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Understanding and teaching climate change

in the Secondary Education Geography Curriculum in Swaziland.

by

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A thesis submitted in partial fulfillment of the requirements for the degree of Philosophiae

Doctor (PhD)

in

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Faculty of Education

University of Pretoria, South Africa

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Co-Supervisor: Prof. W.J. Fraser

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I Thank You.

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Abstract

Climate change education is globally recognised as a key approach through which to enhance the knowledge and understanding of climate change among learners and teachers. This study thus sought to investigate the understanding and teaching of climate change in the Secondary Education Geography Curriculum in Swaziland. The major goal of this study was to establish the understanding and teaching of climate change in the secondary education Geography curriculum of the country. To investigate the understanding and teaching of climate, the study employed an exploratory design comprising methods like questionnaire, focus group interviews as well as document analysis in the form of secondary records. The data was collected from 16 principals, 32 Geography teachers from 16 high schools; four from each region of Swaziland, one Senior Environmental Education Officer, one senior inspector of Geography and one senior Geography curriculum designer. Numerous gaps and misconceptions were found to exist in learners and teachers understanding of climate change education. The findings reflected that the teachers were not comfortable with the integration of climate change education into all the secondary education Geography curriculum lessons. However, they claimed to be unknowingly practising its integration to a limited extent. Although the teachers generally supported the integration of climate change education into the geography curriculum, they cited challenges like lack of proper training on climate change education, a shortage of teaching resources on CCE and the already overcrowded geography curriculum which then made it impossible for CCE integration. The study recommends that the Ministry of Education and Training need to train teachers on CCE both at in-service and pre-service level and providing the resources required for CCE, for instance, the internet and good libraries for research, since CCE requires perpetual learning.

Concepts

1. Climate Change Education,
2. Climate Change,
3. Adaptation,
4. Mitigation,
5. Resilience,
6. Curriculum.
7. Education stakeholders,
8. Teaching and learning methodologies,
9. Climate change education for sustainable development,
10. Formal and informal education.

Acronyms

BA- Bachelor of Arts

Bed- Bachelor of Education

CCE - Climate Change Education

CCESD - Climate Change Education for Sustainable Development

DSED - Education for Sustainable Development

EEASA- Environmental Education Association of Southern Africa

EE- Environmental Education

EEPAP- Environmental Education and Public Awareness Programme

EIO- Environmental Information Officer

ESD - Education for Sustainable Development

EIO- Environmental Information Officer

FAO - Food and Agricultural Organization

HDR - Human Development Report

ICPAC - IGAD Climate Prediction and Application

IGCSE - International General Certificate of Secondary Education

IGU - International Geographical Union

ICT- Information and Communication Technology

IPCC - Intergovernmental Panel on Climate Change

MA- Master's degree in Arts

MEd-	Master degree in Education
MDGs -	Millennium Development Goals
NCC-	National Curriculum Centre
NERCHA-	National Emergency Response Counselling HIV and AIDS
NGO's-	Non Government Organisations
NWP -	Nairobi Work Programme
PGCE-	Post Graduate Certificate in Education
UNCED -	United Nations Conference on Environment and Development
UNCCD -	United Nations Convention to Combat Desertification
UNFCCC -	United Nations Framework Convention on Climate Change
UNEP -	United Nations Environment Programme
SEA-	Swaziland Environmental Authority
SIMPA-	Swaziland Institute of Management and Public Administration
SGCSE -	Swaziland General Certificate of Secondary Education
SWADE-	Swaziland Agricultural Development Enterprise
SNTC-	Swaziland National Trust Commission

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Chapter 1

Orientation, problem statement and focus of the study

1. Contextualisation

1.1. Introduction

UNEP (2011:11) has stated that "climate change is one of the most pressing environmental issues facing the world today". Meanwhile, according to Selim (2011:4) "climate change threatens the broader sustainable development agenda, the mandate of which is to reduce poverty and child mortality, ensure universal primary education for all children and enhance gender equality". This implies that the Millennium Development Goals (MDGs), especially those related to child welfare, are compromised. As the effects of climate change worsen, escaping poverty becomes more difficult. UNESCO (2012:8) has noted the following in this regard:

> "Eleven out of the last twelve years have been the hottest on record since 1850. The IPCC also estimated that the average global surface temperature from 1850/1899 to 2001/2005 has increased by 0.760^0c. The global sea level increased at an average rate of 1.8 mm per year over the period 1961 to 2003 and, over the 20th century, sea levels rose by 0.17m. Since the middle of 20th century human activities have contributed to global warming, a phenomenon which is expected to continue to increase at a faster rate in the 21st century if there is no effort to address it."

Ekpoh (2009:106) attests that "the climate change phenomenon has serious deleterious consequences for the earth in the form of, amongst other effects, significant variations in regional climates, recurrent droughts, excessive heat waves, windstorms, and killer floods" The impacts of climate change are shown in Figure 1.1. This figure presents a clear mind map of the impacts of climate change on the livelihoods of people across the globe. The key impacts shown in this figure indicate that global warming will be more serve than just famine, plague or even nuclear war, all of which affect significant proportions of the world

population. From this figure, it becomes clear that there is an urgent need for climate change issues to be integrated holistic into the SGCSE Geography curriculum. This will ensure that learners gain knowledge and understanding of climate change.

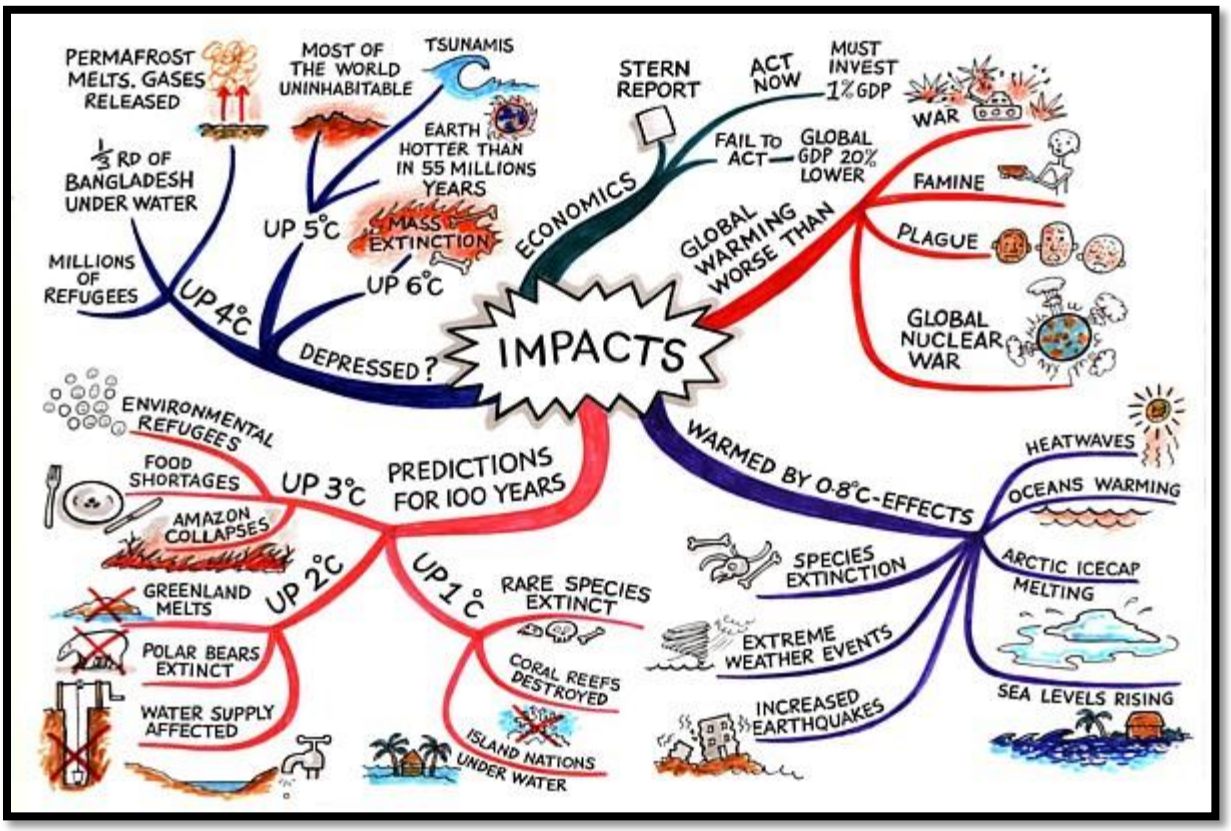


Figure 1.1 Impact of climate change
Source: https://geotallis.weebly.com

According to Offorma (2006:20), "climate change is a result of human activities such as agriculture, mining, manufacturing and processing industries, to mention a few". Ozor (2006:21) states that "climate change is also caused by natural phenomena, which include solar output, variations in the Earth's orbit, volcanism, ocean variations etc". However, it is important to note that developing countries like Swaziland are particularly at risk due to their high dependency on agriculture, and have fewer resources and options to combat damage from climate change (Manyatsi, 2008:12). According to FAO (2007:24) "agriculture is involved in both the causes and effects of climate change; for example, the livestock sector alone accounts for eighteen percent of global greenhouse gas emissions,

while deforestation is responsible for eighteen percent of carbon dioxide emissions". Figure 1.2 illustrates the earth's greenhouse effect. UNESCO (2013:35) states that "the greenhouse effect is the natural process of the atmosphere letting in some of the energy we receive from the Sun (ultraviolet and visible light) which stops it being transmitted back out into space (infrared radiation or heat) making the Earth warm enough for life". Figure1.2 presents the argument that human activities, such as burning coal, oil and gas, have led to an increase in greenhouse gases in the atmosphere, causing an enhanced greenhouse effect and extra warming. Therefore, it is important for humans to minimise their activities, which lead to the greenhouse effect. "As long as human activities continue to add greenhouse gases like carbon dioxide, methane and nitrous oxide into the earth's atmosphere, global temperatures are expected to rise, causing the earth's climate to change" (Hansen, 2009:18). These climate changes affect precipitation patterns, severe and extreme weather events, and overtime, the interconnections of environmental systems.

