

AWARENESS OF CAUSES AND EFFECTS OF CLIMATE CHANGE AMONG SENIOR SECONDARY SCHOOL STUDENTS IN NSUKKA LOCAL GOVERNMENT AREA, ENUGU STATE

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Abstract

The study investigated awareness of causes and effects of climate change among senior secondary school students in Nsukka Local Government Area. Two research questions and four null hypotheses guided the study. The study adopted the descriptive survey research design. The study was conducted in Nsukka Local Government Area. The population for the study comprised 1864 senior secondary two (SS 2) students in Nsukka Local Government Area. Simple random sampling technique was used to sample students comprising 286 female students and 114 male students, 218 science students and 182 arts students. A structured questionnaire titled Awareness of Causes and Effects of Climate Change Scale was used for data collection. The instrument was face validated by three experts. Cronbach's Alpha method was used to establish the reliability of the instrument, which yielded a reliability coefficient of 0.86. Data collected were analyzed using frequency and percentage for the research questions while t-test was used to test the null hypotheses. The findings showed that secondary school students in Nsukka Local Government Area are not aware of the causes and effects of climate change. There was no significant difference between the male and female students' awareness of the causes and effects of climate change score, while there was a significant difference between the arts and science students' awareness of the causes and effects of climate change score. Based on the findings of the study, it was recommended that curriculum planners should infuse more climate change education contents for the senior secondary school education into the relevant subjects that could increase students' awareness on the causes and effects of climate change. Also, to increase students' awareness and information about climate change, climate change education should be integrated into the art student curriculum, such as incorporating the themes of climate change and environmental safety when students study literary texts, language texts, novels and films among others.

Keywords: Climate Change, Awareness, Causes, Effects

Introduction

Climate change is one of the most important environmental issues facing the world today. It is unequivocal and occurring at an alarming price, according to evidences available (Inter-Government Panel on Climate Change, 2018). Changes in average conditions of the climate, its variability and extreme events constitute climate change. It is a long term change in weather conditions recognized by temperature change, rate of precipitation, wind speed and pattern and other indicators (Haq & Ahmed, 2020). Climate change is the average seasonal change in weather over a long period of time (Ezeudu, Ezeudu & Sampson, 2016). It is the significant and measurable change of the global temperature which is believed to be rather on the increase. Climate change describes any kind of change in climate which may be natural or human-induced. Jan (2015) opined that climate change is any long-term change in the patterns of average weather of a specific region or the earth as a whole. Climate change is the abnormal variation in the earth's climate and weather for a long period of time. The IPCC, (2014) defined climate change as statistically significant variations in climate that persist for an extended period, typically decades or longer. Cook (2019) posited that climate change is simply a change in the climate condition of the world and the change is found by the scientists and other concerned agencies to be on the increase line. A long term measurable change in the elements of climate tending towards extreme is climate change.

Climate change is stirred by two fundamental agents which are human (anthropogenic) and nature. The earth's climate is dynamic and always changing through a natural cycle. However, what the world is more worried about is that the changes that are occurring today have been speeded up because of human activities (Thackeray, 2020). Similarly, Glick (2019) remarked that human have been changing their environment in very significant ways ever since they learnt how to hunt with weapons, domesticate animals and farm crops, in addition to human modernized transportation and industrial system, which facilitate easy movement and production.

Human activities especially combusting of fossil fuels (coal, oil and natural gas) to make electricity and power vehicles, clearing forests for farms and cities among others causes climate change. Consequently, these activities increase the concentrations of Green House Gases (GHG) (Akpomi & Vipene, 2016). According to Blumenfeld (2019), greenhouse gases mean the gases that contribute to the greenhouse effect by absorbing infrared radiation. The main greenhouse gases are water vapor (H^2O), carbon dioxide (CO^2), methane (CH^4), nitrous oxide (N^2O), and fluorinated gases such as halocarbons, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). These gases having been accumulated in the atmosphere, allow radiation from the sun to pass through but trap some of the heat radiating back from the earth. This is called the "greenhouse effect" because the principle is similar to a greenhouse, where the glass roof allows sunlight in but traps heat for growing plants (Prevedello, Winck, Weber, Nichols, & Sinervo, 2019). The natural causes include changes in the earth orbit and spin, variations in solar activity and volcanic activities (Hegerl, Brönnimann, Cowan, Friedman, Hawkins, Iles, Müller, Schurer, Undorf, 2019).

