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# **An Assessment On The Knowledge Of Climate Change In The Primary Schools Of Yenagoa And Its Environs.**

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## **ABSTRACT**

The call for the introduction of climate change education is generating interest in the global community. The study under investigation aims at discovering levels of knowledge of climate in the area (Yenogoa and its environs) from primary school pupils (primary 5). Thirty (30) primary schools (Public and Private) of the Yenogoa metropolis were investigated. 1273 pupils were interviewed using discussion methods to investigate the level of knowledge on the nature, causes and the consequences of the level of the knowledge of climate change. The study adopted the specifically-designed climate change Knowledge Test. 10 questions in each aspect was developed and discussed in the thirty schools. The research data were processed using the Frequency Distribution Analysis with a simple True or false dichotomous answers. A categorization of Knowledge into three classes, Low (Less than 33.3%, Moderate (33.3 -66.6%) and High (above 66.6%) was designed to assess respondents. The ages of 10-12 had the highest number of respondents (296 or 23.3%); 9 – 10 (288 or 22.6%); 8 – 11 (281 or 22.1%), while the least fall into 9 – 11 (98 or 7.7%) and 10 – 14 (105 or 8.2%) respectively. The overall climate change knowledge moderate in the consequences, cause and the nature of climate change as 61.5%, 58.44% and 58.8% respectively. The research concluded that the respondents had a relative moderate knowledge on climate change, and suggests the further study on comparative analysis be carried out to improve the present report.

**Keywords:** Climate change, knowledge, Primary schools, nature, causes and effect.

## **1.1 INTRODUCTION**

### **1.2 Concept of Climate Change**

The concept of climate change is in the global literatures for decades. Organized conferences, seminars and workshops have since been recognized as a serious environmental issue at local, regional and global scale. Environmental problems are the most dangerous threat for recent and future generations (Kotaman, Karaboga, Bilgin & Tugrul, 2016). However, the extent to which it may harm a given ecosystem varies depending on the systems sensitivity, ability to adapt to new climatic conditions, economic circumstances and institutional infrastructure (Ayuba, Maryah & Gwary, 2007). Improving the public understanding and awareness of anthropogenic climate change is vital to cultivating the political will to do something about it (Peters, 2010).

Researchers have shown that simply improving peoples understanding will not necessarily do much to change their stance. But, improving the curriculum to provide pupils with a better understanding of all climate issues, including climate change will enhance and awaken the knowledge of primary school pupils at the primary school level. In the same way, the philosophy of pragmatism apart from promoting the idea of child centered school has also promoted interest-centered education and has since been advocated by the planners of educational institutions world over. In other words, children born with the physical and mental equipment allow them full participation in the physical and social environmental activities. Whatever values and ideas people believed in would be regarded as tentative since future social development may refine or change them. (Osborne & Feberg, 1985).

Acquiring knowledge of such phenomenon at the stage of the primary school education is a prerequisite to the social and economic development of any nation. It also helps in the conservation and preservation of our

natural environment. Plans in the new national curriculum to provide pupils with better understanding of all climate issues have been addressed in the United Kingdom, the Nordic countries (Seikkulia-Leino et al., 2021), and other developed nations where climate change has been emphasized (Bybee, 1993) as more countries are linked to these issues.

Climate change is being mentioned in the science curriculum as both climate and weather features are specifically mentioned throughout science and geography curriculum (Dijkstra & Goedhart, 2012). It has also been advocated that pupils should learn how the production of carbon dioxide and other gases by human activities have negative consequences on our physical environment. This is the explicate coverage of the science of climate change. It is at least an extensive, and certainly more precise, than the current National Curriculum for an aged group, which says that ‘human activities and natural processes can lead to change in the natural environment (Drivers, 1985; Osborne, & Freyberg, 1985).

Knowledge is awareness, familiarity or understanding of something or someone gained by experience of a fact or situation, such facts as information, descriptions, or skills which is acquired through experience or education by perceiving, discovering or learning. Generally, knowledge also refers to a theoretical understanding of a subject. For instance, indigenous knowledge as stated by Orlove et al., (2009); Hulme et al., (2009), knowledge of climate change by Obiene, (2016); Gazzaz & Aldeseet, (2021); Ratinen, (2021) and Kutuywayo, (2022), are well established in the literatures (Papadimitriou, 2004; Orlove et al 2009). Moreover, it was also argued that the value of local (traditional) knowledge on climate change has received little attention, though it is not completely clear whether all of these are in fact adaptation to climate change: rain and or reduced soil, floods, cyclones, etc., were identified as an indirect impact of adverse climate change (Mertz et al, 2009).

Review of the literatures revealed that knowledge about climate change has appreciated by the developed countries over the years, but not so in the developing countries like in Africa, and from varying perspective (Gazzaz & Aldeseet, 2021, Kutuywayo, et al., 2022; Nepras et al., 2022). While Knowledge of environmental education, entrepreneurial education as well as environmental sustainability (Seikkula-Leino, 2022; Kumar, 2021; OECD, 2014, Ruskovaara et al., 2015) has become relevant in understanding climate change.

Historically, interest in the topics of indigenous knowledge began several decades with the study of ethnoscience and taxonomy (Orlove et al., 2009). It then expanded into many areas of agricultural development and natural resource management and resource use. Recent studies document the effectiveness of indigenous knowledge in land management in a number of settings and shows that indigenous knowledge persists even in the contexts and governmental land management of commercial land use (McDaniel et al, 2005; Orlove et al., 2009). The term ‘indigenous knowledge’ is also well established in the literature, even though other terms like local, tradition, vernacular, or folk knowledge, are also used (Ellen Harris, 2000; Antweiler, 2004; Orlove et al., 2009). Here, the term is used to refer to a place-based knowledge that is rooted in all local cultures and generally associated with long-settled communities which have strong ties to their natural environments. Such knowledge tends to be the result of cumulative experience and observation tested in the context of everyday life, and devolved by oral communication and repetitive engagement rather than through formal instruction (Ingold, 2003; Sillitoe, 2006; Orlove et al., 2009).

### **1.2 Statement of the Problem**

The fact that climate change is a phenomena caused mostly by human activities and the growing emission of the Greenhouse gas (GHGs) to the atmosphere has damaged the ecosystem reducing the benefits accrued to man in their natural environment. The anthropogenic activities have over the years left man vulnerable, particularly in the developing countries. This is the reason the poor will likely be hit hardest by climate change since they lack the capacity to respond positively (Olmos, 2009). Since vulnerability is marked by the poor countries, they are less liable to respond to stimuli because certain regions are more severely impacted by the effects. It is the reason that the United Nations Framework Convention on climate change (UNFCCC) came with the view to assist the vulnerable countries in the areas least able to adapt.

