing faster than any witnessed in the last 2,000 years [1]. The report "Preparing for a Changing Climate" reveals that rising levels of carbon dioxide and other heat-trapping gases in the atmosphere have warmed the earth and are causing wide-ranging impacts, including rising sea levels, melting snow and ice, more extreme heat events, fires and drought, and more extreme storms, rainfall and floods [2]. Scientists project that these trends will continue and in some cases accelerate, posing significant risks to human health, our forests, agriculture, freshwater

supplies, coastlines and other natural resources that are vital to economy, environment and our quality of life [1]. Scientists have advised that societies around the globe reduce human-caused greenhouse gas emissions (GHGs) to avoid worsening climate impacts and lower the risk of creating changes beyond our ability to respond and adapt [3]. The urgency of climate change as a political issue was clearly conveyed during the world summit in New York, where the UN Secretary General (Ban Ki-moon) informed world leaders that the world's glaciers are melting faster than the climate negotiations.

The United Nations Framework Convention on Climate Change (1992) defines climate change as changes in climate that is usually attributed straightforwardly or not directly to human activity which alters the composition of the overall atmosphere in addition to the usual climate changeability observed over similar periods. In addition climate change is identical to global warming. The Intergovernmental Panel on Climate Change [4] defines climate change as statistical variations that persist for an extended period, typically decades or longer. It includes shifts in the frequency and magnitude of sporadic weather events as well as the slow continuous rise in the global mean surface temperature. According to Spore [5], each day the sun emits rays of light onto the earth's surface. The earth absorbs part of the heat, reflects another part into the atmosphere and sends out a third part in the form of infra-red rays. These rays are cushioned by the clouds and water vapor, which stabilize the earth's temperature under normal circumstances. The gases absorb

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the terrestrial radiation from the earth and re-radiate the heat back to the earth, leading to a general increase in temperature known as global warming.

Changes in climate are currently at the center of our daily life, as its impacts and consequences are being experienced in all regions of the world [1]. Climate change refers to the alterations in the atmosphere that are over and above natural climate variations and are caused by human activity. This means that the situation can be changed if human beings transform their ways of living to be more environmentally sustainable and friendly.

Climate change is a considerable and lasting alteration in the numerical distribution of weather patterns over a period of time. It may perhaps be changes in weather conditions (that is, more or fewer extreme measures). Changes in climate are caused by factors that include oceanic processes (such as oceanic circulation), variations in solar radiation, biotic processes, volcanic eruptions and plate tectonics, and human-induced alterations of the natural world; these human-induced effects are currently causing global warming, and climate change is often used to describe human specific impacts [6].

It is noteworthy that human life style affects climate through its dispositions in the carbon and water cycles and such means as albedo, cloud formation, evapotranspiration and weathering [7] [8]. The ways in which human life may have affected past climate over the years is triggered by the evolution of oxygenic photosynthesis; long-term interment of decomposition challenging detritus of vascular land plants (forming coal) [9].

Climate change is as old as human existence. People around the globe have been experiencing alternate cooling and warming of the earth which has been caused by eruptions of volcano, increasing the carbon dioxide content of the atmosphere and also changes in the amount of energy emitted from the sun and other sources. The Industrial Revolution increased the warming of the earth due to the anthropogenic emission of greenhouse gases (GHG). It is very clear that the rising levels of GHG emissions caused an approximate 24% increase in the re-radiation of heat back towards the Earth's surface, which therefore increased global average temperatures by approximately 0.4°C —a rate unparalleled in the last ten thousand years [10].

Lee is of the opinion that the most formidable challenge posed by climate change is that there is no one single answer, no one single solution. He asserts that there is a need to develop a whole host of technologies and also continue to improve their energy efficiency. One of the new technologies that scientists want to develop and deploy is CO_2 capture and storage, which gathers the carbon dioxide or CO_2 that comes from power generation or from industries, refineries and also from natural gas production. First, the CO_2 is separated and the captured CO_2 is compressed to a density that is very similar to a light liquid. After compression, the CO_2 is injected into suitable reservoirs beneath the earth. What this means is that safely storing CO_2 underground will help reduce greenhouse gas emissions that

come from energy production [11].