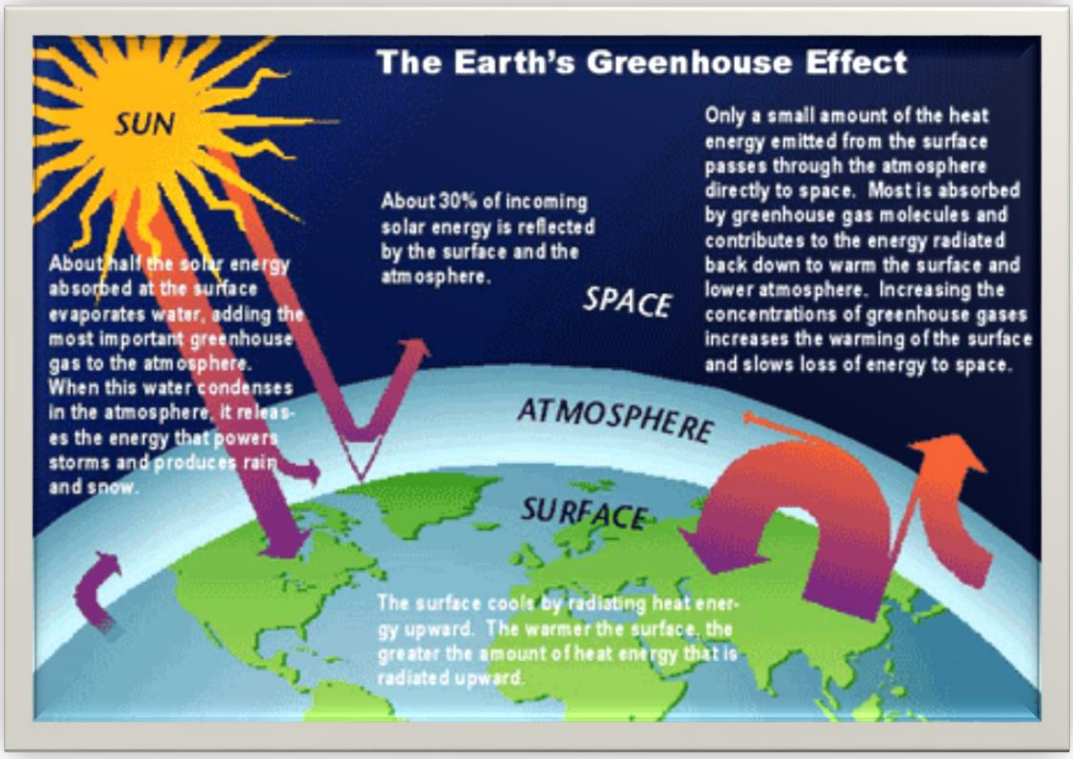


Figure 1.2: Illustration of the earth's greenhouse effect

Source: https://geotaliss.weebly.com

It is well understood that "the climate system is vast and that human interactions with it present complexities that are not yet fully understandable" (Antilla, 2005:345). These uncertainties notwithstanding, no country can justify reason for inactivity especially in the light of the high stakes involved and the reality that damage caused today may turn out to be irreversible should the assumptions hold (Aladag, 2010:4). Such being the case, policymakers and stakeholders in Swaziland are keen to accept expert advice based on objective scientific, technical and socioeconomic information available on climate change in general and how Swaziland will fair in it, particularly in future years. As a result, in 1994, Swaziland established a team of professionals which conducted research on the effects of climate change in the country. The findings of this research were presented to the United Nations Framework Convention on Climate Change (UNFCCC, 2010:23).

Climate change is a complex global problem because it is intertwined with many other issues, such as economic development and poverty reduction (UNESCO, 2010:4). "Developing countries are the least responsible for climate change, yet the most at risk from its effects" (Kyoto Protocol, 2005:14). The challenge posed by climate change, when superimposed on the multitude of structural problems the African countries are facing, means that meeting the Millennium Development Goals (MDGs) can actually be a much greater task than previously thought (Robinson, 2011:9). However, it is important that in 2015 the MDGs have since been replaced by the Sustainable Development Goals (SDGs). A glance at the rate at which development is taking place in a number of African countries, one can observe that the impact of climate change has greatly hindered the progress towards meeting the Millennium Development Goals (MDGs). For instance, most of the developing countries are forced to channel large sum of their budgets to health, and food security thus jeopardize developing other sectors of the economy (UNESCO, 2007:18). Therefore, it becomes difficult for the countries to address fully the issues of poverty reduction, child mortality, and morbidity, strengthening gender equality and ensuring universal access to primary education for all children which forms part of the most significant objectives of the MDGs (UNESCO, 2012:4). For instance, in Swaziland more than fifty thousand children are in primary or secondary schools. However, a big number of these children fail to complete their education due to distant location, poor quality of school, lack of fees,

discrimination based on gender, HIV and AIDS and disabilities (Government of Swaziland Report, 2008:12). This observation is supported by Anderson (2010:4), who writes:

> "Disasters caused by hazard-induced climate change can damage or destroy school facilities and educational systems, threatening the physical safety and psychological well-being of communities and interrupting educational continuity. The economic impacts of disasters reduce school enrollment, as children are kept out of school to help with livelihoods".

One can attest that climate change will remain a stumbling block towards Swaziland's quest for development as already discussed that a large portion of the country's budget goes to food security and health hence the other sectors of the economy are neglected. Therefore, it is imperative for teachers to understand the causes, dynamics and impacts of climate change in order to adopt a holistic approach in developing a oriented and transformative capacities (Aderogba and Ogunnow, 2010:24).

"The literature suggests that climate change is likely to be one among many other factors that determine whether the MDGs will be met or not in any country" (Chang, 2013; Cherry, 2011; Flannery, 2006; Fullan, 2007). According to FAO (2014:10) "where people are unprepared or adaptation strategies are inadequate, climate change can easily set back development gains by affecting key sectors such as agriculture, water resources, infrastructures and health". On the other hand, as Hansen (2009: 13) has noted "meeting the goals means that stronger economies and more resilient societal and environmental systems will emerge, thus reducing the vulnerability of the populations to the negative impacts of climate change".

Countries will always have the challenge to reduce poverty as per the attainment of the Millennium Development Goals (MDGs), which remain a priority. However, the challenge here is to accomplish the MDGs, while reducing dependence on carbon, promoting climate resilience and ensuring balanced economic development (FAO, 2007:12). Moreover, climate change is already slowing progress towards the MDGs and increasing inequalities

within and across countries (Human Development Report, 2007-2008: 23). Actually, the continuous decrease in soil moisture and water runoff to rivers as effects of El Nino in Southern Africa may affect crop production which is vital to guarantee food security and poverty reduction as required by Goal 1 of MDGs (Chishakwe, 2010:5). Therefore, it can be argued that unless addressed, this trend will cause reversals to the gains made in sustainable human development in the years ahead.

Despite the fact that climate change is a long-term problem, developing countries pay little attention to its effects (Olsen, 2006:12). However, the effects of climate change will be felt sooner than expected, according to scientists (IPCC, 2007:9). Research has shown that hundreds of millions of people in developing countries are likely to face natural disasters, water shortage and hunger due to the effects of climate change. For instance, "extreme weather events are likely to become more intense and more frequent, while higher global temperatures could affect crops and water supplies and spread diseases" (UNESCO, 2010:12). Furthermore, Anderson (2010:3) observes that "the average number of disasters caused by natural hazards has increased in the last 20 years from 200 a year to more than 400 today where this is predicted to increase by as much as 320 percent in the next 20 years". Therefore, it can be argued that education has a huge role to play in attempt to combat climate change. The education sector has the potential to contribute mitigation efforts to enhance adaptive capacity of education systems and learners, thus reducing vulnerabilities and building resilient societies (Anderson, 2010:4).

As such, it can be asserted that at both primary and secondary school level, climate change education has the potential to play a crucial role in developing awareness and improving understanding of this important issue. This in turn could drive important environmental value, attitude and behaviour changes, which may contribute to mitigating climate change (UNEP, 2006; UNESCO, 2009; Selim, 2011). According to Dlamini (2011:37) "education may help individuals to make informed decisions, which will benefit the environment, and thus minimise the impact of climate change". Actual education is important in the sense that it has the ability to raise awareness of any issue declared a disaster, and thus inspire

behavioral, value and attitude changes among various members of society (UNEP, 2006:24). According to UNICEF (2012:4), "children are powerful agents of change, and can be resilient when faced with challenges". As such, providing children with relevant education on disasters and climate change can enable them to reduce the vulnerability of communities to risks.

