Climate Change and Adaptation Concepts: An Indispensable Curriculum Innovation at Higher and Basic Levels of Education in Developing Countries of Africa.

Ezeugwu J. J. O
Department of Science Education, University of Nigeria (Nigeria)
Ezeugwujustin@gmail.com

Abstract

This paper presents the outcome of an investigation that considered the current global changes in climate and discussed "climate change and adaptation concepts" for inclusion as innovations in curriculum planning, revision and implementation at both basic and higher levels of education in countries in Africa. This investigation was carried out in Nigeria, an African country and therefore considers African countries', especially Nigerian educational system as possible areas where the suggested "climate change and adaptation concepts" could best be infused as innovations in curriculum provisions, curriculum revision, and implementation at both Basic and Higher levels of education. In this context, Africa countries are assumed to have approximately similar climatic conditions and can be considered together. The design employed in the investigation was a survey that involved the opinions of a randomly composed sample of one hundred and twenty (120) respondents to a questionnaire instrument developed by the researcher. The sample was made up 30 (thirty) higher education (University lecturers, 30 (thirty) College of Education lecturers, 30(thirty) basic education (secondary education tutors) and 30(thirty) literate adult members of the public, all drawn from University of Nigeria town in Nsukka, Ehamufu College of Education, Secondary School in Nsukka and Adult members of the public within the metropolis. A total of 5(five) research questions were posed, a total of 20(twenty) questionnaire items were used and 3(three) research hypotheses were formulated to guide the study. Data collected were analysed using some descriptive statistics like frequencies of the responses obtained on a 4-point likert scale, weighted average responses, as well as z-test statistic for answering the hypotheses formulated. Results obtained showed that all the items of the five research questions posed were considered acceptable by the three categories of respondents used in the study. Results also showed that there was no significant difference in the mean opinions of University lecturers, college of education lecturers, secondary education tutors and the literate adult members of the public that served as respondents to the questionnaire items. Recommendations made include that the performance objectives; content areas to be used; instructional methods for teaching and learning of the concepts; as well as evaluation techniques suggested be infused in the curriculum at both levels of education as innovations in Africa countries, especially in Nigeria.

1. Introduction

Historically mankind has always been in aware of the weather and weather changes. Ancient civilization had considered disasters as only natural and to be the works of gods. Whether changes have continued to be our every day experiences and have also been affecting our lives in one way or the other. Weather changes affect many things we do, from the clothes we wear, food we eat, our habitation, how and when to travel (i.e flights) etc and this have made the concept of whether change or climate change very interesting to us. The earth's climate is dynamic and is always changing through a natural cycle. Evidences of these changes abound; like we have rainy season, dry season, summer, winter, spring, autom and other seasons at different times as a result of changes in the weather globally.

However, today, what the world is more worried about is that the weather or climate changes that are occurring have been speeded up because of activities, not only related to nature, but also to man. Climate change, has various conceptions. According to Miller (2001) [4]. Climate change is the average variations in weather of a region or place over a period of time. As also opined by the International Panel on Climate Change (IPCC (2003) [2] in their 3rd Assessment Report (AR-3), notably referred to as, "Synthesis Report", for policy makers:

Climate changes are long term alterations in global weather patterns, especially increases in temperature and storm activities. In the opinion of IPCC (2004) [3] also, the continuous emission of carbon iv oxide (Co_2) into the atmospheric temperature worldwide is a major cause. Carbon dioxide (Co_2) is solely responsible for temperature increases. It constitutes about 80% of the of the green house gases around the earth's atmosphere that collect heat and light from the sun. Other green house gases are methane (CH_4), water vapour, fluorinated gases, nitrious oxide (N_{20}), hydroflouricarbon, (HFC_6 perfloucarbon (PFCS) and sulphur, hexafluoride (SF_6). With too many of these green house gases in the air, the earth atmosphere will trap too much heat and the earth will become too hot. As a result people, animals and plants would die because the heat would be too strong. These green house gases, act as a green house around the earth. This means that they let the heat from the sun into the atmosphere but do not allow the heat to escape back into space. This is what the green house gases does to the earth.