The consequences of the climate change have resulted to a colossal loss to lives and properties, and to the economy of those nations arising from climate change issues. In Nigeria, for instance, the Niger Delta region has over the years suffered significant losses of the ecosystem due to environment degradation as a result of

vast human incursion on the environment such as crude oil exploration and exploitation resulting from the emission of GHGs into the atmosphere, hence, the ecosystem services are not optimally utilized.

The dearth of information on climate change in the area has left the region unaware of the damage caused to the region. For instance, Kutuywayo et al. (2022) stated that increasing the awareness of climate change and the importance of protecting the environment are likely to be critical for mounting an effective response to climate change and full engagement with mitigation and adaptation. In South Africa, Kenya, Uganda, Jordan, and Bangladesh, studies have suggested that familiarity with climate change and general knowledge among adult and children, and its negative consequences have scaled the awareness and taken action (Olmos, 2001; Orlove, et al, 2007) through knowledge and perception (Shisanya & Khayesi, 2007; Gazzaz and Aldeseet, 2021; Kutuywayo et al, 2022; Ratinen, 2021), mitigation and adaptation (Orlove, et al, 2007; Ratinen, 2021

Climate change affects all regions of the world causing serious threats to life and properties. This include the natural causes such as high temperatures, drought and wildfires, floods, sea level rise and coastal incursion, biodiversity, soil amongst several others. The social threats are health, employment and education, while the threats for business are building, infrastructures, energy and Tourism.

In this study, the challenge is enormous, and is largely due to the nature of the environment and therefore requires environmental education to propagate awareness and knowledge. Countries like South Africa and the Nordic countries (Sweden, Finland and Iceland), have seen that the future belong to the youth, a knowledge of climate change will help to tackle issues affecting the environment and sustainability of the environment.

Climate change poses a major environmental threat to the future of today's youth. Generally, young people world over, are at the forefront of climate activism (Kutuywayo, 2022). The ability to engage, however, depends on the level of awareness or knowledge of climate and climate change. The frequency and intensity of climatic events such as floods, heat waves, tropical cyclones, and droughts are increasing globally due to climate change (Hug et al., 2015). The capacity to response to climate change is lacking except in the developed countries because of the high level of awareness and knowledge of technology, including environmental education.

There are limited research and knowledge about climate change in the educational system. Literatures have shown that studies on climate change and knowledge at primary school level is lacking. This is an indication that knowledge about the nature, causes and consequences of climate change is inadequate for personal engagement, mitigation and adaptations (Olmos, 2001, Bord, et al., 2000, Lorenzoni et al 2007, Gazzaz and Aldeseet, 2021).

More so, global literatures on the level and knowledge of climate change have received greater attention. Gazzaz & Aldeseet, (2021) carried out a study on the level of knowledge of climate change of undergraduate science and Agriculture students. Kutuywayo et al., (2022) Climate Change knowledge and Concerns about experiences of secondary school learners in South Africa. Seikkula-Leino et al., (2022), on global challenges through Education in the Nordic Teacher Education Curricula. Nepras et al., (2022), on Climate Change Education in Primary and Lower Secondary Education: Systematic Review Results), Kotaman, et al., 2016 on Impact of the In-Service Environmental Education on Early Childhood Teachers' Environmental Attitude); Hug et al 2015 on Climate impacts in Agricultural communities in Rural areas of Coastal Bangladesh; Olmos, S.2001 reviewed on Vulnerability and Adaptability to climate change: Concepts, Issues, Assessment Methods; Ratinen (2021) carried a study on Student's Knowledge of climate change, Mitigation and Adaptation in the contextual of Constructive Hope) Kumar, 2021 (Importance of Environmental Education- A Teaching perspective).

At the local or regional level, there are absence of literatures on primary school pupils' conception/ awareness/knowledge of climate change. Agboola & Emmanuel (2016) investigated the awareness of climate change and student's ability, development among undergraduates from two selected Universities in Oyo State, Nigeria. Falaye & Okwilagwe (2016), on the Assessment of the Senior School students' knowledge, attitude and practices related to climate change.; Odjugo (2010), General overview of climate change impacts in Nigeria; Ojomo et al., (2015) Climate change preparedness: Acknowledgement and attitude studies in Southern Nigeria; Olaniyi, Olutimehin and Fumulayo (2019) Review of climate change and its effect on Nigerian ecosystem; Orunoye (2011), Assessment of the level of awareness of the effects of climate change among students of tertiary institutions in Jalingo Metropolis. Over all, there are no enough studies on primary

school pupils and hence is the purpose of this study. It is on this premise the proposed research is attempting to investigate primary schools knowledge on climate change in the area.

The purpose of this study is to assess pupil's knowledge and perception on climate change in the primary schools in Yenagoa and its environs, the following objectives shall be vigorously pursued:

1. To determine whether primary school pupils have knowledge on the nature of climate change.
2. To determine whether the primary school pupils have an understanding on the causes of climate change
3. To determine whether the primary school pupils have knowledge on the consequences or effect of climate change in the study area
4. Proffer solution the the environmental challenges of climate change

## **2.0 Review of the Literatures**

Numerous definitions of climate change (CC) are found in the literatures. According to Lineman et al. (2015,) Gazzaz & Aldeseet, (2021) defined climate change as a change in global or regional climate patterns, in particular a change apparent from the mid to late 20<sup>th</sup> century on the increased level of atmospheric carbon dioxide arising from the use of fossil fuels.

The United Nations Climate Action (UNCA) defines climate change as a long-term shift in temperatures and weather patterns. Such shifts can be natural, due to changes in the sun's activity or large volcanic eruption. However, since the 1900s, human or anthropogenic activities have been the main driver of climate change, primarily due the burning fossils (like coal, oil and gas). The United Nations Framework Convention on Climate Change (UNFCCC) defined Climate Change as 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which in addition to natural climatic variability' (Gazzaz & Aldeseet, 2021).

Shogren & Toman (2000) pointed out that Climate Change is a historical fact, as illustrated by the ice ages. Part of the controversy presently, is the extent to which human activities are responsible for the changes in the climate system. While, acknowledging the many uncertainties about the precise nature and strength of the link between human activities and climate change, Shogren & Toman (2000) stated that many scientists have argue that the evidence points to an effect from people emitting too much carbon dioxide (CO<sub>2</sub>) and other greenhouse gas (GHGs) into the atmosphere.