The purpose of this research was to explore the understanding and teaching of climate change in the Secondary Education Geography Curriculum in Swaziland. Geography, as one of the subjects offered at high school in the country, has been described by literature as "both a powerful medium for promoting the education of individuals, as well as a major contributor to international, environmental and development" (Ekpoh, 2009:98). Furthermore, literature suggests that geography education would provide the avenue to address sustainability issues (Tan and Chang, 2008:289). In addition, Lidstone and Stoltman (2007:1) and Ozor (2009:15) have observed that school geography trains future citizens to accurately imagine condition of great world stage, so to help them to think sanely about political and social problems around them. Empowering the youth to acquire skills and knowledge on climate change issues will not only lead to the development mechanisms for adaptation but also will make them become environmentally responsible. Selim (2011:4) states that:

> "To respond to the needs of children most at-risk and marginalized by climate change, quality education aims to make all girls and boys more resilient to the impacts of climate change. Quality education is a key component of adaptive capacity, the knowledge and skills needed to adapt lives and livelihoods to the ecological, social and economic realities of a changing environment. The child-friendly schools approach is most effective when it starts before school, continues throughout the child's life cycle and leads to lifelong learning in adulthood".

1.2 Background to the study

The Kingdom of Swaziland is a monarchy and land-locked country located in the south eastern part of Africa, covering an area of 17,363 km^2. Figure 1, shows the location of Swaziland.

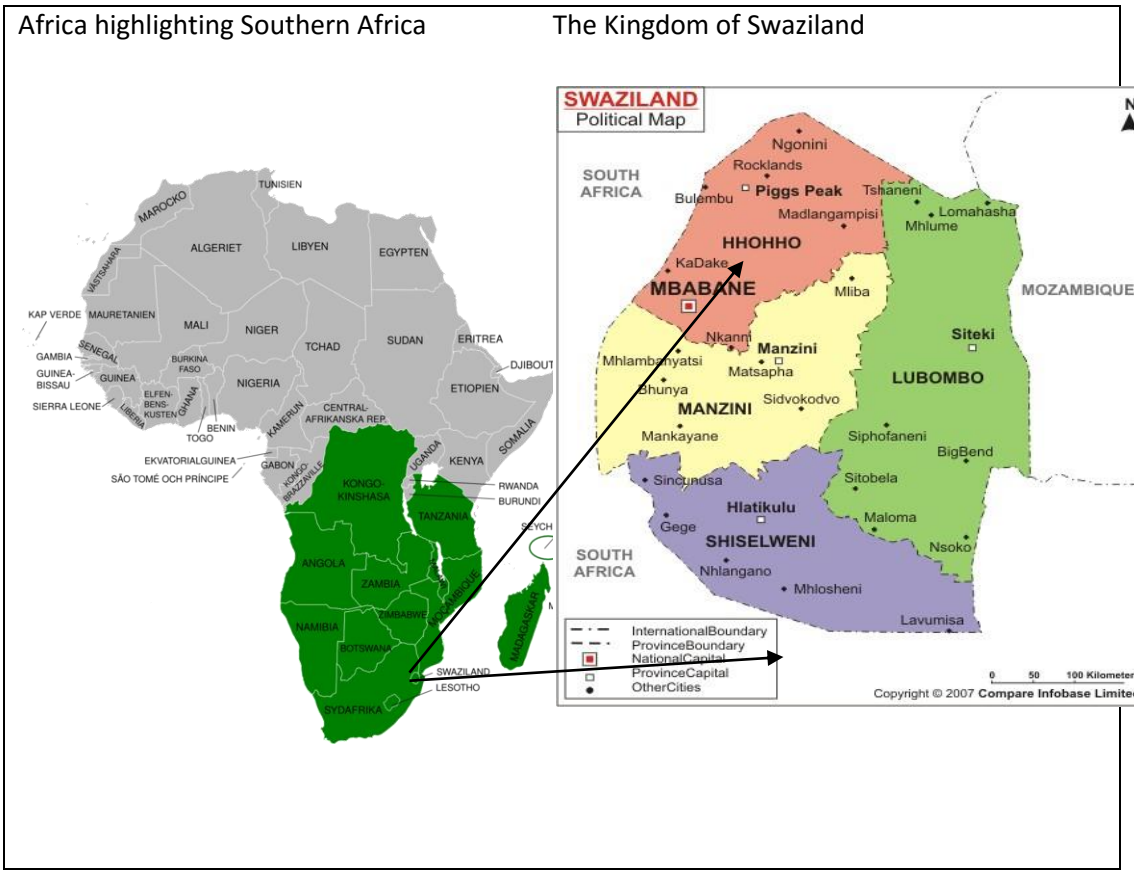


Figure 1.3: The Kingdom of Swaziland in relation to Africa

Source: Statistics Office of Swaziland, (2007)

It is a mountainous country with forest liable to forest decay, and a fragile mountainous ecosystem. Swaziland is surrounded on the north, west, and southern sides by the Republic of South Africa and on the east by Mozambique. Swaziland is the smallest country in the region. Altitudes range from 40m to over 1800m.

Similar to much of south eastern Africa, Swaziland's climate is generally hot and wet in summer with cold and dry winters. Mean annual rainfall range between 1500 mm on the highveld, and 450 mm on the lowveld, whereas daily temperatures can range from 33°C to below 0°C on the Highveld with temperatures in the lowveld often above 35°C (Ministry of Public Works and Meteorological Services, 2015). Swaziland is sometimes subject to the passage of tropical cyclones from the southwest Indian Ocean and frequently experiences heavy lightning during summer time.

Swaziland has been experiencing consecutive drought seasons over a continuous period of five years since the 2001/02 rainfall season to present, with a forward shift on the start of the season and spatial distribution of the rainfall, resulting in what was previously an abnormal condition becoming normal (Dlamini, 2011:21). As a result of the variations in the amount of rainfall received in the country, a significant number of households in the rural Lowveld have since stopped farming. Actual household livelihood vulnerability baseline surveys conducted in 1998, 2002 and 2006 show that the Lowveld zone is more vulnerable to the effects of drought compared to the other three ecological zones (Government of Swaziland Report, 2008:10). For instance, in the 2004/05 cropping season, most approximately (90%) of the arable land in the Lowveld was not cultivated due to the shortage of draught power, delayed rains, the high risk of making a loss from agriculture and a shortage of seeds for alternative crops (Mhazo, 2010:3). To make things worse, even for those homesteads that attempted to grow crops using small-scale irrigation, the water resources are no longer reliable due to a persisting lack of rainfall. The result has been chronic food shortages in the entire country (UNDP, 2010:8). In attempt to rescue the communities affected, the Government of Swaziland has established a Disaster Tusk Force a department under the Deputy Prime Minister's office, which is responsible for food aid provision to most affected homesteads. In the process, a 'dependency syndrome' has emerged, making these households even more vulnerable, where external assistance can be found to be shrinking.

Furthermore, livestock farming is another important agricultural activity for Swaziland's population and national economic development. According to Mhazo (2010:3) "livestock rearing, especially cattle farming, plays a key role in the lives of over 70% of the population". In fact, households rely on cattle rearing as a major source of income and food security, either as small-scale producers or as recipients of income from employment (about 20,000 people) on medium and large-scale farms and estates (Manyatsi, 2010:163). For instance, livestock production is a major agricultural activity in Swaziland, with small farmers owning about 77% of the total cattle population. However, it must be noted that the number of livestock has been declining in recent years due to drought and overgrazing of rangelands, resulting in reduced productivity, and to some extent, also because of allocation of land for human settlement and agricultural schemes as the population grows, which in

turn increase the demand for resources. In fact, the effect of drought is always severe on cattle. For instance, the 1992 drought led to loss of as many as 90,000 cattle (Government of Swaziland Report, 2008:12).

While the rearing of cattle is a common practice amongst the Swazis, it has lead to land degradation, which is now recognised as a very serious problem in Swaziland and a critical issue for continued sustainable social and economic development and poverty alleviation. Current deforestation and degradation of the natural forests and woodland areas has taken place due to a number of factors, which include conversion of land to agriculture, uncontrolled extraction of forest products from communal land, and a large livestock population (Mhazo, 2010:4). In addition, forest degradation is compounded by a number of underlying socio-economic conditions, such as increasing population pressure, that counteract rational utilisation of forest and woodlands (Nsingwane, 2011:6). The most conspicuous form of land degradation in Swaziland is soil erosion (gully, rill and sheet erosion), but the degradation of natural vegetation and forests is also commonly observed.

In Swaziland, land degradation is more dominant in the Lowveld and Middleveld, due to heavy exploitation of wood for fuel, wood carving and furniture by local communities. This problem is aggravated by poverty, which has forced rural communities to cut trees for energy purposes. However, it is imperative to note that, rural communities have gone as far as selling the logs in attempt to generate income. As a result, a large number of indigenous trees are daily deforested for this purpose. This practice has contributed significantly to the impact of climate change currently dominant in the country.

As a result, one can attest that climate change is expected to have a further negative effect on land degradation through reduction of vegetation cover and changes in species composition, as well as through increased deforestation, desertification and disaster hazards (Ministry of Tourism Climate Change Report, 2012:5). Photo 1.1 shows a severe degraded area at Lawuma in the Lubombo region of Swaziland where community members are seen taking an initiative to control the donga by protecting the already degraded area.

Photo1.1 severe degraded land
Source: Fieldwork at Lawuma Community 2015

Industrialisation has greatly increased throughout the whole world. Small and large countries alike have come to realise the benefits of a properly developed industrial environment, with all its benefits, including reduced unemployment and reduced poverty. Swaziland is no exception. Swaziland is a small country with an estimated population of 1,000,000. Its major cities are Mbabane and Manzini. Each city has its own industrial area where most industries are concentrated. Whilst the increase in the numbers of industries is applauded, attention should also be directed towards the impact these industries have on the environment.