The impacts of climate change are felt globally and disproportionately. Climate change has devastating impacts on living standards, health and well-being, habitats and species, utilities, facilities, and economic, social, and cultural assets that can have positive or negative consequences (Global climate action, 2019). Climate change phenomenon has serious consequences for the earth such as significant variations in regional climates, recurrent droughts, excessive heat waves, windstorms, among others. In Nigeria, the noticeable consequences of climate change include intense thunderstorms, widespread floods and incessant droughts, desertification, temperature rise, low agricultural yield and dry up of water bodies (Ovuyowiroye, 2013). Badjie, Yaffa, Sawaneh and Bah (2019) disclosed that climate change impacts pose great dangers with consequences such as desertification, sea level rise, flooding, water salination, among others. These impacts could manifest in food security challenges, damage to infrastructure and social dislocation. Additional impacts include threat to health as rising temperature could bring about diseases such as chronic heat rashes, Cerebra-Spinal Meningitis (CSM), stroke, malaria and other related diseases. Climate change will affect every citizen, every part of the environment, the natural resources, and thus practically every aspect of human life, the economy, the urban and sub-urban development patterns (Ekpoh & Ekpoh, 2011). The resilience of natural, economic, political, and social systems is threatened by climate change impacts.

In the North East is shrinking. Since 1960, Lake Chad has shrunk by 95% of its size (Malgwi & Joshua, 2021). Also, Malgwi and Joshua asserted that the Sahara Desert in the northern part of Nigeria is expanding to all directions at an annual rate of 1-10km. Subsistence farming, which provides staple foods for the people, is being threatened. Another big threat of climate change is hydroelectric power generation (Olaniyi, Funmilayo & Olutimehin, 2014). Nigerians experience seasonal reduction in the amount of electricity generated annually, and it is due to drought conditions which are getting worse. This reduction has implications on industrial development in Nigeria.

Southern Nigeria is experiencing increasing rainfall and getting wetter leading to flooding. Major cities such as Lagos, Gboko, Benin, Warri, Port Harcourt, Calabar, and those along major water ways such as Lokoja, have experienced flooding after heavy rains causing loss of human lives, livestock, and property (Okunlola, Oke, Adekunle & Owolabi, 2018). The northern part of Nigeria has experienced the incidences of floods in states, such as Sokoto, Niger, Jigawa, Yobe, Borno, Taraba, and Kebbi. Apart from the serious impact of floods on agriculture and displacement of inhabitants and destruction to property, floods threaten the health of the populace by exposing them to cholera, diarrhoea, malaria, and other water-borne diseases (Ogunjinmi & Ogunjinmi, 2022). This impact is so because according to United Nations Educational, Scientific and Cultural Organization (UNESCO), developing countries (of which Nigeria is one) are disproportionately affected by natural disasters because they lack resources, infrastructures, and disaster preparedness systems (Adamgbe & Kor, 2022). In view of these consequences of climate change, Amuzu, Jallow, Kabo-Bab and Yaffa (2018) opined that it would be prudent to begin thinking about what the changes might be and how humankind might best avoid or ameliorate the unfavorable effects and gain the most benefit from the favourable ones.

However, to avoid or ameliorate the effects of climate change, it is important to explore the awareness of different segments of the population with regard to the causes and effects of climate change. Awareness is the state or ability to perceive, to feel or to be conscious of events, objects or sensory patterns (Sampson & Ezeudu, 2017). Awareness means having an idea of the existence of something. Awareness is perception of something, be conscious of something/peripheral idea of something. Contextually, awareness implies the perception and consciousness of the causes and effects of climate change. The perception and consciousness could to a large extent help ameliorate the effects of climate change.

