UNIJERPS
Unizik Journal of Educational Research and Policy Studies VOL.6;
https://unijerps.org
2021 Impact Factor: 5.641; 2020 Impact Factor: 5.355. January-June, 2021
Indexing and Impact Factor URL: http://sjifactor.com/passport.php?id=21363

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THE PLACE OF CLIMATE CHANGE IN THE NEW SENIOR SECONDARY SCHOOL CURRICULUM FOR SUSTAINABLE DEVELOPMENT IN NIGERIA

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ABSTRACT
Climate change has become very topical because of the crisis it has caused in every part of the world. Natural disasters are fast becoming global phenomena. There are now such familiar expressions as hurricane Katrina, sunnami, and others which past generations did not know of. These words simply emphasize the dimensions wind, flood, and rains have taken in recent times. In Nigeria particularly, flooding is taking an embarrassing dimension. It now sacks communities and destroys lives and property. Farms are being washed off daily and houses are being pulled down by wind in various areas of the country. The concept of secondary school education, reasons for climate change in the senior secondary school curriculum and sustainable development are reflected. Some suggestions are reflected that people should develop habit of being environmentally friendly about the way they live to manage the climate change pandemic.

Key Words: Climate change, Sustainable development curriculum and senior secondary school.

Introduction
The world today is facing very serious problems as a result of climate change. Every part of the world is suffering from one form of the devastating effects of climate change or the other. With time, some communities in some parts of the world may go extinct because of the natural disasters that result from the climate change being experienced today in the world.

The dimensions such natural disasters as flood, fire outbreak, excessive sunlight and so on are fast taking are placing citizens of various countries in serious danger. Every country appears to be at risk of either earthquake, landslide, flooding, excessive wind, fire outbreak and so on. There are now such new expressions as "sunnami", hurricane Katrina, and so on, which past generations never heard of. Countries now live in abject poverty because of some of these devastating disasters. Haiti is yet to recover from the earthquake it suffered from some years ago and Japan's pride in technological development has been challenged by a similar earthquake. China has a bitter story as well. In fact, watching cable - news in recent times like devoting time for a litany of disasters in various parts of the world. Everybody is concerned. The world leaders have made some efforts towards halting climate change and itsdevastations, but to no avail.

Nigeria is not spared of the challenges of climate change at all. Though there have not been earthquake, "Sunnami" or hurricane Katrina, in the country, there are cases of flood, landslide and winds ravaging some communities in the country. Many Nigerians have been rendered homeless and eternally poor, because of these unfortunate natural disasters which also claimed some lives. In addition to the problems traditionally experienced by the riverine peoples during this season many non-riverine peoples are experiencing devastating flooding in different parts of the country, including the far northern peoples who would not have experienced flooding, ordinarily. Wind is blowing down people's houses in both the northern and southern parts of the country. There is fear of desert encroachment in some parts of the North and ocean surge in Lagos. No part of the country is entirely free from the devastating effect of climate change.

Climate change results from man's activities on earth, mostly. It is man also that will control it through his positive activities on earth. Man's environment friendly activities cannot only result from legislation. Education alone, can create that culture among Nigerians and this education must start with teachers first. This paper therefore, discusses how climate change can be combated through further greening of teacher education curriculum in Nigeria. This can be done through examination of the meanings of climate change, causes of climate change, effects of climate

change, sustainable development concept of secondary education, reasons for climate change in the senior secondary school curriculum. There will then be suggestions and conclusion.

The Meaning of Climate Change (Sustainable Development) and Curriculum

None of the words or expressions here is very strange. They are always used. Climate change which could have appeared strange is recently becoming a household expression because of its impact on the modern society. Thus, much time will not be needed in explaining them.