Each industry that is developed adds a certain amount of pollution to the environment. It must be noted that if pollution is not controlled to certain tolerable levels, it can lead to disastrous effects. The extent of pollution varies with the size of industry, the nature of the

industry, the type of products used and produced, etc. Among other things, industries cause air pollution, water pollution, soil erosion, diseases related to soil degradation and injuries to mankind, along with many other forms of environmental degradation (Human Development Report, 2007/2008).

The increase in industrial development affects the Swazis directly or indirectly. Man is surrounded by air, land and water, which can be affected by industrial development. "The atmosphere in most towns is polluted with particulate matter (dust, grit, smoke and fumes), sulphur oxides, carbon monoxide, hydrocarbons, nitrogen oxides, lead and a host of other contaminants" (Fahey, 2007:54). Sources of such pollution include motor vehicles, manufacturing industry, power plants, space heating for houses, offices, stores, restaurants, hospitals, schools, hotels, refuse disposal, etc. Photo 1.2 shows the emissions by a manufacturing company in Matsapha.

Photo1.2 Industrial area at Matsapha
Source: Statistics Office in Swaziland (2007)

Water levels have greatly declined, and in regions such as Lubombo and Shiselweni people are sharing the limited remaining water with animals. Livestock have played an important

role in the livelihoods of the majority of smallholder farmers as key sources of income, food and draught power, with cattle being the most prevalent. Cattle numbers have, however, been declining due to a contraction of rangelands and inadequate pastures, as a result of successive years of low rainfall. For instance, "between 2000 and 2002, cattle numbers fell from 588,288 head to 522,260, a decline of 11 percent in two years" (Mhazo, 2010:29). According to the July 2007 draft report of the Vulnerability Assessment Committee (VAC), the condition of cattle is reported to be generally poor, due to death of necessary pastures and water.

Almost 80% of the Swazi population is rural with livelihoods predominantly dependent on subsistence farming and/or livestock herding. According to the Ministry of Agriculture Report (2016), it is the case that "over the past years, multiple interrelated factors such as small fragmented landholdings and minimal access to agricultural inputs, reduced employment opportunities, market inefficiencies and high HIV/AIDS prevalence have contributed to chronic food insecurity and gradually weakening livelihoods." In addition, the agricultural system is dominated by a single crop, maize, with extensive dependence on rain-fed agriculture, which increases a households' vulnerability to erratic weather. For this reason Mhazo (2010:32) points out that "minimal shocks to agriculture therefore have a profound impact on the ability of rural households, especially the chronically poor, to maintain their food security". Thus, the estimated "60% reduction of the 2006/2007 agricultural season's harvest will have a dual impact on these households: on the one hand, reliance on their own production is compromised; on the other, increased market purchases are required at a time of rising prices and reduced labour opportunities" (Ministry of Agriculture Report, 2016).

1.3 Problem statement

The world is currently facing complex environmental problems caused by increasing population together with increased development that have both resulted in environmental degradation. Climate change is one of the major problems faced by the global world. Brown (2011:4) defines climate change as:

> "any long-term and significant change in the expected patterns of a specific region's average weather for an appropriately significant period of time. It is the result of several factors, including Earth's dynamic processes, external forces, and more recently, human activity. External factors that shape climate include such processes as variations in solar radiation, deviations in Earth's orbit, and variations in the level of greenhouse gas concentrations. Evidence of climatic change taken from a variety of sources can, in turn, be used to reconstruct past climates. Most climate evidence is inferred from changes in key climate indicators, including vegetation, ice cores, dendrochronology, sea-level change, and glacial geology".

These problems have the potential to cause a negative impact on national development activities such as tourism and trade, food supplies, public health and the environment. In addition, the action themes of the UN Decade for Education for Sustainable Development (DSED, 2005-2014), which include the environment, water, rural development, sustainable consumption, sustainable tourism, intercultural understanding, cultural diversity, climate change, disaster reduction, biodiversity and the market economy, all have a geographical dimension (Hanbrich, 2007:43). It is important to note that in 2013 UNDESD was replaced by the Global Action Programme (GAP) on ESD which attempts to help UN member states in the realization of the 2030 Agenda for Sustainable Development by reorienting education and learning so that everyone has the opportunity to acquire the knowledge, skills, values and attitudes that empower them to contribute to sustainable development.

Therefore, this research attempts to investigate the role of the Swaziland General Certificate of Secondary Education Geography curriculum in helping students develop more holistic, informed and considered views, and understanding about the effects of climate change.

In order for this research to contribute to a body of knowledge about climate change perceptions and the contribution of SGCSE Geography curriculum to students'

understanding of climate change, there are a number of issues to be considered. Issues such as: the representation of critical issues in the curriculum; the impact of poverty; instructional interventions that can enhance the teaching of climate change; the student's responsibility towards society and morality; and the development of a personal moral identity, are more important. This will help to close the main gaps in students' understanding, and the way in which educators and governments ought to address these gaps, through a specific educational approach to climate change, to contribute to a better informed public and population of students.

In Swaziland, unfortunately, there are no specific resources available that can help Geography teachers to integrate climate change more comprehensively into their lessons. This observation is supported by McCaffrey and Berbeco (2013**:**3), who have noted:

> "Both climate change and the impact of fossil fuels on climate and the environment have been largely neglected in current science education standards and curricula; professional development for educators is uneven or non-existent; quality instructional resources for the classroom are hard to find; and there has been a concerted effort to foster doubt and denial of climate change science, inside of classrooms and throughout society".

Based on the discussion of research by Dlamini (2011:75), it can be suggested that the level of climate change education awareness among secondary school geography teachers is significantly low. Therefore, when teaching Geography topics, climate change education has always been ignored. This may be attributed to the fact that there are barriers to the effective teaching of climate change education, which include the 'over-saturation' from media and curriculum coverage, existing misconceptions, incomplete knowledge, and difficulties with threshold concepts and areas of troublesome knowledge such as timescales, systems thinking, as well as interdisciplinary and scientific uncertainty (Robinson, 2009:24). Students are exposed to information about global warming and climate change, and how it daily lives of citizens around the world. Therefore, this research attempts to explore how the SGCSE Geography curriculum and teaching methods can enhance learners understanding of

climate change through themes such as climatology, agricultural systems, urban systems and industries. It is anticipated that apart from the knowledge of the causes and impact of global warming, the students are expected to learn how to describe and evaluate the measures required to reduce the impact of global warming-induced climate change.

This research addresses climate change as one of the grand challenges facing society, and has implications for many facets of life. Therefore, it will help teachers and learners realise that it is imperative that as citizens, they ought to gain an understanding of the climate system and the impacts that changes to the system will have. Therefore, this research deliberates what climate change education research could be, and why it matters. It also sees an important research programme in this area, which has the potential to expand both research and climate change education paradigms, and to create opportunities for discussion, debate, and continuous learning.

Research has shown that at both primary and secondary school level, climate change education has the potential to play a crucial role in developing awareness and improving understanding of this important issue. As a result, this could in turn drive important environmental value, attitude and behaviour changes, which may contribute toward climate change mitigation (UNEP, 2006:6; UNESCO, 2009:7). Therefore this study discovered that climate change education may equip learners to better adapt to the predicted social and projected environmental impacts of climate change. Lastly, climate change education may generate learner support for, and awareness of, key mitigation policies and legislation put in place by local governments (UNEP, 2006:5).

This study explored the contents of the SGCSE Geography curriculum, which can help students develop attitudes such as accountability, social responsibility, personal care, and concern for the environment. As such, through the SGCSE Geography curriculum teachers are provided with opportunities to move students from an awareness phase into taking action phase, assuming that the values are well learnt.

In another development, the study attempted to evaluate how best the SGCSE Geography curriculum might further address, beyond the knowledge and skills of geography, the values we desire our students to develop so as to take action to ensure sustainable development in the future. Sellan, Chong and Tay (2006:149), argues that if we want our geography students to be informed critical citizens, then it will be necessary for them to develop evaluation skills in relation to information surrounding a geographical issue. Unfortunately, the current SGCSE Geography curriculum does not compel teachers to lesson themes in such a way that the learners can critically analyse information, such as the causes of a given problem, solutions and adaptive strategies.

The study assumed that the adoption of environmental behaviours is very important in the context of the temperature fluctuations and ecosystem, social and economic perturbations that climate change is likely to engender. However, there is still a concern as to how the SGCSE Geography curriculum and learning might help citizens change the daily habits that cause the production of greenhouse gases. Once citizens have chosen to modify certain habits, how does the process of behavioural change work? (Prone, Doyon, Langis, Martin, Ouellet, McLaughlin and Boudreau, 2006:33). This research therefore, examines the reasons why SGCSE Geography teachers and learners may decide to commit to climate protection.

Towards reducing the production of greenhouse gases, in preparing societies for adaptability to risk and physical environmental change, climate change education also needs to be practice-centered and focused on solutions (UNEP, 2007). The SGCSE Geography curriculum lacks the practice-centered approach, which can enhance learners' understanding of climate change mitigation measures. Therefore, learning-centered actions for change are needed (e.g. learning to implement energy saving measures), so that learners can experience and reflexively review their participation in climate change solutions. Such methodologies are culturally situated and learner-centered. They require teachers to have a good knowledge and understanding of their content and possibilities. For effective change, such participatory, practice-centered methodologies need to be well researched and prepared, so as to ensure maximum benefit and real engagement with change. These approaches should provide

learners with positive ways of contributing to the future, so as to avoid 'doom and gloom' approaches to climate change education.