2. Causes of global warming

There have been many phases of warming and cooling over the billions of years of the earth's existence due to the green house effects. There are also many natural factors that contribute to the green house effects globally but most of these occurred very slowly over many millennia. Since the Industrial Revolution of the 19th century, human activities have increased the amount of green house gases in the atmosphere leading to increased radiation from Co_2, Methane Chlorofluorocarbon (CFC_S) and nitrous oxide. Since then the concentration of Co_2 and Methane have increased by 36% and 148% respectively as observed by Environmental Protection Agency, EPA 2007, USA) (Budyco M.I 1997) [1]. These levels are much higher than at any time during the last 800, 000 years. Carbon dioxide values higher than this, were last seen about 20million years ago and the burning of fossil fuels such as petroleum and natural gas has produced about three- quarters of the increase in Co_2 from human activities. Over the past 20 years. The rest of the increase is caused by changes in land-use, particularly deforestation. In fact the current warming globally is anthropogenic, created by humans. Climate change and global warming have varied according to regions countries depending on the amount of green house effect prevalent in the particular part of globe. Africa and South America has some similarities historically in this phenomenon. The causes of these climate changes and global warming can be divided into two categories – (a) those that are due to natural causes (b) those created by man.
Natural causes prominently include continental drift, volcanoes, ocean currents, the earth tilt and comet's and meteorites

2.1 Human causes

The industrial revolution in the 19th century witnessed a large- scale use of fossil fuels for industrial activities. More and more lands that were covered with vegetation have been cleared to make way for houses; national resources (trees, timber, etc) are being used for construction, industries, transportation and for consumption. Increased consumption, population explosion, in the cities have also led to a rise in green house gases in the atmosphere.
Carbondioxide is undoubtedly the most important green house gas in the atmosphere. Changes in land use pattern, deforestation and clearing for agriculture and other human activities have all led to a rise in the emission of carbon dioxide. Methane, another important green house gas in the atmosphere come from domesticated animals such as dairy cows, goats, pigs, buffaloes, camels houses and ship, These animals produce methane during the cud chewing process. Methane is also released from rice or baddy feeds that have been flooded during sowing and harvesting period. When soil is covered with water, it because anaerobic or lacking in oxygen.

3. Climate change in Nigeria

The unprecedented flooding witnessed in many parts of Nigeria, and other areas around the world have been attributed to climate change. In Nigeria's and other nations' quest for industrialization and fossil fuel exploitation different parts of the world have unwittingly infested themselves with thousands of environmental pains. Different parts of the globe are now witnessing frequent and severe heat

waves, hurricanes, tornadoes, flooding, typhoons and other extreme weather events. There is a scientific consensus that these extreme weathers are related to climate change.
In Nigeria, climate change is contributing to flooding in two main ways, namely (a) through the dramatic reduction of ice in the Arctic Region. As a result of the warming of the earth from human activities the ice that existed in the Arctic for millions of years is now melting at an alarming rate. As the ice melts and changes to water, it feeds the seas and oceans and eventually rivers, thereby rising their levels and these affected the dams. Consequently when it rains, there is heavy flooding of coastal regions, low lying plains and areas near rivers. This explains why Nigerians experienced flooding in some parts of the country - Lokoja, Bauchi, Kano, parts of rivers state where people ran for their dear lives and lived on house tops, tree tops to escape the devastating floods. However there are also human activities that contributed to the massive flooding in Nigeria. These include deforestation, burning of fossil fuels methane carbon dioxide and nitrous oxide emissions in the atmosphere resulting from human activities. (b) The second way climate change is contributing to flooding in Nigeria has to do with global warming, which is one of the symptoms of climate change. As a result of global warming, much of Northern Nigeria is experiencing desertification. Desertification dries up land to the point that the land looses its ability to absorb water because the land has become almost like concrete. As a result, even a small amount of rain fall can cause a flash flooding. This is why Nigeria experienced flooding in parts of Kano, Bauchi, and even Niger Republic. These are places where one would not ordinarily expect to see massive flooding. Climate change leads to whether anomalies. Flooding in Nigeria, is a living evidence of why we must take steps to reduce our contributions to climate change.
Nigeria, the most populous country in Africa with over 150 million people is one of the major contributors to climate change in Africa because of gas flarring, vehicle pollution, crude agricultural practices, excessive diesel and gasoline generator usage and continued use of incandescent bulbs. Because of her strategic location, Nigeria is the country that will be most affected by climate change in Africa. People, including children living near gas producing regions are faced with increased risks of acid rain, cancer, asthma, and environmental degradation. Gas flarring releases harmful green house gases such as carbon dioxide, nitrogen oxides, and methane which contribute to climate change. It is estimated that Nigeria has over 60 million diesel and gasoline generators in operation today, in addition to the giant generators from telecommunication mast operators that use, often a minimum of two giant diesels generators per site to power their tens of thousands of masts across the country. Globally, countries like Cauba, Venezarella, Ireland, Argentina, the United State and Ghana, are either phasing or have already concluded plans to phase out the use of incandescent bulbs and replacing them with compact fluorescent lamps (CFLS).