2. Response to Climate Change in Nigeria

Building Nigeria's Responses to Climate Change (BNRCC) project aims to help build informed responses to climate change in Nigeria by enhancing capacity at the community, state and national levels in order to implement effective adaptation strategies, policies and actions [12]. The development of the BNRCC project sprung from the achievements of an earlier initiative called the Canadian-Nigeria Climate Change Capacity Development Project (C-NCCCCDP), implemented with funding from the Canadian International Development Agency (CIDA) between 2001-2004 and the Nigeria Environmental Study/Action Team (NEST). The C-NCCCCDP project involves raising awareness of climate change issues and mobilizing a network of people willing, capable and prepared to work at addressing them. It facilitated the first multi-sector assessment of climate change impacts and adaptation in Nigeria, which resulted in the preparation of five assessment reports. These assessments provided the framework for the BNRCC project. In essence, they were the key components of a strategic environmental assessment; they also noted important 'lessons learned' and specific recommendations, which have been integrated into the BNRCC Project. BNRCC has also outlined some possible follow-up project concepts and made them available to donors and government agencies in Nigeria, in addition to developing a climate change policy brief.

The success of BNRCC depends on the project team's ability to inform, inspire, engage and collaborate with interested and affected parties across the country. It is assumed that Nigeria's climate change must be directed by the people of Nigeria. It is interesting to note that the BNRCC project, through its implementation and outputs, reaches out to the ministries and legislatures at federal and state levels, including the Ministries of the Environment, Agriculture and Water Resources, Women Affairs and Social Development, Health, Education, Information, Finance, and Justice, as well as the National Planning Commission, and the Energy Commission.

BNRCC has also engaged parastatals and agencies such as the Nigerian Meteorological Agency (NIMET), the National Emergency Management Agency (NEMA), State Environmental Protection Agencies and the Department of Petroleum Resources (DPR), which in turn assist in disseminating information concerning climate change.

There are other stakeholders involved in BNRCC which must not be waved aside, including media outlets, non-governmental organizations (NGOs), faith-based organizations (FBOs), community-based organizations (CBOs), professional and scientific associations, universities, research institutions and local community leaders. It is of the utmost importance that the Nigerian educational system and curricula are also overhauled to include the issue of climate

change.

The Minister of Environment, Hajia Hadiza Mailafia, has said that the federal government is mindful of the adverse consequences of the phenomenon, adding that it is striving to sensitize citizens to the dangers of climate change. The Minister announced that a graduate program in the field of climate change would soon be introduced in two Nigerian Universities, under the aegis of the German Initiative on the West African Science Service Center on Climate Change and Adaptive Land Use. In addition, the Minister also said that Nigeria has collaborated with other ECOWAS member states to develop a West African Climate Change Adaptation Strategy (WACCAS) (<http://issuu.com/pml01/docs/110512>).

Scientific studies e.g., [1] [2] tremendously indicate that global changes in climate are unequivocal, and already causing significant harm, as well as posing great risks to our future. It should be noted that the actions that governments and individuals take today will influence the magnitude of warming and the amount of greenhouse gas emissions. These activities also affect people's ability to take action and adapt to changes in weather conditions, and potentially reduce the susceptibility of people and their places. Educating students about the effects and causes of global change in weather conditions is crucial because putting into practice viable solutions depends on well informed populace.

Education is an essential element of the global response to climate change. It helps young people understand and address the impact of global warming, encourages changes in their attitudes and behavior, and helps them adapt to climate change-related trends. Through the Climate Change Education for Sustainable Development program, UNESCO aims to make climate change education a more central and visible part of the international response to climate change. The program aims to help people understand the impact of global warming today and increase "climate literacy" among young people. It does this by strengthening the capacity of its member states to provide quality climate change education, and encouraging innovative teaching approaches to integrate climate change education in schools by raising awareness as well as enhancing non-formal education programs through media, networking and partnerships [13].