Education has been recognized as one of the important tools for conserving the environment and solving environmental problems through the cultivation of knowledge, skills, values and positive attitudes towards the environment among the people. Therefore, education serves as one of the social pillars that raise the younger generation's climate change knowledge, awareness, and attitudes (García Vinuesa, Rui Mucova, Azeiteiro, Meira Cartea, & Pereira, 2022). The United Nations (UN) and United Nations Educational, Scientific and Cultural Organization (UNESCO) have been stressing the need for climate change education, and this is reflected in the ever-growing significance to young people (Kuthe, Keller, Körfgen, Stötter, Oberrauch, & Höferl, 2020). Students' awareness should be increased through education in order to foster active participation in promoting climate change. Education contributes to bridging gaps in scientific and social comprehension of climate change (Bofferding & Kloser, 2015). Consequently, environmental-related contents were infused into most secondary school curriculum such as Geography, Social Studies, Agricultural Science among others to address climate change covered under topics, such as climate change, global warming, environmental hazards among others. Environmental education is an important tool to raise communities' students' inclusive awareness about climate change. Education has a serious role to play in helping to give out the correct message about climate change so as to mitigate and alleviate its effects. However, despite the infusion of climate change education in the curriculum, people tend to increase the rate of climate change by still indulging in the acts that cause climate change. It is therefore imperative to explore the students' awareness on the causes and effects of climate change. In other words, what are the senior secondary school students' awareness on the causes and effects of climate change in Nsukka Local Government Area, Enugu State.

In determining students' awareness of the causes and effects of climate change, the influence of gender and field of study should be taken into consideration. Gender refers to roles, responsibilities, identities or other qualities attributed to people because they are men or women (Rolleri, 2012a). Kah, Kargbo, Mendy, Jawo & Mendy (2021) stressed that gender is an important variable in any environmental discussion. Gokmen (2021) found out that gender variable affected the awareness of students on climate change causes and effects. According to Adebayo, Mubi, Zemba & Umar (2013), females are more aware of climate change, its causes and effects. Eneji, Onnoghen, Acha and Diwa (2021) noted that men and women play different roles in their daily relationship with the environment, thereby posing different perception and knowledge of the environment and the events in the environment. However, Ezeudu, Ezeudu and Sampson (2016) found out that there is no significant difference between the male and female students' mean score on climate change awareness. Oruonye (2011) noted that the different ways male and female are socialized tend to determine their environmental exploration, degree of environmental manipulation and overall relationship with the environment, including the general awareness and attitude towards environmental problems, such as climate change. Indeed, this present study sought among other things to determine if gender has influence on students' awareness on the causes and effects of climate change as a peculiar environmental problem.

The students' field of study can influence their awareness of the causes and effects of climate change. According to Eze (2020), students who major in Science and Social Sciences are more aware of climate change than those who major in the arts. According to Adebayo, Mubi, Zemba & Umar (2013), science students are more aware and sensitive towards climate change. This is because art students study climate change less frequently than Science and Social Science majors. If art students do not study the curriculum on climate change, they have limited knowledge of climate change.

Indeed, few studies have been done to determine the students' awareness towards climate change. For instance, Fernandez and Shaw (2019) found that the students' possessed low awareness towards climate change. Kumar, Jacob, Nimitha & Rakesh (2019) found that the students are not aware of climate change. Although related studies have been done with respect to secondary school students' climate change awareness, none was carried out in Nsukka Local Government Area, Enugu State. Thus, the status of secondary school students' awareness of the causes and effects of climate change in Nsukka Local Government Area (LGA) is not known at present. This gap is what this study

filled by determining the secondary school students' awareness of the causes and effects of climate change.