Nepras et al., (2022) emphasized the power of humans to fundamentally change the landscape and the environment, and that the collapses of the ecosystems, such as agricultural systems or local climates have led to the weakening or destruction of entire empires. The consequence of the changes, Nepras et al (2022) stressed the emergence of war conflicts, population declines, and a general regression of cultural and social development and with human-induced climate change as another in a long line of consequences that the development of human civilization has brought about to date, impact of past environmental crises has mostly been local or regional.

Life on Earth is possible partly because some gases such as carbon dioxide (CO<sub>2</sub>) and water vapor which naturally occur in Earth's atmosphere trap heat—like the greenhouse gas. As a scientific background, Shogren & Toman (2000) stated that CO<sub>2</sub> released from use of fossils fuel is the most plentiful human-created greenhouse gas (GHG). While the nitrous oxide associated with fertilizer use are emitted in lower volumes that CO<sub>2</sub> but trap more heat.

In a series of UN reports that thousands of scientists and government reviewers agreed that the limiting global temperature rise to no more than 1.5°C would help us avoid the worst climate impacts and maintain a livable climate. However, policies currently in place point to a 2.8°C temperature rise by the end of the century. The causes of climate change can be traced back to varying natural and anthropogenic causes. Gazzaz & Aldesst (2021) in Odjugo (2010) and Falaye & Okwilagwe (2016) understood that climate change is caused by two factors. The bio-geographic factors, which encompass natural forces, are linked with human activities. The later encircle the emission of large gas quantities of GHGs into the atmosphere through fossil fuel burning, gas flaring, industrialization, biomass burning, animal farming, and solid waste incineration as well as human activities reduce the amount of carbon that it absorbed from the atmosphere like deforestation (Gazzaz & Aldeseet, 2021). The emissions that cause climate change comes from every part of the world and effect

everyone, but some countries produce much more than others, and the emitted GHGs are the major culprit for global warming (Odjugo, 2010; Wright & Boorse, 2012; Yang et al., 2018; Akrofi et al., 2019; Gazzaz & Aldeseet, 2021).

However, Gazzaz & Aldeseet, (2021) in Crowley, (2000) and Frigg et al.,(2015) emphasized their findings that the temperature increase in the 20<sup>th</sup> century was caused primarily by GHG forcing and that our trust in the GHGs explain that the global warming is very high. These gases aforementioned include carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), ammonia (NH<sub>3</sub>), nitrous oxide (N<sub>2</sub>O), chlorofluorocarbon (CFC<sub>3</sub>) and sulfur hexafluoride (SF<sub>6</sub>). Other Fluorinated gases include Hydrofluorocarbons (HFCs), Nitrogen trifluoride (NF<sub>3</sub>), and Perfluorocarbons (PFCs).

Another historical causes of global climate change is that pollution has been a relatively local problem, effecting a given river, lake, bay or slightly large area such as the air (Wright & Boorse, 2012). Presently, scientists are analyzing pollution on a global scale. For instance, concerning about the depletion of the stratospheric ozone layer Wright & Boorse (2012) stated that the concept has led to international action such as the Montreal Protocol in 1987 aimed at curbing pollution from the release of chlorofluorocarbon refrigerants into the atmosphere. The Intergovernmental Panel on Climate Change (IPCC) was established by the United Nations in 1988 and giving the responsibility to report its assessment of climate change at five year intervals (Olmos, 2001; Wright & Boorse, 2012). The latest of this is the Fourth Assessment Report (FAR) which was released in 2007.

In developing the necessary pathways for dealing with, and preventing global problems, the concept of education was emphasized. Gazzaz & Aldeseet, (2021), pointed out that, the case of problems arising from man-made climate change; the concept of climate change education was developed. This according to Gazzaz & Aldeseet, (2021), climate change education is a relatively new discipline of education that has quickly established itself given the urgency of the climate crisis. Climate change education finds its root primarily in environmental education, sustainability and science education respectively. This relatively new discipline is designed to equip students with the knowledge, skills and competencies that will make them the agents of change much needed to deal with the climate change crisis. Thus, properly implemented climate change education can be one of the most effective mitigation measures with long-term effects. As complex as change is, so are the educational strategies employed in climate change education. The aim of this study therefore, is to assess the knowledge of climate change on the primary school pupils of Yenagoa and its environs.

### **3.0 MATERIALS AND METHODS**

#### **3.1 Research design**

The research design adopted for this study is the descriptive and cross section survey techniques for the data collection such as class room discussion, questions for interview and mapping the environment where the primary schools are located. The purpose of mapping is to correlate spatial data with the school environment, linking it with knowledge of climate change on pupil's behavior.

#### **3.2 Area of study**

Yenagoa and its environs are chosen as the study area. Reasons are that Yenagoa Local Government Area is the administrative headquarters of the Bayelsa state, Nigeria. Geographically located within Latitude 04 56°N and 05 02°N and Longitude 06 16°E and 06 24°E of the Greenwich meridian, Due to its significant location there is high concentration of different people from all works of life covering the three axes of Epie-Atssa.(EA), Gbaran-Ekpetiama (GE) and the Zarama-Okodia-Bisseni.(ZB). The three clans have their different dialect with English as the common language. Environmental factors and challenges are similar, with the oil and gas exploration and exploitation resulting in the emission of the greenhouse gas (GHGs), perennial flooding, river bank erosion leading to ecosystem loss, environmental degradation, health hazards which brings about the regression of culture and social development of the area are among several reasons for the study selection.

#### **3.3 Data Source**

Primary and secondary are the main source for the study, from designing of questions for class discussion including oral interviews with the teachers of the classes they teach. GPS data shall be generated for spatial

referencing of primary schools. Secondary data from textbook, journals, libraries government gazettes shall also be used

### **3.4 Sampling and Sampling Techniques**

The area selected for study, Yenagoa and its environs consists of over 69 public primary schools and about 600 private schools distributed across the three zones of Epie-Atisa (EA), Gbaran-Ekpetiama (GE) and Zarama-Okodia-Bisseni(ZB) (Ministry of Education, Bayelsa State). Stratified sampling techniques shall be used to select the schools (public and private) for the study. Both public and private schools are more in the Yenagoa metropolis, and greater proportion of the private primary schools are selected using convenient sampling particularly schools register with government, while the public schools shall be selected using the strata method. Thirty (20 public and ten (10) of the private schools are selected across the three (3) strata's respectively. Primary five (5) pupils are considered for the study.