Climate change ordinarily means change in the climate. The climate can be hotter and it could also be cooler and all these connote change. In most literature, it is called climatic change and so, climate and climatic are used interchangeably. According to the 1999 edition of the *Hutchinson Encyclopedia*, climatic change is a change in the climate of an area or even of the whole world, over an appreciable period of time. Climate change is not just weather changes which occur more often. It is rather a sustained atmospheric change. This is made clearer by Bellamy (2007) who sees the climate as accumulated general and averaged weather patterns of a considerable duration in a locality or region. According to him, climate refers to yearly cycles of temperature, wind, rainfall and so on. This is different from daily variations of the weather which is the state of the atmosphere at particular time. Climate change is a near permanent change of the atmosphere. The definition given of climate change as in the 1999 edition of The Hutchinson Encyclopedia above is considered appropriate in this paper.

Curriculum is the easiest concept to explain here. It is neither the syllabus, nor the scheme of work, or even the list of subjects learners must be exposed to in school. All these are rather, aspects of the curriculum. Akudolu (1994) insists that curriculum covers every element in the learning environment, such as the subject matter to be learned, the students, the teachers and the physical environment. According to her, it is the organized knowledge learners are exposed to in school. This is often the general view of curriculum, but it appears narrow. Tanner and Tanner's (1995) view appears adequate enough and acceptable in this paper. According to them, it is a planned and guided learning experience and the intended learning outcome

formulated through systematic reconstruction of knowledge and experience under the guidance of the school for the learner's willful growth in social and personal competence. If this definition is accepted, then greening teacher education curriculum will simply mean laying further emphasis on environmental issues in every aspect of teacher education programmes.

Causes of Climate Change

Climate change has attracted so much global attention in recent times. Its devastating impacts on communities have kept so many people perpetually at alert and so frightened that some people may be planning to evacuate from their homes without knowing where to go to. Many still wonder why natural disasters are so rampant now in the world. This is why the causes of climate change must be properly highlighted.

Climate change has been there with man, though in less magnitude. The dimension it is now taking is what makes it appear strange and worrisome to many people. As Enger and Smith (2006) in Okwuenu (2012) observe, evidence of climate change dates back to 160,000 years ago. There may be some remote causes of climate change, but the activities of man contribute so much to climate change. According to Enger and Smith, there is a very close correlation between the concentrations of green house gases in the atmosphere and global temperature. The activities of man generate the gasses that cause the depletion of the ozone layer and the greenhouse effect. As Michaels (1998) observes, the enhanced greenhouse effect, or global warming potentially represents the greatest environmental disturbance ever associated with human species. According to him:

> *Concern that climate may be changing and that human beings are the cause is not new. Thomas Jefferson hypothesized that the deforestation of the Mid-Atlantic region resulted in changed wind patterns as far west as the blue Ridge Mountains ...* A *hundred years later, the British physicist John Tyndall performed pioneering laboratory experiments on the absorption of infrared energy by certain constituents of the atmosphere,*

> *including carbon dioxide and water vapour. In 1986$_t$ the Swedish chemist Svante Arrhenius generalized Tvndail's findings* to *the globe and concluded that if the atmospheric carbon dioxide were* to *doublet the mean temperature of the planer would rise some five degrees Celsius. (p. 610).*

Michael's story here exposes man as the major cause of the problem of climate change and the victim as well, in every part of the globe. The invention of the digital computer has helped in explaining Tyndall's theory through the "General Circulation Model" which tries to simulate the atmosphere disturbed by an enhanced greenhouse effect, and the global warming. How then does man influence climate change?

Man's activities cause the release of gases such as carbon dioxide ($C0_2$), chlorofluorocarbons (CFCs) and others which cause havoc to the ozone layer with bitter consequences on the planet. Mcintosh in Enger and Smith (2006) explain that these gases in the atmosphere are transparent to ultraviolet and visible light but absorb infrared radiation and allow the sunlight to penetrate the atmosphere and be absorbed by the Earth's surface. According to him, the sunlight energy is re-radiated as infrared radiation, which is now heat which is absorbed by the greenhouse gases in the atmosphere. Other gases such as methane (CH_4) and nitrous oxide (N_20) contribute to climate change.