1.4 The main research question and secondary research questions

The main research question for this study is as follows

How do teachers and learners understand the inclusion of climate change in the Secondary Education Geography Curriculum in Swaziland?

In order to understand the depth of the problem, the following secondary research questions are posed as follows:

1. What are the characteristics of climate change in Swaziland?
2. How are the elements of climate change captured in the curriculum?
3. How do teachers understand and interpret climate change in the curricula?
4. How do teachers teach climate change from the curricula?
5. How do learners learn and deal with climate change in the classroom?

1.5 Rationale of the study

The aim of the study is to establish how teachers and learners understand the inclusion of climate change in the secondary education Geography curriculum in Swaziland. From my experience of teaching Geography for fourteen years at Junior and Secondary levels, I have noted that the Geography curriculum at the various levels do contain topics which can be used to integrate climate change education. Education is very important in increasing public consciousness about climate change (UNESCO, 2012:1). However, the extent to which the curriculum translates into climate change education and awareness is not known. In fact, in Swaziland, school Geography examinations both at Junior and Secondary levels only measure cognitive abilities of candidates without requiring them to apply geographical knowledge to climate change issues and problems.

I have realised that the awareness level of climate change issues remain very low, and that, if holistic action cannot be taken appropriately, then it is possible to head towards an irreversible direction on climate change disasters. Anderson (2010: 3) meanwhile observes that:

> "Disasters caused by hazard-induced climate change can damage or destroy school facilities and educational systems, threatening the physical safety and psychological well-being of communities and interrupting educational continuity. The economic impacts of disasters reduce school enrollment, as children are kept out of school to help with livelihoods".

Actual climate variability is evident in Swaziland, as it manifests itself in hydrological disasters, change in rainfall regime, as well as extreme weather conditions. Swaziland has always been affected by hazards such as climate variability induced droughts, floods, wild fires, windstorm, hailstorms and epidemics, amongst others (Brown, 2011:6). These have resulted in widespread destruction of property, economic losses, environmental loses and death. Since the 1980s, the levels of disaster risk have been increasing concomitant with more frequent occurrence of disaster events. The periods at which drought has occurred and a number of people were affected. The most severe drought occurred in 1983, 1992, 2001, 2007, 2008, and it was reported that over 500 people lost their lives due to the drought of 1983 (Manyatsi, 2008: 34).

Communities in Swaziland have reported that they are experiencing increased frequencies of drought, wind storms, lightening, and hailstorms. All these accompany physical damage to property and personal injuries (Manyatsi et al, 2010:8). With the increasing manifestation of global warming, it is expected that such hazards will continue to have adverse effects on developing countries, including Swaziland. According to Lowe (2010:436) "climate change experts have predicted that southern Africa is becoming drier, with obvious implications for agricultural production, food security and economic development".

Ekpoh (2009:36) has stated that "education is still a powerful tool towards initiating change, as well as transforming and empowering communities, especially the youth". As such, I

hope that this research will show how best climate change education can be integrated into the SGCSE Geography curriculum. The integration of climate change issues across learning areas of the Geography curriculum will help to inform and educate today's youth to be responsible in managing their future environment. Climate change, in particular global warming, has clearly identified causes and effects that need to be explicitly and consistently taught within the SGCSE Geography curriculum. I believe that students have the power to be active citizens and make decisions which address global warming at local levels. This is supported by Selim (2011:2), who noted:

> "On any given day, more than a billion children are in primary or secondary schools. However, many fail to complete their education, deterred by poor school quality and persistent challenges caused by deepening poverty, gender inequities, location, emergency and conflict situations, HIV and AIDS, disabilities, chronic environmental degradation and climate related hazards."

Climate change threatens the broader sustainable development agenda to reduce poverty and child mortality, to ensure universal primary education for all children, and to enhance gender equality. It jeopardises efforts to meet the Millennium Development Goals (MDGs), especially those related to child welfare (Dlamini, 2011:23). This observation is supported by Anderson (2010:2) in the following excerpt:

> "Climate change threatens to undo and even reverse the progress made toward meeting the Millennium Development Goals (MDGs) and poses one of the most serious challenges to reducing global poverty for the international community. However, the education sector offers a currently untapped opportunity to combat climate change. There is a clear education agenda in climate change adaptation and mitigation strategies, which require learning new knowledge and skills and changing behaviors in order to reduce the vulnerabilities and manage the risks of climate change. Therefore, investing in quality education to combat climate change is an essential tool in achieving the MDGs".

I consider it important to integrate climate change into the teaching and learning of geographic topics, because the already predicted changes from sea-level rises for people living in coastal areas and the effect of drought upon rural and regional communities have an impact on the lives of many students in the future. In fact, global climate education must be taught through decision-making, critical thinking, researching, and discovery and not only as giving information.

1.6 Significance of the study

This research will contribute to the existing body of knowledge about climate change education. The existing literature suggests that "climate change is an issue that has left the public confused, not polarised, in terms of what might happen and what should be done" (Selim, 2011:3). There is much room for improvement in climate change communication, since most researchers suggest that effective environmental education, targeting, and clarifying the confusion around the relation between climate change and these cultural models can be integral to the mobilisation of the lay-community to support of necessary climate change policies and actions. According to Ozor, (2010:25) "an increased understanding of what the common differences in perception are will help researchers understand the root causes of the miscommunication between the lay public and the scientific communities". This research seeks to help researchers identify how best the understanding and teaching of climate in the secondary education Geography curriculum in Swaziland can help learners understand climate change. Thus, it may be able to assist in bridging this gap between scientific communities, other organisations involved in climate change discourses, and the general public.

1.7 Aim and objectives of the study

The purpose of this study is to establish the understanding and teaching of climate change in the Secondary Education Geography Curriculum in Swaziland.

To achieve this aim, the following objectives have been operationalised:

- Review documents and other literature to identify effects of climate change in Southern Africa and Swaziland.
- To explore the historical trend of climate change effects in the country.
- To determine the extent at which the Swaziland sectors exposed to climate change.
- To determine how the SGCSE Curriculum and other regulatory make provision for teaching learners about climate change.
- To determine the topics in the SGCSE Geography syllabus that addresses climate change.
- Determine the instructional design strategies that are used to enhance learners' understanding and awareness of climate change.
- To identify the initiatives undertaken by schools to promote public awareness of environmental issues like climate change.
- To establish the basic sets of learning and teaching resources on climate change that allow geography teachers to design their own lessons.

1.8 Conceptual and theoretical framework guiding the empirical study

It has been discussed how climate change is a key challenge to communities in Swaziland. According to the Swaziland's First National Communication to UNFCCC (2010), in Swaziland the sectors that are climate sensitive and hence highly at risk are:

- water resources, especially in international shared basins;
- agriculture, in issues of food security at risk from declines in production in an uncertain climate;
- natural resources and biodiversity, on future types of ecosystems, tree growth, distribution and mortality of species; and
- health, on vector-borne diseases as they relate to anticipated changes in climate

parameters, notably precipitation and temperature (SFNC, 2010: 10).

The theoretical framework of this research will be developed in line with the Engeström Activity Theory, shown in Figure 1.4. According to Engeström (1987), any theory of learning must answer at least four central questions: (1) who are the subjects of learning, how they are defined and located? (2) why do they learn, what makes them make the effort?, (3) what do they learn, what are the contents and outcomes of learning? and (4) how do they learn, what are the key actions or processes of learning?

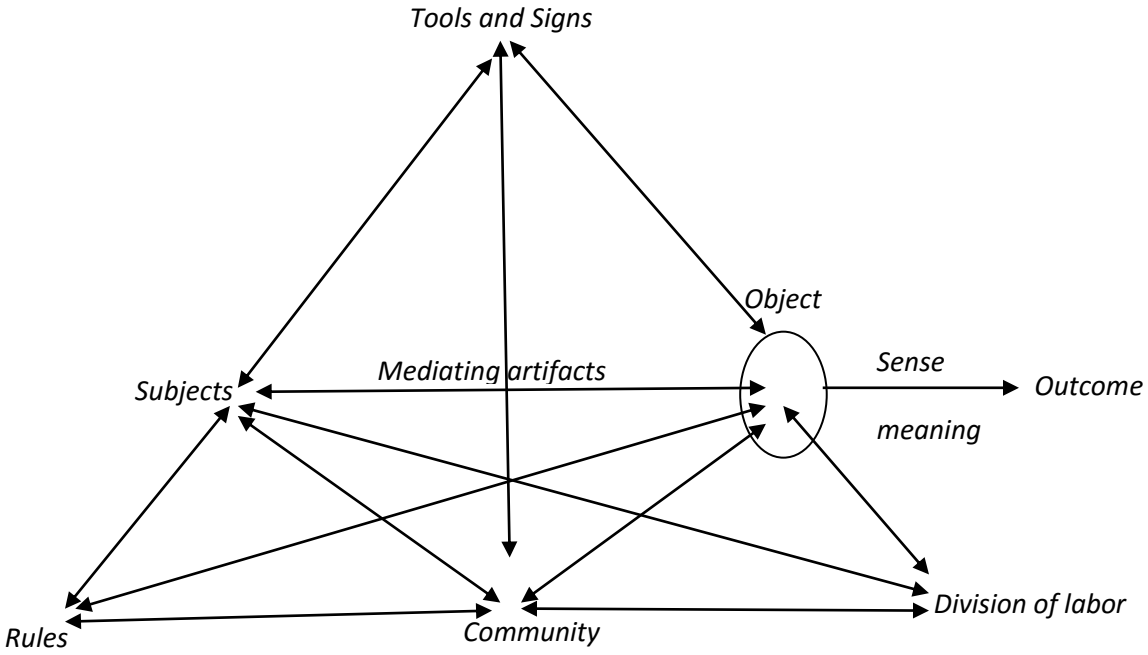


Figure 1.4 : Engeströms' Activity Theory
Source: Engeström (1987:78)

This first approach drew heavily from Vygotsky's (1978)' concept of mediation. This triangle represents the way in which Engeström brought together cultural artifacts with human actions in order to dispense with the individual and social dualism. During this period studies tended to focus on individuals. The components in Figure 1.4 are equated against all the components that are part of the investigation. For instance, the object represents learners who have been investigated in attempt to establish their understanding of climate change inclusion in the SGCSE Geography curriculum.

