

UNIVERSITY OF CAPE COAST

SOCIAL STUDIES CURRICULUM RESPONSE TO CLIMATE CHANGE:
THE VIEWS OF SOCIAL STUDIES TEACHERS IN PUBLIC SENIOR HIGH
SCHOOLS IN THE CAPE COAST METROPOLIS

FRANCIS BAKER

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SCHOOLS IN CAPE COAST METROPOLIS

BY

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College of Education Studies, University of Cape Coast, in partial fulfilment of
the requirements for award of Master of Philosophy Degree in Curriculum Studies

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature: Date:

Name: Francis Baker

Supervisors' Declaration

We hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature: Date:

Name: Prof. Kankam Boadu

Co-supervisor's Signature Date:

Name: Prof. Yaw A. Ankomah

ABSTRACT

In the 21st century, scientists and climatologists have raised a lot of concerns about the world's climate. Climate change is one of the major challenges in recent times and adds considerable stress to societies and to the environment. The search for lasting solution(s) to this menace is (are) still on course. The use of education has been found to be instrumental in addressing the challenges posed by climate change. This study, therefore, sought to find out the extent to which the Social Studies curriculum which is one of the common core integrated subjects in Ghana has responded to climate change issues.

The study was conducted in public Senior High Schools in the Cape Coast Metropolis of Central Region in Ghana. In all, 79 Social Studies teachers in the selected Senior High Schools were used for the study. The study is a descriptive survey and data were collected using questionnaire designed in Likert-type scale. Data collected were analysed and presented using frequency counts and percentage tables. It was evident from the study that the response of the Social Studies curriculum at the senior high school (SHS) level to climate change is not enough for students in the SHS to internalise the concepts, attitudes and skills that are expected to transform and shape the disposition of learners on climate change. It became evident that the curriculum may require a redesign to include more topics on climate change issues. It was thus, recommended that the rich knowledge of the teachers both in pedagogy and climate change should be tapped when redesigning the SHS Social Studies curriculum to respond to climate change in the country.

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DEDICATION

To my parents Mr. John Baker and Miss Cecilia Eyiaah.

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CHAPTER ONE

INTRODUCTION

Background to the Study

The World Meteorological Organisation (WMO) defines ‘climate’ as the total effect of the interaction between temperatures, humidity, precipitation, winds, radiation, and other meteorological conditions characteristic of a locality or region over an extended period of time (IPCC, 2007). In the 21st century, scientists and climatologists have raised a lot of concern about the world’s climate. They have argued that the climate has changed over the past few decades and in effect has generated a lot of international debate as to how this global threat which is new and infant in the literature can either be mitigated or adapted. Several works have been done by international bodies such as United Nations (UN), Intergovernmental Panel on Climate Change (IPCC), United Nations Educational, Scientific and Cultural Organisation (UNESCO), United Nations Framework Convention on Climate Change (UNFCCC), National Research Council (NRC) among others.

For most people, the expression “climate change” means the alteration of the world’s climate that we humans are causing, through fossil fuel burning, clearing forests and other practices that increase the concentration of greenhouse gases (GHG) in the atmosphere. This is in line with the official definition by the

United Nations Framework Convention on Climate Change (UNFCCC) that climate change is the change that can be attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods (UNFCCC, 2007).

Climate change encompasses all forms of climatic inconsistency (that is, any difference between long-term statistics of the meteorological elements) and it is believed to have implications for sustainable development. Scientists believe that a warmer Earth may lead to changes in rainfall patterns, a rise in sea level caused by slow melting of polar ice, and a wide range of impact on plants, wildlife and humans. The report by the world's top climate scientists (Shi, 2008) indicates that global warming was very likely man-made and would bring higher temperatures and a steady rise in sea levels for centuries to come regardless of how much the world slows or reduces its greenhouse gas emissions. Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global mean sea level (Chen, 2006).

Several theories have been postulated to explain the causes of climate change. From the literature, these theories can be grouped into two schools of thought. One school of thought argues that climate change can be related or attributed directly or indirectly to human activities (UNFCCC, 2007). The second school of thought also attributes climate change to natural causes. Some of these theories worthy of mention are the Anthropogenic Global Warming, Human

Forcing besides Green House Gases, Bio-thermostat, Cloud Formation and Albedo, Ocean Currents, Planetary Motion and Solar Variability (Bast, 2013).

It is argued that climate change is caused by both physical processes and directly or indirectly by human factors. Earth's climate changes naturally. Changes in the intensity of sunlight reaching the earth causes cycles of warming and cooling that have been a regular feature of the Earth's climatic history. Other natural causes of climate change include variations in ocean currents (which can alter the distribution of heat and precipitation) and large eruptions of volcanoes (which can sporadically increase the concentration of atmospheric particles, blocking out more sunlight).

Most climate scientists agree, however, that the main cause of the current global warming trend is human expansion of the "greenhouse effect"- warming that result when the atmosphere traps heat radiating from Earth toward space. Certain gases in the atmosphere block heat from escaping. Long-lived gases, remaining semi-permanently in the atmosphere, which do not respond physically or chemically to changes in temperature, are described as "forcing" climate change whereas gases, such as water, which respond physically or chemically to changes in temperature are seen as "feedbacks." (IPCC Fourth Assessment Report, 2007)

The crucial component that causes greenhouse gases such as Carbon dioxide, Methane, Chlorofluorocarbons (CFC's), and Nitrous Oxide to be released into the atmosphere is human activity. The burning of fossil fuels (i.e., non-renewable resources such as oil, coal, and natural gas) has a significant effect on

the warming of the atmosphere. The heavy use of power plants, cars, airplanes, buildings, and other man-made structures release carbon dioxide into the atmosphere and contribute to global warming. Nylon and nitric acid production, the use of fertilizers in agriculture, and the burning of organic matter also release the greenhouse gas Nitrous Oxide. These are processes that have been expanded since the mid-twentieth century (Nicole, 2012).

Climate change is a key priority for international development as its impact is likely to be disproportionately felt in developing countries. Climate change will affect all countries, but people in the poorest countries and poor people in richer countries are more likely to suffer the most. They tend to live in high- risk areas such as unstable slopes and flood plains, and often cannot afford well-built houses. Many of them depend on climate-sensitive sectors, such as agriculture, and have little or no means to cope with climate change, for example owing to low savings, no property insurance and poor access to public services. Climate change is expected to reduce already low incomes and increase illness and death rates in many developing countries. Africa, small island states, and the Asian and African mega-deltas are likely to be particularly affected by climate change (Stern, 2007).

According to the IPCC (2007), Africa is particularly vulnerable to the effects of climate change because of multiple stresses and low adaptive capacities, arising from endemic poverty, weak institutions, and complex disasters and associated conflicts. Drought will continue to be a primary concern for many African populations. The frequency of weather and climate-related disasters has

increased since the 1970s, and the Sahel and Southern Africa have become drier during the twentieth century. Water supplies and agricultural production will become even more severely diminished. By 2020, in some African countries, agricultural yields could be reduced by as much as 50%. By the 2080s, the area of arid and semiarid land in Africa will likely increase by 5-8%. This is because developing countries are generally warmer, more prone to rainfall variability, more dependent on agriculture -the most climate-sensitive of economic sectors - and as a result of low income have limited risk mitigation infrastructure, both physical and financial (e.g. insurance) (Stern, 2007).

Furthermore, increased instances of drought, flooding and severe weather events as well as incremental environmental change through processes such as inundation, desertification and salination are likely to exacerbate existing problems related to agricultural production, communicable diseases, migration streams, poverty and conflict (Bangay & Blum, 2010; Smith & Vivekananda, 2007; UNICEF UK, 2008; WHO, 2008).

Consequences for the majority of people in Asia and Africa as well as those living in Small Island Developing States (SIDS) are likely to be particularly significant, although the specific nature of climate threats will vary between countries. Climate change presents an international challenge of a magnitude not previously encountered. Its impacts have the potential to exacerbate existing tensions and create new ones, which, in turn, have implications for stability and security at a local and international level. An effective response to climate change and its associated biophysical and socio-economic impacts will therefore need to

be multifaceted and inherently political. Thus, the concept of climate change has attracted global concern and the schools have been charged with transmission of knowledge and skills needed by students to prevent climate change (Meng, 2009).

Several countries have made strenuous efforts to include issues on climate change as part of their curriculum. This is because schools serve as places that assist students in developing understanding of society, resources, climate and climate change and also to show commitment to reducing or preventing climate change.

Since 1990, China has provided compulsory education on climate change for the world's population from pre-school level to the tertiary levels of education. The Chinese government has adopted climate change action plans which include specific education initiatives. Knowledge about climate change will be included in basic, higher and adult education with a focus on awareness and participation in relevant activities (Yi & Wu, 2009).

China has formulated and implemented a national plan for coping with climate change and adopted series of policies and measures in this regard. China combines the handling of climate change with its execution of its sustainable development strategy, acceleration of buildings, a resource-conserving and environmental-friendly society and construction of a country of innovation (Yi & Wu, 2009). This implies that China's development agenda incorporates climate change issues in the execution of projects.

Similarly, in the Canadian Province of Newfoundland and Labrador, there has been a Climate Change Action Plan since 2005, which emphasises Climate

Change Education. In this Province, the origin of the action plan may be attributed to the clearly visible local effects of climate change (Nazir, Pedretti, Wallace, Montemurro, & Inwood, 2009). Newfoundland and Labrador was one of the first jurisdictions in Canada to develop policy to directly address the issue of climate change. The Climate Change Action Plan (2005) is described as complementary with the government's ongoing policy objectives and commitment to sustainable development. Newfoundland and Labrador's Department of Education has developed several policies to foster the implementation of Education for Sustainable Development and Climate Change Education in schools. One major initiative is the reorientation of existing educational programmes to incorporate concepts related to sustainability.

Again, the Danish government's 2009 Education for Sustainable Development (ESD) strategy also launched a number of specific initiatives concerning Climate Change Education. New Climate Change Education initiatives under the rubric of Environmental Education and Education for Sustainable Development can likewise be found in other countries (Breiting, Jeppe, Rolls & Karsten, 2009). The Danish government described sustainable development as a challenge which will require an integrated approach and broad participation.

In South Africa, the development of knowledge and understanding of climate change and the use of natural resources resides largely in the Social Science and Natural Sciences Learning Areas. Both learning areas expect learners to develop critical skills in order to make wise use of natural resources. In Ghana,

the threat of climate change is not new. There have been national calls to reduce human activities, especially, the burning of fossil fuels (e.g. coal and oil) which intensify climate change (Evans, 2004). These national calls can only be successful if Ghana can make conscious efforts to utilise the principles of environmental education and education for sustainable development to structure holistic curriculum content on climate change.

It is said that any attempt to make the concept climate change a curricular issue unavoidably comes with its own challenges. This is because, society is not prepared to respond to climate change because the climate-related decisions and policies that need to be made over the next decades will require a citizenry that is better informed and more engaged than it is today (NRC, 2010a). History shows that society has successfully coped with and adapted to the existing relatively stable climate variability; the challenge now is to respond effectively to the threats presented by climate change (NRC, 2010b). Again global climate changes are complex and challenging to communicate to society. An understanding of science is fundamental to appreciating the forces that produce climate change and the effect of changing climate on different regions of the world.

However, science education is not available to everyone and scientists and educators, in general, lack sufficient capability to translate sciences to lay audiences. This situation makes it difficult for people to become informed or educated about climate science. As a consequence, society lacks the knowledge and skills to modify its behaviours to adapt to the effects, or mitigate climate change. Greater awareness or knowledge about climate change may lead to a

more engaged citizenry (Kahlor & Rosenthal, 2009), but only if special attention is directed to the cultural diversity of our audiences when tailoring messages aimed at generating a sense of urgency and being a cue to act (Kahan, Wittlin, Peters, Slovic, Larrimore Ouellette, Braman & Mandel, 2011).

In the words of Hamilton (2008), public opinion about climate change is largely influenced by political preferences. Sometimes, it appears that political orientation is a stronger determinant of attitudes towards climate change than other demographic attributes. The politicisation of the debate on climate change has led members of the public to perceive it more as a matter of personal opinion or a political ideology, distracting attention from the known facts about climate change and the basic causes of those changes (Furman, Roncoli, Crane, Paz, & Hoogenboom, 2009). Consequently, there is an acute and demonstrable need to better educate and inform decision-makers and citizens in general on the most basic facts of climate change (Hassol, 2008), so as to develop a more climate science literate society.

The chronic shortage of scientific knowledge and expertise around climate change and its impact in many developing countries are also a key concern for educators and policy makers at both secondary and tertiary levels. The level of incorporation of climate change issues will vary greatly depending on the level of education, and the local and national contexts being addressed. In primary education, for instance, a core concern is when to introduce the issue of climate change. This decision is important in order not to frighten children and young people, but to empower them to understand and critically engage with

environmental change. In secondary education, tensions exist between a centralised curriculum and the need to promote locally based and locally appropriate knowledge on climate change.

Overloaded curricula frequently present additional challenges in mainstreaming climate change issues into the Social Studies curriculum. Identification of the most appropriate issues and areas of knowledge will require cooperation between local, national and international actors. Educators at all levels will also need support and training to deliver quality education about complex, climate related topics in ways which are both relevant to local, environmental, social and political contexts, and which meet wider educational targets e.g. literacy, numeracy, employability (UNESCO, 2012).

At present, climate change education is still a peripheral topic in both educational research and practice. In research literature, climate change education has been addressed almost exclusively as a domain of science education. Within the realm of practice, climate change is situated within environmental education and education for sustainable development, a minor theme within a peripheral area of the curriculum. Although the role of education in addressing the challenges of climate change is being increasingly recognised, the capacity of education to contribute to adaptation and mitigation measures has yet to penetrate mainstream development thinking. In practical terms, the integration of climate knowledge and skills into existing education systems represents both immediate and longer-term challenges for responding to climate change (UNESCO, 2012).

Although a number of subjects such as Integrated Science and Geography have been introduced into the SHS curriculum in Ghana for the purpose of teaching students to address changes in society including climate change (Ghana Education Service, [GES] 1987), it is the Social Studies education with its integrative and incorporative nature [integrating other social science disciplines], that has been acknowledged as a major vehicle in promoting effective knowledge about climate change among Ghanaian students (Evans, 2004). Social Studies education provides students with diverse knowledge about the social and natural environment by developing the knowledge and understanding of students on the society and the use of natural resources.

Despite education on climate change through Social Studies curriculum, the problem of climate change still remains. At the Senior High School level (SHS), the courses which have link with climate change and can likely make a significant impact on the climate change debate are Social Studies and Integrated Science since they form part of the common core curriculum in Ghana's educational system. The Social Studies curriculum which span three years has three main sections: 1) Environment; 2) Governance, Politics and Stability; 3) Socio- Economic Development (GES, 2010). Some of the topics studied in the third year under the broad section of Environment include the Ecosystem, Physical Environment and Human Activities, the Influence of Climate, Rainfall, Land and Environmental Degradation, The Green House Effect, the Challenges of Mining and Conservation of Environment. Although the students are introduced to some concepts of climate change at this level of their education, it appears

there is no continuity in the subsequent years. Besides, the third year in which these aspects of climate change is taught, is an examination year and the students attention and time are taken up by six or seven other subjects which have to be passed if the student is to progress to the next stage of the educational ladder. Moreover, the third year is not a full academic year since the WASSCE examinations start in the first quarter of the year. Similarly, in the Integrated Science syllabus, issues of climate change can also be found in the theme Interaction of Matter which includes topics such as ecosystem, human activities and their effects on the atmosphere, major sources of atmospheric pollutants and their effects, greenhouse effect and climate change, desertification, drought, melting of ice and polar ice caps, rising sea levels, causes and effects of the depletion of the ozone layer and tectonic movements. Although there is evidence of exposure of students to issues of climate change at this level, the challenge is that there is little reinforcement of the issues raised in the subsequent years of study. This generates a great concern on whether Social Studies, for instance, merits its introduction in the Ghanaian education system or not. The issues also seem to border on the views of teachers on the responses Social Studies curriculum has towards climate change. This is because the teachers' views will to some extent inform curriculum designers and policy makers as to what to incorporate into the existing curriculum.

Statement of the Problem

Social Studies education at the SHS level has been acknowledged as one of the subjects that are in tune with environmental issues including climate

change. In this regard, it is expected that such a curriculum that is poised in dealing with environmental challenges will highlight more topics on climate change. However, it appears the curriculum effort is not enough in addressing climate change in the Social Studies curriculum at the SHS level. Athman and Monroe (2004) support this view when they state that interdisciplinary efforts to combat climate change have not been too successful in the formal education sector (Athman & Monroe, 2004).

Again, the chronic shortage of scientific knowledge and expertise around climate change and its impact in many developing countries are also a key concern for educators and policy makers at both secondary and tertiary levels of education. It appears there is little provision in the existing Social Studies curricula to address moral issues, human behaviour, and attitude, and teachers' views: the core of all problems to climate change, hence the need for this research. The views of Social Studies teachers are particularly relevant for this research in the sense that in curriculum implementation, the teachers are the foot soldiers in terms of the content and learning experiences that learners are made to go through in the process of learning. Ghana's hope for successful climate change initiatives hinges on Social Studies curriculum frameworks that is grounded on the values and principles of education for sustainable development and provides an opportunity to utilise the principle of education for sustainable development to structure a curriculum response to combat climate change. There seems to be gaps in studies regarding climate change in Social Studies curriculum at the SHS level. Hence, the choice of the topic to fill these gaps.

Purpose of the Study

The main purpose of this study was to solicit teachers' views on the extent to which Social Studies curriculum responds to climate change. Specifically, the study sought to examine teacher's level of understanding of climate change. It was also to examine what teachers perceive as the causes of climate change. The study was to investigate the extent to which Social Studies curriculum respond to climate change and also to find out the challenges Social Studies education face in responding to climate change.

Research Questions

The following research questions guided the direction of the study:

1. What is the level of teachers' knowledge about the meaning of climate change?
2. What do teachers perceive as the causes of climate change?
3. To what extent does the Social Studies curriculum respond to climate change?
4. What do teachers perceive as challenges Social Studies education face in responding to climate change?

Significance of the Study

A study of this nature is significant for a number of reasons. To start with it will aid students understanding and forecast of coming climatic conditions, current trends, and possible hazards such as tsunamis, flooding and drought. Secondly, it will provide learners with the knowledge base and an understanding of the measures needed to adapt, mitigate and prevent negative change such as

extreme weather conditions. Thirdly, the findings of the research can help the Ghana Education Service (GES) and the Curriculum Research and Development Division (CRDD) to come out with a comprehensive and holistic curriculum that will sharpen the knowledge, attitudes and skills of students about climate change.

More so, it will provide a policy framework and guidelines to governments, stakeholders and non-governmental organisations (NGO's) to facilitate short, medium and long term planning. Finally, the study adds to the literature already existing on climate change and serve as basis for further research.

Delimitation of the Study

The study was delimited to only teachers' views on the extent to which Social Studies education responds to climate change. The study was confined to the Public Senior High Schools in the Cape Coast Metropolis of Ghana.

Limitations of the Study

The study was not insulated from limitations. First, the nature of the closed-ended questionnaire might have made it possible for the Social Studies teachers to respond to the items without understanding or even reading them (because they were to respond to the closed-ended items by just ticking).

The delimitation of the study also made it inappropriate, in one way or another, to generalise the results to the whole regions of Ghana and beyond. But, I have little doubt that these limitations affected (to a large extent) the validity and reliability of the results obtained.

Organisation of the Rest of the Study

The thesis was organised into five chapters. Chapter two reviewed related literature under headings clearly marked based on the research objectives. Chapter three indicated the methodology used in the study. It highlighted the research design, population, sample and sampling procedures, research instrument, data collection procedures as well as data analysis procedures. Chapter four dealt with results of the data analysis and their discussion. Finally, chapter five provided a summary of the major findings of the study, the conclusions, and recommendations based on the findings as well as areas for further studies.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

This chapter reviews literature related to the topic under study as documented by some authorities, educationists, and researchers. The literature review is categorised into three: the conceptual framework, the theoretical review and the empirical review.

The conceptual framework covered the following sub-headings;

1. The Concept of Curriculum
2. The Concept of Climate
3. Social Studies Teachers' understanding of climate change
4. Social Studies Teachers' Perceptions of the Causes of Climate Change
5. Curriculum Response to Climate Change
6. Challenges associated with Climate Change and the Curriculum

Seven theories from two schools of thought have been reviewed under the theoretical related literature. These are;

1. The Anthropogenic Global Warming Theory and the Human Forcing besides Green House Gases Theory as propounded by those who believe that climate change is human-caused.

2. Bio-thermostat, Cloud Formation and Albedo, Ocean Currents, Planetary Motion and Solar Variability Theories as proposed by those who consider climate change to be naturally-caused.

The empirical literature featured studies conducted by scholars including Adedayo, Mudasiru and Saheed (2012); Alice and Abdulraheem (2012); Buadi (2012); Kankam and Oden (2012), and Daniel and Emmanuel (2012).

Conceptual Framework

The conceptual framework highlighted issues relating to the concept of curriculum and climate, Social Studies teachers' understanding of climate change, Social Studies teachers' perception of the causes of climate change, curriculum response to climate change and challenges Social Studies curriculum faces in responding to climate change.

The Concept of Curriculum

The concept of curriculum is very difficult to define. There is no widely accepted definition of the term curriculum. Wilson (2006) opines that "curriculum is a planned, experienced and result-oriented series model that goes on within the school and the extra - class activities, guidance and interpersonal relationships that pupils and students learn" (p. 72). Stenhouse (1976) asserts that a curriculum is an attempt to communicate the essential principles and features of an educational proposal in such a form that is opened to critical scrutiny and capable of effective translation into practice. Again, "the term curriculum, in the words of Hirst (1968), is of course excessively broad, I shall take it to mean a programme of activities designed so that pupils will attain as far as possible certain

educational ends or objectives” (p. 40). Taba (1962) posits that a curriculum usually contains a statement of aims and specific objectives. It indicates some selection and organisation of content; it either implies or manifests certain patterns of learning and teaching and finally, it includes a programme of evaluation of the outcomes. In the words of Tyler (1949) a curriculum can be defined as a plan for action or a written document that includes strategies for achieving desired goals or ends.