Carbon dioxide is the most abundant of the greenhouse gases, mostly resulting as a waste product of energy production such as burning of coal, oil, biomass and natural gas for the provision of heat and electricity for domestic and industrial processes. The concentration of carbon dioxide is further heightened by deforestation. Omoruyi (1997) explains that the indiscriminate and unwholesome felling of trees, excessive grazing by cattle and desert encroachment destroy the plants which help to regulate the atmospheric pile-ups or accelerated load of carbon dioxide and adds to the greenhouse effect and the subsequent global warming. Since trees and vegetation absorb the carbon in the air through photosynthesis, their destruction makes them release so much carbon dioxide into the atmosphere. Omoruyi adds that the emission of saw dust into the atmosphere as noticed in sawmills also helps in depleting the ozone layer. The

combination of these factors results in climate change.

Cholorfluorocabrbons (CFCs) result almost entirely from human actions. They are greenhouse gases, even when their quantity may be minute. They were usually used in refrigerators, air conditioners, cleaning solvents, propellants in aerosol containers and also as expanders in foam products (Mcintosh in Engar and Smith, 2006). These gases appear to retard heat loss much more than the carbon dioxide though their use has been greatly reduced after the Montreal Protocol Substances that Deplete the Ozone Layer of 1987.

Methane Is another Important greenhouse gas, mainly from biological sources, rather than fossil-fuel sources. Many bacteria in wetlands and rice farms release methane into the atmosphere along with others in the guts of termites and some ruminant animals like cattle. Nitrous (N_20) is another type of gas that causes climate change. This greenhouse gas goes into the atmosphere mostly from fossil fuels and fertilizers. Michaels (1998) emphasizes that it is the combination of these greenhouse enhancing gases that has raised the CO_2 level in the atmosphere from the natural 270 parts per million to almost 410. This is what is expressed as CO_2 equivalent that allows for the different characteristics of the various greenhouse gases.

Effects of Climate Change

It is speculated that about half of the increase in the emission of substances that make the ozone layer very vulnerable has occurred since the Second World War. The processes that cause the depletion of ozone layer are still on and pose greater danger to man's survival. The effects of climate change are many and global, though they cannot be the same on all people. They range from deteriorating health of man, hunger, displacement of communities, ecological disasters, imbalance in the ecosystem, extinction of species of wildlife to some other problems that may not have been anticipated yet.

The very first visible impact of climate change is the deteriorating health of the people. Almost everybody now has one health problem or the other, resulting from climate change. As Omoruyi (1997) puts it:

> *If the sun rays are allowed* to *hit the earth surface it could pose great danger* to *human health . . . the ultra-violet rays can make the lens of the eyes of*

Nigerians to *cloud up with cataracts which can result* to *blindness . . . the excessive radiation can cause mutations . . . in the system of human beings leading to skin cancer. Besides, excessive ultra-violet radiation can also affect body's general ability* to *fight disease. In this same vein, it can . . . reduce the resistance of human system . . . against diseases. Recently, in the country we have witnessed* an *upsurge in the number of people who fall sick . . . sickness like malaria has become widespread and endemic inspite of the various efforts made* to *eliminate it. This cannot be unconnected with the inability of the body system* to *fight against such diseases. This inability of the body* to *resist disease can be traced* to *the exposure of the human skin* to *ultra-violet rays of the sun, which can also result in dehydration . . . (p. 84).*

Many Nigerians are fast becoming victims of excessive ultra-violet radion due to climate change. Diseases such as cancer, eye problems, lung, liver and heart-related diseases are becoming very rampant in the country due to global change. Very hot temperatures increase the death rate among the people.

Climate change can also result in hunger. Enger and Smith (2006) emphasize that climate change poses challenges to agriculture and the food supply. According to them, climate strongly affects crop yields since a carbon dioxide concentration of 550ppm is likely to increase crop yields in some areas by up to 30 - 40% and decrease yield of the same crop in other places. Hotness of the temperature can also lead to very short supply of sea foods, as the death of the minute organisms on which the big fish in the sea depends will reduce the number of such maritime food.