Prior to the visit formal letters, stating the purpose/date and time of visit and if possible any change of date or/time shall be communicated to the selected head of schools and the respective teachers (primary five teachers).A corresponding reply shall be expected from the Head teacher or the administrative head of the school for researcher to gain access in the data collection.

The modified knowledge test kits adopted used by (Gazzaz and Aldeseet, 2021) was used for the study designed for data collection. This Climate Change Knowledge Test (CCKT) consists of two main parts, the demographic data and the test section. The test section is divided into three sub-sections that defined by the three scales of Climate Change Knowledge such as the nature, causes and consequences/effects as shown in tables 2, 3 and 3

The Climate Change Knowledge Kit test are designed such that it will be easy for the target population to respond positively (the primary five pupils) in the process of data collection and in the presence of the class teachers virtually in English language and translated into their local dialect for those that may not be familiar with the concept of climate change in the English version. This approach was also adopted by (Kutywayo et al., 2022; Nepras et al., 2022; Seikula-Leino et al., 2021). Also an interactive class with teacher concerning the inclusion of climate change in the primary school curriculum will be advanced.

A qualitative approach would be adopted as questions on climate change would be presented as a series of 1-10 statements to which respondents had to reply Yes/No or True/False. The indicator used to evaluate knowledge assessed whether the pupils knew about the causes of climate change, and its manifestations in the natural world and in humans.

Data collected shall be analyzed using qualitative and quantitative methods such as percentage, averages The demographic data shall be subjected to Frequency Distribution Analysis (FDA), (Gazzaz & Aldeseet, 2021; Kutywayo et al., 2011).

### **3.5 Statistical data analysis**

The data for the research were processed using simple descriptive analysis of percentages. The demographic data of the sample population were subjected to frequency distribution analysis to obtain a description of the study sample. The frequency distribution table was also introduced to the individual questions or statement to probably scale the climate change kit test in order to determine the pupil's levels of knowledge of each statement of the CC such as the nature, causes and effects of the CC. Similarly, descriptive statistics were calculated from the average count and percentages of each class discussion.

The knowledge of climate change was categorized into three classes of knowledge as this procedure was used by Gazzaz & Aldeseet (2021) as low, medium and high using the formula for width of class interval ( $w_i$ )

$$w_i = \text{Range}/\text{number of intervals} \quad 1$$

Where  $w_i$  is class interval width and range is the difference between the highest score and lowest.

$$w_i = \text{Highest score on the scale} - \text{Lowest score on the scale}/\text{number of classes} \quad 2$$

However since the research tool is a knowledge test, the highest score in the test is 100%, corresponding to the yes or right answer to all test items. In the measure, the lowest score is 0.0%, corresponding to the No or wrong answer to all test in the items; hence

$$w_i = 100\% - 0.0\%/3 = 33.3\% \quad 3$$

The three levels of knowledge are defined in terms of percentages of knowledgeable pupils as follows: low level of knowledge correspond to percentage of the knowledgeable pupils that is less than 33.3%; medium

level of knowledge is defined in the range of 33.3% - 66.6%, while high level of knowledge is defined by greater than 66.6%

## RESULTS AND DISCUSSION

Demographic characteristics of the study

The result of the demographic characteristics indicates that there are 1273 pupils, of which 643 or 50.5% females and 630 (49.5%) are males; this is an indication that females are more in the schools than the males. In terms of age, it is dominated by the age from 10 – 12 from the sample study (table 1.0) which is 296 (23.3%) of the sample study. The second age group in the study is between 10 -12 which represents 288 (23.3%), while the third highest age group is from 8 – 11 which represents 281 (22.1%). Others include ages from 8 – 13, 9 – 11 and 10 – 14 representing 205 (16.1%), 98 (7.7%) and 105 (8.2%) respectively. This is an indication that the sampled study was dominated by female pupils and that the age category is dominated by 8 – 11. This falls into what Jean Piaget described as operant age group on learners.

Table 1 Show the demographic characteristics of the study

S/N	Category	Freq	No of Pupils	Female	Male	%Female	%Male	Valid%
1	8 – 11	8	281	137	144	23.3	22.8	22.1
2	8 – 13	6	205	105	100	16.3	15.9	16.1
3	9 – 11	2	98	53	45	8.2	7.1	7.7
4	9 – 14	6	288	138	150	21.5	23.8	22.6
5	10 – 12	6	296	156	140	24.3	22.2	23.3
6	10 -14	2	105	54	51	8.4	8.1	8.2
		<b>30</b>	<b>1273</b>	<b>643</b>	<b>630</b>			

### *Pupils Assessment on the knowledge of climate change*

Three aspects on the knowledge of climate change were examined from the pupils in the study. The nature of climate change was examined from the ten (10) questions discussed with the respondents. Table 1.2 is the distribution of the response of the pupils in a frequency distribution format.

Table 2 showing the response of the discussion in the classes

S/N	ITERMS	TRUE	% TRUE	FALSE	% FALSE
1	Climate change is different from region to region	480	37.7	593	62.3
2	Climate change is inevitable due to nature and style of modern life	674	52.9	572	47.1
3	Climate change is about fluctuation in temperature of the Earth	701	55.1	572	44.9
4	Climate change is real	470	36.9	803	63.1
5	Human being can control climate change.	588	46.2	685	53.8
6	Climate change is bad; it is more destructive that gain	699	54.9	574	44.1
7	Climate change is the long-term change in weather condition associated with the concentrations of the Green house gases in the atmosphere.	912	71.6	361	28.4
8	Scientific evidence in climate change is not reliable	439	34.5	832	65.5
9	The temperature of the Earth did not increase since	900	70.7	373	29.3
10	It is too late for human being to do something about climate change	501	39.4	772	60.6

Table 2 depicts the discussion of the respondents on the nature of climate change, the sampled study revealed that they are knowledgeable about climate change in the area of the temperature of the Earth did not increase is false (70.7%). Secondly, 71.6% are knowledgeable about the fact that Climate change is the long-term change

in weather condition associated with the concentrations of the Green house gases in the atmosphere. Over 50% of the pupils have high knowledge that Climate change is inevitable due to nature and style of modern life and that again Climate change is about fluctuation in temperature of the Earth and that Climate change is bad; it is more destructive than gain. Though there are challenges as some of the respondents could not define climate change. This revelation goes to conclude that a greater proportion of the study populations are knowledgeable about climate change but incomplete understanding of the concept. A greater proportion of the discussion could not agree that climate change is different from region to region and that scientific evidence in climate change is not reliable is 65.5% (table 1). About 65.5% have an incomplete understanding of whether human being can control climate change. These revelations imply that most of the pupils though believed that climate change is real but are confused about the concept of climate change.