The numerous definitions of the term curriculum highlighted above make the field of curriculum very broad in scope. Curriculum in my view is the planned and unplanned activities that learners go through in a school environment that seek to develop the mental faculties of learners, transform the behaviour and attitude of learners to contribute to societal development. It is the curriculum that provides the needed guidance in schools for educational aims, goals and objectives to be achieved. Education is the key ingredient for change by which learners come to terms with the social, physical and economic environment that has a direct bearing on their source of livelihood. This presupposes that the curriculum must be tailored to satisfy the needs, aspirations, curiosity, frustrations and survival of the learner. Bondi and Wiles (1998), point out that there will never be a perfect curriculum for all ages. Since society and the environment keeps changing and the changes create new needs and challenges, the curriculum can never remain static. It has to grow to address new societal needs and demands dictated by current issues of mutual concern.

The Concept of Climate

The concept climate relates to persistent study of the weather elements. In this regard, the public simply explains the term climate in terms of the weather. There is a basic distinction between weather and climate. The difference between weather and climate is a measure of time (NASA, 2005). Weather is basically the way the atmosphere is behaving, mainly with respect to its effects upon life and human activities. The weather consists of the short-term (minutes to months) changes in the atmosphere. Most people think of weather in terms of temperature, humidity, precipitation, cloudiness, brightness, visibility, wind, and atmospheric pressure, as in high and low pressure (NASA, 2005).

Climate is a measure of the average pattern of variation in temperature, humidity, atmospheric pressure, wind, precipitation, atmospheric particle count and other meteorological variables in a given region over long periods of time (Wikipedia, 2015). Climate is different from weather, in that, weather only describes the short-term conditions of these variables in a given region. A region's climate is generated by the climate system, which has five components: atmosphere, hydrosphere, cryosphere, land surface, and biosphere. The climate of a location is affected by its latitude, terrain, and altitude, as well as nearby water bodies and their currents (Wikipedia, 2015).

The Understanding of Climate Change

Climate change is one of the major challenges in the world and adds considerable stress to societies and to the environment. From shifting weather patterns that threaten food production, to rising sea levels that increase the risk of

catastrophic flooding, the impacts of climate change are global in scope and unprecedented in scale. Without drastic action today, adapting to these impacts in the future will be more difficult and costly (UNEP, 2009). This has prompted scientists, researchers, educationists, policy makers and governments to give this global phenomenon the desired attention.

Evans and Steven (2007) admit that the first World Climate Conference was held in 1979, and the Second in 1990. The Intergovernmental Panel on Climate Change (IPCC) was set up in 1988 and its first report was produced two years later. In recognition of the negative impact of climate change is the institution of the Kyoto Protocol (1997) which is an environmental treaty to the United Nations Framework Convention on Climate Change (UNFCCC). Its aim is to fight global warming by achieving stabilisation of the greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.

Another earlier protocol is the Montreal Protocol (1985) on substances that deplete the ozone layer. This is a protocol to the Vienna Convention and also an intergovernmental treaty designed to protect the ozone layer by phasing out numerous substances believed to be responsible for ozone depletion. Other protocols include the Helsinki Protocol (1989), which addressed issues of carbon dioxide emissions, and required 30% cut by 1993 and the Sofia Protocol, which targeted reduction of nitrogen oxides (Anijah-Obi, 2001). A more recent attempt at addressing the issue is the Copenhagen Climate Council, which brought councillors together to create global awareness of the importance of the UN

Climate Summit (COP15) in Copenhagen in December, 2009. This was to ensure technical and public support and assistance to global decision makers as they agree on a new climate treaty to replace the Kyoto Protocol from 1997 (UNESCO, 2010).

All these efforts have resulted in very useful contributions to the issue of climate change. Unfortunately, a lot of greenhouse gases have already been produced and emitted into the environment such that even if the process is halted immediately, there will still be changes to the climate. This, in effect, presupposes that if humanity is to respond to the challenges, education has a key role to play in promoting understanding and helping individuals, society and governments to make informed choices. This is not simply about giving people information, but ensuring that education and schools specifically, are mobilised to re-orient society towards sustainable practice. There is thus the need for adaptation, in which any action designed is to respond to the anticipated or actual conditions related to climate change.

For most people, the expression “climate change” means the alteration of the world’s climate that we humans are causing, through fossil fuel burning, clearing forests and other practices that increase the concentration of greenhouse gases (GHG) in the atmosphere (IPCC Fourth Assessment Report, Working Group I, 2007). This is in line with the official definition by the United Nations Framework Convention on Climate Change (UNFCCC) that climate change is the change that can be attributed directly or indirectly to human activity that alters the

composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods (UNFCCC, 2007).

Climate change in IPCC usage refers to a change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity. This usage differs from that in the United Nations Framework Convention on Climate Change (UNFCCC) which attributes climate change directly or indirectly to human activities. The IPCC's definition recognises both human activities and natural phenomena as the driving forces behind climate change.

Again, climate change is a significant and lasting change in the statistical distribution of weather patterns over periods ranging from decades to millions of years. It may be a change in average weather conditions, or in the distribution of weather around the average conditions, that is, more or fewer extreme weather events (IPCC, 2007).

Climate change is a long-term shift in the climate of a specific location, region or planet. The shift is measured by changes in features associated with average weather, such as temperature, wind patterns and precipitation (Climate Change Fact Sheet, 2013). What most people do not know is that a change in the variability of climate is also considered climate change, even if average weather conditions remain the same. Climate change occurs when the climate of a specific area or planet is altered between two different periods of time. This usually occurs

when something changes the total amount of the sun's energy absorbed by the earth's atmosphere and surface. It also happens when something changes the amount of heat energy from the earth's surface and atmosphere that escapes to space over an extended period of time. Such changes can involve both changes in average weather conditions and changes in how much the weather varies around these averages (Climate Change Fact Sheet, 2013).

The changes can be caused by natural processes like volcanic eruptions, variations in the sun's intensity, or very slow changes in ocean circulation or land surfaces which occur on time scales of decades, centuries or longer. But humans also cause climates to change by releasing greenhouse gases and aerosols into the atmosphere, by changing land surfaces, and by depleting the stratospheric ozone layer. Both natural and human factors that can cause climate change are called 'climate forcings', since they push, or 'force' the climate to shift to new values (Climate Change Fact Sheet, 2013).

It must be emphasised, however, that the concept 'climate change' is different from 'global warming' but sometimes people use the two concepts to mean the same thing. It is important at this stage to clarify this public misunderstanding for the purpose of this work.

Climate change refers to general shifts in climate, including temperature, precipitation, winds and other factors. Global warming (as well as global cooling) refers specifically to any change in the global average surface temperature. Global warming is often misunderstood to imply that the world will warm uniformly. In fact, an increase in average global temperature will also cause the circulation of

the atmosphere to change, resulting in some areas of the world warming more, others less. Some areas can even cool. Unfortunately, although it significantly misrepresents what really happens, the term ‘global warming’ is still often used by media and others to describe climate change (Climate Change Fact Sheet, 2013, p.1).

Global Warming also describes the average temperature of the Earth’s oceans, land and atmosphere. The individual measurements are from a very large, international network of weather observations, and typically averaged on a yearly basis. It also relates to the general increase in the earth’s near-surface air and ocean temperatures (IPCC, 2007).

Perceptions of the Causes of Climate Change

The earth’s climate has varied considerably in the past, as shown by the geological evidence of ice ages and sea level changes, and by the records of human history over many hundreds of years. The causes of past changes are not always clear but are generally known to be related to changes in ocean currents, solar activity, volcanic eruptions and other natural factors (UNISDR, 2009). The difference now is that global temperatures have risen unusually rapidly over the last few decades. There is strong evidence of increases in average global air and ocean temperatures, widespread melting of snow and ice, and rising average global sea levels. The IPCC Fourth Assessment Report concludes that the global warming is unequivocal. It further posits that increasing concentration of greenhouse gases is accountable for most of the observed temperature increase since the middle of the 20th century. Atmosphere and ocean temperatures are

higher than they have been at any other time during at least the past five centuries, and probably for more than a millennium (UNISDR, 2009).

Scientists have long known that the atmosphere's greenhouse gases act as a "blanket" which traps incoming solar energy and keeps the Earth's surface warmer than it otherwise would be, and that an increase in atmospheric greenhouse gases would lead to additional warming (UNISDR, 2009). The current concentration of greenhouse gases in the atmosphere is now the highest it has been for the past 500,000 years, having grown by 70% between 1970 and 2004 alone, and having reached this level exceptionally quickly (IPCC Fourth Assessment Synthesis Report, 2007). While there has been some controversy in the past, it is now widely accepted that human activities, in particular fossil fuel use and changing land-uses, are the dominant factors in this growth and are responsible for most of the warming observed over the past 50 years (UNISDR, 2009).

Verlag & Muller (1992) stated that chief among the causes of climate change are greenhouse gases which result mainly from human activities. They further point out that "worldwide, the use of fossil fuels, coal, oil and gas for energy purpose accounts for 50% of the additional man-made greenhouse effect" (p. 57). The situation is exacerbated by the destruction of forest ecosystems which play an important role in the absorption of carbon dioxide from the atmosphere.

Most climate scientists agree, however, that the main cause of the current global warming trend is human expansion of the "greenhouse effect"- warming that result when the atmosphere traps heat radiating from Earth toward space.

Certain gases in the atmosphere block heat from escaping. Long-lived gases, remaining semi-permanently in the atmosphere, which do not respond physically or chemically to changes in temperature, are described as “forcing” climate change whereas gases, such as water, which respond physically or chemically to changes in temperature are seen as “feedbacks” (IPCC Fourth Assessment Report, 2007).

Once more, the crucial component that causes greenhouse gases such as carbon dioxide, Methane, Chlorofluorocarbons (CFC’s), and Nitrous Oxide to be released into the atmosphere is human activity. The burning of fossil fuels (i.e., non-renewable resources such as oil, coal, and natural gas) has a significant effect on the warming of the atmosphere. The heavy use of power plants, cars, airplanes, buildings, and other man-made structures release carbon dioxide into the atmosphere and contribute to global warming (Nicole, 2012). Greater amounts of these emissions emanate from the industrialised nations and are reaching alarming proportions. The quest for industrialisation and urbanisation are the trigger causes of the greater demand for energy and its attendant effects.

Verlag and Muller (1992) state that in 1989, global energy - related carbon dioxide emissions amounted to 21.6 billion tons. The industrialised nations were responsible for three quarters of those emissions, with the Organisation for Economic Cooperation and Development (OECD) countries accounting for 47 per cent (or 10 billion tons of carbon dioxide) and the industrialised, former centrally planned economies accounting for 25 per cent of the total emissions. Nylon and nitric acid production, the use of fertilizers in agriculture, and the burning of

organic matter also release the greenhouse gas Nitrous Oxide. These are processes that have been expanded since the mid-twentieth century (Nicole, 2012).

Gases that contribute to the greenhouse effect include: Water vapour, the most abundant greenhouse gas, acts as a feedback to the climate. Water vapour increases as the Earth's atmosphere warms, but so does the possibility of clouds and precipitation, making these some of the most important feedback mechanisms to the greenhouse effect (NASA, 2015).

Carbon dioxide, a minor but very important component of the atmosphere, is released through natural processes such as respiration and volcano eruptions and through human activities such as deforestation, land use changes, and burning fossil fuels. Humans have increased atmospheric carbon dioxide concentration by a third since the Industrial Revolution began. This is the most important long-lived "forcing" of climate change (NASA, 2015). Carbon dioxide provides the dominant means through which carbon is transferred in nature between a number of natural carbon reservoirs - a process known as the carbon cycle. Human beings contribute to this cycle every time there is breathing. Using the oxygen we take in from the atmosphere, carbon from our food is burnt and turned into carbon dioxide that we then exhale; in this way we are provided with the energy we need to maintain our life. Because carbon dioxide is a good absorber of heat radiation coming from the Earth's surface, increased carbon dioxide acts like a blanket over the surface, keeping it warmer than it would otherwise be. This increase in global temperature will lead to global climate change (Houghton, 2004).

Methane, a hydrocarbon gas is produced both through natural sources and human activities, including the decomposition of wastes in landfills, agriculture, and especially rice cultivation, as well as ruminant digestion and manure management associated with domestic livestock. On a molecule-for-molecule basis, methane is a far more active greenhouse gas than carbon dioxide, but also one which is much less abundant in the atmosphere. That is, the enhanced greenhouse effect caused by a molecule of methane is about eight times that of a molecule of carbon dioxide. Nitrous oxide, a powerful greenhouse gas is produced by soil cultivation practices, especially the use of commercial and organic fertilizers, fossil fuel combustion, nitric acid production, and biomass burning (NASA, 2015).

Chlorofluorocarbons (CFCs), a synthetic compound which is entirely of industrial origin is used in a number of applications, but now largely regulated in production and released to the atmosphere by international agreement for their ability to contribute to destruction of the ozone layer are also greenhouse gases (NASA, 2015). The CFC's are man-made chemicals which, because they vaporise just below room temperature and because they are non-toxic and non-flammable, appear to be ideal for use in refrigerators, the manufacture of insulation and aerosol spray cans. Since they are so chemically un-reactive, once they are released into the atmosphere they remain for a long time before being destroyed. Depletion of the ozone element available at the stratosphere is another important cause of climate change. Chlorofluorocarbons and halons are mainly responsible for this depletion.

Verlag and Muller (1992) assert that these two gases are highly inert chemical compounds which are broken down almost exclusively by photodecomposition in the stratosphere, hence, their ozone depletion on global warming potentials. This gives an impression that the more these CFC's are released into the atmosphere, the higher the rate at which global warming would occur since it will act as a catalyst in speeding up global warming leading to climate change.

In Ghana, the human activities that trigger climate change includes burning of fossil fuel, especially petroleum products in vehicles, generators and other industrial machines. There is a phenomenal increase in the number of vehicles in towns and cities, a number of which are imported second hand vehicles (Obeng, 2012). Besides, the inefficient power supply system in the country has resulted in the increasing use of generators. Increase in the number and use of vehicles and generators, coupled with poor servicing record of owners, result in the production of a lot of smoke which increases the carbon dioxide concentrations. Secondly, the indiscriminate bush burning for hunting and farming purposes also add to the production of green house gases because deforestation increases the carbon dioxide concentrations since plants and trees which make use of it are destroyed (Obeng, 2012).

Again, illegal mining activities lead to the pollution of the land and water bodies and sometimes to the extinction of water bodies. This affects the rainfall cycle. Also, indiscriminate dumping of refuse which degrades the land and kills water bodies, and also causes the release of large amounts of methane gas-CH₄

into the atmosphere. Not all, use of imported old refrigerators and air conditioners which contain chlorofluorocarbons (CFC's) as coolants. These equipment are not properly disposed off when they are no longer in use and the gases leak out into the atmosphere (Forster, Ramaswamy, Artaxo, Bernsten, Betts, Fahey, Haywood, Raga, Schulz and Van Dorland, 2007).

It can be inferred from the discussions above that, continuous warming of the globe by rapid release of green house gases such as carbon dioxide, methane, nitrous oxide and CFC's as well as depletion of the ozone layer in the stratosphere directly or indirectly by human ingenuity and by physical factors are the major causes of climate change. Figure 1 provides a summary of the causes and effects of climate change.

It can be observed from figure 1 that the causes of climate change emanate from two sources (Man-made and Natural). The human induced causes of climate change are the emission of green house gases such as carbon dioxide, methane, nitrous oxide, chlorofluorocarbons, and water vapour as well as fossil fuel burning, land use among others. The natural causes, on the other hand, are propelled by factors such as solar variability, volcanic eruption, ocean circulation planetary motion, cloud formation and albedo etc. These two sources together drive climate change and subsequently, lead to high global temperatures, melting of ice and snow, rise in global sea level, flooding, drought, migrating streams, crop failures, and animal extinction.

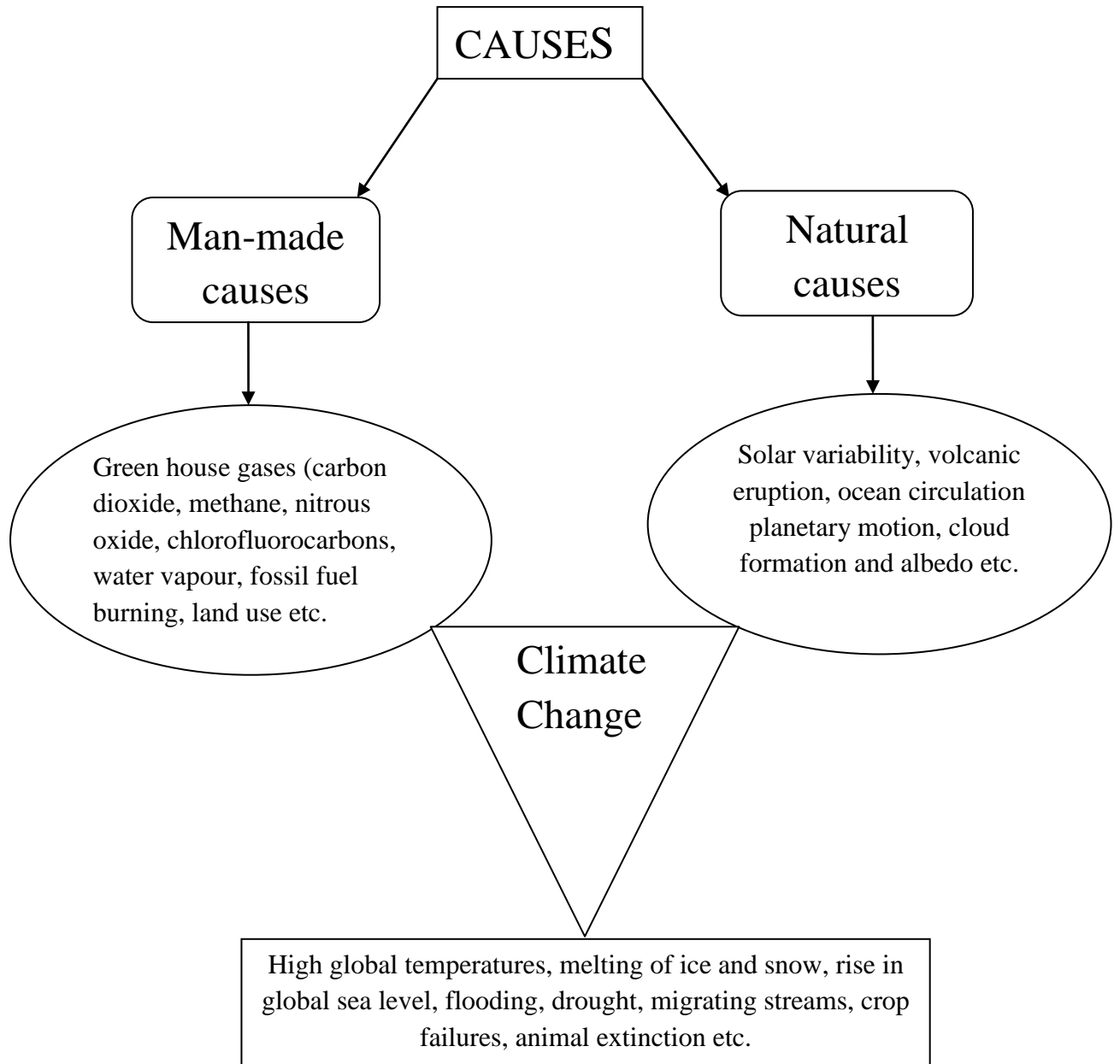


Figure 1: *A summary of the causes and effects of climate change*

Source: Baker (2015).

Curriculum Response to Climate Change

Across the world the term curriculum is used in several different ways. It was traditionally used to refer to a race course or running course of the horse in

the game of ancient Rome. In education it may imply a course to be followed by educands or group of subjects chosen by educands to study in school. This makes the field of curriculum very broad. Hirst (1968) observes that the term curriculum is of course excessively broad, I shall take it to mean a programme of activities designed so that pupils will attain as far as possible, certain educational ends or objectives. A curriculum usually contains a statement of aims and specific objectives. It indicates some selection and organisation of content; it either implies or manifests certain patterns of learning and teaching. Finally it includes a programme of evaluation of the outcomes (Taba, 1962). Robinson (1983) states that the curriculum can be defined as a course of learning activities set out for the learner to perform to make him achieve certain goals prescribed by the educational system. The curriculum generally includes all subjects and activities over which the school has responsibility. It also defines the limits within which certain types of learning are to take place. It denotes those experiences and activities which are devised by the school or other institutions of learning for the purpose of changing a learner's behaviour, acquiring or reinforcing certain skills and preparing him to fit properly into his society.

Again, Miller and Seller, (1985) aver that curriculum is an explicitly and implicitly intentional set of interactions designed to facilitate learning and development and to impose meaning on experience. The explicit intentions usually are expressed in written curricula and in courses of study; the implicit intentions are found in the 'hidden curriculum' by which we mean the roles and norms that underlie interactions in the school. From the definitions above, it can

be inferred that the term curriculum has different meanings and interpretations based on the orientations of the various experts in the field and how each of them sees it.

In recent times, colleges and universities are being called upon to provide all students with high-quality, effective educational experiences, which prepare these students to live and work in a highly diverse society. In response, various educational and training approaches are being used to help students develop specific behaviours, attitudes, and skills to enable them to work effectively in cross-cultural situations. This implies that students must be trained in a holistic manner such that the multifaceted dimensions of challenges of a dynamic society today can be curtailed with an integrated approach. This also means that issues of climate change which is a global challenge cannot be left out in the curriculum of schools today.

Climate change and the individual and societal actions needed to address its challenges are not new topics for education. Both can be found in environmental teaching materials from recent decades. Indeed, Climate Change Education has not emerged as an independent field, but rather as an integral part of Environmental Education and Education for Sustainable Development (ESD). Climate Change Education has only gradually developed its own identity during the last three years, and is therefore still in its infancy (Laessoe, Schnack, Breiting, & Rolls, 2009).