Research Questions

The following research questions guided the study

1. What is the awareness of causes of climate change among senior secondary students in Nsukka LGA?
2. What is the awareness of effects of climate change among senior secondary students in Nsukka LGA?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance

1. There is no significant difference in the mean response of awareness of male and female senior secondary school students on the causes of climate change.
2. There is no significant difference in the mean response of awareness of arts and science senior secondary school students on the causes of climate change.
3. There is no significant difference in the mean response of awareness of male and female senior secondary school students on the effects of climate change.
4. There is no significant difference in the mean response of awareness of arts and science senior secondary school students on the effects of climate change.

Methods

The study was conducted in Nsukka Local Government Area, Enugu State. The descriptive survey research design was adopted for the study. Descriptive survey research design according to Nworgu (2015) enables the researcher to describe existing status of the population with respect to the issue investigated and such result can be generalized to the entire population. This study intends to describe the students' awareness on the causes and effects of climate change, thus the design is considered appropriate for the study. The population for the study comprised 1,864 senior secondary two (SS 2) students in Nsukka Local Government Area, Enugu State. Simple random sampling technique without replacement was used to sample (400) senior secondary students. The sample is made up of 286 female students and 114 male students. Out of sampled senior secondary school students, 218 are science inclined and 182 are arts inclined. A structured questionnaire titled Senior Secondary School Students' Awareness of the Causes and Effects of Climate Change Scale was used for data collection. The questionnaire has two sections, A and B. Section A is on personal data of the students while section B is made up of two clusters. Cluster 1 elicits information on the awareness of causes of climate change and Cluster 2 elicits information on the awareness of effects of climate change. The questionnaire was rated on a modified four point Likert scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). The response was weighted as follows for positively keyed items: SA = 4 points, A = 3 points, D = 2 points and SD = 1 point the reverse in the negatively worded item. The instrument was face validated by three experts. Two of the experts are in Environmental Education, while one of the experts is in Measurement and Evaluation unit, all in University of Nigeria, Nsukka. Cronbach's Alpha method was used to establish the reliability of the instrument. The instrument yielded a reliability coefficient of 0.86. Frequency and percentage was used to analyze the Research questions. A benchmark of 50% is set to guide interpretation of the results of the responses percentage and frequency. Thus, any items that obtained 50% and above will be accepted, while any item that obtained less than 50% will be rejected. The t-test was used to test the null hypotheses at 0.05 level of significance.

Results

Table 1: Responses on Awareness of Causes of Climate Change among Senior Secondary School Students

S/N	Item Statement	Aware		Not Aware		Decision
		F	%	F	%	
1.	Deforestation	186	46.5	214	53.5	Not Aware
2.	Bush Burning	252	63.5	146	36.5	Aware
3.	Use of Insecticides and herbicides	81	20.3	319	79.8	Not Aware
4.	Air Pollution	305	76.3	95	23.8	Aware
5.	Emission of greenhouse gases (GHGs)	131	32.8	269	67.3	Not Aware
6.	Changes in the earth orbit and spin	113	28.2	287	71.8	Not Aware
7.	Increasing Population	81	20.3	319	79.8	Not Aware
8.	Burning of Fossil Fuels	96	24.0	304	76.0	Not Aware
9.	Automobile exhaust smoke	291	72.8	109	27.3	Aware
10.	Variations in solar and volcanic activities	127	31.8	273	68.3	Not Aware

The result in table 1 shows that senior secondary school students are not aware of the causes of climate change. This statement is anchored on the fact that all the items reached the benchmark of 50% and above except items 2, 4 and 9 which did not reach the benchmark of 50%.