In terms of the classification of the level of knowledge in to three type, and from the results it reveals that the knowledge of the nature climate change in the study area is relatively high, such as in the area of Climate change is the long-term change in weather condition associated with the concentrations of the Green house gases (GHGs) in the atmosphere; The temperature of the Earth did not increase since: Climate change is about fluctuation in temperature of the Earth, and that Climate change is bad; it is more destructive than gain. The people are however, moderate in the rest of the test. From this development the research discovered and average of 58.8% respondents are knowledgeable of the concept of climate change but not aware of the nature. This development implies that additional information about climate change is required from the respondents in the sampled study. Approximately 50% of the pupils have high knowledge of climate change on the 10 items raised in the study, even with respect to the three levels of categorizing the knowledge of climate change test.

**Table 3 Climate Change Knowledge Test: Causes of Climate Change**

<b>S/N</b>	<b>ITEMS</b>	<b>TRUE</b>	<b>% TRUE</b>	<b>FALSE</b>	<b>% FALSE</b>
<b>1</b>	Environmental pollution resulting from industry is the Brain behind the cause of climate change	925	72.7	348	27.3
<b>2</b>	The effect of human activities on temperatures on the surface of the Earth is not high	524	41.2	749	58.8
<b>3</b>	Burning of fuel fossils like oil and gases contributes to climate Change	747	58.7	526	41.7
<b>4</b>	Deforestation is among the causes of climate change	743	58.4	530	41.6
<b>5</b>	The cause of climate change is the global warming associated with the increases in concentrations of the GHGs in the atmosphere	769	60.4	504	39.6
<b>6</b>	The transportation sector does not contribute to climate change.	841	66.1	432	33.9
<b>7</b>	Climate change result mainly from ozone hole	567	44.5	706	55.4
<b>8</b>	Climate change is a result of natural processes	783	61.5	490	38.5
<b>9</b>	Agricultural activities such as plants and animal production Contribute to climate change	698	54.8	575	45.2
<b>10</b>	10 The sector with the highest contribution to climate change is the energy sector	841	66.1	432	33.9

In terms of the causes of climate change kit test, 10 items were raised (table 3) describe the characteristics of the response of the respondents, nine hundred and twenty five or 72.7% of the pupils are knowledgeable about climate change on the issues of Environmental pollution resulting from industry as the brain behind the cause of climate change. This also is in line with the issue of the sector with the highest contribution to climate change is the energy sector (841 or 66.1%). Similarly, in agreement with knowledge ability of climate change the issue of climate change is as result of natural process (783 or 61.5%) give more attention as to what causes natural processes, such as wind, flood sea-level rise, etc. On the issues of the cause of climate change is the global warming associated with the increases in concentrations of the GHGs in the atmosphere (769 or 60.4%), this drew their attention of the immediate environment towards over exploration and exploitation of the oil and



gas industry that increases the concentration of the GHGs in the environment of the sampled study. These concepts also lead to the issues of Agricultural activities such as plants and animal production contributes to climate change (698 or 54.8%). From this analysis the research discovered that indigenous knowledge plays a major role in understanding climate change. The reason is that they grow up in an environment where such activities are common, that cause environmental change and hence such questions are easily answerable by the respondents in the study area. On the issues of the effect of human activities on temperatures on the surface of the Earth is not high the respondent link this to item 3, 4 and 5 (table 3) to understand more on climate issues in the study area are known to be among the causes of climate change in the study area. Though, the respondent's concept of climate change may not be scientific, but observed that there are certain anthropogenic facts that come to mind by the respondents. On the whole the three level of categorization is low, while the rest is high and the percentage is 58.44%.

S/N	ITEMS	TRUE	%TRUE	FALSE	%FALSE
1	Climate change causes biodiversity loss	835	65.6	438	33.4
2	Climate change brings about drop in temperatures of the Earth all over the world	941	73.9	332	26.1
3	Climate change leads to soil fertility increase	899	70.6	374	29.4
4	The human community lives the effect of climate change	729	57.3	544	42.7
5	Rise in water level in sea is a result of climate change	791	62.1	482	37.9
6	Climate change leads to decrease in incidence of contagious and infectious plants, animals, and human disease.	835	65.6	438	34.4
7	Decline in plant and animal food production, and hence Deterioration of food security, may result from climate change	709	55.3	564	44.3
8	Shortage of water that is suitable for domestic use and for Irrigation of plants and animal may result from climate change.	466	36.6	807	63.4
9	Climate change may cause an increase in the frequency and intensity of extreme weather conditions such as heat waves, drought, hurricanes, and heavy rains.	866	68.0	407	32.0
10	Climate change contributes to increased wind water erosion of soil.	729	57.3	544	42.7

Table 4 depicts the characteristics of the respondents on the third aspect on the knowledge of climate change. Considering the three levels or scale of measuring the knowledge of climate change (Low, moderate and high). Evidence on the knowledge of climate change by the respondents is observed in Climate change brings about drop in temperatures of the Earth all over the world, over nine hundred and forty one (941 or 73.9%) and that Climate change leads to soil fertility increase (899 or 70.6%) are knowledgeable to the respondents. Items 6 and 9 are also contended by the respondents (table 4) as given by eight hundred and thirty five (835 or 65.6%) and (866 or 68.0%) respectively. Rise in water level in sea is a result of climate change (791 or 62.1%) and Climate change causes biodiversity loss (835 or 65.6%) are also identified as causes of climate change by the respondents among the 10 items for investigation which were knowledgeable by the respondents. However, about seven hundred and nine (709 or 55.3 %) of the respondent have knowledge of climate change on the effect of climate change is the decline in plant and animal food production, and hence deterioration of food security, may result from climate change. On shortage of water that is suitable for domestic use and for Irrigation of plants and animal may result from climate change in item 8, there is a mixed reaction as 807 or

63.4% have incomplete knowledge of the effect on climate change as the response is related to the cause of climate change is the global warming associated with the increases in concentrations of the GHGs in the atmosphere in item 5 (table 3). In item 9 and 10, 866 and 729 or 68.0% and 57.3% of the respondents have knowledge of climate change that climate change may cause an increase in the frequency and intensity of extreme weather conditions such as heat waves, drought, hurricanes, and heavy rains. The investigator concluded items 1 - 10 are consequences of climate and that the curriculum need to be revisited to enhance better understanding of the concept of climate and weather in the primary schools in the area. In the curricula there are no detailed explanations on the topic of weather and climate.