In some countries, this recent development is driven by government initiatives concerning climate change. The Chinese government, for example, has

adopted climate change action plans which include specific education initiatives. Knowledge about climate change has been included in basic, higher and adult education with a focus on awareness and participation in relevant activities (Yi & Wu, 2009). After the United Nations Conference on Environment and Development in 1992, China was one of the first countries to formulate and carry out a strategy of sustainable development. The congress of Environment and Development under the U. N. in 1992, made the sustainable become the cognition in common for the common strategy of development in the future by all the countries in the world.

The Information Office of China's State Council issued a white paper titled China's Policies and Actions for Addressing Climate Change, which addressed main issues of climate change in China, including climate change and China's situation, impact of climate change on China, strategies and objectives for addressing climate change, policies and actions to decelerate and adapt to climate change, public awareness of climate change, international cooperation on climate change, and institution and mechanism building for coping with climate change (Yi & Wu, 2009).

Some extract from this white paper is the following: as developing country with a large population, a relatively low level of economic development, a complex climate and a fragile co-environment, China is vulnerable to the adverse effects of climate change, which has brought substantial threats to the natural ecosystems as well as the economic and social development of the country. These threats are particularly pressing in the field of agriculture and

livestock breeding, forestry, natural ecosystems and water resources, and in coastal and eco-fragile zones. Therefore, China's priority task at present is to adapt itself to climate change. The multiple pressures of developing the economy, eliminating poverty and mitigating the emissions of greenhouse gases constitute difficulties for China in its efforts to cope with climate change, since the country is undergoing rapid economic development (Yi & Wu, 2009).

A responsible developing country, China sets great store by climate change issues. Fully aware of the importance and urgency of addressing climate change, following the requirements of the Scientific Outlook on Development, and taking into overall consideration (of both economic development and ecological construction, domestic situation and international situation, and present and future), China has formulated and implemented a national plan for coping with climate change, and adopted a series of policies and measures in this regard. China combines the handling of climate change with its execution of its sustainable development strategy, acceleration of building a resource-conserving and environmental-friendly society and construction of a country of innovation. Taking economic development as the core objective, and placing emphasis on energy conservation, optimisation of the energy mix, reinforcement of ecological protection and construction, and scientific and technological progress as back up, China strives to control and mitigate the emission of greenhouse gases and continuously enhance the capability of adapting itself to climate change.

The first principle to address climate change is to address it within the framework of sustainable development. Climate change arises out of

development, and should thus be solved along with development. It is necessary to promote sustainable development amidst efforts to address climate change, and strive to achieve the goal of win-win in both.

Similarly, in the Canadian province of Newfoundland and Labrador, there has been a Climate Change Action Plan since 2005, which emphasises climate change education. In this province, the origin of the action plan may be attributed to the clearly visible local effects of climate change (Nazir, Pedretti, Wallace, Montemurro, & Inwood, 2009). Newfoundland and Labrador were one of the first jurisdictions in Canada to develop policy to directly address the issue of climate change.

The province of Newfoundland and Labrador issued its Climate Change Action Plan in 2005 (Newfoundland and Labrador Department of Environment and Conservation, 2005). In it, the government of Newfoundland and Labrador acknowledged that climate change is a serious issue and that efforts are needed to reduce greenhouse gas emissions. The vulnerability of the province to the possible impact of climate change especially rising sea levels and destruction of natural ecosystems seemed particularly salient to the government's interests. The document goes on to outline commitments for reducing climate change to be enacted by most government departments. The plan affirms the importance of education in addressing climate change.

The action plan document realises that the importance of education in addressing climate change cannot be stated enough. Education on this issue has to be broad enough to include all aspects of this phenomenon: science,

direct and indirect impacts (biophysical, socioeconomic and health), measures for reducing greenhouse gas emissions and measures to adapt to a changing climate (Newfoundland and Labrador Department of Environment and Conservation, 2005). Specifically, the document promises continued support and funding to the Newfoundland and Labrador Climate Change Education Centre. This centre is part of a national network of public education and outreach hubs. Its work focuses on educating the public about Greenhouse gas emission reduction measures and encouraging actions to reduce personal emissions. Extended funding is expected to assist with programme development and expansion of public education efforts.

The Climate Change Action Plan (2005) is described as complementary with the government's ongoing policy objectives and commitment to sustainable development. Newfoundland and Labrador's Department of Education has developed several policies to foster the implementation of education for sustainable development and climate change education in schools. One major initiative is the re-orientation of existing educational programmes to incorporate concepts related to sustainability.

Accordingly, on-going curriculum development and renewal have been taking place in all school curricula at the province of Newfoundland and Labrador. A cross-curricular approach is being taken to infuse concepts of sustainability into all subjects taught in schools. This process is already almost complete for the disciplines of Science and Social Studies. The issue of climate change is generally

treated in curriculum documents as a part of the issue of sustainability (Nazir et al, 2009).

Again, the Danish government's 2009 Education for Sustainable Development (ESD) strategy also launched a number of specific initiatives concerning Climate Change Education. New Climate Change Education initiatives under the rubric of Environmental Education and Education for Sustainable Development can likewise be found in other countries (Breiting, Jeppe, Rolls & Karsten, 2009). The Danish government described sustainable development as a challenge which will require an integrated approach and broad participation. In addition, the key paragraphs on education for sustainable development state that "education for sustainable development should be pursued at all levels of education; it should be included in all curricula or equivalent instruments corresponding to the level of education. Such education should rest on a broad scientific knowledge and be both integrated into existing disciplines and developed as a special competence. It demands an educational culture directed towards a more integrative process-oriented and dynamic mode emphasising the importance of critical thinking, and of social learning and a democratic process (Breiting et al, 2009).

Education for Sustainable Development should be based on an integrated approach to economic, environmental and societal development and encompass a broad range of related issues such as democracy, gender equity and human rights. This broad approach should be recognised in both natural science and social science, and should complement and build on

existing initiatives in environmental education. Education for Sustainable Development should also be regarded as an important tool for achieving sustainable consumption and production patterns as well as for necessary life style changes (Breiting et al., 2009).

In a similar vein, in Australia where ESD is well established, the new and ambitious National Solar School Initiative has been launched under the auspices of ESD but with specific reference to climate change. This initiative has set a goal “for all Australian schools to be ‘solar schools’ by 2016” (Chambers, 2009). A major ESD initiative that has climate change mitigation as an element is the National Solar Schools Initiative. This initiative began in July 2008 and replaced the similar ‘Green Vouchers’ scheme.

Through the National Solar Schools Initiative, schools are eligible to apply for grants for a range of energy and water efficiency measures including; installation of a minimum 2 kilowatt solar panels, energy efficient lighting, skylights, shade awnings, solar hot water systems, and rain water tanks. The objectives of the scheme are to allow schools to: generate their own electricity from renewable sources, improve their energy efficiency and reduce their energy consumption, adapt to climate change by making use of rain water collected from school roofs, provide educational benefits for school students and their communities to support the growth of the renewable energy industry. As can be seen from the objectives, educational outcomes are seen as an important aspect of this initiative, in addition to the environmental benefits of reduced green house

gas production and the benefits that can be realised by the nation through stimulating the renewable energy industry (Chambers, 2009).

The climate change initiatives and education is not different in Sri Lanka where women even in marginalised communities have taken an active part in the planning of an integrated programme for drought risk reduction, better land use and water management with the aim to improve livelihoods (UNESCO, 2012). Women and men both worked on planning and deciding the ways each household would contribute and benefit, and both were involved in identifying the crops, trees and making land use plans which would increase resistance to drought. With decades of practical experience in managing their environment and knowledge of how climate change-related hazards affect them, they have used their knowledge and experience to work out locally appropriate strategies. The process of capacity building and empowerment has allowed women and men to take responsibility for the work being done (UNESCO, 2012).

The process of social mobilisation, particularly of women as equal and responsible partners, has enabled the communities to improve and diversify their livelihoods, taking measures that both sustain their survival, and decrease the risk of drought and landslides. In addition to employing traditional knowledge, the programme in Sri Lanka also benefited from increased women's participation.

Madagascar also took an initiative on Disaster Risk Reduction (DRR) which was mainstreamed into school curricula. The Project "I Protect My Country from Natural Disasters" was implemented from April to October 2006 by the National Office for Disaster Risk Management in close cooperation with the

Malagasy Ministry of National Education and Scientific Research. The Project was part of on-going efforts to mainstream DRR into school curricula in Africa. Such efforts were recommended during a United Nations International Strategy for Disaster Reduction (UN/ISDR) Africa regional consultative meeting held in Kenya in March 2006, attended by Ministry of Education officials from 19 African countries (Maceda, Gaillard, Stasiak, Le Masson, and Le Berre, 2009). The workshop which was held in Kenya recommended among other things that knowledge acquired during the workshop be shared with primary and secondary school teachers. In line with that recommendation, selected local government officials and teachers were trained in Madagascar, a student manual and a teacher guide on DRR were developed, and DRR was mainstreamed into school curricula. The Project was an effort to implement the Hyogo Framework for Action, Priority for Action 3: "Using knowledge, innovation and education to build a culture of safety and resilience at all levels".

More importantly, the Project helped mainstream DRR into the school curricula, a crucial step towards institutionalising DRR in society. This was a major objective pursued by the ongoing World Disaster Reduction Campaign 2006-2007 under the theme "Disaster Risk Reduction Begins at School" (Maceda, et al., 2009). In addition to these government-led initiatives, there are also examples of other concrete initiatives organised by Non Governmental Organisations (NGO's) and other institutions. Furthermore, in Brazil, various other stakeholders like the corporate sector, academic community and media are

also involved in debating the role and place of climate change education (Jacobi, Silva, Amia, Sulaiman, Nepomuceno, & Ratinho, 2009).

This climate change education and the efforts various countries have made towards incorporating it into the curriculum of schools is supported by the United Nations Framework Convention on Climate Change (UNFCCC) Article 6: Education, Training and Public Awareness, which recognises that education, must play a key role in a holistic response to climate change at local, national and global levels. United Nations Education, Scientific and Cultural Organisation, for example, promotes the continuous strengthening of the interdisciplinary climate change knowledge base, primarily involving the sound and unbiased generation and use of data, information and research concerning climate change (climate science) assessment, monitoring and early warning of relevance to climate change mitigation and adaptation (UNFCCC, 2007).

This is being integrated with UNESCO capacities in natural and social sciences, culture, education and communication to improve the resilience of Member States to climate change through national and local climate mitigation, adaptation and risk management policies based on science, local and indigenous knowledge, and ecological and socio-cultural systems. Simply introducing new content about climate change science, causes, consequences and solutions will not be an adequate response to climate change. New values, creative thinking and problem solving-skills need to be instilled at all school levels through teaching and learning methodologies that are participatory, experimental, critical and open-ended (UNESCO, 2009).

This UNESCO Policy Dialogue brief provides recommendations and guidance to decision makers in terms of how education systems need to be adapted and re-oriented to best address the challenge of integrating Climate Change Education for Sustainable Development (UNESCO, 2010). Policies that do not take account of the social drivers and impacts of climate change are unlikely to succeed in protecting the interests of the most vulnerable. The strengthening of the interdisciplinary climate change knowledge base as reported by UNESCO, it is believed, will improve understanding of the social dimensions, including gender equality issues related to climate change, and develop and implement a policy-relevant, action-oriented research programme focusing in particular on the design and implementation of appropriate climate change adaptation action.

In Ghana, the threat of climate change is not new. There have been national calls to reduce human activities, especially, the burning of fossil fuels (e.g. coal and oil) which intensify climate change (Evans, 2004). The evolving culture of contemporary society has continued to hold profound implications for climate change in Ghana. The evolution of the society from a traditional low technology base to a modern high-technology society has increasing environmental impact. The recent discovery and exploration of crude oil in Ghana imposes certain demands on the environment through water pollution and gas flaring, which also pollutes the air. These, added to the pre-existing environmental problems are likely to aggravate the situation (Boadu & Oden, 2013).

Again, change in climate has equally introduced hot weather conditions, crop failure, hunger, outbreak of strange diseases, among others. Owing to this development, Fischer, Shah, Tubiello, and Velhuizen (2005) note that if care is not taken, 9% - 20% of Sub-Saharan Africa's land will soon become less suitable for agricultural purposes. This is in addition to death of livestock, and alarming rate of diseases such as malaria, resulting from rising temperature.

On 14th November, 2013, the Ghanaian Times newspaper reported that climate change is affecting country's agriculture. This was made known by a Paramount Chief of Lawra traditional area, Naa Edward Puowele Karbo III, who observed that the recent changes in weather patterns have had far reaching consequences for farmers in the country. He lamented that "the traditional problems of our subsistence agriculture are well known and well documented, however, recent changes in weather patterns which are attributed to the global phenomenon called climate change, has introduced yet another factor into our farming with far reaching consequences on the lives of our farmers.

In furtherance of this, the dependence on rain-fed agriculture across the country makes farmers in Ghana particularly vulnerable to climate change. For instance, the high level of dependence on agriculture for livelihoods in the northern Ghana in particular, also makes it the most vulnerable region to climate change (Obour, 2013). The area is also climatically sensitive with low, decreasing rainfall and frequent recurring droughts making the situation more serious. Mr. Emmanuel Salu, Director and Head of Environmental Education Department of the Environmental Protection Agency (EPA) said this at a workshop on

Environmental and Climate Change Policy Node held in Accra. The workshop, organised for stakeholders and institutions by the Centre for Scientific and Industrial Research (CSIR) - Science, Technology, and Policy Research Institute (STEPRI) in collaboration with the Alliance for Green Revolution Africa (AGRA) was on the theme: “Enhancing the Adaptation of Smallholder Farmers Especially Women to Climate Change for Improved Agricultural Production in Ghana” (Obour, 2013).

Mr. Salu lamented that, there had been a visible evidence of climate change in Ghana and that included rising temperatures in all ecological zones, rainfall levels and patterns increasingly erratic, streams drying up having adverse impacts on livelihoods, health, nutrition and hydropower generation. He held that majority of farmers interviewed had also expressed the belief that temperature had become warmer with the timing of the rains becoming irregular and unpredictable. There were also increased droughts. He advised that, there was the need for government and other stakeholders to implement adaptable and mitigation strategies to address the situation since any change in crop yields and distribution would affect livelihoods (Obour, 2013). It was reiterated that adaptation strategies should include development or acquisition and use of drought varieties, the use of early maturing genotypes, use of conservation agriculture including low tillage, altered planting dates to suits changing cropping cycles and an increased use of irrigation. He called on the Ministry of Food and Agriculture to dialogue with scientists, farmers, development partners and

financial institutions to develop the sectors that were sensitive to climate vulnerability and sustainable exploitation (Obour, 2013).

Dr. Kwasi Ampofo, Director of Alliance for Green Revolution Africa (AGRA), indicated that the institution works to achieve a food secure and prosperous Africa through the promotion of rapid, sustainable agricultural growth based on smallholder farmers, particularly, women farmers, majority of whom produce most of Africa's food with minimal resources and little government support (Obour, 2013). He explained that the Environment and Climate Change Policy Action Node was one of the five main policy Action projects in Ghana and in other parts of Africa to help AGRA achieve its mission of food security and prosperity among smallholder farmers.

In response to climate change, Ghana has launched a National Climate Change Policy (2013) that would provide strategies and actions, which when effectively implemented, it is believed, would help mitigate the effects of climate change on the country. The Policy, which was recently approved by Cabinet, is in three phases with the first phase being the presentation of the policy, analysing the current situation and giving the broad policy vision and objectives. The second phase presents the initiatives and programmes identified in the form of action plans for implementation, while the last phase details how climate change programmes and actions, identified in the second phase, could be mainstreamed, time-bound, budgeted for and translated into annual work plans of implementing units (Yeboah, 2013).

Dr. Bernice Heloo, Deputy Minister of Environment, Science, Technology and Innovation, who announced this at a workshop in Accra, said the main objective of the NCCP included effective adaptation, social development and mitigation to climate change effects. She mentioned priority areas that would be tackled as agriculture and food security, disaster preparedness and response, natural resource management, equitable social development, and energy, industrial and infrastructural development. She said, like other problems confronting the human race such as HIV and AIDS, food crisis and natural disaster, climate change posed a greater challenge to the world, especially developing countries, and there was, therefore, the need to take a cursory look at our development strategies and seize the opportunities presented by climate change so as to find solutions to these challenge (Yeboah, 2013).

The Deputy Minister held that, in Ghana, the issue of mitigation had always been an important agenda for discussions and it was also regarded as a very crucial step towards adaptation to climate change challenges. Also Ghana had submitted a list of 55 Nationally Appropriate Mitigation Actions to the United Nations Framework Convention on Climate Change which, when implemented, would lead to the attainment of Ghana's emission reduction objectives for sustainable development (Yeboah, 2013). Mr. Tirso Dos Santos, Director and Representative, UNESCO, said the UN was making many global efforts at deepening the understanding of climate change among member states in its bid to help develop appropriate mechanisms to assist states and local communities in dealing with consequences of climate change (Yeboah, 2013).

The Regional Institute for Population Studies of the University of Ghana on Thursday, July 24, 2014 organised its third climate change and population conference in Accra, with a call on policy makers to consider using migration as a climate change adaptation strategy to reduce the impact of climate change. Representatives from the security agencies, academia, policy makers, civil society and international organisations were admonished to share lessons on climate innovation with stakeholders to demonstrate the relevance of scientific research to solving societal problems in the sub-region. It was observed that since 2008, more than 20 million people had been displaced internally as a result of climate change. Doctor Kwasi Appeaning Addo, said countries needed to speed up their climate change strategies because “we do not have to waste time as climate change is happening faster than predicted” (Emelia, 2014).

According to National Climate Change Policy (NCCP), Ghana, as signatory to the United Nations Framework Convention on Climate Change (UNFCCC), has been involved in a number of activities aimed at addressing the climate change challenge. A number of initiatives are on-going and need to be effectively coordinated, in order to derive the maximum benefits and synergy to support the national development agenda as well as reduce risk and vulnerability of Ghanaians to climate events (MESTI, 2013). The Ministry of Environment, Science, Technology and Innovation (MESTI) in particular has sought to ensure that the development agenda of government responds to the emerging trends of global warming and to how Ghana could better contribute to the common objective, and to position herself as a leader within the Africa region. Ghana is

keen to include climate resilience in its development. In addition, Ghana is adequately represented at various international conferences on climate change to keep abreast with developments in global and regional thinking and decisions on climate response measures, as have been deliberated and agreed by the parties. Since Ghana joined the global community on climate change, the Government has been making strides towards fulfilling its obligations under the climate change convention and the Kyoto Protocol (MESTI, 2013).

The government of Ghana has also shown commitment when it promised sustainable funding for climate change. It was announced that government is exploring ways of carrying out sustainable surveillance on the emergence of climate change and environmental degradation. This surveillance would also be backed by sustainable means of acquiring funding, to propel the policies by mobilising resources from all the necessary avenues to execute the agenda (Arhin, 2014). This was said at the official launching of the National Climate Change Policy and National Environment Policy in Accra, as one of the measures Ghana was taking in reaction to the global challenge of climate change and environmental degradation.

The National Climate Change Policy, which has been prepared and designed within the context of national sustainable development, is Ghana's integrated response to climate change, and will provide a clearly defined pathway for dealing with challenges. The policy would also provide policy vision and objectives and present a greater detail, the initiatives and programmes identified in the form of action programmes for implementation among others. It was

reiterated by Ghana's President Mahama that all aspects of human existence were affected by climate change and environmental degradation, which government would continue to fight relentlessly, to ensure that poverty, deprivation and hunger were eliminated in the coming years. He also appealed to Ministries, Departments and Agencies to play their roles responsibly towards the positive reaction to climate change to change the losses into gains in succeeding years (Arhin, 2014).

It can be inferred from the discussions above that Ghana has taken a bold step in responding to climate change. This is evident in the country's commitment in developing a national climate change policy and what corporate organisations and private individuals have done. A cursory look at the national climate change policy in Ghana for example reveals that much attention has been given to how government can strategise and develop adaptation and mitigation policies that would safeguard our environment for sustainable development.

However, the policy appears to be a bit more silent on the curriculum efforts that can be made to infuse the concepts of climate change into the curriculum of schools. This in my view is the missing link between policy and implementation. This policy gap needs to be filled the essence of which this research was conducted. If the issue of climate change which has become one of the global environmental threats is to be curtailed, then the role of education cannot be overemphasised. This is because it is through education that knowledge, concepts, values and skills about climate change can be internalised by students to transform the attitude, behaviour and disposition of the learner.

Through education, students may become climate sensitive and contribute their quota in the nation's resolve to combat climate change. I believe Social Studies curriculum with its integrated nature offers a brighter opportunity in terms of addressing environmental issues such as climate change. This makes it imperative for curriculum experts in the field of Social Studies education to turn the attention of government and the NGO's to this global menace by incorporating and utilising the principles of education for sustainable development to structure a holistic curriculum to better respond appropriately to climate change.

World Bank's Development Report (2010) for instance, estimates the value of the costs associated with malnutrition and diarrheal diseases in Ghana to be as high as 9% of GDP after accounting for long-term productivity losses.

Some inferences can also be made from the discussions that several countries on the globe have made strenuous efforts to respond appropriately to the issues of climate change by utilising the principles of education for sustainable development and incorporating it into the existing curriculum of schools. This is evident from the report submitted by various countries on the platform of The International Alliance of Leading Education Institutes on the subject Climate Change and Sustainable Development: The Response from Education.

Challenges Associated with Climate Change and the SHS Curriculum

In recent years, climate change has received significant global attention. Climate change presents a unique challenge. The world is changing rapidly economically, ecologically, technologically, culturally; in terms of population, international relations, and social structures. These changes result in increased

tension between development and sustainability. At present, accelerating climate change has drawn increased attention to this tension. Warnings from scientists have increased and a mood of urgency marks the present situation (UNESCO, 2012).

Traditionally, educational institutions were established and structured on the basis of a strong belief in objective knowledge and forming the ‘right’ answers to every question. In this light, the task of education was to provide students with the truth and correct techniques. This role is still valid as factual knowledge and efficient techniques are crucial prerequisites for rational action. It should not be the singular approach. Climate risks contain a degree of uncertainty and addressing them requires being able to assess the interplay between a number of aspects, including ethical considerations of what is good and bad, rather than of solely aiming to uncover the truth (UNESCO, 2012).