The Dominican Republic relies on education to combat the disastrous effects of climate change on its people and environment. Its government believes that education is important if the environment is to be protected, which can only happen when everyone involved understands what is at stake. A study published by Hamann [14] showed that while most Dominicans are aware that climate change exists, only 22% know its exact causes. This case could be compared to the situation in Nigeria where residents experience annual floods but many do not have known what causes floods and occasional extreme heat to occur. Throughout the Caribbean country, along its roads and past its villages and towns, many families still burn their waste in the backyard, sending plumes of smoke wafting among the surrounding palm trees. For locals, it is an easy and effective way of getting rid of

garbage, but they are unaware of the grave consequences for their environment. Alvarez, the National Coordinator of the United Nations on climate change, who also works for the Dominican Council on Climate Change, asserts that no strategy can work if the public is not sufficiently educated and informed. He believes that local decision-makers must know more about climate change and its consequences and the factors that accelerate the phenomenon. He further emphasizes that knowledge is critical in order to tackle problems such as disposal at the community level more efficiently. The government of the Dominican Republic emphasizes education on the effects and causes of climate change as a principal means of social and political change [1].

Nigerians are facing the same serious problems related to climate change as other countries but have yet to recognize that education is the most effective counter-strategy. Massive public education should be embarked on to save people and the environment but currently there is a deficit in the fields of climate change and education that curriculum planners need to address.

3. Environmental Education and Climate Change

Nigeria experiences both dry and rainy season; these two seasons come with terrible heat and horrible rainfall that obstruct peoples' movement. Too much heat damages crops and vegetation while too much rainfall causes widespread flooding causing some households to relocate. Weather-related calamities have become a yearly occurrence for which people have not learned to prepare. Scientific findings reveal that changes in weather conditions have and will continue to have a major impact on human life and ecosystems. Rising temperatures, floods, droughts, and heavy precipitation can lead to severe problems such as increased diarrhea, malnutrition and malaria. Floods and rising sea levels can cause injuries, drowning, severe physical and mental trauma, particularly for citizens who live along major river deltas, on islands and in low-lying coastal areas.

In Nigeria, no particular area is spared from flooding, which destroy human property, marooned people, with canoes occasionally deployed to relocate people to more convenient quarters. Last year some places in the Niger delta regions, including Lagos and its environs, were worse hit. Some places in the northern part of Nigeria were also drastically affected; for instance, because of heavy flooding that covered even bridges, participants attending the Nigeria Institute of Management (NIM) Conference at Abuja in 2012 were unable to travel back home because of flooded areas around the confluence town called Lokoja. In Anambra state, flooding destroyed several homes, rendering many people homeless around the Aguata area, where erosion has been a menace for years despite the fact that the state government has been tackling the problem at great expense. No area of

Nigeria is secure from the effects of flooding.

According to a recent UNICEF [15] report, although children are worse hit however, they should not be considered inactive or weak. Children can be powerful agents of change. Studies have shown that many children can be astonishingly resilient in the face of significant challenges when they arise. UNICEF advocates empowering children through germane education on climate change and disasters management, which can reduce their susceptibility to risk for sustainable development of their communities. Educating students on issues of climate change is one of the best ways of strengthening communities on the problems of adaptation to climate change [16]. Due to the serious and adverse effects which climate change has caused on the environment, UNICEF is working on scaling up and mainstreaming climate change adaptation, disaster, and risk reduction plans in school systems globally. These works are based on the principles of child-friendly education aimed at integrating climate change, disaster, risk management and environmental concerns across education system. They include education sector plans, policies, legislation, school budgets, teacher education, curricula and examinations, infrastructure and facilities in school, learning environments, school management and governance. An inclusive climate change and environmental education, and education on disaster-risk management into school curriculum guarantees the realization of students and children's environmental rights as preserved in articles of the Convention on the Rights of the Child [15].