There is no doubt that climate change will result in displacement of communities. As the temperatures rise, evaporation in some areas will increase and lead to desertification or excessive drought while concentration of vapour in the air will cause constant rainfall in another area and result in flooding. These are two extremes that can cause communities to vacate their locations for safety in another place. Such people

become refugees in strange places in most cases. Climate change, in the same vein can cause problems to smooth movement of seafarers, hydropower supply, water-supply and demand, tourism, environmental quality, flood control and so on, in almost every part of the world. Changes in the hydrologic cycle is constantly devastating the world today in various ways, including ecological disasters due to climate change.

The extinction of species of wildlife is a critical issue in climate change. Dramatic changes of the climate naturally affect life in the ecosystem and usually make it difficult for the species to adapt. This situation can lead to movements of species and even death of some animals and plants. Mcintosh in Enger and Smith (2006) assert that the wetlands in some areas of America and Canada which support half of the waterfowl population of North America could diminish in area and change. According to them, these kinds of changes can result in an accelerated loss of species and an additional challenge to efforts to protect biological diversity. Forests easily succumb to climate change and seriously endanger the lives of every other thing that depends on them.

Many efforts have been made in the past and some are still on towards effective control of those human actions that influence climate change. According to Nwosu (2006), since 1972, the scope of international agreement has expanded from trans-boundary pollution agreement to preservation of designated species and conservation of ecosystem and from control of direct emissions into lakes to comprehensive river basin system regimes and so on. There are now Vienna Convention on ozone layer, Motreal Protocol the Basel Convention and so on, for the control of climate change. Much however, has not changed in the people's attitudes towards the depletion of Ozone layer. This is because legislation alone, cannot make the people change their attitudes in environmental issues. Only education which Enu (2002) refers to as the instrument for achievement of sustainable development, can do it. Students must be exposed to critical environmental issues for the people's attitudes to change favourably to issues of sustainable development. Students are members of any community through their involvement is interaction creating a better future for the community and so, they are in the best position to influence positive changes in the people's attitudes

towards the environment, now and in future. This is the secondary education curriculum should be adjusted to reflect climate change.

Concept of Sustainable Development

The term "sustainable development" was brought into common use by the World Commission on Environment and Development (The Brundtland Commission) in its seminar report "our common word". The idea of sustaining the earth has proved a powerful metaphor in raising public awareness and focusing on the need for better environmental stewardship. The Bruntland Commission defines sustainable development as the need of future development as "meeting the needs of the present generation without compromising the needs of future generations" (World Bank Report, 1992). According to Todaro and Smith (2008) sustainable development entails making simultaneous progress on three variables: economic growth, improved social conditions and reducing certain environmental pleasure, with all the carrying common linkage. It is usually understood that this international justice would be impossible to achieve in the absence of present-day social justice if the economic activities of some groups of people continue to jeopardize the wellbeing of people belonging to the other group or living in the other parts of the world. Only development that manages to balance these three groups of objectives can be sustained for long.

So, ignoring one of the aspects can threaten economic growth as well as entire development process. the ultimate objectives is to improve the quality of life on earth while also ensuring life in harmony with his fellow man and with nature through a system of sharing with one another caring for the environment and seeking to take no more from nature than can easily replenished (Uche, 1995). Also, sustainability is the act of supporting or bearing the weight of some responsibility for a long period of time. Sustainability is to encourage, support or give nourishment to sustain life. Asabe (2008) viewed that sustainable development means social progress which recognizes the needs of every one, effective protection of the environment, prudent use of natural resources and maintenance of high and stable levels of economic growth and development. This paper therefore focus on the place of climate change in the new secondary school curriculum for sustainable development.

Concept of Secondary Education

FRN/NPE (2014 edition) has two broad goals of secondary education is to bring about useful living within the society, and higher education in which specifically to:

1. Provide all basic education school leavers with the opportunity for education of a higher level of education, irrespective of sex, social status, religious or ethnic background.
2. Provide trained manpower in the applied science, technology.