Furthermore, the balancing act between tackling long-term sustainable development issues and more immediate economic imperatives is another challenge for the education sector. Globalisation has drawn attention to the relationship between the competitiveness of country workforces and student performance, particularly within science. The effect on the educational system has been a greater focus on empirical tests and performance indicators, and less willingness among teachers and schools to experiment with new approaches to teaching and learning. Both these factors impact negatively on the innovative, interdisciplinary and competence-centred aspects of climate change education (UNESCO, 2012).

National Research Council (NRC) also reports that society is not prepared to respond to climate change because the climate-related decisions and policies that need to be made over the next decades will require a citizenry that is better informed and more engaged than it is today (NRC, 2010a). History shows that society has successfully coped with and adapted to the existing relatively stable climate variability; the challenge now is to respond effectively to the threats presented by climate change (NRC, 2010b). All types of decision-makers (e.g. governments, businesses, and individuals) are already taking actions to respond to climate change (NRC, 2010c). However, large segments of society still remain unconvinced that climate change is real (Kohut, Doherty, Dimock & Keeter, 2009) and, therefore, these segments remain inactive. Society as a whole must realise that climate change is happening and that human activity is playing a part in this change (NRC, 2011; Hassol, 2008).

Recent surveys show that the American public for example, wants more information about climate change and the ways in which it may affect their lives; citizens also expect responsive action from the government and are willing to take action themselves (NRC, 2010a). The truth is that global climate changes are complex and challenging to communicate to society. An understanding of science is fundamental to appreciating the forces that produce climate change and the effect of changing climate on different regions of the world.

However, science education is not available to everyone and scientists and educators, in general, lack sufficient capability to translate sciences to lay audiences. This situation makes it difficult for people to become informed or

educated about climate science. As a consequence, society lacks the knowledge and skills to modify its behaviours to adapt to the effects, or mitigate, climate change. Greater awareness or knowledge about climate change may lead to a more engaged citizenry (Kahlor & Rosenthal, 2009), but only if special attention is directed to the cultural diversity of our audiences when tailoring messages aimed at generating a sense of urgency and being a cue to act (Kahan, Wittlin, Peters, Slovic, Larrimore Ouellette, Braman & Mandel, 2011). The sustainability of our society within an ever changing climate, regardless of the source of change, requires that we place climate science education, including education about climate change, on a level of education similar to that of the basic sciences, such as biology, chemistry, and physics. This is consistent with National Research Council's recommendation in its report on Informing an Effective Response to Climate Change (2010a) that the Federal Government should establish a national task force that includes formal and informal educators, government agencies, policymakers, business leaders, and scientists, among others, to set national goals and objectives, and to develop a co-ordinated strategy to improve climate change education and communication.

Another challenge worthy of mention is that climate change has emerged over the past two decades as an issue of global political and social significance. The issue was given political legitimacy by key figures like Thatcher in the late 1980s, and by the collaborative involvement of both political and scientific representatives in the production of the IPCC's reports.

Houghton (2004) suggests that:

The assessments have been owned by both groups, an important factor when it comes to policy negotiations; furthermore, scientific consensus has been of great importance in persuading politicians and policymakers to take seriously the problem of global warming and its impacts (p. 221).

The weight of scientific evidence demonstrating the reality of the threat from climate change was effectively a precondition for government commitment potentially to transform economies and human behaviour (O’Riordan & Rayner, 1991). Hamilton (2008) admits that public opinion about climate change is largely influenced by political preferences. Sometimes, it appears that political orientation is a stronger determinant of attitudes towards climate change than other demographic attributes. The politicisation of the debate on climate change has led members of the public to perceive it more as a matter of personal opinion or a political ideology, distracting attention from the known facts about climate change and the basic causes of those changes (Furman, Roncoli, Crane, Paz JO,& Hoogenboom, 2009). Consequently, there is an acute and demonstrable need to better educate and inform decision-makers and citizens in general on the most basic facts of climate change (Hassol, 2008), to develop a more climate science literate society.

There will be significant challenges to integrating in education the knowledge and skills required to respond to the impacts of climate change. The level of incorporation of climate change issues will vary greatly depending on the level of education, and the local and national contexts being addressed

(UNESCO, 2012). In primary education, for instance, a core concern is when to introduce the issue of climate change. This decision is important in order not to frighten children and young people, but to empower them to understand and critically engage with environmental change. In secondary education, tensions exist between a centralised curriculum and the need to promote locally based and locally appropriate knowledge (UNESCO, 2012).

Overloaded curricula frequently present additional challenges. Identification of the most appropriate issues and areas of knowledge will require cooperation between local, national and international actors. Educators at all levels will also need support and training to deliver quality education about complex, climate related topics in ways which are both relevant to local, environmental, social and political contexts, and which meet wider educational targets (e.g. literacy, numeracy, employability).

Furthermore, the chronic shortage of scientific knowledge and expertise around climate change and its impact in many developing countries are also a key concern for educators and policy makers at both secondary and tertiary levels. At present, climate change education is still a peripheral topic in both educational research and practice. In research literature, climate change education has been addressed almost exclusively as a domain of science education. Within the realm of practice, climate change is situated within environmental education and education for sustainable development, a minor theme within a peripheral area of the curriculum. Although the role of education in addressing the challenges of climate change is being increasingly recognised, the capacity of education to

contribute to adaptation and mitigation measures has yet to penetrate mainstream development thinking. In practical terms, the integration of climate knowledge and skills into existing education systems represents both immediate and longer-term challenges for responding to climate change. The immediate task is to climate proof education systems (adaptation), while the longer term call is to develop education systems that equip learners with the requisite skills, knowledge and attributes to deal with future challenges (UNESCO, 2012).

Lotz-Sisitka and Le Grange (2009) also point out that the empowerment view of climate change education (where people's empowerment to take actions) poses a far greater challenge to the field of education, as it is needed to foster action research with proactive response to the climate change. There is a stark contrast between the enormity of this task and the limited scale of current education for sustainable development projects around the world. The urgency and global nature of climate change reveal a pressing need to develop and strengthen education for sustainable development, which means that researchers, as well as practitioners and other education for sustainable development stakeholders, are faced with an important task in the coming years.

The over dependence on the scientific literature on climate change has given room for people in society to treat it as a science only issue which must be explained in the field of science education. This implies that those in the field of arts and humanities as well as lay persons in society are deprived of knowledge about climate change.

I am of the view that scientific knowledge that is discovered has implications on society, because scientific knowledge and facts are discovered in order to solve problems that confront humanity. This presupposes that scientific facts and knowledge about climate change must be made available to people in society. Education is seen as one of the key areas through which this can be achieved. There is, therefore, the need to structure a holistic curriculum that will demystify the myths surrounding scientific knowledge and facts about climate change and also cater for the varying needs and aspirations of learners and stakeholders in society.

The Social Studies curriculum with its integrative nature and place in the Ghanaian educational system I believe will more likely make a huge impact in transforming the knowledge base of learners, effect attitudinal change and provide requisite skills needed to combat climate change and its devastating impacts. That was one of the reasons why the researcher undertook this research to investigate whether the integrated Social Studies curriculum in Ghana has responded appropriately towards climate change education.

From the literature, schematic framework of anthropogenic climate change drivers, impacts and responses can be identified. The framework was adapted to explain the concept of climate change and its impact on both human and earth systems. In figure 2, it can be observed that climate change affects both Earth Systems and Human Systems.

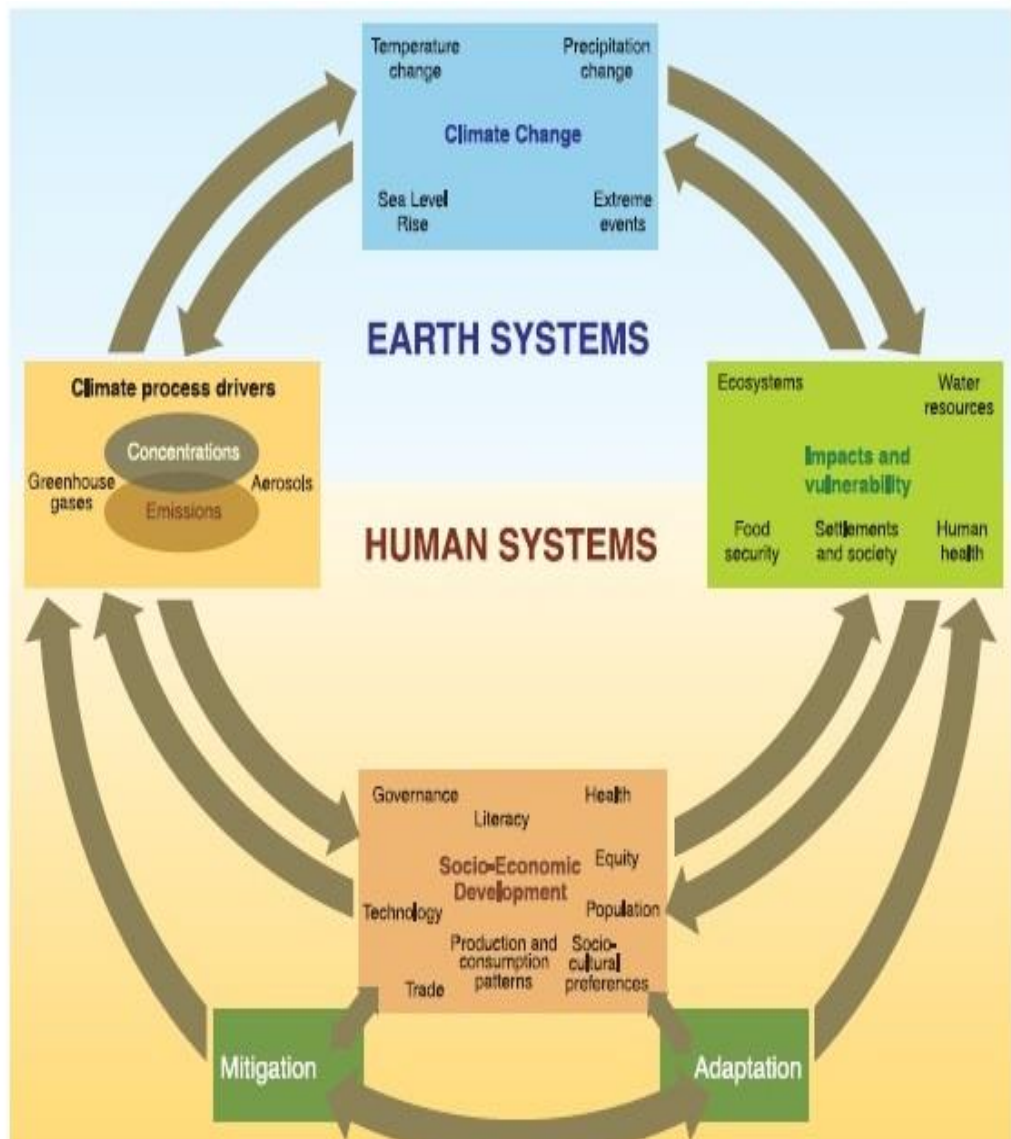


Figure 2: Schematic framework representing anthropogenic drivers, impacts of and responses to climate change and their linkages.

Source: IPCC, 2007

These are the ecosystems, water resources, settlements and society, food security and human health. The major climate process drivers include emissions and concentrations of Greenhouse gases and aerosols. These processes lead to changes in temperature and precipitation, rise in sea level as well as extreme events such as droughts, flooding, wildfire, insects, and ocean acidification. Socio-economic

development which improves the well-being of the human systems is greatly compromised. This is because climate change has an impact on governance, literacy, health, equity, technology, production and consumption patterns, trade as well as socio-cultural preferences.

This in effect implies that socio-economic development will experience a serious setback since more resources might be directed towards climate change adaptation and mitigation strategies. It is, therefore, evident from the framework that the two main ways through which these impacts can be minimised or dealt with are the adaptation and mitigation strategies. Societies can respond to climate change by adapting to its impact and by reducing greenhouse gas emissions (mitigation) thereby reducing the rate and magnitude of change (Climate Change Synthesis Report, 2007).

Theoretical Framework

Several theories have been postulated to explain the causes of climate change. From the literature, these theories can be grouped into two schools of thought. One school of thought argues that climate change can be related or attributed directly or indirectly to human activities. The second school of thought also attributes climate change to natural causes. Discussions on the theories of climate change were done in relation to the two schools of thought. Theories that support the human-induced causes include the Anthropogenic Global Warming Theory and the Human Forcing besides Green House Gases Theory.

A. Theories on Human-Induced Causes of Climate Change

(i) Anthropogenic Global Warming (AGW) Theory

The theory of climate change that most people are familiar with is commonly called anthropogenic (man-made) global warming (AGW). Leading advocates for this theory Al Gore, National Oceanic and Atmospheric Administration (NOAA) and Intergovernmental Panel on Climate Change (IPCC) contend that man-made greenhouse gases, primarily carbon dioxide, are the predominant cause of the global warming that occurred during the past 50 years. This theory of climate change contends that human emissions of greenhouse gases, principally carbon dioxide, methane, and nitrous oxide, are causing a catastrophic rise in global temperatures. The mechanism whereby this happens is called the enhanced greenhouse effect.

They aver that energy from the sun travels through space and reaches earth. Earth's atmosphere is mostly transparent to the incoming sunlight, allowing it to reach the planet's surface where some of it is absorbed and some is reflected back as heat out into the atmosphere. Certain gases in the atmosphere, called "greenhouse gases," absorb the outgoing reflected or internal thermal radiation, resulting in Earth's atmosphere becoming warmer than it otherwise might be. Water vapour is the major greenhouse gas, followed by carbon dioxide, methane and ozone. During the past century, human activities such as burning wood and fossil fuels and cutting down or burning forests are thought to have increased the concentration of carbon dioxide in the atmosphere by approximately 50 per cent (Al Gore, 2006).

Earth's climate also responds to several other types of external influences, such as variation in solar radiation and in the planet's orbit, but these "forcing," according to the proponents of AGW, cannot explain the rise in Earth's temperature over the past three decades. The forcing caused directly by man-made greenhouse gases is also small, but the AGW theory posits that positive feedbacks increase the effects of these gases between two- and four-fold. A small increase in temperature causes more evaporation, which places more water vapour in the atmosphere, which causes more warming. Global warming may also lead to less ice and snow cover, which would lead to more exposed ground and open water, which on average are less reflective than snow and ice and thus absorb more solar radiation, which would cause more warming. Warming also might trigger the release of methane from frozen peat bogs and carbon dioxide from the oceans.

Proponents of the AGW theory (Al Gore, NOAA and IPCC) believe man-made carbon dioxide is responsible for floods, droughts, severe weather, crop failures, species extinctions, spread of diseases, ocean coral bleaching, famines, and literally hundreds of other catastrophes. All these disasters will become more frequent and more severe as temperatures continue to rise, they say. Nothing less than large and rapid reductions in human emissions will save the planet from these catastrophic events (Bast, 2013).

(ii) Human Forcing Besides Green House Gases

The second theory of climate change which relates to the first school of thought is Human Forcing besides Green House Gases. Roger Pielke, a leading proponent of this theory, holds the view that mankind's greatest influence on

climate is not its greenhouse gas emissions, but its transformation of Earth's surface by clearing forests, irrigating deserts, and building cities. He observes that although the natural causes of climate variations and changes are undoubtedly important, the human influences are significant and involve a diverse range of first-order climate forcings, including, but not limited to, the human input of carbon dioxide (Pielke, 2009). Short descriptions of some of these "human forcings" other than greenhouse gases are as follows; cities tend to be warmer than suburbs, and suburbs warmer than rural areas, because they have greater concentrations of energy-producing machines and vehicles and large amounts of concrete, asphalt, and other building and road materials that absorb solar energy and then re-emit thermal energy. Advocates of the AGW theory falsely attribute higher temperatures caused by urban heat islands to rising atmospheric carbon dioxide levels (Pielke, 2009).

Anthropogenic aerosols and ozone have shorter lifetimes than greenhouse gases, and therefore their concentrations are higher in source regions and downwind. Pielke and colleagues estimate the effect of human aerosols on the gradient of radiative heating on regional scales "is on the order of 60 times that of the well-mixed greenhouse gases." With many surface-based temperature stations located in urban or near-urban areas, it is likely they are registering the warming effects of these aerosols and ozone, not carbon dioxide (Pielke, 2009).

Removing trees by burning, a common practice in developing countries releases carbon dioxide into the atmosphere and prevents forests from sequestering carbon in the future. The pasture or crop land that replaces the forest

lacks the shade created by a forest canopy and tends to be warmer. The IPCC has estimated that between one-quarter and one-third of anthropogenic carbon dioxide emissions are due to deforestation, not the burning of fossil fuels, though this estimate has been challenged as being too high (IPCC, 2007).

Anthropogenic activities in coastal areas such as logging, agriculture, construction, mining, drilling, dredging, and tourism all can increase or (more rarely) decrease surface temperatures of nearby bodies of water. For example, storm runoff from city streets following heavy rains can result in seawater dilution and temperature increases. Development can produce sediment that reduces stream flow and damages coral reefs by reducing the penetration of sunlight or by direct deposit on the coral, causing damage mistakenly attributed to global warming. Anyone living in or near a large city knows that jets often leave trails behind them, called contrails. Composed of water vapour, they precipitate the creation of low clouds that have a net warming effect. A study published in 2006 in the *International Journal of Climatology*, states that contrails in the United States may cause a net warming of the surface rivalling that of greenhouse gases and in certain regions, contrails already may contribute as much as the present anthropogenic carbon dioxide forcing on climate. Several of these “human forcings” have local and regional effects on climate equal to or even exceeding that of anthropogenic greenhouse gas emissions. This leaves little or no warming left to be explained by the AGW theory (Travis, Carleton & De Grand, 2007).

Unfortunately, as Pielke concludes, the IPCC in 2007 did not sufficiently acknowledge the importance of these other human climate forcings in altering

regional and global climate and their effects on predictability at the regional scale. It also placed too much emphasis on average global forcing from a limited set of human climate forcings (Pielke, 2009).

B. Theories on Natural Causes of Climate Change

The second school of thought, on the other hand, attributes causes of climate change to natural phenomena. Some of the theories advanced to explain their claims are Bio-thermostat, Cloud Formation and Albedo, Ocean Currents, Planetary Motion and Solar Variability. Leading advocates of these theories are Idso and Singer (2009), Gray (2009), Lindzen, Chou and Hou (2001), Sciare, Mihalopoulos and Dentener (2000). These theories emerged as a reaction to the continuous dominance of the Anthropogenic Global Warming theory in almost all climate change debates. The proponents of these theories sought to highlight and open other gates to the discussions on climate change.

(i) Bio - Thermostat Theory

The bio-thermostat theory of climate change holds that negative feedbacks from biological and chemical processes entirely or almost entirely offset whatever positive feedbacks might be caused by rising carbon dioxide. These processes act as a “global bio-thermostat” keeping temperatures in equilibrium. The scientific literature contains evidence of at least eight such feedbacks as Carbon Sequestration, Carbonyl Sulphide, Diffuse Light, Iodocompounds, Dimethyl Sulphide, and other Aerosols (Idso & Singer, 2009).

Increased carbon sequestration by plants is perhaps the best-known consequence of the rise in atmospheric carbon dioxide (Idso & Singer, 2009). The

productivity of most plants is enhanced because carbon dioxide is the primary raw material utilised by plants to construct their tissues. The more carbon dioxide there is in the air, the better plants grow and the more carbon dioxide they remove from the air and store in their leaves, branches, trunks, and roots, as well as in the soil beneath the plants—a suite of processes called “sequestration.” Higher temperatures also tend to increase carbon sequestration rates. Sequestration offsets some of the temperature-increasing power of higher levels of carbon dioxide

Carbonyl sulphide (COS) is also a biologically produced sulphur gas emitted from soils. Carbonyl sulphide eventually makes its way into the stratosphere where it is transformed into sulphate aerosol particles, which reflect solar radiation back into space, producing a cooling effect on Earth’s climate. The rate at which COS is emitted increases as vegetation responds to the on-going rise in the air’s carbon dioxide content, meaning it is another negative feedback. The latest research indicates that the COS-induced cooling mechanism also operates at sea, as higher carbon dioxide and temperatures increase surface-water chlorophyll concentrations (Idso & Singer, 2009).

A third negative feedback phenomenon is diffuse light. As higher levels of carbon dioxide promote greater plant productivity, plants emit greater amounts of gases converted into aerosols called “biosols.” Biosols in turn act as cloud condensation nuclei, helping to create new clouds that reflect more incoming solar radiation back to space, thereby cooling the planet. More than that, they diffuse solar radiation close to the ground, reducing shade under plant canopies and

thereby enhancing photosynthesis, which increases the amount of carbon dioxide plants absorb from the air and can sequester (Idso & Singer, 2009).

Iodinated compounds, or Iodocompounds, are particles formed in sea air from iodine-containing vapours emitted by marine algae. These compounds, like the biosols previously discussed, help create clouds, which reduce the amount of solar radiation reaching the surface. Also like biosols, the creation of Iodocompounds is stimulated by rising carbon dioxide levels and warmer temperatures. A study published in *Nature* in 2002, alerts that emission of Iodocompounds from marine biota can increase by up to five times as a result of changes in environmental conditions associated with global change. A change of this magnitude can lead to an increase in global radiative forcing similar in magnitude, but opposite in sign, to the forcing induced by greenhouse gases (Idso & Singer, 2009).

The amount of biologic Dimethyl sulphide (DMS) emitted by the world's oceans is closely related to sea surface temperature: the higher the sea surface temperature, the greater the sea-to-air flux of DMS. Dimethyl sulphide is a major source of cloud condensation nuclei, which generate clouds with greater cloud albedo. The greater the cloud albedo, the more incoming solar radiation gets blocked and reflected out to space. A study published in the *Journal of Geophysical Research* in 2000 found that a sea surface temperature increase of only 1°C was sufficient to increase the atmospheric DMS concentration by 50 per cent. The warming typically predicted to accompany a doubling of the air's carbon dioxide content would increase the atmosphere's DMS concentration by a

factor of three or more, providing what the study's authors call a "very important" negative feedback that could potentially offset the original impetus for warming. The effects of this process are not incorporated into today's state-of-the-art climate models.