The overall average rating scale is 61.5% as compared to the causes of climate change which is 58.44%. While that of the nature of climate change is 58.8% average. Similarly, the average number of respondents who are knowledgeable to climate change in terms of the consequences/effects of climate change is 613 as compared to the nature and causes as 743.5 and 636.4 respectively.

Literatures on climate change have reported comparable studies on the knowledge of climate change. For instance, Valdez et al., (2018) investigated on how communication with teachers, family and friends contributed to predicting climate change behavior among adolescents. They used qualitative and mixed method with the use of questionnaires on predicting the causes of climate change. Kutywayo et al., (2022) investigated on climate change knowledge, concerns and experiences in secondary school learners in South Africa and their experiences of heat exposure. A cross-sectional survey in a clustered randomized trial among 924 secondary school learners in 14 public schools in low-income Western Cape Areas. The study learner's mean age was 15.8 years and was predominantly females. The researcher's learners had lower knowledge of climate change than male learners, but more frequent heat related symptoms. Nepras et al. (2022) also investigated on climate change education in primary and lower secondary education: a systematic review results. The review study presents an analysis of papers focusing on climate change education for International Standard Classification of Education 1 and 2 students. The selection of the analyzed sources follows the PRISMA 2020 statement, out of 850 identified records, 43 made into the analysis. The qualitative description of the results shows that the most frequent addressed topics focus on knowledge, behavior, actions, experiences, and attitudes. Ratinen,(2021) also investigated on Student's knowledge of climate change, Mitigation and Adaptation in the context of constructive Hope. The research focuses on looking at mitigation and adaptation from the perspective of children on meaning making coping strategies to enable the maintenance of constructive hope regarding climate change. A sample of 950 students of elementary and secondary children responded to an online questionnaire. Statistical methods were used gather data generally on how knowledge of climate change and their mitigation and adaptation knowledge predicted their constructive hope regarding climate change. The study discovered that student's had a relatively high knowledge of constructive hope and that general climate knowledge predicted constructive hope. In the comparative analysis above the causes of climate change knowledge kit test was adopted to primary school pupils. All others including Gazzaz and Aldersee (2021) included higher education students of secondary and tertiary institution in the search on the knowledge of climate change, hence the gap.

## CONCLUSION

The fact that the primary school pupils are actually our future leaders. It graduates to the secondary before the tertiary students, without the primary knowledge there will not be secondary. This informed us that knowledge gained at the primary level (adolescent) is applied at adulthood. This is why Peter, (2010) stated that if the knowledge of the human race and ended with Aristotle the account of knowledge and the methods necessary to acquire it might be sufficient. It is indeed significant that those who advocated educational knowledge methods which stress the importance of first-hand experience have in mind mainly children of 7 – 12 who are at what Piaget calls the stage of concrete operational thought when the world of things presented through the senses is being ordered and structured. What is required at this stage is plenty of experience together with classificatory schemes to structure it. The classroom becomes a lyceum in miniature (Peter, 2010). This investigation have identified that the average learner is 127.3 and between the ages of 8 – 14 which falls in the Jean Piaget theory and principles of learning. The study identified lack of environmental education infrastructure and curriculum review to ensure climate change education in incorporated in the primary school

curriculum. On the average the research conclude that there is relatively climate change knowledge in the primary schools and need further research development and comparison for public and private primary schools. This will engineer the knowledge pupils in climate change research in the area. This again will help to be in tandem with the global community.

## REFERENCES

- Agboola, O. S. & Emmanuel, M. (2016). Awareness of climate change and sustainable development among undergraduate from two selected universities in Oyo State, Nigeria. *World Journal of Education*, 6(3). 70-81. <https://doi.org/10.5430/wje.v6n.3p70>
- Akrifi, M., Antwi, S. H., & Gumbo, J. R.(2019). Students in climate action: A study of some influential factors and implications of knowledge gaps in Africa, *Environments*. 6(12), 1-15. <https://doi.org/10.3390/environments6020012>
- Antweiler, C. (2004). Local knowledge theory and method: an urban model from Indonesia, In: Bicker, A., Sillitoe, P., Pottier, J. (eds.) *Investigating Local knowledge; new directions, new approaches*, Ashgate, Burlington; VT, 105-128
- Ahrens, C.D.(2005). *Essential Meteorology. An invitation to the Atmosphere* (4<sup>th</sup> ed.) Canada. Thomas Books,
- Ayuba, H.K, Maryah, U.M, & Gwary, D. M (2007)..Climate Change Impact on Plants Species Composition in the Six Semi-Arid Rangeland of Northern Nigeria. *The Nigeria Geographical Journal*. 5(1); 35-42.
- Bayelsa State Ministry of Education, Annual report.
- Bayelsa State Statistical Year Book. 2005
- Bord, R. J., O'Connor, R. E., & Fisher, A. (2000). In what sense does the public need to understand global climate change? *Public Understanding of Science*, 9(3), 205-218. <https://doi.org/10.1088/0963-6625/9/3/301>
- Brody, M. (1991). Understanding of pollution among 4<sup>th</sup>, 8<sup>th</sup>, & 11<sup>th</sup> grade students. *Journal of Science Education* 6(4), 421-435 .
- Brownlee, M., Powell, R. B., & Jeffrey, H. C.(2012) A Review of the Foundational Processes that Influence Beliefs in Climate Change: Opportunities for Environmental Education Research, *Environ, Edu. Res*, 19, 1-20. <https://doi.org/10.1080/13504622/2012/683389>.
- Bybee, R.W. (1993). *Reforming Science Education-Social perspectives and Personal Reflections*. Teacher College Press.
- Cook, J., Nuccitelia, D., Green, S. A., Richardson, M., Winkler, B., Painting, R., Way, R., Jacobs, P., and Skuce, A. (2013). 'Quantifying the Concensus on anthropogenic global warming inn the scientific literature'. *Environmental Research Letters*.IOP Publishing, 8(2), p.024025. doi: 10.1088/1748-9326/8/2/024024.
- Crowley, I.J. (2000). Causes of climate change over the past 1000 years. *Science*, 289(5477),270-277, <https://doi.org/10.1126/science289.5577/270>
- Cunningham; W. P., and Saigo, B. W. (1997). *Environmental Science*. 4<sup>th</sup> ed. London. Longman Publishers.
- de Blig, H. J., Multer, P.O., Williams, R.S., Conard, C.T Long, (2005). *Physical Geography; The global Environment*. Canada: Oxford University Press.,
- Dijkstra, E.M., Goedhart, M.J. (2012). Development and Validation of the ACSI: Measuring Students' Science Attitudes, Pro-Environmental Behavior, Climate Change Attitudes and Knowledge.*Environ.Edu.Res*.18, 733-749. <https://doi.org/10.1080/13504622/2012/662213>
- Drivers, R. (1985). *The pupils as Scientist?* Milton Kenes: Open University
- Ellen, R., & Harris, H. (2000). Introduction, In: Ellen, R., Parkes, P., Bicker, A. (eds) *Indigenous environmental knowledge and its transformations*. Harwood, 18-34.
- Efe, S. I. (2011). Climate change and flood Hazards in the Niger Delta Region of Nigeria. *Niger Delta Research Digest. Journal of the Centre for the Niger Delta Studies, Niger Delta University, Wilberforce Island, Bayelsa State* 5; 43- 61.
- Falaye, F. V., & Okwilagwe, E. A.(2016). Assessing the senior school students' knowledge, attitude and practices related to climate change: Implication for curriculum review and teacher preparation. *Journal of the International Society for Teacher Education*, 20(1). 43-53.