Outcomes represent the learning and assessment objectives of the SGCSE Geography curriculum which will be evaluated to establish if they do address climate change. The

learning and assessment objectives indicate the concept which the learner is expected to be able to tackle after going throughout the learning process. They can be general or specific. Developing objectives is a major activity in curriculum development. This is then followed by selection of the content. Content here refers to the topics and sub-topics in a subject or course. The content is based upon the objectives that have been formulated. In many cases, the formulation of the objectives and the selection of the content go together. Some curriculum developers may want to think of the content and then the objectives that could be covered through that content. The caution one needs is that content may be meaningless, unless the objectives of including that content are clear.

Rules represent the curriculum with all its components, that is, the topics that expose teachers and learners to the concept of climate change. However, lessons on key climate change topics such as global warming, the greenhouse effect and weather-related disasters are not enough. Risk communities must develop local adaptation policies and practices, addressing disaster risk reduction, emergency preparedness and locally relevant sustainable development options.

Tools refer to the teaching strategies and methodologies employed by geography teachers in their classes. This investigation assumes that there are certain strategies and methodologies to raise awareness, for example: media campaigns; field excursions; assignments; topical events messaging through youth radio programmes; theatre and music; conferences; environment day celebrations; and other events and programmes within and outside of school that are able to complement formal curricula and significantly strengthen learning. These strategies require collaboration with non-governmental organisations (NGOs) and the private sector.

Subject and division of labour are equated against teachers. The geography teachers will be investigated in this study in an attempt to establish their understanding of climate change. Human resources are the most important asset of any country. Climate change is a new phenomenon in Swaziland, and hence, most teachers and other trainers lack adequate capacity to implement the concepts, and thus will require capacity building. In addition, curriculum support materials include all that is needed to help the teacher and the learner to

efficiently and effectively achieve the set objectives. Commonly-used curriculum support materials include a teachers' guide, a learner's manual, and other print and non print materials; all these make a complete package of the curriculum. This will be especially important in teaching climate change curriculum, because there are very few experts in the area.

In order to progress in the development of Activity Theory, Engeström (1999) expanded the original triangular representation of activity to enable an examination of systems of activity at the macro-level of the collective and the community, in preference to a micro-level concentration on the individual actor or agent operating with tools. This expansion of the basic triangle aims to represent the social and collective elements in an activity system, through the addition of the elements of community, rules and division of labour while emphasising the importance of analysing their interactions with each other (Engeström, 1999:28) . In Figure 1.4 above the object is depicted with the help of an oval indicating that object-oriented actions are always, explicitly or implicitly, characterised by ambiguity, surprise, interpretation, sense making, and potential for change (Engeström, 1999:29). At the same time, Engeström emphasises the importance of contradictions within activity systems as the driving force of change, and thus, of development. Robinson, (2011:62) argues that "global change will affect every citizen, every part of the environment and our natural resources, and thus practically every aspect of our lives, by affecting our economy, our urban and suburban development patterns, natural areas we protect, and our lifestyles". For this reason there is great interest in educating pupils, the future citizens, about it.

In the third generation of Engeström's (1999) Activity Theory sees joint activity or practice as the unit of analysis for activity theory, not individual activity. He is interested in the process of social transformation and includes the structure of the social world in analysis, taking into account the conflictual nature of social practice. He sees instability, (internal tensions) and contradiction as the motive force of change and development (Engeström, 1999:9) and the transitions and reorganisations within and between activity systems as part of evolution; it is not only the subject, but the environment, that is modified through

mediated activity. He views the reflective appropriation of advanced models and tools as ways out of internal contradictions' that result in new activity systems.

Engeström (1999) intends to develop conceptual tools to understand dialogues, multiple perspectives, and networks of interacting activity systems. He draws on ideas on dialogicality and multivoicedness in order to expand the framework of the second generation. The idea of networks of activity within which contradictions and struggles take place in the definition of the motives and object of the activity calls for an analysis of power and control within developing activity systems. The minimal representation which Figure 1.4 provides shows but two of what may be a myriad of systems exhibiting patterns of contradiction and tension. According to UNESCO (2009:34) the following implications of climate change pertain to education and ought to be taken into account:

- All levels and forms of existing educational and teaching and learning programmes need to be reviewed and re-oriented to address the causes and consequences of climate change.
- Climate change requires educators to include new content into education, training and public awareness programmes.
- Creativity, problem solving and social transformation skills need to be developed and nurtured.
- Positive, participatory action and solution-centered approaches to education and learning need to be developed.

Educating students regarding issues of global climate change is a challenge for educators because the traditional didactic strategies are inappropriate and so new innovative instructional approaches and techniques should be created. Traditional ways of teaching, which are largely based on the transmission of knowledge, are inappropriate as they do not help pupils to use the knowledge learned to understand real issues from everyday life (Papadimitriou, 2004:10).

The challenge of education for global climate change is to make these global issues meaningful to learners, by focusing on individual contributions to the problems, and then, using problem-solving and decision-making strategies to develop, refine and redirect the

thinking and the learning. For this reason, instruction in hands-on and computer based classroom activities, field trips, and project work, can be helpful.

Swaziland, as one of the United Nations' member states, is obligated to implement Climate Change Education. Education and teaching as attested to by UNESCO (2010) can be seen as a "major vehicle that can help communities to develop an understanding of climate change". Offarma (2006:17) adds to this by noting "education, especially curriculum and teaching, has been cited by numerous authors as an important pillars in addressing the major challenge for learners to minimise the causes of climate change within their communities". This argument is supported by (O'Brien, 2009:1), who noted that climate change is not simply an environmental problem that can be addressed by regulating greenhouse gas emissions, but that instead, it is about human development, social justice, equity, human security and the capacity of individuals and communities to respond to threats to their social, environmental and human rights.

1.9 Research design and methodology

In this study, an exploratory research design has been used complementary qualitative strategies to improve the validity and reliability of the study. The study followed a mixed methods approach namely document study, questionnaires and interviews to collect data from participants. The triangulation of data was done to determine whether there were discrepancies, corroboration or new insights that surfaced. The details of the methodology will be discussed in Chapter Three.

1.10 Conclusion

The conceptual framework was discussed in this chapter which explains the basis on which the investigation proceeded. The subsequent chapters discuss critical issues in depth. Chapter Two provides a critical review of literature pertaining to this research: overview of climate change education, the importance of Pedagogic Content Knowledge in climate change education, the role of education in addressing climate change, the impact of

education on climate change, the policy dynamics on climate change education, enhancing learners and teachers' understanding of climate change through the SGCSE curriculum. Chapter Three focuses on an in depth discussion of strategies used to collect empirical research data. Chapter Four outlines data collection and data analysis while Chapter Five provides recommendations, implications and conclusions of the study. This study is important because it addresses a topical issue which has adverse effects on the lives of Swazis.

Chapter 2

Literature review

2.1 Introduction

The purpose of Chapter Two is to review the way in which literature addresses the question of how teachers and learners understand the inclusion of climate change in the Secondary Education Geography Curriculum in Swaziland. The chapter starts with an overview of climate change education globally. The chapter further evaluates how scholars have addressed the contribution of education to teachers and learners' understanding of climate change and identifies core concepts emanating from literature review to guide the collection of empirical data. The chapter also addresses the conceptual framework that was used to develop the questions for interviews and questionnaires.

2.2 Overview of climate change education

In the last decade, a significant amount of research has been conducted concerning pupils' and adults' understanding of global warming and other global environmental problems. These studies uncovered the misconceptions and misunderstandings people, of all ages, hold of many aspects of these issues in terms of causality, possible consequences, and possible cures (Boyes and Stanisstreet, (1992), Carter, (2006), Harrington, (2008), Dove, (1996), Boyes and Stanisstreet (1998), UNESCO (2012), Ekpoh (2009), Andersson (2010). Research has shown that misconceptions and misunderstandings about many environmental issues, climate change included, are not only held by pupils but by teachers as well (Fortner and Corney, (2010), Hestness, MacDonald, Breslyn, McGinnis & Mouza (2013), Papadimitriou, (2004). These misconceptions and misunderstandings are probably due to, among other things, the complexity of the science involved, and the uncertainties and the controversies surrounding them. By understanding these misconceptions, teachers are in a better position to devise strategies for successfully addressing them in the classroom.

To date, research on education and climate change has focused on the impact of climate and associated environmental changes on schooling (UNESCO, 2012:1). For instance, there are two recent publications: Legacy of Disasters (Save the Children's 2008) and Our Climate, Our Children, Our Responsibility (UNICEF UK's 2008). In both papers, children are portrayed those to be hardest hit by the effects of climate change.