All these are inline with the philosophy and goals of education in Nigeria which states as thus:

1. Live in unity and harmony as one indivisible, democratic and sovereign nation founded on the principles of freedom, equity and justice.
2. Promote inter-African solidarity and world peace though understanding in line with the policy of education there is desirous need to believed that.
3. Education is an instrument for national development. To this end, the formulation of ideas, their right interpretation for national development and the interaction of persons and ideas are all aspect of education.
4. Education fosters the worth and development of individual, for each individual's sake and for the general development of the society.
5. There is need for equal educational opportunities to all Nigerian children, irrespective of any real or imagined disabilities each according to his or her ability.
6. There is need for functional education for the promotion of a progressive, united Nigeria. To this end, school programmes needs to be relevant, practical and comprehensive. While interest and ability should determine individuals' direction in education.

This is inline with the national education goals, such as the:

1. Inculcation of national consciousness and national unity;
2. The inculcation of the right type of values and attitudes for the survival of the individual and Nigerian society.
3. The training of the minds in the understanding of the world around and
4. The acquisition of the appropriate skills and the development of mental physical and social abilities

and competencies as equipment or the individual to live in and contribute to the development of the society.

Accordingly, education shall continue to be highly rated in the national development plans because education is the most important instrument for national change; any fundamental change in the intellectual and social outlook of any society has to be proceeded by an educational revolution. Also education and training facilities shall continue to be expanded in response to societal needs and aspiration, (FRN, 2014).

Reasons for Climate Change in Senior Secondary School Curriculum

1. The school curriculum in the secondary schools when include climate-friendly agricultural practices for students to be taught hence this will improve their livelihood and it will reduce carbon emission from agriculture and store carbon in plant biomas and soils while increasing production.
2. The school curriculum should include topics in water and environment in order to abreast the students with the knowledge of environmental issues and protection of natural resources including water protection to creates awareness in student.
3. This will encourage students after studying to develop habit of water and environmental knowledge such as environmental problems and solutions couple about climate change.
4. Students will be aware of issue of misuse harp and resources and how land is used to produce food and its enormous impact on the environment and its sustainability which often has nothing to do with population.
5. It will enable students to develop knowledge in climate change and global warming, which increase water insecurity that the world's most water-stressed areas will get less water and water flow and subject to extreme events.
6. Students knowledge of climate change will enable them know measures to be used in solving the problem in the use of bioenergy, reforestation, and the adoption of improved agricultural practices that help reduce emission from agriculture while increasing production.
7. This will enable students at that level develop awareness on soil protection

which is the main foundation of human activity which however is erosion, the loss of organic matter, landslides and various forms of contamination and problems that environmental policy seems to address such as soil protection, integrated pollution prevention and control, assessment of the environmental impact of project, etc. Hence the need to catch them young.

8. The curriculum would include energy and environment studies to have students who will have idea of the sources of energy are fossil, fuel, renewable and nuclear. All these when included in the curriculum will enhance students at these levels to have knowledge of environmental problems and proffer solution to them.

Conclusion/Suggestions

Given the enormous and detestable degree of climate change in the world, there is gross inequality and inequity in their desire to achieve sustainable development of the environment and prepare for the unknown, hence the need for the curriculum innovation to bring in climate change as a topic in the school curriculum.

The suggestions are that:

Climate change has become a critical factor in our environment in which the curriculum should be accommodate it in the secondary school syllabus.

Also, the purpose of education is to solve problems bedeviling the nation, since climate change is with us. We should be thinking how to address the problem through education particularly from the secondary school to catch them young.

People should develop the habit of being environmentally consciousness about the way to live and manage the climate change pandemic.

Humanity should adopt best practice to live with the incidence of climate change such as natural disasters that result are from climate change, i.e couple with excessive rainfall and sunlight, landslide fire outbreak, flooding, excessive wind storm and so on which has not place humanity in a better situation. So, the senior secondary school curriculum should reflect the realities of the time for sustenance development of man.

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