Table 2: Responses on Awareness of Effects of Climate Change among Senior Secondary School Students

S/N	Item Statement	Aware		Not Aware		Decision
		F	%	F	%	
1.	Low agricultural yield	215	53.8	185	46.3	Aware
2.	Water scarcity	157	39.3	243	60.8	Not Aware
3.	Death of livestock	294	73.5	106	26.5	Aware
4.	Spread of diseases	104	26.0	296	74.0	Not Aware
5.	Dry up of water bodies	137	34.3	263	65.8	Not Aware
6.	Desertification	123	30.8	277	69.3	Not Aware
7.	Widespread floods	108	27.0	292	73.0	Not Aware
8.	Economic and financial collapse	104	26.0	296	74.0	Not Aware
9.	Economic disruption and poverty	129	32.3	271	67.8	Not Aware
10.	Population displacement	129	32.3	271	67.8	Not Aware

The result in table 2 shows that senior secondary school students are not aware of the effects of climate change. This statement is anchored on the fact that all the items reached the benchmark of 50% and above except items 1 and 3 which did not reach the benchmark of 50%.

Table 3: Independent t-test analysis of gender influence on Senior Secondary School Students' Awareness of the Causes of Climate Change

Gender	N	Mean	SD	Df	t	Sig.	Deci
Male	114	2.23	0.64	398	7.39	0.72	Accept H ₀
Female	286	2.27	0.50				

Key: N = Number of respondents, \bar{x} = mean, SD = Standard Deviation, Dec. = Decision

Result in Table 3 reveals that t-value of 7.39 with a degree of freedom of 398 and a probability value of 0.72 was obtained. This means that the null hypothesis which stated that there is no significant difference in the mean response of awareness of male and female senior secondary school students on the causes of climate change is accepted. Inference drawn therefore is that there is no significant difference in the mean response of awareness of male and female senior secondary school students on the causes of climate change.

Table 4: Independent t-test analysis of field of study influence on Senior Secondary School Students' Awareness of the Causes of Climate Change

Field of Study	N	Mean	SD	Df	t	Sig.	Deci
Science	218	3.32	0.20	398	6.04	0.10	Reject H ₀₂
Arts	182	3.31	0.21				

Key: N = Number of respondents, \bar{x} = mean, SD = Standard Deviation, $Dec.$ = Decision

Result in Table 4 reveals that t-value of 6.04 with a degree of freedom of 398 and a probability value of 0.10 was obtained. This means that the null hypothesis which stated that there is no significant difference in the mean response of awareness of science and arts senior secondary school students on the causes of climate change is rejected. Inference drawn therefore is that there is a significant difference in the mean response of awareness of science and arts senior secondary school students on the causes of climate change.

Table 5: Independent t-test analysis of gender influence on Senior Secondary School Students' Awareness of the Effects of Climate Change

Gender	N	Mean	SD	Df	t	Sig.	Deci
Male	114	3.14	0.31	398	-6.02	0.69	Accept H ₀₃
Female	286	3.22	0.31				

Key: N = Number of respondents, \bar{x} = mean, SD = Standard Deviation, $Dec.$ = Decision

Result in Table 5 reveals that t-value of -6.02 with a degree of freedom of 398 and a probability value of 0.69 was obtained. This means that the null hypothesis which stated that there is no significant difference in the mean response of awareness of male and female senior secondary school students on the effects of climate change is accepted. Inference drawn therefore is that there is no significant difference in the mean response of awareness of male and female senior secondary school students on the effects of climate change.

Table 6: Independent t-test analysis of field of study influence on Senior Secondary School Students' Awareness of the Effects of Climate Change

Field of Study	N	Mean	SD	Df	T	Sig.	Deci
Science	218	3.41	0.23	398	7.31	0.14	Reject H ₀₂
Arts	182	3.34	0.09				

Key: N = Number of respondents, \bar{x} = mean, SD = Standard Deviation, $Dec.$ = Decision

Result in Table 6 reveals that t-value of 7.31 with a degree of freedom of 398 and a probability value of 0.14 was obtained. This means that the null hypothesis which stated that there is no significant difference in the mean response of awareness of science and arts senior secondary school students on the effects of climate change is rejected. Inference drawn therefore is that there is a significant difference in the mean response of awareness of science and arts senior secondary school students on the effects of climate change.