Johnson (2011) has done research on climate change education, teacher preparation, understanding, needs and concerns, which concluded that, "there are significant advantages to including climate change in the curriculum, which include the opportunity to teach about the unifying concepts that are related to climate change" (2011:12).

In an article entitled *Teaching Climate Change in Higher Education: Barriers and Opportunities,* Robinson (2011:1) argues the following with regards to teaching:

> "Teaching the topic of climate change comes with a responsibility to support students to develop more holistic, informed and considered views and understanding. Further barriers to the effective teaching of climate change include 'over-saturation' from media and curriculum coverage, existing misconceptions, incomplete knowledge, and difficulties with threshold concepts and areas of troublesome knowledge such as timescales, systems thinking, interdisciplinary and scientific uncertainty."

The author (2009:12) proposed that "climate change educators should also be aware of the great opportunities and benefits that effective climate change education can bring to learners, educators, institutions and to wider society." Hestness, et al. (2013:8) have noted that "these opportunities include providing a framework and context for students (and educators) to form a more holistic and interdisciplinary world view." As such, a topical context for teaching core discipline concepts like climate change is provided. In the process there will be "an increase in learners' environmental awareness which contributes to enhanced environmental citizenship and behavioural change amongst the student cohort, the world's future leaders" (Robinson, 2011:1).

Haigh (2005: 23) has identified "climate change education as traditionally viewed as coming from within the Geography, Earth and Environmental Science disciplines." However, Chalkey, (2002: 37) argues as follows:

> "the focus of coverage of climate change topics and linkage to sustainability issues is highly variable between disciplines, ranging from consideration of solely scientific issues such as natural climate change variability on geological timescales, to interdisciplinary considerations of anthropogenic causes and impacts of predicted climate change and climate change 'solutions' covering science and technological issues through to social, economic, political and ethical factors. A consideration of anthropogenic-scale climate change clearly relates closely to issues of sustainability, whereas an understanding of longer-term natural climate variability may link less clearly to sustainability issues."

According to Robinson, (2009:36) "climate change education therefore offers many opportunities and benefits for learners, educators, institutions as well as for wider society, but there are also many challenges, which can hinder the successful integration of climate change education beyond the consideration of the scientific processes." Climate change is a topic about which everybody has an opinion, often based largely on incomplete knowledge and major misconceptions (Gautier, Deitsch, Rebich, 2006, McCaffrey and Buhr, 2008). Harrington, (2008:578) attest that "effective climate change education therefore requires the construction of new knowledge and understanding within learners' existing, often well-established and deeply personal frameworks of existing beliefs, incomplete knowledge and understanding".

The influence of existing knowledge on learners' abilities to take on new understanding is significant and affects how information is perceived, how judgments are made about this information, and what students are able to understand and remember (Alexander, 1996:89). Studies have shown that students and the wider public may hold a large number of misconceptions about weather and climate change (Gautier et al., 2006:374). Dupigny-Giroux (2008:484) has noted that there is a "disconnect between actual climate science

knowledge and perceived knowledge." Such misconceptions within prior knowledge can pose a significant barrier to deeper learning and conceptual change (Gautier et al., 2006:380). This implies that it is incumbent upon climate change educators to deconstruct extant partial or incorrect knowledge, as Harrington (2008:578) has put it "as part of the educational process in order to achieve effective climate change education."

Research into misconceptions surrounding climate change has suggested that, misconceptions are difficult to dislodge (Gautier et al., 2006). As existing knowledge serves as a foundation for the integration of new concepts and is therefore central to learning, there is a need to attend to misconceptions that present an impediment to deeper learning that form part of a "clear need to assess prior knowledge at an early part of the education process" (Gautier et al., 2006:390).

According to Fortner and Corney, (2010:127), "the challenge of education for global climate change is to make these global issues meaningful to learners by focusing on individual contributions to the problems, and then, using problem-solving, decision-making strategies to develop, refine and redirect the thinking and the learning". UNESCO (2009:34) has mandated that education take into consideration the following implications of climate change:

- All levels and forms of existing educational and teaching and learning programmes need to be reviewed and re-oriented to address the causes and consequences of climate change.
- Climate change requires educators to include new content into education, training and public awareness programmes.
- Creativity, problem solving and social transformation skills need to be developed and nurtured.
- Positive, participatory action and solution-centered approaches to education and learning need to be developed.

From the experience of teaching, educating students about issues of global climate change is a challenge for educators, because traditional didactic strategies are inappropriate and so new innovative instructional approaches and techniques ought to be created. Papadimitriou, (2004:35) makes the case that, when it comes to traditional teaching methods, "which are largely based on the transmission of knowledge, these prove inappropriate as they do not help pupils to use the knowledge learned to understand real issues from everyday life." For this, instruction in hands-on and computer based classroom activities, field trips, and project work can be helpful.

In the Swazi situation in particular, educational studies need to be undertaken in the field of changing global climate. The main aims of these studies would be to "make students conscious of their environment, to improve their environmental attitudes, knowledge and behaviour and to increase consciousness in society" (Dlamini, 2011:45). Therefore, global climate change will become part of the curriculum in primary and high schools. The teaching methods and materials will then be designed according to these aims.

Climate change education is critical as part of the framework, because its role in addressing the challenges of climate change is increasingly recognised (UNESCO, 2012:8). However, it is important to note that the capacity of education to contribute to adaptation and mitigation measures, which have yet to penetrate mainstream development thinking. As such, the framework for this study is based on the fact that education about climate change serves three primary purposes, cited here from the National Research Council, (2009 and 2010:3): "to build understanding of why change is occurring, to help people learn how to reduce emissions of climate change gases and to increase knowledge and skills to adapt to changing climate impacts." Climate change education uses innovative educational approaches to help a broad audience with particular focus on youth, understand, address, mitigate, and adapt to the impacts of climate change (UNESCO, 2009:2). This will therefore encourage the changes in attitudes and behaviours needed to put our world on a more sustainable development path, and build a new generation of citizens who are climate change aware. More importantly, in order for climate change education to be achieved in Swaziland, the

current education system should show a view of the world as a holistic socio-cultural, economic and ecological system.

McCaffrey, (2013:1) has underscored that "understanding the causes of and responding to climate change still remains the major challenge of the 21st century". Research shows that, in general, "those who have a basic understanding of the science are more concerned with addressing climate change than those who do not" (Leiserowitz 2010, 2011, Miller 2010). Improving society's climate change literacy should be a top priority addressed through science education and through a range of other education, communication, and outreach strategies (McCaffrey, 2013:1). Ekpoh (2009:23) states that this is shown by "the number of conferences, campaigns, reports and research initiatives on climate change in the last 20 years, notably the United Nations Conference on Environment and Development in Rio declaration of 1992, Intergovernmental Panel on Climate Change (IPCC) in 2001", to mention but a few. According to Ozor (2006:8), "presently, there is widespread consensus in the scientific community and even among politicians that climate change is happening, and its impact is already felt globally." The world has had the COP 17 Conference in 2011 in South Africa to deliberate on climate change issues. The attendees included climate, energy, education, technology, and research experts, curriculum developers, philanthropists, science journalists, representatives from climate- and energy-related non-profits and professional societies, federal and state agencies, and the National Academy of Sciences.

In addition, in the last twenty years, researchers have recognized "climate change to have become one of the major issues affecting the future" (Flannery, 2006:13). In this regard, the "abnormal changes in temperature and rainfall, and the increasing frequency and intensity of droughts and floods have long-term implications for the viability and productivity of world agro-ecosystems" (Manyatsi, 2008:10). In the context of Swaziland, Manyatsi, Mhaza, and Masarirambi (2010:165) observe, that "climate change is evident as it manifests itself in hydrological disasters, change in rainfall regime as well as extreme weather conditions."

2.3 The Importance of Pedagogic Content Knowledge in Climate Change Education

Lee Shulman, an educational researcher developed the Pedagogical Content Knowledge (PCK) in 1987. Solis, (2009:12) observes that "Shulman's PCK has significantly contributed towards the comprehension of teaching and teaching methods". Shulman, (1987:9) points out that "teachers' subject knowledge and their pedagogical knowledge should no longer be considered separate aspects, instead should rather be merged". Archambault, and Crippen, (2009) attest that PCK, as discussed by Shulman (1987), refers to "teachers' knowledge of how to represent and explain subject matter covered in the classroom, such that it is most clear and understandable to learners". It is important for teachers to have a clear understanding of the subject matter in this case climate change so that the correct information is relayed to learners. Anderson (2010:5) has argued that "successful climate change adaptation and mitigation require appropriate knowledge, skills and behavior change" noting that education is capable of providing these. Hestness et al (2013:5) also argue that "teachers must also have an understanding of future projections, natural and anthropogenic factors related to climate change impact".

However, it is important to note that, in order for teachers to develop a rich and well founded PCK, the following steps should be followed (Jaung, 2008:147):

- Teachers should be involved in a variety of aspects of education such as curriculum development.
- Teachers should take part in research based activities, the application of learning in everyday classroom practice, information technology and collaborative learning.
- Teachers should constantly enhance their knowledge of teaching methods and approaches.

This observation is supported by Coe, Aloisi, Higgins and Major (2014:2), who have noted that:

> "The most effective teachers have deep knowledge of the subjects they teach, and when teachers' knowledge falls below a certain level it is a significant

> impediment to students' learning. As well as a strong understanding of the material being taught, teachers must also understand the ways students think about the content, be able to evaluate the thinking behind students' own methods, and identify students' common misconceptions".