According to UNESCO [13], education alone cannot achieve a more sustainable future; however, without education and learning for sustainable development, we will not be able to reach that goal. It is remarkable that UNICEF has made great efforts in educating people on sustainable development. The IAC promotes the role of ESD and its implications for all forms of international initiatives such as the Millennium Development Goals (GOALs). The IAC therefore aims to achieve the following goals:

- Share a common vision, principles and values on ESD and ensure DESD visibility as a common objective and agenda for the system;
- Share programs and plans in order to encourage mutual reinforcement and avoid duplication or overlap within the UN system;
- Share good practices and lessons learned and coordinate ongoing activities to further advocate for the decade;
- Harmonize approaches to ESD and sustainable development practices within each organization;
- Provide a forum for agencies to integrate the insights and perspectives of other international actors into their ESD agenda;
- Provide an international platform to ensure high visibility of the challenges and progress of ESD as well as the maximum impact of ESD initiatives.

4. Impacts of Climate Change on Schooling

About eighty percent of enlightened Nigerians lament that they are hard hit by climate change, with farmers and fishermen – representing two major employment sectors – being particularly impacted. Climate change interferes with all aspects of life including schooling. In Nigeria, especially in the Rivers state, many children are absent from school during heavy rains, especially in the villages where there are no means of transportation. Such absenteeism obviously affects children's academic performance. Climate change particularly affects women and girls. In some places, girls are kept at home doing domestic chores while boys were allowed to go to school. If there is drought, it is mainly women and girls that are responsible for collecting water—a burden which may also prevent them from either attending school or taking their school attendance seriously.

Serious drought leads to food scarcity, which leads to hunger, which in turn affects the ability of learning of children. Children often have to move with their families to places where there is safety from flooding, which also affects their education adversely by interrupting their studies and potentially increasing their distance from available schools. Children's right to receive an education also results in damage to houses, school buildings and other infrastructures such as roads and bridges. Last year, some school premises were used as temporary settlements for disaster victims. In Kilosa, for example, two primary schools were closed for weeks in order to provide settlements for flood victims. Such closure also impacts their capacity to study at home [17].

4.1. Developing Solutions to Climate Change

Chevron has stated that it is working to reduce greenhouse gas emissions while expanding its energy supply portfolio to meet the world's energy needs. Arthur Lee, Chevron climate change advisor, is an expert in carbon capture and storage. He has participated in industry workshops and the Intergovernmental Panel on Climate Change's [18] Report on Carbon Dioxide Capture and Storage. The following principles serve as guideposts for Chevron's policy development:

- Global Enlightenment
- Energy Security
- Maximum conservation
- Measured and Flexible Approaches
- Broad, Equitable Treatment
- Transparency

Chevron is working at state, federal, and international levels to contribute to climate change policy discussions. Its stance reflects a balanced approach to addressing climate change through short- and long-term measures. As it works to reduce GHGs, its collective challenge is to create solutions that protect the environment without undermining the growth of the global economy. It believes that a successful

climate policy would be one that would equally share the task of reducing GHGs among the top emitting countries of the world through long-term and coordinated national frameworks. Chevron also supports research to explore technologies that may reduce emissions or improve efficiency. Through its Chevron Technology Ventures (CTV) business unit, it could identify, develop and commercialize emerging technologies that have the potential to transform energy production and use. CTVs portfolio includes biofuels and emerging energy and investments in startups designing technology valuable to Chevron [11].

According to the Institute of Development Studies (IDS) [40], Southern nations could help farmers adapt to changes in the global weather conditions, but a problem is how to make current research findings reachable to rural communities. Apart from that, IDS has also made a separate audio version that can be used in radio broadcasts [19].

4.2. Knowledge and Learning: Strategies for Managing of Climate Change

Many Nigerians are aware that some changes occur in the environment year in and year out but lack knowledge of the reasons for such change. They are also aware of increased disease, food shortages, and extreme flooding at various localities during certain periods of the year. Yet there have been no efforts to reduce the occurrences or avert them altogether. There is a need to educate the public of the signs of climate change as well as management and prevention strategies.

Many of us are aware that climate change is severely affecting livelihoods in Nigeria through changes in rainfall patterns. About seventy percent of the farmers interviewed expressed that their crops were washed away by floods, eliminating their yields for consumption or sale. In Rivers State the fishermen were not spared since they could not catch as much fish as they used to and the environment was not conducive for human life since all the debris washed away by water or flood was deposited at various places. About 70 percent of them at various fishing ports lamented that they suffer this disaster yearly but do not have the solution to their problems.