- Field, C. B., Barros, V. R., Diokken, D. J., Mach, K. J., MD, M., Bilir, T. E., Chatterjee, M., KL, E., Estrada, Y. O., Genova, R. C., Girma, B., Kissel, E. D., Levy, A.N., MacCracken, S., Masstrandea,, P. R. and White, L.L. (eds) (2014). *Climate change 2014: Impacts, Adaptation and Vulnerability. Contribution of Working Group 11 to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, United Kingdom and New York, NY. USA: Cambridge University Press.
- Flemming, R.(1988).Undergraduate Science Student’s view on the relationship between science, technology and society. *International Journal of Science Education*, 10(4), 449-463.
- FME/NTI (2016) . Sustainable Development Goals Project 2016 SDG Workshop Manual for Primary Teachers Effective Classroom Management Skills.
- Frigg, R., Thompson, E., & Wemd, C. (2015). Philosophy of Climate Science, Part 1: Observing climate change, *Philosophy Compass*, 10(12), 953-964, <https://doi.1111/phc3.12294>
- Gagne, R.M.(1977). *The condition of learning*. (3<sup>rd</sup> ed.). New York: Holt, Rinehart and Winston.
- Gazzaz, N .M, and Aldeseet, B.A. (2021). Assessment of the Level of Knowledge of Climate Change of Undergraduate Science and Agriculture Studies. *World Journal of Education*, 11(5), 41- 60, <https://doi.org/10.5430/wje.v11n5p41>
- Gbamanja, S. P.T (1991), *Essentials os Curriculum and Instruction; Theory and Practice* (2<sup>nd</sup> ed,) Ado-Ekiti: Hamaz Global Publishing Coy.
- Giddens, A. (2011). *The Politics of Climate Change*. 2<sup>nd</sup> ed. Cambridge, UK and Malden, USA: Polity Press.
- Grin, J., Rotamans, J., and Schot, J. (2010). *Transitions to sustainable Development*. New York: Routledge.
- Hamylm, D. W.(2010). The logical and psychological aspects in Teaching in R. S Peters, *The concept of education*, London. Routledge; 17 – 30.
- Hist, P. H. (2010). The psychological aspects of teaching as subject, in R. S. Peters, *The concept of education*, London. Routledge; 17 – 30.
- Hulme,M ., Dessai, S., Lorenzoni, I., & Nelson, D. R.(2009) Unstable climates: Exploring the statistical and social constructions of climate, *Geoforum*, 40, 197-206. <https://doi.org/10.1016/j.geoforum.2008.09.010>
- Huq, N, Boon, E, & Gain, A. (2015). Climate Change Impacts in Agricultural Communities in Rural Areas of Coastal Bangladesh: A Tale of Many Stories. *Sustainability*.7; 8437-8460l doi: 10.3390/su7078437.
- Igbogi, I. (2015). *Introduction to Principles and methods of Teaching*. Yenagoa, Srinte.
- Ingold, T.(2003). Two reflections on indigenous knowledge, In: Sango, G., Ortalli, G.(eds.) *Nature Knowledge ethnoscience cognition, and utility*. Berghahn.
- IPCC (2007). Summary for Policy Makers. Synthesis Report.
- Jonasen, D.H.(1991). Objectivism versu Constructivism. Do we need a new Philosophical paradigm? *ETR & D*. 39; 5 – 14.
- Karpudewan, M., Roth, W, Mohd Nor Syahrur Ban Abdullahi (2015). Enhancing Primary School Students’ Knowledge about Global Warming and Environmental Attitude Using Climate Change Activities. *International Journal of Science Education*, 2015 Vol. 37, No. 1, 31–54, <http://dx.doi.org/10.1080/09500693.2014.958600>
- Kim, M. and Jin Q. (2024). 9 – 10 Year-Old Children Understands of climate Change. *International Journal of Elementary Education*. 13 (1); 13-22
- Kotaman, H.,Karaboga, I., Bilgin, S. P. & Tugral, B. (2022). Impact of In-Service Environmental Education on Early Childhood Teachers’ Environmental Attitude,. *Discourse and Communication for Sustainable Education*. 13.(2); 26-39. .Doi:10.2478idcse-2022-0016.
- Koutsoyiannis, D. (2021). Rethinking climate change, and their relationship with water. *Water*, 13(849), 1-38, <https://doi.org/10.3390/w13060849>
- Kumar, S, K. (2021). Importance of Environmental Education- A Teacher Perspective. *Environmental Journal of Multidisciplinary Education Research*. 10(7(12); 108 -112; DOI: <http://ijmer.in.doi./2021/10.07.256>.
- Kutywayo,, A Cherich, M, Naidoo, N. R,Scorge, F, Bottoman, L,Mullick, S (2022) Climate Change Knowledge, Concerns and experiences in secondary school learners in South Africa, *Jamba: Journal Disaster Risk Studies* .14(11),a1162https://doi.org/10.4102/jamba.v14i11:1162.