There are many other kinds of aerosols, which scientists classify as marine biological, terrestrial biological, anthropogenic non-biological, and natural non-biological. Many of them are created, distributed, or destroyed in biological and chemical processes that tend to be counter-cyclical to the forcing of carbon dioxide. When carbon dioxide is plentiful or when temperatures rise, these aerosols tend to increase in presence and reflect more solar radiation away from the planet's surface, causing it to cool. The IPCC gives short shrift to the extensive scientific literature on aerosols, estimating their net effect to be just a small fraction of that of carbon dioxide.

However, a literature survey conducted by Idso and Singer (2009) indicates the IPCC's estimate is far too low. Many studies suggest the cumulative negative forcing of aerosols is large enough to completely offset the positive forcing due to rising atmospheric carbon dioxide. Some of these individual negative feedbacks may be sufficiently large to counter much of the effect of higher levels of carbon dioxide on global temperatures. They constitute a bio-thermostat keeping Earth's temperature relatively stable. This would mean rising carbon dioxide would not cause catastrophic global warming.

(ii) Cloud Formation and Albedo

Another theory of climate change postulates that changes in the formation and albedo of clouds create negative feedbacks that cancel out all or nearly all of the warming effect of higher levels of carbon dioxide. This theory is based largely on observational data reported by a series of researchers, rather than computer models as in the case of the AGW theory (Yogesh, 1999).

Sud (1999) a NASA scientist, and his colleagues found that changes in cloud coverage in the tropics acted as a natural thermostat to keep Sea Surface Temperature (SST) between approximately 28°C and 30°C. Their analysis suggested that as SSTs rise, air at the base of the clouds is charged with the moist static energy needed for clouds to reach the upper troposphere, at which point the cloud cover reduces the amount of solar radiation received at the surface of the sea and cool and dry downdrafts promote ocean surface cooling.

Lindzen (2001), a professor of meteorology at Massachusetts Institute of Technology (MIT), and colleagues examined upper-level cloudiness data and SST data and discovered a strong inverse relationship between upper-level cloud area and the mean SST of cloudy regions of the eastern part of the Western Pacific. The area of cirrus cloud coverage decreased about 22 per cent for each 1°C increase in SST. Lindzen, Chou and Hou (2001), aver that the cloudy-moist region appears to act as an infrared adaptive iris that opens up and closes down the regions free of upper-level clouds, which more effectively permit infrared cooling, in such a manner as to resist changes in tropical surface temperature. The sensitivity of this negative feedback was calculated by Lindzen et al. to be so

substantial that it would more than cancel all the positive feedbacks in the more sensitive current climate models.

(iii) The Ocean Currents Theory

Gray (2009), a leading proponent of this theory explains that global temperature variations over the past century-and-a-half, and particularly the past 30 years, were due to the slow-down of the ocean's Thermohaline Circulation (THC). Ocean water is constantly transferred from the surface mixed layer to the interior ocean through a process called ventilation. The ocean fully ventilates itself every 1,000 to 2,000 years through a polar region (Atlantic and Antarctic) deep ocean subsidence of cold-saline water and a compensating upwelling of warmer less saline water in the tropics. This deep ocean circulation, called the Meridional Overturning Circulation (MOC), has two parts, the primary Atlantic Thermohaline Circulation (THC) and the secondary Surrounding Antarctica Subsidence (SAS). A slowdown of the global THC circulation occurs due to Atlantic Ocean salinity decreases. This brings about a few decades of reduction in Antarctic deep-water formation.

Gray (2009) admits that changes of the Meridional Overturning Circulation (MOC) since 1995 led to the cessation of global warming since the 1998-2001 period and triggered the beginning of a weak global cooling trend since 2001. Gray projects this weak cooling to continue for the next couple of decades.

(iv) The Planetary Motion Theory

The Planetary Motion theory of climate change contends that most or all of the warming of the latter part of the twentieth century can be explained by natural gravitational and magnetic oscillations of the solar system induced by the planet's movement through space. These oscillations modulate solar variations and/or other extra-terrestrial influences of Earth, which then drive climate change (Bast, 2013). Earth's orbit around the sun takes the form of an ellipse, not a circle, with the planet passing farther away from the sun at one end of the orbit than at the other end. The closest approach of the planet to the sun is called "perihelion" and the farthest is called "aphelion." Perihelion now occurs in January, making northern hemisphere winters slightly milder. The change in timing of perihelion is known as the precession of the equinoxes, and it occurs every 22,000 years.

The shape or "eccentricity" of Earth's orbit also varies on cycles of 100,000 and 400,000 years due to the tug of other planets, specifically Jupiter and Saturn, on Earth. It shifts from a short broad ellipse that keeps Earth closer to the sun, to a long flat ellipse that allows it to move farther from the sun and back again (Scafetta, 2009).

Earth also spins around an axis that tilts lower and then higher during a 41,000-year cycle. More "tilt" roughly means warmer northern hemisphere summers and colder winters; less "tilt" means cooler summers and milder winters. The coincidence of these cycles is known to lead, with the help of positive climatic feedbacks such as water vapour, to the cooling and warming periods we recognise from historical data as Ice Ages and Interglacial Periods. Scientists now

know that the precession of Earth's orbit means that about 11,000 years from now, the northern midwinter will fall in July instead of January, and the continental glaciers may return.

Variations in the earth's movement around the sun changes climate in two main ways: the varying tidal gravitational and magnetic forces of the planets on the sun, in particular of Jupiter and Saturn, modulate solar activity and then solar variations modulate the terrestrial climate and secondly, the varying gravitational and magnetic fields generated by the movement of Jupiter and Saturn modulate some terrestrial orbital parameters, for example the spinning of Earth better known as the "length of the day" (LOD), which then drives the ocean oscillations and, consequently, the climate (Scafetta, 2009).

(v) Solar Variability Theory

The last view of climate change related to the second school of thought postulates that solar variability accounts for most or all of the warming in the late twentieth century and will dominate climate in the twenty-first century regardless of man-made greenhouse gas emissions. Active mixing of gases on the near-surface of the Sun, denoted by changes in the number of sunspots, causes changes in the radiant energy emitted by the sun in cycles of roughly 11, 87, and 210 years. There is evidence that Earth's climate warms and cools in synchrony with these cycles. Solar flares, which are bursts of energetic particles and radiation from the surface of the Sun, can work additively. These events cause an out-flowing of charged particles - called "solar wind" - that reaches Earth and its atmosphere. Solar wind affects galactic cosmic rays, which in turn affect cloud

formation. Changes in cloud formation are linked to variations in sea surface temperatures, wind patterns, and the oceans' Thermohaline circulation. This factor is especially important during periods of solar activity minima because of the least resistance to incoming cosmic rays imposed by the solar wind (Bast, 2013).

Models of Curriculum Evaluation

Several models of curriculum evaluation exist in the literature. Curriculum evaluation has two elements which demands explanation - curriculum and evaluation. Stenhouse (1976) asserts that a curriculum is an attempt to communicate the essential principles and features of an educational proposal in such a form that is opened to critical scrutiny and capable of effective translation into practice. Evaluation in education is the process of judging the worth of an educational programme or instruction in relation to an evaluation instrument or criteria.

Stufflebeam, Foley, Guba, Hammond, Merriman, and Provus (1971) aver that "educational evaluation is the process of delineating, obtaining and providing useful information for judging decision alternatives" (p. 43). In a similar vein, MacDonald (1973) quoted in Stenhouse (1975) says, "evaluation is the process of conceiving, obtaining and communicating information for the guidance of educational decision making with regard to specified programme" (p. 112). It can be observed from the definitions above that curriculum evaluation is a process of gathering data about an educational programme or instruction and using set

criteria to judge the worthiness of the programme or instruction with the aim of improving educational practice.

It is difficult to get a single correct way to conduct an evaluation in education. This has given rise to several models of curriculum evaluation in education. Some of these evaluation models worthy of mention are: objectives-based evaluation, formative and summative evaluation, decision-oriented evaluation, goal-free evaluation, responsive evaluation, and illuminative evaluation among others. The evaluation model to use depends to a large extent on the goals and objectives of what is to be evaluated. This research was based on the decision-oriented evaluation.

Borich (1991) aver that decision-oriented evaluation is a process that produces information for selecting among alternative courses of action. He states: “An evaluation is decision-oriented if it services a decision, implies a choice among alternatives, and is used in committing resources for the next interval of time before another is to be made” (p. 414). Stufflebeam et al, (1971) whose work represented one of the first attempts to consider evaluation from a decision perspective, in their Context, Input, Process and Product (CIPP) model of evaluation, identify four types of evaluation for different educational decisions. This evaluation model requires the evaluation of context, input, process and product in judging a programme’s value.

The context evaluation helps to identify needs, set objectives and plan or choose strategies for achieving the objectives; input evaluation serves structural decisions by projecting and analysing procedural designs; process evaluation

which is also a programme monitoring activity to detect procedural or design defects is a record of the actual implementation process; and product evaluation identifies and assess programme attainments and also provides decisions on the continuation, modification or termination of the programme.

CIPP model of evaluation is a decision-focused approach to evaluation and emphasises the systematic provision of information for programme management and operation. In this approach, information is seen as most valuable when it helps programme managers to make better decisions, so evaluation activities should be planned to coordinate with the decision needs of programme staff. In this regard, data collection and reporting are then undertaken in order to promote more effective programme management. Since programmes change as they are implemented, decision makers need could change so the evaluation activities have to adapt to meet these changing needs as well as ensuring continuity of focus where appropriate in order to trace development and performance over time.

The CIPP framework was developed as a means of linking evaluation with programme decision making. It aims to provide an analytic and rational basis for programme decision-making, based on a cycle of planning, structuring, implementing and reviewing and revising decisions, each examined through a different aspect of evaluation -context, input, process and product evaluation.

Stufflebeam viewed evaluation in terms of the types of decisions it served and categorised it according to its functional role within a system of planned social change. The CIPP model is an attempt to make evaluation directly relevant to the

needs of decision-makers during the different phases and activities of a programme. In the CIPP approach, in order for an evaluation to be useful, it must address those questions which key decision-makers are asking, and must address the questions in ways and language that decision-makers will easily understand. The approach aims to involve the decision-makers in the evaluation planning process as a way of increasing the likelihood of the evaluation findings having relevance and being used. Stufflebeam thought that evaluation should be a process of delineating, obtaining and providing useful information to decision-makers, with the overall goal of programme or project improvement.

In a similar vein, decision-oriented view of evaluation can be found in the work of Alkin (1969) who emphasised the notion that the evaluator's most important function is to report summary data to the decision maker in the form of practical and clear statements about what alternative course of action should be taken.

Climate change is an on-going global phenomenon which poses a serious threat to mankind. Due to its devastating impact, it has become necessary for curriculum of schools to respond appropriately to curb this menace. The CIPP model of curriculum evaluation upon which this research was based deals with a cycle of planning, structuring, implementing and reviewing and revising decisions, each examined through a different aspect of evaluation -context, input, process and product evaluation. This implies, in evaluating the Social Studies curriculum response to climate change, one needs to look at the programme objectives and needs of society, take a critical look at the structure of institutions,

as well as the implementers of the curriculum and examine the extent to which Social Studies education has responded appropriately in churning out students who are climate sensitive in character. This is because programme evaluation is a systematic collection of information about the activities, characteristics, and outcome of programmes for use by specific people to reduce uncertainties, improve effectiveness, and make decisions with regard to what those programmes are doing and affecting (Patton, 1986).

Empirical Review

Several studies have been conducted to find out how global climate has changed and how the curriculum of schools in the world has responded to this global threat.

A survey was conducted by Adedayo, Mudasiru and Saheed (2012) in Nigeria to find out the perceptions of teachers and students on climate change and the implications for curriculum development. The rationale for the study stemmed out from their observation that climate change is one of the pressing issues of our time. Thus, if humanity is to respond to the challenges posed by climate change, education which is the process of developing individuals and the society has crucial role to play.

The study was carried out to examine the perceptions of teachers and students of secondary schools in South Western States of Nigeria about climate change. Random sampling technique was used to select 1000 students and 500 teachers from the region. Data were collected using questionnaire. The data

collected were analysed and presented using frequency counts, percentages and t-test statistical techniques.

The results showed that majority (84%) of the teachers were aware of climate change; while majority (69%) of the students indicated low awareness of the phenomenon. There was significant difference between teachers' and students' perceptions of climate change (t - value = 4.74, $p \leq .05$; $df = 1498$) as teachers were more aware (mean = 121) about climate change than the students (mean = 116). There was significant difference between male and female perception of climate change (t - value = 6.04, $p \leq .05$; $df = 1498$). Based on the findings, it was recommended, among others, that: climate change should be introduced into the basic education curriculum while programme on climate change should be introduced into teacher education studies. However, the study did not consider the challenges that would emerge as a result of introducing topics on climate change into the curriculum. Also, the study failed to find out how the curriculum responds to climate change.

Another study was conducted by Alice and Abdulraheem (2012) on "Creating Climate Change Awareness on the Nigerian Citizens: Challenges for Social Studies Curriculum Planners and Implementers". They found that the impact of climate change include floods, landslides, drought and famine. For this reason, they observed that as weather becomes fiercer and storms increase in frequency and intensity, serious socio-economic consequences result. Malnutrition and disease become common occurrences. Despite these multi-

various impact of climate change, the biggest obstacle is the lack of its awareness and knowledge and that Nigerians need to be educated and informed about it.

The researchers suggested that to tackle climate change and its attendant effects has to be from the early stage in school, right from the elementary to the highest level. Since climate is not restricted to any particular discipline, and the fact that Social Studies is a problem solving subject whose contents are derived from different areas, to tackle the problems which man is facing in his environments, its curriculum should be enlarged to include vital aspects of climate change. However, doing this would pose some challenges to the developers and the implementers of the Social Studies curriculum. The Social Studies curriculum developers should enlarge the contents of the curriculum while the teachers should be saddled with the responsibilities of teaching climate change and its impact and specific impact on Nigeria, its knowledge and awareness by Nigerians and how the Nigerian citizens can be made aware of its effect and what the Social Studies curriculum planners and implementers should do to face the challenges. The study failed to find out how the curriculum responds to climate change which is one of the vital areas to deal with if the problem of climate change is to be addressed.

Furthermore, Buadi (2012) conducted a study on the topic “Curriculum Response to Climate Change and Development.”He indicated that in recent times there have been several unusual experiences about the climate in Ghana. These include: floods, rainstorms and an unusual heat in the atmosphere. Scientists

attempt explanations and point to the fact that the occurrences are due to climate change phenomenon.

The paper examined what climate change is and the challenges it brings upon the environment and its humans. The paper observed that the development of every nation depends, to a large extent, on the climatic conditions of the place since such conditions can affect whatever things people do. Negative climatic conditions like prolonged drought, incessant rainstorms and floods can draw back societal development. Since climate change brings along with it devastating experiences like excessive heat, rainstorms and consequent health hazards, it behoves every nation to study the characteristics of climate change so as to know its consequences and get ready to mitigate the negative effects.

The paper proposes that Ghana's primary, secondary and tertiary school curriculum can assist in disseminating the characteristics of climate change phenomenon. The curriculum, which is the set of courses, course work and content offered at a school or university in Ghana's educational system should include studies on climate change so as to help learners, who are the future policy makers, to understand the phenomenon of climate change and how to deal with its challenges. This will enable them to further prepare themselves to mitigate the negative consequences of climate change. Recommendations were made as to how the modification in the school curriculum can be effected in Ghana, in particular, and in the West African sub-region as a whole. The study can be criticised on grounds that it did not highlight the causes of climate change which is one of the fundamental ways to address climate change.

Boadu and Oden (2012) carried out a study on Climate Change and Development in Ghana: Implications for curriculum Innovation in Senior High School Social Studies and Language Arts Curricula. They realised that climate change is a global phenomenon which has been largely attributed to the activities of man in the biosphere. It has equally brought about grave consequences in the human ecosystem and thus requires mitigation measures if man's survival in the environment as well as his quality of life are to be assured.

The researchers thus examined the concept of climate change, its effects on humans and the environment and the various actions that have been taken globally to meet the challenge. They further analysed the contents of both the Social Studies and language arts curricula for SHS in Ghana to determine the extent to which they are capable of advancing knowledge and skills on climate related issues. While the Social Studies curriculum was found to reflect environment related topics to some extent, the language arts curriculum was found not to reflect any.

Based on these findings, the researchers recommended that climate change education be integrated into both curricular, using either the interdisciplinary, multidisciplinary and trans-disciplinary approach. While they advocated for inclusion of more climate related topics into the Social Studies curriculum, the researchers called for the use of climate related topics in the teaching of language and literary based skills. On the contrary, the study fell short of the causes of climate change which is the root of the problem. Again, it failed to deal with how

the Social Studies and language arts curriculum have responded to climate change.

In addition, Daniel and Emmanuel (2012) also conducted a study on the topic “Profile of Temperature Changes and Rainfall Patterns in Ghana from 1931 to 2007”. The study was to provide evidence of climate change in Ghana by analysing available rainfall and temperature records of mean monthly minimum and maximum temperature data for Kumasi, Accra and Navrongo synoptic stations. They were analysed for 30 years periods interval, 1931-1960, 1961-1990 and 1991-2007. Comparisons were made in order to determine the differences in climate statistics between the three periods reflecting global warming.

In general, there had been significant increase in temperatures from January to December over the period of study, although not all the districts showed an increasing temperature pattern. From the records, there had been an average increase of 1.1 °C, 0.8 °C and 1.2 °C in maximum temperatures from 1961 – 1990 to 1991 – 2007 for Navrongo, Accra and Kumasi respectively. There was a significant reduction in annual rainfall in some months, while others had increases. Generally, there was a significant increasing trend in maximum temperatures. Temperatures rose to their absolute peak in March and April, and dropped to their lowest in August. These changing trends have had serious effects on agriculture practices and disease vector distribution. A regression analysis to establish the relationship between rising temperatures and rainfall showed that when temperatures increased, there were reductions in amount of rainfall. The coefficients of determination (R^2), for the equation in some synoptic stations were

quite high. The high R^2 value from the regression equation of Accra indicates that higher temperatures could result in lower rainfall amounts. Despite the fact that the study had revealed an evidence of rising temperatures and fall in rainfall statistics in Ghana indicating climate change, it did not tackle the causes of climate change as well as how the curriculum can respond to climate change. Added to this, it failed to put in the picture the challenges that the curriculum would face in responding to climate change.

Summary of the Review of Related Literature

The literature review highlighted issues that border on the conceptual framework which dealt with the concept curriculum, climate, Social Studies teachers understanding of climate change, Social Studies teacher's perception of the causes of climate change, the extent to which Social Studies curriculum has responded to climate change and challenges Social Studies curriculum faces in responding to climate change.

The theories that underpin the concept of climate change have been discussed. It was observed that these theories can be grouped into two schools of thought based on their line of argument in explaining the causes of climate change. One school of thought argues that climate change is caused by human activities. The theories which are in favour of the human-induced climate change are the Anthropogenic Global warming theory and Human Forcing besides Green House Gases theory. The second school of thought also argues that climate change is caused by natural processes. Some of the theories advanced in line with

their claim are bio-thermostat, cloud formation and albedo, ocean currents, planetary motion and solar variability.

Models of curriculum evaluation have been reviewed. It has been emphasised that it is difficult to get a single correct way to conduct an evaluation in education. This has given rise to several models of curriculum evaluation in education. Some of these evaluation models worth noting are: objectives-based evaluation, countenance evaluation, formative and summative evaluation, decision-oriented evaluation, goal-free evaluation, responsive evaluation, and illuminative evaluation among others. The evaluation model to use depends to a large extent on the goals and objectives of what is to be evaluated. This research was based on decision-oriented evaluation. Decision-oriented evaluation is a process that produces information for selecting among alternative courses of action. An evaluation is decision-oriented if it services a decision, implies a choice among alternatives, and is used in committing resources for the next interval of time before another is to be made. This evaluation model requires the evaluation of context, input, process and product in judging a programme's value. The ultimate aim is to provide an analytic and rational basis for programme decision-making, based on a cycle of planning, structuring, implementing and reviewing and revising decisions, each examined through a different aspect of evaluation -context, input, process and product evaluation.

Several studies have been conducted to find out how global climate has changed and how the curriculum of schools in the world has responded to this global threat. It is evident from these studies that several countries in the world

have made positive strides in incorporating and utilising the principles of Education for Sustainable Development to structure a curriculum response to combat climate change. This research sought to find out curriculum efforts that Ghana has made to curb this global menace.

CHAPTER THREE

METHODOLOGY

An Overview

This chapter deals with the methodology of the study. The areas considered under the methodology include the research design, population, sample and sampling procedure, instrument, data collection procedure and data analysis. The chapter three explains in detail, the research design adopted for the study, the target population and the extent to which the population is relevant for the research, how the sample was taken from the population as well as the design of instruments, data collection procedures and how it was analysed.

Research Design

The descriptive design was used for the study. Many educational research methods are descriptive; that is, they set out to describe and to interpret what is. Gay (1992) also affirms that descriptive research design involves collecting data in order to test hypothesis or answer research questions concerning the current status of the subject of the study. Descriptive research is typically identifiable as having some inherent characteristics. The researchers conducting descriptive research use a pre-established instrument to collect data. Also, while survey responses can vary from quantitative (quantitative research is research in which numerical data is collected) to qualitative (qualitative research is research in

which narrative or visual data is collected to describe social settings (Slavin, 2007)) in nature, they are typically quantitative and are summarised in accordance to quantitative analyses. More so, descriptive design was used because it is comparatively quick and cheap to conduct and administer (Krejcie & Morgan, 1970). Given that this research is aimed at “determining and reporting” (Amedahe & Gyimah, 2005, p. 136) and also interpreting information on the current knowledge base of Social Studies teachers on climate change, descriptive survey was the most convenient research design to use. It was my hope to examine the current status of the phenomena under study. That is, the teacher’s views on the extent to which Social Studies education responds to climate change, hence the use of descriptive design. It was my objective also to provide “accurate description and interpretation of the activities, objects, processes and persons” (Amedahe, 2002, as cited in Amedahe and Gyimah, 2005, p. 136) related to the issues of climate change. Descriptive research is significant as surveys abound in educational research and are utilised by many researchers as an investigative tool to collect data in order to address educational questions (Gay, Mills, & Airasian, 2006). However, Critics of descriptive research typically point out that the quality of descriptive research is often vulnerable to poor planning, poor implementation of research methods, and poor development of research instruments (Gay, et al., 2006).