Discussion of Findings

Tables 1 and 2 showed the results of frequency of responses on data analyzed. The senior secondary school students are aware of bush burning, air pollution and automobile exhaust smoke as causes of climate change but not aware of deforestation, use of insecticides and herbicides, emission of GHGs, change in the earth orbit and spin, increasing population, burning of fossil fuels and variations in solar and volcanic activities as the effects of climate change. They are also aware of low agricultural yield and death of livestock as effects of climate change but not aware of water scarcity, spread of diseases, dry up of water bodies, desertification, widespread floods, economic disruption and poverty and population displacement as effects of climate change. This result is in line with the findings of Fernandez and Shaw (2019) who found out that the students' possessed low awareness towards the effects of climate change. Also, Khoirunisa(2018) in a study on the middle school students of awareness of the causes of climate change found that the students are not aware of the causes of climate change. The major findings of the study conducted by Ezeudu, Ezeudu and Sampson

(2016) were that senior secondary school students in Umuahia education zone have low climate change awareness. Following this result, it can be deduced that the set objectives of Environmental Education is not achieved. According to GarcíaVinuesa, RuiMucova, Azeiteiro, MeiraCartea, & Pereira (2022), education serves as one of the social pillars that raise the younger generation's climate change knowledge, awareness, and attitudes. Environmental education is an important tool to raise students' inclusive awareness of the causes and effects of climate change. The unawareness of the causes and effects of climate change by the students could as a result of little climate change related contents in the secondary school curriculum and also as a result of the teaching methods teachers use in conveying climate change contents to the students.

The findings of the study with respect to hypothesis one and two analyzed in tables 3 and 4 respectively showed that there is no significant difference in the mean rating scores of male and female students on their awareness of the causes and effects of climate change. This result is in line with the findings of Haq and Ahmed (2020) who found that being a male or female student has no significant difference with respect to their knowledge towards environmental events like climate change. Ezeudu, Ezeudu and Sampson (2016) noted that there is no significant difference between the male and female students mean score on climate change awareness. These findings however disagree with Kumar, Jacob, Nimitha and Rakesh (2018), who found a significant difference between male and female tertiary education students' awareness to climate change.

The findings of the study in tables 5 and 6 showed that there is a significant difference in the mean rating scores of arts and science students on their awareness of the causes and effects of climate change. This result is in line with the findings of Eze, (2020), who found out that students who major in Science and Social Sciences are more aware of climate change than those who major in the arts. For Yang, Liao, Liu, Zhang, Zhong & Huang (2018), science students are more aware of climate change than any other field of study. This could be that more climate change related contents are infused in science subjects than arts subjects.

Conclusion

The finding of this study concludes that the senior secondary students are not aware of the causes and effects of climate change.

Furthermore, it concludes that there is no significant difference in the mean response of awareness of male and female senior secondary school students on the causes and effects of climate change.

The study also concludes that there is a significant difference in the mean response of awareness of science and arts senior secondary school students on the causes and effects of climate change.

Recommendations

Based on the findings of the study, the following recommendations are made:

1. Curriculum planners should consider infusing more climate change education contents for the senior secondary school education into the relevant subjects that could help the students to understand the causes and effects of climate change.
2. To increase students' awareness and information about climate change, climate change education should be integrated into the art student curriculum, such as incorporating the themes of climate change and environmental safety when students study literary texts, language texts, novels and films among others.
3. In-service training should be organized for climate change educators in senior secondary school in order to expose them on need to promote climate change awareness of students.
4. Methods of teaching and learning in climate change education should be focused on field work thereby making the students have direct the experience with the environment and nature through "hand-on activities"
5. Relevant subjects used in promoting students' climate change awareness in secondary schools, should be used adequately to promote climate change awareness. To achieve this effectively, conferences, workshops and seminars directed at exposing the climate change educators on the need to reflect climate change causes and effect during the implementation of environmental relevant contents should be organized and supported by the government and other relevant non-governmental organizations. The exposure could also include teaching methods that could enhance inculcation of climate change contents to the students.

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