According to Zack [20], Knowledge Management consists of a series of strategies and practice used in an organization to identify, create, distribute and enable adoption of insights and experiences. Such insights and experiences consist of knowledge integrated into or embodied in organizational theories and practice [21].

For many years, researchers have explored local knowledge about environmental change and increasingly over the past decade, local knowledge in relation to climate change specifically. They know much more about the content of the different types of knowledge that are important for responding to climate change-from modeling future rainfall changes in a particular country to how to get the most out of an agricultural environment in highly variable conditions. However, they still do not know how to translate these different forms of knowledge into practice

and make them accessible to policymakers, front-line staff (such as agricultural extension officers or health workers), and people in poor communities on the ground. They also have a poor grasp of strategies for bringing together people from different backgrounds and starting points, so that they can reconcile what they know. Bringing together different perspectives is important for both the quality and legitimacy of decisions about adaptation [22].

In Nigerian schools, practical demonstrations are needed in order for children to actively use their acquired knowledge and skills to improve society. Teachers should also demonstrate the importance of agriculture in the growth of the nation. In the fishing ports where fish farmers and their children reside, experts should be sent to demonstrate the modern way of processing and preserving fish both for local consumption and for exportation. Children should be thoroughly guided so as to enable them do the same in their various localities.

There is a need to strengthen climate change knowledge architecture in Nigeria to reach policy-makers, students and researchers, as well as community-based organizations and NGOs, who are in the frontline of delivering adaptation projects. This knowledge architecture has already been developed in Nepal (Nepal Climate Change Knowledge Management Centre). Ideally, it would include a center that would serve as a platform for coordinating and facilitating the regular generation, management, exchange and dissemination of climate-related knowledge and capacity-building services. Climate change researchers who receive grants through the project would be provided with mentoring in learning and knowledge sharing. The Climate and Development Knowledge Network (CDKN) has contracted an external consultant to drive the monitoring and evaluation of the project, whose role is to ensure that learning from the project is captured and used throughout the project's implementation [23].

It would be instructive for the Nigerian governments to borrow a leaf from Nepal to drive climate change knowledge at home for the benefit of the citizenry. It would benefit the agriculturists who make food available to the people, the students who would gather knowledge to disseminate to people in our various communities, and the policymakers and managers of education who would ensure that such knowledge is part of the education curricula. It might attract investors to the country, thereby creating job opportunities.

The World Bank is noted for its development project lending; knowledge services are becoming increasingly important. Governments, private sector and civil society organizations are eager to learn from others what is working and what is not working when it comes to climate change. Knowledge exchange, South-South learning, communities of practice, and training are crucial to ensure that development gains can be sustained and lead to lasting results. The new Climate Change Knowledge Portal, the Open Data Initiative, Mapping for Results, the Green Growth Knowledge Platform and Connect 4 Climate Change are a few examples of how the World Bank shares knowledge and connects

practitioners around climate change [24].

Knowledge is strategically important in technology, teaching and learning. In order to survive and thrive, institutions of learning, primary, secondary and tertiary, must ultimately engender a knowledge culture, grappling with information and knowledge management, and developing accessible technological systems along with the associated tools and resources.

What Nigerian children need is practical application of the theories of climate change that they have learned. Students should be taught to put their knowledge to meaningful use, which is only possible when educators practice what they teach so as to guide the learner properly. Nigerian schools should be well equipped and teachers should receive further training to update their knowledge and skills. The present curricula will not enable Nigeria to compete with other developed economies. As agents of change, children can assist in educating their communities in their various localities to adapt to climate change. When Nigerian children are provided with adequate knowledge and skills, coupled with sufficient infrastructure, there will be less damage sustained from climate change.