Population

The population is said to be the target group about which the researcher is interested in gaining information and drawing conclusions. Population in research

refers to the aggregate or totality of objects or individuals regarding which inferences are to be made in a sampling study (Seidu, 2007). The population for this study consisted of all Social Studies teachers in selected Senior High Schools (SHS) in the Cape Coast Metropolis during the period of the study. Since the respondents involved in census surveys are all the members of a given population, the data is more comprehensive as it represents the views of everybody in the population. In all, 79 Social Studies teachers in 10 public Senior High Schools (SHS) in the Cape Coast Metropolis made up the population for the study.

Sample and Sampling Procedure

Kumekpor (2002) explains sampling as the use of definite procedure in the selection of a part for the express purpose of obtaining from its description or estimates certain properties and characteristics of the whole. Sampling is the process of selecting a representative unit from a population. Sample as used in this work is a small proportion of the population selected for the study. It is the selected subject of the whole which is being used to represent the population (Seidu, 2007), so that the results could be generalised to the whole population from which the sample is selected. All the Social Studies teachers numbering 79 in SHS in the Cape Coast Metropolis were selected (census) for the study because of their number. Census as used in this work implies collection of data from a whole population rather than just a sample. One of the advantages of census surveys over the other types of surveys is accuracy. However, it has been criticised for being time consuming. In all, 79 teachers were used for the study.

Instruments

Questionnaire is a form of enquiry document which contains a systematically compiled and well organised series of questions intended to elicit information which will provide insight into the nature of the problem under study (Seidu, 2007). The main data collection instrument was a self-developed questionnaire which consisted of five sections. Section A consisted of personal data which in effect highlighted the level of experience of the respondents as well as gender variation while sections B, C, D, and E catered for the teacher's understanding of climate change, the causes of climate change as perceived by teachers, Social Studies curriculum responses to climate change, and the challenges Social Studies education faces in responding to climate change respectively.

The close and open-ended types of questionnaire were employed for the study. The open-ended questions gave the Social Studies teachers the opportunity to express their views on issues that they wished to comment on. The questionnaire enabled me to cover all the Social Studies teachers in the public senior high schools in the Cape Coast Metropolis. It also gave me the opportunity to interact with the respondents more easily. Added to this, the questionnaire was appropriate for the study since in the views of McMillan and Schumacher (2001) a questionnaire is recommended if the researcher knows that the respondents will be able to read, understand and answer the questionnaire. However, it was time consuming to use questionnaire to gather data in the public senior high schools in the Cape Coast Metropolis. In some instances the teachers misplaced their

questionnaires and had to be replaced. Due to regular visits and upon some persuasions I was able to retrieve the questionnaires sent out. It delayed the time of retrieval.

Validity and Reliability of the Instruments: To ensure that the instruments were valid and reliable, I gave them to my supervisors for their perusal and approval. The supervisors ascertained that face validity and content validity have been met. They suggested that certain corrections and changes be made in order to improve upon the instruments.

A pilot test of the questionnaire was conducted using 16 Social Studies teachers drawn from University Practice SHS, Efutu SHS Wesley Girls SHS and Academy of Christ the King SHS. It was revealed in the pilot study that some of the questions appeared ambiguous and teachers had difficulty in responding to them. Those statements were later reframed to make them more comprehensible.

The data gathered were coded into themes and transferred onto Statistical Product for Service Solutions (SPSS) to analyse the data. The reliability was tested and found to be reliable as maintained by Fraenkel and Wallen (2000) that if the co-efficient alpha value is .70 and above then the instrument is reliable and of good quality for collecting useful data for the study. The Cronbach's alpha of .88 was established for all sections of the questionnaire. Thus, the questionnaire was of good quality for collecting useful data for the study.

Data Collection Procedure

The various schools were contacted by the researcher first to seek the consent of the headteachers and the teachers (target population) for the study.

This was done through introductory letters (see Appendix A) which were sent from the Department of Arts and Social Sciences Education in the University of Cape Coast. The data were collected within one month two weeks (from the first week of October to the second week in November, 2013). After the questionnaire was tested for validity and reliability, they were administered to the targeted population. Each school was separately contacted to arrange on appropriate time to administer the questionnaire.

The questionnaires were distributed personally and respondents were allowed ample time to complete so that it could be retrieved easily for the purposes of analysis. This was to ensure accuracy in data gathering and to achieve very high return rate (and indeed, the return rate was 100%).

Data Analysis

According to Glass and Hopkins (1996), descriptive statistics involves tabulating, depicting, and describing collections of data. The large masses of data collected would undergo a process of summarisation or reduction before they would become comprehensible.

The data were organised into various themes and categories (four themes) based on the research questions and the purpose of the study such that each section provide answers for each of the research questions. Prior to coding and tabulating the questionnaire for analysis, I checked all the items to see if instructions had been followed uniformly and whether all items had been responded to. The response to the questionnaires were then coded by assigning

numbers to the various categories of responses for the purposes of analyses and were transferred to Statistical Package for Social Sciences (SPSS version 16).

The analyses were done based on frequencies and percentages for all the questions based on the objectives of the study. Views reflecting high frequencies and percentages were treated as the emerging opinion on the topic. I used frequencies and percentages because it gives a quick visual impression of the phenomena under study and are also easy to interpret.

CHAPTER FOUR

RESULTS AND DISCUSSION

Climate change is one of the contemporary environmental challenges of the world (United Nations, 2009). It does not matter where it is caused: the effect is phenomenal. Education, formal or informal, is a major factor that can help nib the causes of climate change in the bud and to prevent its negative impact. The most efficient way to formally impart the knowledge about the causes and effects of climate change into the citizens, especially the youth, is to get it into the school curriculum. In Ghana, the subject that is better poised to offer this kind of education at the Senior High School (SHS) level is the Social Studies curriculum.

This study was, thus, conducted to find out the extent to which the Social Studies curriculum responds to climate change. To do this, a questionnaire designed in Likert-type scale was used to collect data from 79 Social Studies teachers in public senior high schools in the Cape Coast Metropolis. The data collected was analyzed and discussed using frequencies and percentages. The results have been presented in the tables according to the four research questions posed. However, Tables 1, 2 and 3 carry some essential introductory information about the respondents.

Introductory Information about Respondents

For a teacher to effectively assess the extent to which the Social Studies syllabus responds to climate change, his/her experience in the teaching of the subject is very vital. In view of this, they were asked to indicate the number of years that they had taught Social Studies in their teaching career. Table 1 presents the results.

Table 1: Number of years of Teaching Social Studies

Year Range	No.	%
less than 6yrs	12	15
6 to 10yrs	45	57
11 to 15yrs	16	20
16yrs and above	6	8
Total	79	100

Source: Field data, 2014

It is evidenced from the responses in Table 1 that majority (85%) of the teachers had taught for a minimum of six years. This clearly shows that the teachers were experienced as maintained by Gatbonton (1999) that most commonly, studies identify experienced teachers as those who have approximately five years or more of classroom experience. This presupposes that in terms of number of years, if one works in a particular field of endeavour for five years, all other things being equal, it means the person is experienced. Bivona's (2002) study of K-12 teachers' attitudes found that teachers with more than 10 years of experience had more positive attitudes toward teaching than did

less experienced teachers. By their experience, it can be inferred that their responses to the items on the questionnaire were out of their experience in handling Social Studies over the years. Their experience in teaching from the syllabus is invaluable in assessing the extent to which the curriculum responds to climate change. An impression which seemed to exist prior to this study was that teachers had ignored the current syllabus (2010) insisting that there is no difference in the current and the previous one (the 4-year one). Thus, a provision was made in the questionnaire to find out from the teachers whether they have copies of the new syllabus. Table 2 has the distribution of the results.

Table 2: Teachers’ Possession of Current Syllabus (2010)

Statement	Response	
	No.	%
I have a copy of the SHS Social Studies syllabus		
Yes, I have the current one	73	92
Yes but is not the current one	3	4
Yes but don’t know its whereabouts	1	1
No, I don’t have	2	3
Total	79	100

Source: Field data, 2014

Responses in Table 2 debunk the earlier impression that teachers refused to obtain copies of the current syllabus. This is because 73 (92%) of the teachers had copies of the current syllabus signifying that their responses were the reflection of how the current syllabus responds to climate change.

In curriculum innovation or reform, experienced teachers’ knowledge or contributions are usually found to be useful. However, as shown in Table 3, the

majority, that is, 66 (84%) of these experienced teachers had never participated in the development of any of the Social Studies curriculum.

Table 3: Participation in Curriculum Development

Statement	Response		Total
	Yes No. (%)	No No. (%)	
Have you ever contributed to the development of the Social Studies curriculum or syllabus?	13 (16)	66 (84)	79(100)

Source: Field data, 2014

From Table 3 it can be observed that as teachers with much experience in the field of Social Studies education, climate change should be one of the important phenomena that should be of concern to them since the subject hinges on man and his environment. However, their level of experience may have nothing to do with the extent to which Social Studies curriculum responds to climate change and for that matter their level of understanding of the meaning of climate change. For this reason, research question one delved into the teachers' level of understanding of climate change.

Level of Teachers' Knowledge about the Meaning of Climate Change

Research Question 1: What is the level of teachers' knowledge about the meaning of climate change?

This research question was formulated to test the level of teachers understanding of the concept of climate change. Being at the forefront of education, there is no doubt that they require sufficient knowledge about the

phenomenon in order to impart the appropriate knowledge into the students. The result is presented in Table 4.

Table 4: Teachers’ Level of Knowledge about Climate Change

Statement	Unce- tain No. (%)	Dis- Agree No. (%)	Agree No. (%)	Total No. (%)
Climate change is the alteration of the world’s climate.	4 (5)	8 (10)	67 (85)	79 (100)
Global warming is a sign of climate change.	1 (1)	1 (1)	77 (98)	79 (100)
Melting of ice is an indication of climate change.	5 (6)	7 (9)	67 (85)	79 (100)
Desertification is partly the result of climate change.	6 (8)	13(16)	60 (76)	79 (100)
Change in the pattern of rainfall is climate change.	2 (3)	7 (9)	70 (88)	79 (100)
Climate change is driven by human activities.	2 (3)	3 (4)	74 (93)	79 (100)
Climate change is natural.	10 (13)	47 (59)	22 (28)	79 (100)
Climate change is a political issue.	7 (9)	54 (68)	18 (23)	79 (100)
Climate change is a worldwide phenomenon.	3 (4)	7 (9)	69 (87)	79 (100)
Rise in sea level is the result of climate change.	13 (16)	7 (9)	59 (75)	79 (100)
Anything about the weather is climate change.	22 (28)	35 (44)	22 (28)	79 (100)

Field data, 2014

Table 4 shows that majority (75-98%) of the respondents agreed to all except three of the statements. This implies that the Social Studies teachers have, to a large extent, invaluable knowledge about the meaning of climate change. For example, the teachers believed that climate change is the alteration of the world’s climate. They agreed that global warming, melting of ice, desertification, and

change in the pattern of rainfall, rise in sea level are some of the elements that depict that there is climate change. This goes to confirm the Anthropogenic Theory and an indication that the teachers have much knowledge about what the theory affirms. This also suggests that what they (teachers) consider as the meaning of climate change is precisely what international bodies like the Intergovernmental Panel on Climate Change (IPCC) and the United Nations Framework Convention on Climate Change (UNFCCC) postulate. For example, the IPCC asserts that the expression “climate change” means the alteration of the world’s climate that we humans are causing, through fossil fuel burning, clearing forests and other practices that increase the concentration of Greenhouse Gases (GHG) in the atmosphere (IPCC Fourth Assessment Report, Working Group I, 2007). This is in line with the official definition by the United Nations Framework Convention on Climate Change (UNFCCC) that climate change is the change that can be attributed directly or indirectly to human activity that alters the composition of the global atmosphere as confirmed by 74 (93%) of the respondents in Table 4.

The majority 47 (59%), however, believed that climate change is not a natural phenomenon neither do they agree that climate change is a political 54 (68%) issue. It is rather driven by human activities and that makes it a worldwide phenomenon as contended by United Nations (2009) and confirmed by 69 (87%) of the respondents in Table 4.

It can be observed that there was no majority response to the statement that “anything about the weather is climate change”, those who disagreed 35

(44%) to this statement were more than those who either agreed or were uncertain 22 (28%). This implies that the Social Studies teachers do not agree to the assertion that anything about the weather is climate change since climate change according to IPCC is a significant and lasting change in the statistical distribution of weather patterns over periods ranging from decades to millions of years. It may be a change in average weather conditions, or in the distribution of weather around the average conditions, that is, more or fewer extreme weather events (IPCC, 2007). It further demonstrates that it is not everything about the weather that constitutes climate change.

Hamilton (2008) admits that public opinion about climate change is largely influenced by political preferences. Sometimes, it appears that political orientation is a stronger determinant of attitudes towards climate change than other demographic attributes. The politicisation of the debate on climate change has led members of the public to perceive it more as a matter of personal opinion or a political ideology, distracting attention from the known facts about climate change and the basic causes of those changes (Furman, Roncoli, Crane, Paz JO, Hoogenboom, 2009). However, the respondents are not in favour of this proposition that climate change is a political issue or ideology. This presupposes that the issue of climate change is a worldwide phenomenon that needs a mutually concerted effort from all world leaders than to pursue it from individual political viewpoint or orientation.

Resolving the problems caused by climate change through education is one of the fundamental ways by which it could easily be done. From the above

findings, it can be inferred that the required knowledge for teaching climate change is not a problem if it is included in the curriculum as an explicit topic (instead of being subsumed under the topic “Our Physical Environment” in the curriculum (See Appendix C).

Knowing what the teachers consider as the causes of climate change is as important as knowing their knowledge about what climate change means. Hence, research question two considers the factors that cause climate change as understood or perceived by the Social Studies teachers in the study area.

Perception of the Causes of Climate Change

Research Question 2: What do teachers perceive as the causes of climate change?

Several views have been expressed about the actual causes of climate change. While some researchers believe it is a natural cause, others are of the view that it is a human driven activity which propels climate change. On this basis, it was prudent to find out Social Studies teachers’ views about the causes of climate change since they are the implementers of the Social Studies curriculum. The purviews elicited have been presented in Table 5. The data on the right side of the statement represent teachers’ responses to the factors that cause climate change while those on the left hand side give the teachers’ percentage rating of the degree (extent) to which the factors cause climate change.

Table 5: Perception about the Causes of Climate Change

Rating Degree of Cause			Cause	Cause			Total (100%)
Highest No. (%)	Higher No.(%)	High No. (%)		Uncertain No. (%)	Disagree No. (%)	Yes No.(%)	
31 (40)	24 (30)	24 (30)	Excess CO ₂ in the atmosphere.	6 (8)	4 (5)	69 (87)	79(100)
27 (34)	31 (39)	21 (27)	Chlorofluorocarbons (CFCs).	4 (5)	0 (0)	75 (95)	79(100)
33 (42)	24 (30)	22 (28)	Depletion of the ozone layer.	1 (1)	2 (3)	76 (96)	79(100)
23 (29)	33 (42)	23 (29)	The burning of fossil fuel.	1 (1)	7 (9)	71 (90)	79(100)
11 (14)	10 (13)	58 (73)	Variation in the sun's energy.	13 (16)	25 (32)	41 (52)	79(100)
4 (5)	10 (13)	65 (82)	Ocean circulation (current).	30 (38)	27 (34)	22 (28)	79(100)
22 (28)	40 (51)	17 (21)	Cutting-down of trees and bush burning.	0 (0)	0 (0)	79 (100)	79(100)
9 (11)	14 (18)	56 (71)	Building of cities.	15 (19)	20 (25)	44 (56)	79(100)
9 (11)	6 (8)	64 (81)	Irrigation of the desert.	20 (25)	42 (53)	17 (22)	79(100)
11 (14)	10 (13)	58 (73)	Volcanic eruption.	23 (29)	19 (24)	37 (47)	79(100)

Field data, 2014

Table 5 indicates that the respondents agreed that seven (7) out of the 10 items cause climate change. These include excess carbon dioxide in the

atmosphere 69 (87%), Chlorofluorocarbons (CFCs) 75 (95%) depletion of the ozone layer 76 (96%), burning of fossil fuel 71 (90%), variation in the sun's energy 41 (52%), cutting-down of trees and bush burning 79 (100%) and building of cities 44 (56%). Volcanic eruption did not appear to be a factor that cause climate change and so did not receive the majority's approval, thus, the majority rated it as one of the least in terms of the degree of cause or intensity.

The causes of climate change are quite diverse in nature, however, several surveys conducted by climate science experts support the opinions of the teachers as displayed in Table 5. Observations throughout the world make it clear that climate change is occurring, and rigorous scientific research demonstrates that the greenhouse gases emitted by human activities are the primary driver. These conclusions are based on multiple independent lines of evidence, and contrary assertions are inconsistent with an objective assessment of the vast body of peer-reviewed science (Cook, Nuccitelli, Green, Richardson, Winkler, Painting, Way, Jacobs, & Skuce, 2013). A survey of all peer-reviewed abstracts on the subject 'global climate change' published between 1993 and 2003 shows that not a single paper rejected the consensus position that global warming is man-caused (Oreskes 2004). Thus, the teachers' responses to the items in Table 5 largely reflect the information in the literature. This is supported by a report by IPCC that, while there has been some controversy in the past that natural variability observed over comparable time periods was a factor in causing climate change (UNFCCC, 2007), it is now widely accepted that human activities, in particular fossil fuel use and changing land-uses, are the dominant factors in this growth and are

responsible for most of the warming observed over the past 50 years (IPCC Fourth Assessment Report, 2007).Verlag and Muller (1992) hold up this view in their statement that the chief among the causes of climate change are greenhouse gases which result mainly from human activities. They further point out that “worldwide, the use of fossil fuels, coal, oil and gas for energy purpose accounts for 50% of the additional man-made greenhouse effect” (p. 57).

In terms of the degree of cause, the respondents rated the release of excess carbon dioxide in the atmosphere and the depletion of the Ozone layer as the highest causes of climate change in the world. The release of chlorofluorocarbons (CFCs), burning of fossil fuel and cutting-down of trees and bush burning were rated as “higher” in terms of the causes of climate change. Variation in the sun’s energy and building of cities were the least in terms of the causes as rated by the teachers.

A proportion of 30 (38%), though not the majority, were uncertain as to whether ocean circulation (current) causes climatic change or not. It is thus, the least rated cause by the teachers in terms of the intensity of the causation of climate change. Though Gray (2009) admits that changes of the Meridional Overturning Circulation (MOC) since 1995 led to the cessation of global warming since the 1998-2001 period and triggered the beginning of a weak global cooling trend since 2001and projects this weak cooling to continue for the next couple of decades and subsequently lead to climate change. It appears Social Studies teachers had a contrary view. They have inadequate knowledge about how Ocean circulation triggers climate change. It could mean that the books and the syllabus

which serve as the reference materials for the teachers do not have Ocean circulation as a factor in climate change. Likewise, the students who were taught by these teachers would also be lacking the knowledge of how Ocean circulation activates climate change.

The majority 42 (53%) however, disagreed to the statement that irrigation of desert cause climate change. The change here is a positive change, where the land is watered to regain its fertility to support vegetation growth. This increases the moisture content in the irrigated area and reduces that of the surrounding regions (Bast, 2013). It is this concept that the teachers in this study did not comprehend fully, perhaps, due to the fact that it is not found in the Social Studies curriculum. However, the phenomenon is not obscured in contemporary literature on climate change. For example several climatologists including Pielke Sr (2009), Travis (2007), Matsui and Pielke Sr (2006) have alluded to this fact in Bast's (2013) book entitled *Seven Theories of Climate Change*. International bodies such as National Research Council, Intergovernmental Panel on Climate Change and United Nations Framework Convention on Climate Change have published extensively on climate change in which irrigation of desert features as one of the causes.

Despite the two aforementioned causes of climate change in which the teachers' knowledge was not up to date, they have undoubtedly displayed their high level of knowledge of the major causes of climate change. This means that, all other things being equal, the teachers have the required content knowledge to teach climate change as a topic in the school curriculum. Nevertheless, teachers'

ability to do this depends on the extent to which the Social Studies curriculum responds to climate change and the impact it will make when introduced into the curriculum. In view of this, the next research question was intended to find out how the Social Studies curriculum responds to climate change.

How Social Studies Curriculum Responds to Climate Change

Research Question 3: To what extent does the Social Studies curriculum responds to climate change?

This research question was set to find out the extent to which the Social Studies curriculum (syllabus) is in tune with current global climatic issues. That is, whether the Social Studies curriculum responses appropriately to climate change from the perspective of the Social Studies teachers. For this reason, the questionnaire contained items that elicited the teacher’s opinions on this issue. The results have been collated in Table 6.

Table 6: Social Studies Curriculum Response to Climate Change

Statement	Not At All No (%)	Not Sure No (%)	Some-how No (%)	To a large Extent No (%)	Total No (%)
The Social Studies curriculum is addressing climatic issues.	6 (8)	0 (0)	54(68)	19 (24)	79(100)
The Social Studies curriculum is helping teachers to handle climatic issues sufficiently.	6 (8)	12 (15)	43 (54)	18 (23)	79(100)

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Table 6 continued.