3.1 Infusing climate change and adaptation concepts as innovations in the curriculum of Basic and Higher level of education in Nigeria and other countries of Africa.

Nigeria has virtually the same climatic conditions with other parts of Africa naturally. Nigeria is in tropics, so also are most countries of Africa. Nigeria is a developing country like her counterparts in Africa. Infusing climate change and Adaptation concepts as innovations in the curriculum programmes of Basic and Higher levels of Education in these countries can therefore be achieved by using the following steps, obtained from the results of an investigation using a survey instrument that involved teachers and lecturers in Primary and Tertiary levels of education as respondents to questionnaire instrument with five groups of clustered items and 120 respondents, results of which certified that all the steps can be used as innovations in the teaching of the concept of climate change in African countries including Nigeria, (based on similarities in climatic and socio economic conditions of their countries). The steps to be used in the infusion of the concepts as innovations in the curricular are:

- Determining performance objectives that should be infused into teaching and learning of climate change and adaptation concepts in primary science (for Basic education) or Basic science education in tertiary levels of education.
- Determining the **Content** of climate change and adaptation concepts to be infused in the curriculum of primary and integrated science education programmes.
- Determining teachers' and students' activities in curriculum development and implementation processes at both levels.

- Determining teaching and learning instructional materials/methods to be used in achieving primary objectives.
- Determining evaluation guides in the Teaching and learning of the concepts.

Results obtained from the survey study conducted by this speaker are that five specific objectives stated, five contents areas stated, two Instructional techniques, two instructional methods, and two of the methods of evaluation as indicated below were all okayed by the respondents as being good innovations in curriculum of Basic and Higher levels of Education in Nigeria and other African countries.

Objectives that:

1. will help students (children in primary schools, adolescents and adults in tertiary institutions, literate individuals in the society to gain a wide experience in the maintenance of sustainable environment.
2. will help members of the society, students to acquire skills that will help them minimize human activities that lead to climate change and global warming.

Content areas are:

(a) Depletion Ozoe layer and the effects
(b) Green house gases and their effects

Instructional techniques are:

1. Use of projects
2. Discussion methods

Instructional materials to be used are

1. Use of maps
2. Globes

Method of evaluation of teaching and learning useful for teachers are:

1. Class work
2. Assignment

All the above suggested steps were okeyed by the respondents for use as innovations to be infused in curriculum of Basic and Higher levels of Education in Nigeria and other countries of Africa.

References

[1] Budyko, M. I. (1997) Climate Changes. American Geophysical Union Washington D. C.
[2] Intergovernmental panel on climate change (IPCC, 2003) climate change. The Third Assessment report (AR3) *Synthesis report. For policy makers.* *http://www.IPCC.CH//pdf/assessment report/ar3-3syrspm.pdf(Accesstenmarcg2012).*
[3] Intergovernment panel on climate change (IPCC, 2007) climate change. The Fourth Assessment report (AR4) *Synthesis report. For policy makers.* *http://www.IPCC.CH//pdf/assessment.*
[4] Miller, G.T. (2001) *Environmental Science*. "Work with Earth". 8th ed. Pacific Grove Books Cole.