A United Nations Development Programme (UNDP) report [25] showed that the level of awareness about climate change is rather low in Nigeria and, if care is not taken, will wreak havoc on the daily lives of its citizens. The report showed that the awareness of climate change is highest at the federal level but drops at the state and local government levels where knowledge is highly needed. These levels encompass the people who own and cultivate farmland. As Olorunfemi [26] asserts, the most significant obstacle to reducing the impact of climate change in Nigeria is lack of awareness and knowledge. For this reason, knowledge management must be taken seriously. In addition to educating the citizenry through Town Criers and village gatherings, the government needs to incorporate climate change into the school curriculum in order that school children, the agents of change, can gain new knowledge and skills. Considering the youthful exuberance, inquisitiveness, enthusiasm in these children, the information passed on to them should be looked upon as knowledge delivered. Coupled with the latest technology with which many of them are conversant, the information could be easily delivered and the impact felt within a short time within the school system [27].

4.3. Climate Change and Curriculum Review

Given the impact of climate change in Nigeria, it is paramount to undertake curricula reform and teacher training in order to educate the public, especially schoolchildren. Flooding has become a perennial problem in the Rivers and Lagos states as well as in other areas of the country. Recently, a national newspaper '*The Nation*' printed a story stating that, "the Lagos State Oba Tijani Adetunji Akinloye, Sateru 11, has called on the Lagos State Government to address the issue of perennial flooding from the Agungi River which flows through his domain." The Oba associated the flooding

with a blockage of the Agungu Channel as a result of poor work on the part of the contractor who initially handled the project [28].

Education regarding the effects and management of climate change should be embarked on vigorously. The Nigerian citizens, where this research is focused, should be sensitized toward climate change and the havoc it inflicts on people, property, and crops. Though the school curricula touches on topics related to weather change in the subject of social studies, for example, the content is not sufficiently elaborate to equip students with knowledge of how to address its remedies and causes. The authors are suggesting that in both the primary, secondary and tertiary levels of education climate change education should be included across different subject areas so that children are empowered to protect human lives and the environment.

In a research conducted by Orusha, Alukogu, Onogu, Nwaigwe, Ohuaka, and Tim-Ashama [29], they maintained that because agriculture is affected by so many factors, its participants must always be prepared to react, plan, and adapt. According to the authors, integrating climate change issues into our agricultural education curricula is imperative given that African countries, especially Nigeria are at risk. Boko *et al.* [30] demonstrated that 95% of Africa's agriculture is rain-fed. It is projected that agricultural production, including access to food, will be severely compromised by climate unpredictability and change in many African countries and sub-regions. The areas suitable for agriculture, the length of growing seasons and yield potential, particularly along the margins of semi-arid and arid areas, are expected to decrease. This decrease would further adversely affect food security and exacerbate malnutrition in various countries in the continent; yields from rain-fed agriculture could be reduced by up to 50% by 2020.

Research shows that half of Africa will face water stress; disease will likely spread. UNECA [31] warned that Africa is already vulnerable to a number of diseases such as Rift valley fever, which afflicts both people and livestock; cholera, which is associated with both floods and droughts; and malaria, which has extended to the highlands of Kenya, Rwanda and Tanzania as a result of the warming climate. Records have shown that Africa has been warming throughout the 20th century at a rate of about 0.05 degrees Centigrade per decade. The warming was observed to be significant between June and November each year. For the last 30 years, both droughts and floods have been constant on the African continent. Nkomo, Nyong, and Kulindwa [32] observed that in Nigerian Sahel region, there has been a 25% decrease in precipitation on average in the last 30 years. The Nigerian children are not yet properly educated on how to deal with the situations caused by climate change due to lack of knowledge. The inclusion of climate change in the Nigerian educational curricula is imperative.

It is crucial to prepare the young ones in the right way so as to enable them tackle the challenges they would encounter as they leave school. It will go a long way toward making

them effective and efficient policymakers when they assume their respective places in the governance of the nation. In primary and secondary school education, this curricula reform would take place in the subjects of Social Studies and Citizenship Education; in the tertiary institutions it would take place through the departments of Geography and Environment Studies. Currently these areas fall short of instructing students on climate change and its impact on the environment. Emphasis should be placed on the following areas in particular:

- The meaning of the concept: climate change and how it affects peoples' lives and property;
- Aims and purposes of studying climate change;
- The effect of climate change on local crops and the global economy;
- The definitions of related concepts: greenhouse gas emissions, climate system, reservoir, sink, etc.;
- The challenges farmers (fishermen, crop farmers, etc.) encounter and how they can avert them so as to increase their yield;
- The impact of climate change on transportation, industry and commerce, education, human settlements and housing, health and sanitation, forestry, fresh water resources, coastal water resources and fisheries;
- Climate change and Disaster Risk Management in Nigeria;
- Individual respect for the environment;
- The production of carbon dioxide by human activity and the impact on the climate;
- Ways to reduce emissions (mitigation) and respond to and manage the impacts of climate change (adaptation).
- The basic science of climate change;
- Climate impacts, sustainability and energy use;
- The potential impacts of unmanaged climate change.

Currently the Nigerian curriculum does not sufficiently expose students to the dangers of climate change. One recommendation is that climate change should be taught as a separate subject and, if possible, made one of the compulsory courses offered in the school certificate examination for which Nigerian students study; such studies would allow students to actively disseminate knowledge and information related to climate change. Teacher training and the provision of adequate equipment should be provided to give students the essential knowledge, skills and understanding that they need to be educated citizens.

Basic knowledge about climate change, including both the science and its potentials, should be taught in an objective and evidence-based way in schools to ensure all students understand the fundamentals. The teaching of climate change should be spread between more than one subject area, for instance, science, geography, and social studies. In this, it is important that the areas of study are properly integrated so as to enable students to gain a complete understanding of how issues such as climate change affect all aspects of life.

From all indications, schools would be the ideal place to introduce climate change education where children can be given skills to manage their own environment that they, in turn, will practice in their various localities [33].

The fundamental goal of our educational system in Nigeria is to boost students' learning and this is the place where participants continually expand their capacities to create and achieve where new patterns of thinking are encouraged, and where collective aspirations are nurtured. The organization also expands the capacity for collective reforms, as well as individual innovation, decision-making, and problem solving [34-36].

5. Recommendations

- The curriculum planners should ensure that they put in place core knowledge of, and information about, climate change as part of compulsory education.
- Teaching of the causes and consequences of climate change, including potential societal impacts, should form part of the core knowledge offered to all students, especially at the primary and secondary levels of education, but also at the university level.
- As part of the science of climate change, students should learn about the potential impacts of unmanaged climate change, as well as options for adaptation and mitigation, in order to enable a complete and robust understanding. In other words, teaching of climate change impacts should go beyond a basic understanding of how the climate system works.
- There are several challenges that might mitigate the teaching of climate change in Nigerian schools, related to teacher qualifications and infrastructure.
- Attitudinal changes toward everyday practices related to climate change can only be addressed through curriculum change.
- Education about climate change should be made interesting through the use of innovative methods and techniques. Preferably, the discovery method should be employed in order to effectively reinforce the content for students.
- Policy makers, school administrators, teachers, parents, and students should embark on raising awareness of climate change in Nigeria.
- University lecturers should be financially motivated to carry out research in various fields of knowledge related to climate change, so that innovative research can contribute to practical solutions.

6. Conclusions

Education remains a valuable factor towards national development. The aspiration of establishing a free and democratic Nigeria, a just and egalitarian society, a united, strong and self reliant nation, a great and dynamic economy

[37], would be dashed if our curriculum as it stands is not properly reviewed and implemented especially at secondary school level to meet the growing demand for climate change and issues that will enhance reduction in the effect of climate change. Education at secondary school level serves as a bridge between primary schools and tertiary institutions [38]. Therefore, Nigeria needs visionary leaders who strongly believe in climate change, and are inspired to achieve results [39]. Nigerians are known for their self-efficacy, perseverance and commitment to their vision of education. Nigerians are reflective, follow their inner sense of direction and initiate change. Most of the time the visionary leaders are humble and unpretentious, expressing openness to climate change and ready to make sacrifices to achieve great results. The Nigerian educational system should be proactive and effective so as to make the learners (primary, secondary, and postsecondary students) conveyors of information who can effectively address the issue of climate change. In short, climate change education should be considered with all seriousness and given the attention it deserves in our educational system.

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