The Social Studies curriculum is increasing students' knowledge on climate change.	4 (5)	7 (9)	41(52)	27 (34)	79(100)
The Social Studies curriculum is positively changing students' views about climate change.	2 (3)	19 (24)	36 (45)	22 (28)	79(100)
The Social Studies curriculum should be redesigned to better handle issues of climate change.	1 (1)	5 (6)	19 (24)	54 (69)	79(100)
The Social Studies curriculum would better respond to climate change if it is designed by the teachers themselves.	7 (9)	29 (37)	18 (23)	25 (31)	79(100)
The Social Studies curriculum would better respond to climate change if we use foreign Social Studies curriculum or books.	44 (56)	18 (23)	11 (14)	6 (7)	79(100)

Field data, 2014

From Table 6, majority of the teachers 54 (68%) believed that the Social Studies curriculum is somehow addressing climatic issues to. The respondents rated the curriculum as somehow 43 (54) helping teachers to handle climatic issues and somehow 41(52) increasing students' knowledge on climate change. The choice of the word to somehow implies that the curriculum is not fully

equipping the youth (learners) on the issues of climate change. The overall response in Table 6 is in tandem with the responses presented in Table 7.

In the SHS level, Social Studies is the subject that is well-positioned with the possibility to equip every student who goes through second cycle education with requisite knowledge in social and environmental issues. However, it appears this is not the case. In order to further assess the extent to which the SHS Social Studies curriculum responds to climate change from the perspectives of the teachers as observed in the syllabus (GES, 2010), an open-ended item on the questionnaire required teachers to state topics in the Social Studies syllabus that addresses climate change. Their responses were collated and presented in Table 7.

Table 7: Topics in Social Studies that Addresses Climate Change

Topic	No.	%
Our Physical Environment and Environmental Challenges.	66	83
Resource Development.	4	5
Sustainable development.	3	4
Science and Technology.	3	4
Population Growth and Development.	3	4
Total	79	100

Field data, 2014

In all, there are a total of 23 topics in the SHS Social Studies syllabus, GES (2010), (see Appendix C). From Table 7 above, out of the 79 teachers involved in this study, an overwhelming majority of 66 (83%) indicated that Our Physical Environment and Environmental Challenges appears to be the only topic

that cover some elements of climate change in the syllabus. The remaining 13 (17 %) of teachers rather considered topics such as Resource Development, Sustainable development, Population Growth and Development, Science and Technology to be those that have climate change issues. My personal observation is in tandem with the majority in Table 7. A keen analysis of the Social Studies syllabus depicts its lack of intensive touch on climate change. There is no particular topic on climate change alone. As rightly portrayed by most of the teachers, it is only Our Physical Environment and Environmental Challenges that superficially treats aspects of climate change. This is highly inadequate and makes the call that one of the fundamental ways through which the younger generation can internalise issues of climate change is Social Studies education to make them climate sensitive and ensure sustainable future might not be realised.

The ill-responsiveness of the Social Studies curriculum to climate change in Ghana confirms the report by Laessoe, Schnack, Breiting and Rolls (2009) that climate change education is still in its infancy. Notwithstanding this assertion, some countries have made impressive moves towards the inculcation of climate change issues into their educational systems. The Chinese government, for example, was one of the first countries to formulate and carry out a strategy for sustainable development and adopted climate change action plans after the United Nations Conference on Environment and Development in 1992. On the contrary, casual observation shows that Ghana has not made much effort in this direction though there have been national calls to reduce human activities, especially, the burning of fossil fuels (e.g. coal and oil) which intensify climate change (Evans,

2004).The Ghana national climate change policy also appears to be silent on curriculum effort that is needed to transform the knowledge base of learners in the country.

In Table 6, 54 (69%) of the respondents agreed to a large extent that the Social Studies curriculum should be redesigned to better handle issues of climate change. This is a clarion call, and Ghana could replicate China's example which include specific education initiatives where knowledge about climate change is included in basic, higher and adult education with a focus on awareness and participation in relevant activities (Yi & Wu, 2009). As proclaimed in the National Climate Change Policy (2013), Ghana could integrate and scale up its education efforts on climate change by drawing on its successful tactics in other sectors, such as health education. This is very essential in the sense that the recent discovery and exploration of crude oil in Ghana imposes certain demands on the environment through water pollution and gas flaring, which also pollutes the air. These, added to the pre-existing environmental problems are likely to aggravate the situation as maintained by Boadu and Oden (2013) and consequently lead to climate change.

The Social Studies curriculum would better respond to climate change if it is designed by the teachers themselves". On this statement, majority of the teachers (shown in Table 6) had much divergent views. This is because 29 teachers representing 37% were not sure how this could be possible. Again, 18 (23%) respondents believed the Social Studies curriculum would "somehow" respond to climate change if it is designed by the teachers themselves. However,

on the same issue, 25 (31%) of the teachers agreed to a large extent that if the Social Studies curriculum is designed by the teachers themselves it would better respond to climate change. These opposing views presuppose that the Social Studies teachers are not fully prepared in terms of their competency to handle the development of a worthwhile curriculum that would respond appropriately to climate change. However, their views cannot be ignored when government intends to redesign the Social Studies curriculum to tackle climate change issues.

Closely linked to the foregoing matter discussed is the question of whether Social Studies curriculum would better respond to climate change if we use foreign Social Studies curriculum or books. In Table 6, majority of the respondents, i.e. 44 (56%) disagreed vehemently to the use of foreign Social Studies curriculum or books would address climate change in Ghana. This gives credence to the Ghanaian Social Studies curriculum which is reflective of the local content in social and environmental issues. Given that climate change differs from one region to the other, it would be impossible to adopt a foreign curriculum that is designed to reflect a different environment instead of Ghana's milieu. The teachers being region-sensitive on the issue of climate change is in the right direction since different countries have differences in climate and for that matter the challenges that they experience within their environment. Books and other teaching-learning materials should have local touch in terms of content and learning experiences.

The onus then lies on what should be included in our curriculum (and other materials) to enrich the content of the Social Studies curriculum in the line

of climate change. In Table 6, they have already indicated that the Social Studies curriculum should be redesigned. In doing this they suggested at the open-ended section of the questionnaire some ideal features that, to them, such a new curriculum poised to address climate change should possess. They first called for an all inclusive collaboration between curriculum developers, all stakeholders as well as implementers (especially, teachers) when redesigning the curriculum to respond to climate change. They also suggested an immediate supply of appropriate teaching-learning materials that would facilitate and reinforce the teaching and understanding of climate change in schools. On this same issue, the teachers requested the inclusion of certain topics including major ones like “Climate Change and Global Warming”, “Causes and Effects of Climate Change” “Measures to Solve Problems Created by Climate Change”.

Despite the fact that teachers had a contrary view as to whether climate change was a political issue, I believe it is government that must make the first move in dealing with the issues of climate change. Without government initiative and enforcement of the concepts into the curriculum, experts, individual teachers, associations, NGOs among other stakeholders cannot change the curriculum to respond to climate change issues.

The item that requires a response is why has the Social Studies curriculum failed to respond to climate change? The opinion of the teachers concerning the response to this question is very important, not forgetting that the introduction of new concepts, ideas, knowledge, skills, values and attitudes into an existing curriculum is always bedevilled with some challenges. Social Studies curriculum

response to climate change is most likely to go through similar upheavals. It is therefore imperative to look critically into some of these challenges by reflecting on the shortcomings that might impede the smooth integration of new ideas, skills and values about climate change as part of the curriculum. Thus, they were asked to indicate some of the challenges that in their view, Social Studies education faces in responding to climate change. Table 8 presents the results.

Perception about the Challenges Social Studies Education Faces in Responding to Climate Change

Research Question 4: What do teachers perceive as challenges that social studies education faces in responding to climate change?

Implementation of every curriculum comes with its own challenges. Curriculum innovation and reforms are also not insulated from problems. Therefore, this research question was crafted to solicit the views of Social Studies teachers about the challenges that the Social Studies curriculum would face in responding to climate change. The results are presented in table 8 below.

Table 8: Challenges that Social Studies Education Face in Responding to Climate Change

<i>Degree of being a challenge or not a challenge</i>			<i>Statement</i>	<i>Challenges</i>			
<i>Greatest</i>	<i>Greater</i>	<i>Great</i>		<i>Uncertain</i>	<i>No</i>	<i>Yes</i>	<i>Total</i>
<i>No. (%)</i>	<i>No. (%)</i>	<i>No. (%)</i>		<i>No. (%)</i>	<i>No.(%)</i>	<i>No.(%)</i>	<i>(100 %)</i>
31 (39)	15 (19)	33 (42)	Inadequate TLMs for teaching climate change.	2 (3)	4 (5)	73 (92)	79(100)
17 (22)	27 (34)	35 (44)	Unavailability of resource persons.	2 (3)	12 (15)	65 (82)	79(100)

Table 8 continued

17 (21)	21 (27)	41 (52)	Abstract nature of the causes of climate change.	9 (11)	27 (34)	43 (55)	79(100)
16 (20)	30 (38)	33 (42)	Difficulty in communicating climate change issues to the students.	7 (9)	31 (39)	41 (52)	79(100)
10 (13)	12 (15)	57 (72)	Centralisation of the curriculum.	24 (30)	31 (27)	34 (43)	79(100)
16 (20)	16 (20)	47 (60)	Inadequate teachers' knowledge on climate change.	16 (20)	22 (28)	41 (52)	79(100)
11 (14)	16 (20)	52 (66)	Politicisation of the debate on climate change.	13 (16)	30 (38)	36 (46)	79(100)
19 (24)	16 (20)	44 (56)	Because the effects of climate change has not been sufficiently felt yet.	10 (13)	15 (19)	54 (68)	79(100)
34 (43)	13 (16)	32 (41)	Financial constraint.	9 (11)	9 (11)	61 (78)	79(100)

Field data, 2014

From Table 8, majority of the teachers agreed that about eight (8) out of 12 of the statements constitute some major challenges that Social Studies curriculum is likely to face in responding to and incorporating issues of climate change into the curriculum. The statements among others include: inadequate teaching learning materials for teaching climate change 73 (92%), unavailability of resource persons 65 (82%), Social Studies curriculum is overloaded with other issues 58 (73%), abstract nature of the causes of climate change 43 (55%), difficulty in communicating climate change issues to the students (52%),

inadequate teachers' knowledge on climate change 41 (52%), because the effects of climate change has not been sufficiently felt yet 54 (68%) and financial constraint 61 (78%).

These factors are real and throw a challenge to stakeholders of our educational system to revamp the curriculum by first dealing with the challenges cited above. For example, it is now made clear by the teachers that because the effects of climate change have not been sufficiently felt yet by individuals that is perhaps, why we are paying lip service and not showing much commitment. Most of the challenges exposed by the teachers have their roots in the financial constraint that they emphasised. In teaching the little aspects of climate change that appear under some topics in the syllabus, teachers do not have access to teaching-learning resources resulting in abstract teaching and learning of the concepts that require concrete materials and resource persons. Development and/or redesigning of curriculum either by innovation or reform comes with financial commitment that poses a greater challenge as suggested by the Social Studies teachers.

Other factors which less than half of the respondents agreed but found them as having less intensity include the politicisation of the debate on climate change, the centralisation of the curriculum, and the claim that the designers of the curriculum had inadequate knowledge on climate change. These factors, even though the teachers rated them to have minimal adverse contribution to the issue under consideration, politicisation in particular carries the potency to mar the

smooth acceleration of an initiation and implementation of climate change policies in the school curriculum.

It is argued that although the role of education in addressing the challenges of climate change is being increasingly recognised, the capacity of education to contribute to adaptation and mitigation measures has yet to penetrate mainstream development thinking. In practical terms, the integration of climate knowledge and skills into existing education systems represents both immediate and longer-term challenges for responding to climate change (UNESCO, 2012). Again, history shows that society has successfully coped with and adapted to the existing relatively stable climate variability; the challenge now is to respond effectively to the threats presented by climate change (NRC, 2010b). All types of decision-makers (e.g. governments, businesses, and individuals) are already taking actions to respond to climate change (NRC, 2010c). However, large segments of society still remain unconvinced that climate change is real (Kohut, Doherty, Dimock & Keeter, 2009) and, therefore, these segments remain inactive. This buttresses the point that it appears the effects of climate change has not been sufficiently felt yet.

More so, overloaded curricula, as indicated in Table 5, frequently present additional challenges. Identification of the most appropriate issues and areas of knowledge will require cooperation between local, national and international actors. National Research Council reports that global climate changes are complex and challenging to communicate to society. An understanding of science

is fundamental to appreciating the forces that produce climate change and the effect of changing climate on different regions of the world (NRC, 2010a).

Summary of the Results and Discussion

Many issues have been presented and discussed in this chapter. In sum, the study found that the majority 68 (86%) of the Social Studies teachers have invaluable knowledge, to a large extent, about the meaning of climate change. For instance, they maintained that climate change is the alteration of the world's climate and that climate change is a worldwide phenomenon. Moreover, the majority agreed that melting of ice is an indication of climate change. Nevertheless, they had divided opinions to the assertion that anything about the weather is climate change though those who disagreed were quite more than those who were uncertain or agreed.

The results also showed that the Social Studies teachers practically had full knowledge about the factors that cause climate. They agreed that all the following cause climate change: Excess carbon dioxide in the atmosphere 69 (87%), Chlorofluorocarbons (CFCs) 75 (95%), Depletion of the ozone layer 76 (96%), Burning of fossil fuel 71 (90%), Variation in the sun's energy 41 (52%), Cutting-down of trees and bush burning 79 (100%) and building of cities 44 (56%). Volcanic eruption did not appear to be a factor that causes climate change and so did not receive the majority's approval, thus, the majority rated it as one of the least in terms of the degree of cause or intensity. A proportion 30 (38%), though not the majority, were not sure as to whether ocean circulation (current) causes climatic change or not. It is thus, the least rated cause by the teachers in

terms of the intensity of the causation of climate change. On the issue of whether irrigation of desert cause climate change, a little more than half 42 (53%) disagreed.

The study revealed that the majority of the teachers 54 (68%) contend that the Social Studies curriculum is “somehow” addressing climatic issues. The respondents rated the curriculum as “somehow” 43 (54%) helping teachers to handle climatic issues and “somehow” 41 (52%) increasing students’ knowledge on climate change. The use of the word “somehow” implies that the curriculum is not fully equipping the youth (learners) on the issues of climate change. Majority of the respondents 54 (69%) agreed to a large extent that the Social Studies curriculum should be redesigned to better handle issues of climate change. Yet, as to whether the curriculum would better respond to climate change if it is designed by the teachers themselves, a proportion of them 29 (37%) were not sure. Majority of the respondents believed that the use of foreign Social Studies curriculum or books would not address climate change in Ghana 44 (56%).

In terms of the challenges that Social Studies education face in responding to climate change, the teachers considered the following factors as profound: inadequate teaching learning materials for teaching climate change 73 (92%), unavailability of resource persons 65 (82%), Social Studies curriculum is overloaded with other issues 58 (73%), abstract nature of the causes of climate change 43 (55%), difficulty in communicating climate change issues to the students 41 (52%), inadequate teachers’ knowledge on climate change 41 (52%), because the effects of climate change has not been sufficiently felt yet 54 (68%)

and financial constraint 61 (78%). Nevertheless, the teachers did not see politicisation of the debate on climate change as a factor that impedes Social Studies in responding to climate change.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter provides a summary of the study, key findings, conclusions and recommendations for policy making and professional practice. A suggestion for further research has also been provided in this chapter.

Summary

Overview of the Study

Climate change as already indicated is one of the contemporary environmental challenges of the world (United Nations, 2009). Climate change is a key priority for international development as its impact is likely to be disproportionately felt in developing countries. It is said that Africa, small island states, and the Asian and African mega-deltas are likely to be particularly affected by climate change (Stern, 2007). The fight to reduce the causes and effects of climate change is, however, a global matter because it does not matter where it is caused, the effect is phenomenal.

Many measures have been put in place to fight climate change and its effects. Nevertheless, research and education have been found to be phenomenal in this fight. Yet, report by Laessoe, Schnack, Breiting and Rolls (2009) aver that the introduction of climate change into educational systems is still in its infancy.

Some countries have made impressive curriculum efforts in dealing with the menace caused by climate change while others like Ghana are yet to do so.

Going through Ghana's educational system especially, at the SHS level, one of the subjects that can integrate climate change issues into its curriculum to achieve the desired result is Social Studies. This study was, thus, conducted to find out the extent to which the Social Studies curriculum responds to climate change. To give the study a clear focus, the following research questions were formulated to guide the study:

1. What is the level of teachers' knowledge about the meaning of climate change?
2. What do teachers perceive as the causes of climate change?
3. To what extent does the Social Studies curriculum respond to climate change?
4. What do teachers perceive as challenges that Social Studies education face in responding to climate change?

Relevant literature related to the study was reviewed. These comprised theories, concepts, and empirical studies documented by some authorities, educationists, and researchers. The study employed descriptive survey and collected data through the use of questionnaire. A sample of 79 Social Studies teachers comprised the respondents. The study was delimited to public senior high schools in the Cape Coast Metropolis. The data collected were analysed, discussed and presented through the use of frequency counts and percentage tables.

Key Findings

The following were the main findings of the study.

1. The study found that the majority 68 (86%) of the Social Studies teachers have invaluable knowledge, to a large extent, about the meaning of climate change. For example, they maintained that climate change is the alteration of the world's climate 67 (85%). They also agreed that climate change is a worldwide phenomenon 67 (85%). Additionally, the majority granted that melting of ice is an indication of climate change 69 (87%). However, they had divided responses to the claim that anything about the weather is climate change though those who disagreed 35 (44) were a little more than those who were uncertain 22 (28%) or agreed 22 (28%).
2. It was found that the Social Studies teachers to a large extent had much knowledge about the factors that cause climate change. For instance, they agreed that all the following cause climate change: Excess carbon dioxide in the atmosphere 69 (87%), Chlorofluorocarbons (CFCs) 75 (95%), Depletion of the ozone layer 76 (96%), Burning of fossil fuel 71 (90%), Variation in the sun's energy 41 (52%), Cutting-down of trees and bush burning 79 (100%) and building of cities 44 (56%). Volcanic eruption did not appear to be a factor that causes climate change and so did not receive the majority's approval, thus, the majority rated it as one of the least in terms of the degree of cause or intensity of climate change. A proportion 30 (38%), though not the majority, were uncertain as to whether ocean circulation (current) causes climatic change or not. It is thus, the least

rated cause by the teachers in terms of the intensity of the causation of climate change. On the issue of whether irrigation of desert cause climate change, a little more than half 42 (53%) disagreed.

3. The study revealed that majority of the teachers 54 (68%) believed that the Social Studies curriculum is “somehow” addressing climatic issues. The respondents rated the curriculum as “somehow” 43 (54%) helping teachers to handle climatic issues and “somehow” 41 (52%) increasing students’ knowledge on climate change. The choice of the word “somehow” implies that the curriculum is not fully equipping the youth (learners) on the issues of climate change. Majority of the respondents 54 (69%) agreed to a large extent that the Social Studies curriculum should be redesigned to better handle issues of climate change. However, as to whether the curriculum would better respond to climate change if it is designed by the teachers themselves, a larger proportion of them 29 (37%) were not sure. Majority of the respondents believe that the use of foreign Social Studies curriculum or books would not address climate change in Ghana 44 (56%).
4. Teachers perceived the following factors as challenges that Social Studies education faces in responding to climate change: inadequate teaching learning materials for teaching climate change 73 (92%), unavailability of resource persons 65 (82%), Social Studies curriculum is overloaded with other issues 58 (73%), abstract nature of the causes of climate change 43 (55%), difficulty in communicating climate change issues to the students

41 (52%), inadequate teachers' knowledge on climate change 41 (52%), because the effects of climate change has not been sufficiently felt yet 54 (68%) and financial constraint 61 (78%). The teachers did not see politicisation of the debate on climate change as a factor that impede Social Studies curriculum in responding to climate change.

Conclusions

Based on the key findings, a number of conclusions were drawn. The study found that majority of the Social Studies teachers, to a large extent, have invaluable knowledge about the meaning of climate change. It is therefore concluded that teachers would not find much difficulty in teaching the concepts of climate change should it be introduced fully into the Social Studies curriculum at the S.H.S level.

It was discovered that the Social Studies teachers had knowledge about the factors that cause climate change. Thus, the conclusion is that Social Studies teachers cannot be ignored when devising measures in the curriculum to curb climate change.

On the issue of the extent to which the Social Studies curriculum responds to climate change, the teachers established that Social Studies curriculum is “somehow” 54 (68%) addressing climatic issues. The choice of the word “somehow” leads to the conclusion that the Social Studies curriculum is not fully equipping the youth (learners) on the issues of climate change. The deduction is that the Social Studies curriculum may require a redesign.

The study showed that several challenges impede the current Social Studies curriculum in responding to climate change. Thus, full introduction of climate issues into the curriculum would also face similar challenges.

Recommendations

Based on the main findings of the study and the conclusions drawn, the following recommendations have been made for policy formulation and professional practice.

1. Social Studies teachers should constantly revise their knowledge on climate change to continue keeping them abreast with current climatic issues.
2. The rich knowledge of the teachers should be tapped when introducing climate change issues or redesigning the Social Studies curriculum.
3. More topics relating to climate change should be introduced into the Social Studies curriculum by the Curriculum Research and Development Division. Specific education initiatives which involve knowledge about climate change must be included in basic, higher and adult education with a focus on awareness and participation in relevant activities by the Ghana Education Service.
4. It is also recommended that, any attempt geared towards the introduction of climate change topics into the existing Social Studies curriculum must give ultimate attention to the challenges that might impede the smooth implementation of the curriculum.

Suggestions for Further Research

This study was not exhaustive enough to include adaptation and mitigation strategies, thus, I suggest a study be conducted on the adaptation and mitigation strategies that could transform the disposition of learners on climate change issues.