- Landa, L. N. (1982). The improvement of instruction, learning and performance: Potential of 'Landamatic theory' for teachers, instructional designers and material producers. *Educational technology*.
- Lineman, M., Do, Y., Kim, J., & Joo, G. (2015). Talking about climate change and global warming. *PLoS ONE*, 10(9), e0138996, <https://doi.org/10.1371/journal.pone0138996>
- Lorenzoni, I., Nicholson-Cole, S., & Whitmarsh, L. (2007). Barriers perceived to engaging with climate change among the UK public and their policy implications. *Global Environmental Change*, 17(3-4), 445-459, <https://doi.org/10.1016/j.gloenvcha.2007.01.004>
- Lucas, A.M.(1988). Public Knowledge of elementary physics. *Physic Education*. 23; 10 – 16
- Matthews, M.R. (1994). *Science Teaching – the role of history of phylisophy of Science*. Land on Routledge
- McDaniel, J, Kennard, D., Fuentes, A. (2005) Smokey the Tapir: tradition fire knowledge and the prevention campaigns in lowland Bolivia, *Soc. Nat. Resour*; 18(10);921-931.
- Mertz, O, Mbow, C., Reenberg, A & DIOUF, A.(2009). *Farmers' perception of climate change and agricultural adaptation, strategies in rural areas*, Sarah management Service.
- Montgomery, C. W.(2011). *Environmental Geology* 9<sup>th</sup> ed. New York. McGraw-Hill.
- Muller, Jr., G. T.. (2006). *Environmental Svcience*. Canada: Thomas Learns Institute.
- Nepras, K, Strejkava, T, and Kroufek, R.(2022). Climate Change Education in Primary and Lower Secondary Education: Systematic Review Results. *Sustainability*, 14, 14913. <https://doi.org/10.3390/su142214913>.
- Obiene, E.A. (2016). An Assessment on the Knowledge of climate Change in some selected primary schools in Yenagoa and its environs. Being a project submitted to the National Teachers Institute, Kaduna, Nigersia for the award of Post Graduate Diploma in Education (PGDE). Yenagoa Study Center, Bayelsa State, Nigeria.
- Odjugo, P. O. (2010).General Overview of climate change impacts in Nigeria, *Journal of Human Ecology*, 29(1), 47-55, <https://doi.1080/09709274.2010.11906248>
- Ojomo, E., Elliott, M., Amjad, U., & Bartran, J. (2015). Climate change preparedness: A knowledge and attitudes study in Southern Nigeria, *Environments*, 2(4), 435-448, <https://doi.org/10.3390/environments2040435>
- Olaniyi, O. A., Olutimehin, I. O., & Funmilayo, O. A. (2019)Review of climate change and its effect on Nigeria ecosystem, *International journal of Rural Development, Environment and Health Research*, 3(3), 92-100. <https://dx.doi.org/1022161/ijreh.3.3.3>
- Olmos, S. (2001). *Vulnerability and Adaptability to Climate Change Concepts, Issues, Assessment. Methods of climate change knowledge network Foundation paper* ([www.cckn.net](http://www.cckn.net)).
- Orlove,B, Roncoli, C., Kabugo, M & Majugu, A. (2010). Indigenous climate Knowledge in Southern Uganda: the multiple components of a dynamic regional system. *Climate Change*, 100; 234-265.
- Oruonye, E. D. (2011). An assessment of the level of awareness of the effects of climate change among students of tertiary institutions in Jalingo Metropolis, Taraba state, *Nigeria, Journal of Geography and Regional Planning*, 4(9), 513-517. <https://doi.org/10.5897/JGRP.9000012>
- Osborne, R. & Freyberg, P. (1985).*Learning in Science: the implications of Children's science*. Heinemann.
- Peters,R. .S.(2010). What is an educational precess, in R.S Peters: *The Concept of Education*. Routledge, 11-16.
- Piaget, J. (1952). *The Origins of Intelleigence in Children*. New York. International University Press.
- Quiggin, John (2013). *It is too late to stabilize the global climate?* The Australian Journal of Agriculture and Resource Economic, 57, 1- 14.
- Ratinen, Ilkka.( 2021). Students' Knowledge of Climate Change, Mitigation and Adaptation in the Context of Constructive Hope. *Education Sciences*. 11, 103; <https://doi.org/10.3390/educsci1103-103>.
- Reigeiluth, C.M.( 2015). *Instructional design theories and models. An over view of their current status* (ed), Hillsdale: New Jessey: Laurence Erlbaum Assosiates
- Ruskovaara, E., Pihkala, T, Seikkula-Leino, J.,& Jarvinen, M,R.(2015). Broadening the resource base for entrepreneurship education through teachers' networking activities. *Teach. Teach Education*, 47, 62-70.

- Seikkula-Leino, J., Jonsdoittir, S.R.; Hakansson-Lindqvist, M; Westerberg, M & Eriksson-Bergstrom, S. (2021). Responding to Global Challenges through Education: Entrepreneurial, Sustainable, and Pro-Environmental Education in Nordic Teacher Education. *Sustainability*. 1, 12808. <https://doi.org/10.3390/su1322108>
- Scheffer, I. (2010). Philosophical models in R.S Peters, *The concept of education Records*. Vol. 43
- Shogren, J., & Toman, M.(2000). Climate Change policy: *Resources for the Future*. Discussion paper 00-22. <http://www.rff.org>
- Sillitoe,P.(2007).Local Science, global science: an over view. In: Sillitoe, P. (ed.) *Local science vs global science: approach to indigenous knowledge in international development*, Berghahn, 1-22.
- Solomom, J. (1992). *Getting to know about energy-in school; and society*. The Falmer Press.
- Shisanya, C.A. & Khayesi, M. (2007). How climate change perceived in relation to other socioeconomic and environmental threats in Nairobi, Kenya? *Climate Change*. 85; 271-284. Dio/10.1007/s10584-007-9321-9
- UNCED, (1992). *Agenda 21, the United Nations Programme of Action from Rio*, New York: UN
- UNFCCC (1992). *United Nations Framework Convention on Climate Change*. Article1: Definitions, Retrieved from <https://unfccc.int/resource/docs/convkp/conveng.pdf>
- Vikoo, B. (2015). *Learning theories and instructional processes* 3<sup>rd</sup> Pearl Digital Press.
- Vikoo, B,(2016). *Curriculum Development. A process approach*. Pearl Publishers Int., Ltd
- Wright, R.T, & Boorse, D.F.(2012). *Environmental Science: toward a Sustainable Future*. 11<sup>th</sup> ed. PHI Learning Private LTD.
- Yang, L., Liao, W., Liu, C., Zhang, N., Zhong, S., & Huang, C. (2018). Association between knowledge of the causes and perceived impacts of climate change: Across sectional survey of medical public health and nursing students in university of China. *International Journal of Environmental Research and Public Health*, 15(2650), 1-14. <https://do.org/10.3390/15122650>
- Zoller, U., & Weiss, S. (1983). The issue of ‘sensitive’ interdisciplinary science-oriented curriculum in the social service, *European Journal of Science Education*, 5(2)s, 147-155.