REFERENCES

- Adedayo Y. A., Mudasiru, O. Y., & Saheed, O. (2012). A survey of the perceptions of teachers and students on climate change: Implication for curriculum development. In I. O. Oloyede (Ed.), *Climate change and sustainable development in Africa* (pp.13-30). Proceedings of the second University of Cape Coast and University of Ilorin Joint International Conference. Nigeria: Unilorin Press.
- Al Gore, (2006). *An inconvenient truth, the planetary emergency of global warming and what we can do about it*. Emmaus: Rodale Books.
- Alice, A. J., & Abdulraheem, Y. (2012). Creating climate change awareness on the Nigerian citizens: Challenges for social studies curriculum. In I. O. Oloyede (Ed.), *Climate change and sustainable development in Africa* (pp. 82-94). Proceedings of the second University of Cape Coast and University of Ilorin Joint International Conference. Nigeria: Unilorin Press.
- Alkin, M. (1969). Evaluation theory development. *Evaluation comment*, 2 (1), 2-7.
- Amedahe, F. K., & Gyimah, E. A. (2005). *Introduction to educational research*. Module prepared for centre for continuing education, University of Cape Coast. Cape Coast: University Printing Press.
- Anijah-Obi, F. N. (2001). *Fundamentals of environmental education and management*. Calabar: Clear Lines Publications.

- Arhin, G. B. (2014). *President Mahama Promises Funding for Climate Change*. Accra. Ghana Agricultural News Digest.
- Arku J. (2013). *Cabinet approves national climate change policy*. Accra: Ghana News Agency.
- Athman, J., & Monroe, M. (2004). The effects of environmental-based education on student's achievements motivation. *Journal of Interpretation Research*, 9 (1), 9-25.
- Bangay, C., & Blum, N. (2010) Education responses to climate change and quality: Two parts of the same agenda? *International Journal of Educational Development*, 30 (4), 335-450.
- Bast, J. L. (2013). *Seven theories of climate change*. Chicago: The Heartland Institute.
- Bivona, K. (2002). *Teacher morale: The impact of teaching experience, workplace conditions, and workload*. Retrieved from ERIC data-base. (ED467760).
- Boadu, K., & Oden, S. N. (2012). Climate change and development in Ghana: Implications for curriculum innovation in senior high school social studies and language arts curricula. In I. O. Oloyede (Ed.), *Climate change and sustainable development in Africa* (pp. 109-124). Proceedings of the second University of Cape Coast and University of Ilorin Joint International Conference. Nigeria: Unilorin Press.
- Bondi, J., & Wiles, J. (1998). *Curriculum development: A guide to practice* (5th ed.). New York: Prentice Hall, Upper Saddle Pubs.

- Borich, G.D. (Ed.). (1991). *Evaluating educational programmes and products*. Englewood Cliffs, NJ: Educational Technology Publications.
- Breiting, S., Jeppe, L., Rolls, S., & Karsten, S. (2009). *Climate change and sustainable development: The response from education*. Copenhagen, Denmark: University of Aarhus.
- Buadi, J. (2012). Curriculum response to climate change and development in Ghana. In I. O. Oloyede (Ed.), *Climate change and sustainable development in Africa* (pp.95-107). Proceedings of the second University of Cape Coast and University of Ilorin Joint International Conference. Nigeria: Unilorin Press.
- Chambers, D. (2009). *Sustainable development: The response from education*. Melbourne: Melbourne Graduate School of Education.
- Chen, S. (2006). *Researching on strategy of climate education in middle school geography instruction*. Fujian: Normal University.
- Climate Change Facts Sheet (2013). *Facts about climate change*. Retrieved May 11, 2013, from <http://web.cerritos.edu/tstolze>
- Cook, J., Nuccitelli, D., Green, S. A., Richardson M., Winkler B., Painting R., Way. R., Jacobs P., & Skuce A. (2013). *Quantifying the consensus on anthropogenic global warming in the scientific literature*. Bristol: IOP Publishing Ltd.
- Daniel, S. A., & Emmanuel, P. O. (2012). Profile of temperature changes and rainfall patterns in Ghana from 1931 to 2007. In I. O. Oloyede (Ed.),

- Climate change and sustainable development in Africa* (pp.42-54).
 Proceedings of the second University of Cape Coast and University of
 Ilorin Joint International Conference. Nigeria: Unilorin Press.
- Ekufol, C. (2013, Oct. 21). Climate change affecting country's agriculture.
Ghanaian Times (No. 17038), p. 31.
- Emelia, E. A. (2014, July 24). Climate change induces forced migration. *Daily
 Graphic* (No. 19519), p. 55.
- Evans, A., & Steven, D. (2007). *Climate change: The state of the debate*. Report
 written for the London accord, Dec. 2007.
- Evans, R. W. (2004). *Social studies wars: What should we teach the children?*
 New York: Teachers College Press.
- Fischer, G., Shah, M., Tubiello, F. N., & Velhuizen, H. V. (2005). Socio-
 economic and climate change impacts on agriculture: An integrated
 assessment. *Philosophical Transactions of the Royal Society*, 360 (1483),
 2067-2083.
- Forster, P., Ramaswamy V., Artaxo P., Berntsen T., Betts R., Fahey D. W.,
 Haywood J., Raga G., Schulz M., & Van Dorland R. (2007). *Changes in
 atmospheric constituents and in radiative forcing in climate change*.
 Cambridge: Cambridge University Press.
- Fraenkel, J. R., & Wallen, N. E. (2000). *How to design and evaluate research in
 education* (4th ed.). New Jersey: McGraw-Hill.

- Furman C, Roncoli C, Crane T, Paz J. O., & Hoogenboom, G. (2009). *Managing risk and climate variation among Georgia organic farmers*. Georgia: Gainesville, FL.
- Gatbonton, E. (1999). Investigating experienced ESL teachers' pedagogical knowledge. *Modern Language Journal*, 83(1), 35-50.
- Gay R. (1992): *Educational research: Competencies for analysis and application* (4th ed.). New York: Merrill/Macmillan.
- Gay, L., Mills, G., & Airasian, P. (2006). *Educational research: Competencies for analysis and applications*. New Jersey: Pearson Education, Inc.
- Ghana Education Service (GES). (2010). *Social studies syllabus for senior high schools*. Accra: GES.
- Ghana Education Service [GES] (1987). *The social studies syllabus for JSS*. Accra: Curriculum Research and Development Division.
- Glass, V., & Hopkins, K. D. (1996): *Statistical methods in education and psychology* (3rd ed.). Boston: Allyn and Bacon.
- Gray, W.M., (2009) Climate change: Driven by the ocean, not human activity. In J. L., Bast, (Ed.). *Seven theories of climate change* (pp. 17-19) Chicago: The heartland institute.
- Hamilton, L.C. (2008). Who cares about polar regions? Results from a survey of U.S. public opinion. *Arctic, Antarctic, and Alpine Research* 40 (4), 671-678.

- Hassol, S. J. (2008). Improving how scientists communicate about climate change. *Eos A weekly Journal of the American Geophysical Union*, 89 (11), 36-45.
- Hirst, P. H. (Ed). (1968). *The contribution of philosophy to the study of the curriculum in changing the curriculum*. London: University of London Press Ltd.
- Houghton, J. (2004). *Global warming, the complete briefing* (3rd ed.). Cambridge: Cambridge University Press.
- Idso, C., & Singer, S. F. (2009). *Climate change reconsidered*. Chicago: The Heartland Institute.
- Intergovernmental Panel on Climate Change (2007). *Climate change: The physical science basis*. Cambridge: Cambridge University Press.
- IPCC (2007). *The physical science basis: Contribution of working group I to the fourth assessment report of the intergovernmental panel on climate change*. New York: Cambridge University Press.
- IPCC Fourth Assessment Report (2007). *A blanket around the earth*. Retrieved May 14 2013, from <http://www.ipcc.ch/pdf/assessmentreport/ar4/syr>
- IPCC. (2007). *Climate change: The physical science basis: summary for policy makers*. Retrieved June 3, 2010, from <http://www.ipcc.ch>.
- Jacobi, P. R., Silva, L., Amia, S., Sulaiman, N., Nepomuceno, T., & Ratinho, L. (2009). *Education and climate change in Brazil*. Sao Paolo: University of the state of Sao Paolo.

- Kahan, D. M., Wittlin, M., Peters E., Slovic P., Larrimore O. L., Braman, D., & Mandel, G. N. (2011). *The tragedy of the risk-perception commons: Culture conflict, rationality conflict, and climate change*. Philadelphia: Temple University Legal Studies Research.
- Kahlor, L. A., & Rosenthal, S. (2009). If we seek, do we learn? Predicting knowledge of global warming. *Science Communication*, 3 (30), 299-304.
- Kohut, A., Doherty, C., Dimock, M., & Keeter, S. (2009). *Fewer Americans see solid evidence of global warming*. Washington, D C: Pew Research Centre for the People & the Press.
- Krejcie, R. V., & Morgan, D. W. (1970). *Determining sample size for research activities. educational and psychological measurement*. New York: Sage Publications Inc.
- Kumekpor, T. K. B. (2002). *Research methods & techniques of social research*. Ghana: Son Life Press & Services, Accra, Ghana.
- Laessoe, J., Schnack, K., Breiting, S., & Rolls, S. (2009). *Climate change and sustainable development: The response from education*. Denmark: Danish School of Education, University of Aarhus.
- Lindzen, R. S., Chou, M. D., & Hou, A. Y., (2001). Does the earth have an adaptive infrared iris? *Bulletin of the American Meteorological Society* 82,417-432. In J. L., Bast, (Ed.), *seven theories of climate change* (pp. 12-13), Chicago: The heartland institute.

- Lotz-Sisitka, H. B., & le Grange, L. (2007). *Learning to live with it? Troubling education with evidence of global climate change*. Kenton Phumula: University of KwaZulu Natal.
- Maceda, E. A., Gaillard, J. C., Stasiak, E., Le Masson, V., & Le Berre, I. (2009). Experimental use of participatory 3-dimensional models in island community-based disaster risk management. *The International Journal of Research into Island Cultures*, 3(1), 46-58.
- McKeown, R. (2002). *Education for sustainable development*. Knoxville: University of Tennessee.
- McMillan, J. H., & Schumacher, S. (2001). *Research in education: A conceptual introduction*. New York, NY: Longman.
- Meng, Q. (2009). *Case study of education on climate and sustainable development in the curriculum*. Northeast: Normal University.
- MESTI, (2013). *Ghana national climate change policy*. Accra. MESTI.
- Miller, J. P., & Seller, W. (1985). *Curriculum: Perspective and practice*. New York: London.
- NASA, (2005). *What's the difference between weather and climate?* Retrieved June 3, 2015, from http://www.nasa.gov/mission_pages/noaa-n/climate
- NASA, (2015). *Global climate change: Vital signs of the planet*. California: California Institute of Technology.
- National Research Council, (2005). *Radiative forcing of climate change: expanding the concept and addressing uncertainties*. Washington, D C: The National Academies Press.

- National Research Council. (2010a). *Informing an effective response to climate change*. Washington, D C: The National Academies Press.
- National Research Council. (2010b). *Adapting to the impacts of climate change*. Washington, D C: The National Academies Press.
- National Research Council. (2010c). *Advancing the science of climate change*. Washington, D C: The National Academies Press.
- National Research Council. (2011). *America's climate choices*. Washington, D C: The National Academies Press.
- Nazir, J., Pedretti, E., Wallace, J., Montemurro, D., & Inwood, H. (2009). *Climate change and sustainable development: The response from education*. The Canadian Perspective Centre for Science, Mathematics and Technology Education: Canada. University of Toronto.
- Nicole, L. (2012). *An overview and the causes of global warming*. Retrieved June 3, 2015, from <http://geography.about.com/od/globalproblems>
- O'Riordan, T. & Rayner S. (1991). Risk Management for Global Environmental Change. *Global Environmental Change*.
- Obeng, E. A. (2012). Curriculum response to climate change and development. In I. O.Oloyede (Ed.), *Climate change and sustainable development in Africa* (pp.3-12). Proceedings of the Second University of Cape Coast and University of Ilorin Joint International Conference. Nigeria: Unilorin Press.
- Obour. S. K. (2013) *Danger: Ghanaian farmers to suffer from climate change*. Accra: Ghana News Agency.

- Oreskes, N. (2004). Beyond the ivory tower: The scientific consensus on climate change. *Science* 306 (5702): 1686. Retrieved June 21, 2015, from <http://http://www.sciencemag.org/content/306/5702/1686.full>.
- Patton, M. (1986). *Utilised focused evaluation*. Newbury Park, C A: Sage. Cambridge University Press.
- Pielke, Sr., R. (2009). Climate Change: The need to consider human forcing besides greenhouse gases. In J. L. Bast, (Ed.), *Seven theories of climate change* (pp. 14-16). Chicago: The heartland institute.
- Robinson, J. T. (1983). *Education department: The teacher, school, and society curriculum definitions*. Retrieved June 17, 2015, from <http://www.stcoll.edu>.
- Scafetta, N. (2009). Empirical analysis of the solar contribution to global mean air surface temperature change. *Journal of Atmospheric and Solar-Terrestrial Physics*. In J. L. Bast, (Ed.), *Seven theories of climate change* (pp. 21-22) Chicago: The heartland institute.
- Seidu, A. (2007). *Modern approaches to research in educational administration: (ed)*. Kumasi: Payless Publication Limited.
- Shi, G. (2008). *12 questions about education for climate change*. Hongkong: National Population Council.
- Slavin, R. (2007). *Educational research in an age of accountability*. Boston: Pearson Education.
- Smith, D., & Vivekananda, J. (2007). *A climate of conflict: The links between climate change, peace and war*. London: International Alert.

- Stenhouse, L. (1976). *An introduction to curriculum research and development*. London: Heinemann.
- Stern, N. (2007). *The economics of climate change: The stern review*. Cambridge: Cambridge University Press.
- Stufflebeam, D. L., Foley, W. J., Gephart, W. J., Guba, E. G., Hammond, R. L., Merriman, H. O., & Provus, M. (1971). *Educational evaluation and decision making*. Itasca, IL: F. E. Peacock.
- Sud, Y. C., Walker, G. K., & Lau, K. M., (1999). Mechanisms regulating deep moist convection and sea-surface temperatures in the tropics. In J. L. Bast, (Ed.), *Seven theories of climate change*, (pp. 12-13). Chicago: The heartland institute.
- Taba, H. (1962). *Curriculum development: Theory and practice*. Chicago: Pearson and Merrill.
- Travis D. J., Andrew M. C., Jeffrey, S. J., & James, Q. D. (2007). U.S. Jet contrail frequency changes: influences of jet aircraft flight activity and atmospheric conditions. *International Journal of Climatology*, 27, 621–632.
- Tyler, R. W. (1949). *Basic principles of curriculum and instruction*. Chicago: The University of Chicago Press.
- UNEP. (2009). *Climate change*. Paris: UNEP.
- UNESCO, (2012). *Education sector responses to climate change*. Bangkok. UNESCO.

- UNFCCC. (2007). *Climate change: Impacts, vulnerabilities and adaptation in developing countries*. Bonn: UNFCCC.
- UNISDR (2009). *Regional analysis on disaster risk reduction education in the Asia and Pacific region in the context of HFA priority three implementation*. Bangkok: Scand-Media Corp., Ltd.
- United Nations (2009). *United Nations framework convention on climate change: Conference on the parties (Fifteenth Session)*. Copenhagen: United Nations.
- United Nations Educational Scientific and Cultural Organisation. (2010). *Climate change education for sustainable development*. Paris. (UNESCO).
- Verlag, F., & Muller, V. C. F. (1992). *Climate change: A threat to global development*. Bonn: Bonn Universities Buchdruckerei.
- Wikipedia, (2014). *Climate*. Retrieved July15, 2014, from <https://en.wikipedia.org/wiki/Climate>
- Wilson, L. O. (2006). *Curriculum course packets Ed 721 & 726*. Unpublished Curriculum package, Canada.
- World Bank. (2010). *World development report: Development and climate change*. Washington, DC. World Bank.
- Yeboah, I. (2013). *Climate change mitigation meetings opens in Accra*. Accra. Ghana News Agency.
- Yi, J., & Wu, P. (2009). *Climate change and sustainable development: The response from education*. Beijing: Beijing Normal University

**APPENDIX A
INTRODUCTORY LETTER**

APPENDIX A

UNIVERSITY OF CAPE COAST

FACULTY OF EDUCATION

Department of Arts & Social Sciences Education

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OUR REF: DASSE/ED/CSP/12/0003

YOUR REF:



University Post Office,
Cape Coast, Ghana.

Date: 13th November, 2013

TO WHOM IT MAY CONCERN

LETTER OF INTRODUCTION

The bearer of this letter **Mr. Francis Baker** is a graduate student of the Department of Arts and Social Sciences Education of the University of Cape Coast, Ghana.

He requires some information from your institution for the purpose of writing a thesis which is a requirement of M. Phil Degree Programme.

I would be grateful if you could kindly allow him to collect the information from your institution. Kindly give the necessary assistance.

Yours faithfully,

A handwritten signature in black ink, appearing to read 'S. Asare-Danso'.

REV. DR. SETH ASARE-DANSO
HEAD OF DEPARTMENT

DEPARTMENT OF ARTS &
SOCIAL SCIENCES EDUCATION
UNIVERSITY OF CAPE COAST
CAPE COAST, GHANA

If yes, state the year and the place.....

(A) TEACHERS' KNOWLEDGE ON CLIMATE CHANGE

In each of the following statements, indicate your understanding of climate change by ticking (√)			
Statement	Uncertain	Disagree	Agree
(4) Climate change is the alteration of the world's climate			
(5) Global warming is a sign of climate change			
(6) Melting of ice is an indication of climate change			
(7) Desertification is partly the result of climate change			
(8) Change in the pattern of rainfall is climate Change			
(9) Climate change is driven by human activities			
(10) Climate change is natural			
(11) Climate change is a political issue			
(12) Climate change is a worldwide phenomena			
(13) Rise in sea level is the result of climate change			
(14) Anything about the weather is climate change			

(B) CAUSES OF CLIMATE CHANGE

In each of the following statements, determine the causes of climate change (on the right hand side) and the degree of cause (on the left hand side) by ticking (√)						
THE DEGREE OF CAUSE			STATEMENT	CAUSE		
Highest	Higher	High	Climate change is caused by:	Uncertain	Disagree	Agree
			(165) Excess CO ₂ in the			

			atmosphere			
			(16)Chlorofluorocarbons (CFCs)			
			(17) Depletion of the ozone layer			
			(18) The burning of fossil fuel			
			(19) Variation in the sun's energy			
			(20) Ocean circulation (current)			
			(21) Cutting-down of trees and bush burning			
			(22) Building of cities			
			(23) Irrigation of the desert			
			(24)Volcanic eruption			

(C) SOCIAL STUDIES CURRICULUM RESPONSE TO CLIMATE CHANGE

Indicate your view on Social Studies curriculum's response to climate change by ticking (√)				
Statement	Not At All	Not Sure	Some-how	To a Large Extent
(25) The Social Studies curriculum is addressing climatic issues				
(26) The Social Studies curriculum is helping teachers to handle climatic issues sufficiently				
(27) The Social Studies curriculum is increasing people's knowledge on climate change				
(28) The Social Studies curriculum is positively changing students' views about				

climate change				
(29) The Social Studies curriculum should be redesigned to better handle issues of climate change				
(30) The Social Studies curriculum would better respond to climate change if it is designed by the teachers themselves				
(31) The Social Studies curriculum would better respond to climate change if we use foreign Social Studies curriculum or books				

32. State topics in the Social Studies syllabus that addresses climate change

.....
.....
.....

33. What ideal features should a curriculum (syllabus) that addresses climate change possess? (Name two)

.....
.....
.....

(D) CHALLENGES THAT SOCIAL STUDIES EDUCATION FACE IN RESPONDING TO CLIMATE CHANGE

For each of the following statements determine challenges that Social Studies education face in responding to climate change						
DEGREE OF CHALLENGE <u>OR</u> NO CHALLENGE			STATEMENT	CHALLENGES		
Greatest	Greater	Great		Uncertain	No	Yes
			(34) Inadequate TLMs for teaching climate change			
			(35) Unavailability of resource persons.			
			(36) Social Studies curriculum is overloaded with other issues			
			(37) Abstract nature of the causes of climate change			
			(38) Difficulty in			

			communicating climate change issues to the students			
			(39) Centralisation of the curriculum			
			(40) Inadequate curriculum designers' knowledge on climate change			
			(41) Inadequate teachers' knowledge on climate change			
			(42) Politicisation of the debate on climate change			
			(43) Because the effect of climate change has not been sufficiently felt yet.			
			(44) Financial constraint			

APPENDIX C
TOPICS IN THE CURRENT (2010) SOCIAL STUDIES SYLLABUS

SHS 1	SHS 2	SHS 3
<p>SECTION 1: ENVIRONMENT (Pg. 1-7) Unit 1: Self Identity Unit 2: Adolescent Reproductive Health Unit 3: Our Culture and National Identity</p>	<p>SECTION 1: ENVIRONMENT (Pg. 18-25) Unit 1: The Institution of Marriage Unit 2: Individual obligation in the Family Unit 3: Responsible Parenting Unit 4: Socialisation and our Social Environment</p>	<p>SECTION 1: ENVIRONMENT (Pg. 36-38) Unit 1: Our Physical Environment and Environmental Challenges Unit 2: Education and Societal Change</p>
<p>SECTION 2: GOVERNANCE, POLITICS AND STABILITY (Pg. 8-12) Unit 1: National Independence and Self-reliance Unit 2: Peace Building and Conflict Resolution</p>	<p>SECTION 2: GOVERNANCE, POLITICS AND STABILITY (Pg. 26-29) Unit 1: Leadership and Followership Unit 2: Our Constitution, Democracy and Nation Building</p>	<p>SECTION 2: GOVERNANCE, POLITICS AND STABILITY (Pg. 39-42) Unit 1: Rights and Responsibilities of the Individual Unit 2: Ghana and the International Community</p>
<p>SECTION 3: SOCIO-ECONOMIC DEVELOPMENT (Pg. 13-17) Unit 1: The Youth and National Development Unit 2: Science and Technology Unit 3: Resource Development and Utilisation in Ghana</p>	<p>SECTION 3: SOCIO-ECONOMIC DEVELOPMENT (Pg. 30-35) Unit 1: The Role of the individual in Community Development Unit 2: Promoting National Socio-Economic Development Unit 3: Sustainable Development</p>	<p>SECTION 3: SOCIO-ECONOMIC DEVELOPMENT (Pg. 43-46) Unit 1: Population Growth and Development Unit 2: The world of Work and Entrepreneurship</p>

Source: Ghana Education Service (2010).