In terms of climate change education, sound teacher content knowledge is crucial (McCaffrey and Buhr, 2008:34). It could be argued that if teachers develop a robust PCK, their own misconceptions will be corrected. It is therefore, important that teachers hold minimal misconceptions regarding climate change, as there is a danger of teachers passing on such incorrect conceptions to learners. As highlighted earlier, PCK provides teachers with the knowledge base from which to do this (McCaffrey and Buhr, 2008; Archambault and Crippen, 2009). However, it is also important that teachers are able to extend climate change as a subject of study beyond the scientific facts, to give learners the relevant tools and practical knowledge to successfully adapt to, and mitigate against, climate change (UNESCO, 2010 and UNEP, 2011).

2.4. The role of education in addressing climate change

Literature shows that a number of research studies have been undertaken in attempt to explore and understand the climate change education concept (Anderson, 2010; Boon, 2010; Brown 2011; Hestness, et al 2013). According to Lenglet (2009:14) "climate change education effectiveness is considered to reside in the 'positive' outcomes and results of the behaviour, choices, decisions and actions of human beings as a result of having been exposed to climate change education, instruction, training or capacity building". That is to say, Aladag (2010:24) has argued that "climate change education effectiveness can take place when transformation and action competence are explicitly included in the instructional and learning process." More importantly, education is in no way about telling people what they should think and do – "but about giving them the means and knowledge to develop their own thinking and form their own opinions and choices" (Dlamini, 2011:32).

Actually, up to date researchers are developing technologies to minimise and even eradicate the causes of climate change. However, it can be noted that "educational responses to date

have been mostly limited to raising awareness and individual behaviour change towards climate change issues" (Clover and Hall 2010, Home and Fien 2010). Instead, environmental education has long been developed by researchers as a key element in moving towards a more sustainable future (Manyatsi 2008, Dlamini 2011, UNESCO 2010, Wals 2010). However, due to the impact of climate change these days, Government in a number of countries is urgently developing policies and programmes to help their societies to mitigate and adapt to the impact of climate change.

Extant literature reveals that "the climate change programmes are mainly concerned with the facts of climate, especially the scientific basis of predictions" (Clover and Hall 2010, Padolsky 2006). However, Ogbuigwe (2009:21) notes that despite all these activities being in place, "there is still not an effective capacity to bring the understanding of climate change facts to the public in a manner that influences their day to day actions and habits." As such, "education comes in as the relevant variable which can help the public to learn and develop dynamic skills, appropriate knowledge and change of behavior for successful climate change adaptation and mitigation" (Aladag, 2010:24). In fact, Lenglet (2009:24 has articulated "education provides a benchmark, which can enable individuals and communities to make informed decisions and take action for climate resilient sustainable development." As such, it is imperative for policy makers to take education sector seriously engaging it "through any existing climate change frameworks that can utilise education as both a mitigation and adaptation strategy" (Boon, 2010:13). For instance there are two major climate treaties as noted by Anderson, (2010:2) "the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, which have articles calling on governments to support education for climate change."

2.4.1 The impact of education on climate change

It can also be stated that "what children learn today will shape tomorrow's world" (UNESCO, 2010:14). In fact one can argue that education offers the best opportunity for young people who are future leaders of tomorrow to be empowered to be able to sustain

their livelihoods and that of the future generations. Actually, "the youths are the future policy makers, administrators and leaders, and when not properly empowered, can become the future destroyers of the society and environment" (Ozor, 2010:15) Therefore, "Climate Change Education for Sustainable Development (CCESD) has a central role to play in helping the general public and especially the next generations understand and relate to the issues, make lifestyle changes to reduce greenhouse gas emissions, and adapt to the changing local conditions" (Wals, 2010:35). According to Anderson (2010:46) "CCESD at all levels and in both formal and non-formal settings is needed, instilling climate change awareness and understanding of climate change at a young age is ultimately the best way to achieving lasting change in behaviours and attitudes". To ensure relevance and uptake, CCESD should be oriented according to the local context and prioritize passing traditional knowledge and practices to learners. According, Dlamini (2011:13) "education is held to be central to sustainable development, public understanding and awareness of sustainability is one of the major thrusts of Education for Sustainable Development (ESD)".

With teaching the topic of climate change comes the responsibility to support students to develop holistic, informed and considered views and understanding (Robinson, 2009:32). However, Anderson (2010:30), states that "the teaching of climate change and related sustainability issues is subject to a number of challenges". For instance, "learners have existing mental models of climate change issues and hold widely diverging views in terms of their belief about the importance of humans in recent climate change trends, personal responsibility to tackle climate change, and the importance of the impacts of climate change" (Offorma, 2006:8). According Wiggins and McTighe, (2005:28), "the barriers to the effective teaching of climate change include 'over-saturation' from media and curriculum coverage, existing misconceptions, incomplete knowledge, and difficulties with threshold concepts and areas of troublesome knowledge such as timescales, systems thinking, and interdisciplinary and scientific uncertainty".

2.4.2 The policy dynamics on climate change education

The inclusion of CCE into the school curriculum emanates from "the 1992 the United Nations Conference on Environment and Development held in Rio de Janeiro, which was attended by representatives of governments, international and non-government organisations as well as civil society" (Knight, 2008:13). At this conference Knight (2008:21) points out that the delegates discussed "the challenges of the next century and as a result a global plan of action to meet the climate change challenge was adopted by more than 178 governments". According to Dlamini (2011:56) "the action plan, commonly known as Agenda 21, provided a comprehensive set of principles to assist governments and other institutions in implementing sustainable development policies and programmes". The author also states that "Principle 10 of Agenda 21, states that environmental issues are best handled with participation of all concerned citizens, at the relevant level, has played an important role in fostering connections between human rights and environmental agendas at the national level". Based on this principle, this research strongly believes that education has a significant role to play in addressing the impact of climate change in Swaziland.

According to UNICEF (2007), in an attempt to enhance the comprehension of climate change globally, "three international treaties came out of UNCED in Rio: the Framework Convention on Climate Change **(**UNFCCC), the Convention on Biological Diversity (CBD), and the United Nations Convention to Combat Desertification (UNCCD) collectively, these are known as the Rio Conventions". According to (UNESCO, 2010:13) "the Secretariat of UNFCCC and of the UNCBD and UNCCD were given a huge responsibility to support member states (Parties to the Convention) to form and implement national policies to address these environmental threats and risks to human security". Following on from the CRC and Rio Conventions, a number of international and regional treaties and instruments emerged, relevant to issues related to climate change and children. In the case of Swaziland, the country has already developed the National Climate Change Framework.

UNICEF (2007:17) reports that "the Johannesburg World Summit on Sustainable Development (2002) underpinned the need to integrate sustainable development into education systems at all levels so as to promote education as a key agent for climate change, and recommended the adoption by the United Nations General Assembly of the UN Decade of Education for Sustainable Development". According to UN-DES (2005-2014) "climate change education for sustainable development demands a reorientation away from focusing entirely on providing knowledge in a specific domain, towards dealing with interlinked problems and promoting action competencies for complex issues". Literature shows that "climate change education should be incorporated into mainstream curricula or carried out through informal channels that focus on sustainable development through the acquisition of life skills in a number of behaviour-related areas" (Selim, 2011:4).

On another development, UNFCCC (2010:13) observes that "Article 6 of the UNFCCC addresses education, training, public awareness, public participation and access to information in relation to climate change". Its prescriptions are key in engaging all stakeholders and major groups. "The New Delhi Work Programme, which was adopted at COP-8, aimed at integrating Article 6 activities into existing sustainable development and climate change strategies" Anderson (2010:45). This mandate for education and public awareness is crucial to the role of children in addressing climate change. "The Nairobi Work Programme (NWP**)** which was developed in 2006 at the UNFCCC COP12 summit identifies areas of work that assist countries to assess their climate change impacts, vulnerability, and adaptation, and to be able to make informed decisions to respond" (Knight, 2008:54). Examination of the nine areas of the NWP through the lens of the CRC is indicated.

Disaster risk reduction is a key strategy in the response to climate change (FAO, 2007:42). "The Hyogo Framework for Action presents a 10-year plan to make the world safer from natural hazards, and was accepted by 168 governments in January 2005" (UNFCC, 2010:15). Based on the premise that disasters affect everyone, and is therefore everybody's business, "the Hyogo Framework has the goal of substantially reducing disaster losses by

2015 – in people's daily lives, and in the broader social, economic and environmental assets of communities and countries" (FAO, 2007:48). Together, these many institutions provide a strong basis for action to protect health from climate change. As such one can attest that all the already mentioned institutions and organisations provide a benchmark for individuals, regions, countries, and the entire world a strong base for action to protect health, and all spheres of life from the impact of climate change.

Unfortunately in some developing countries such as Swaziland at present there is no coherent dialogue as to how to expand the climate change agenda to include education as a tool in adaptation and mitigation strategies. Nonetheless, Swaziland ratified the United Nations Framework Conventions on Climate Change (UNFCCC) in 1996 and since then, the country has been working towards the achievement of the objectives of the convention. It has already been acknowledged that climate change is attributed, in the main, to human activities. Therefore, two key legal tools are invariably used to frame the national response to climate change; first, "*national policy* which is a legal and political document prepared by the State in consultation with stakeholders in both public and private sector, civil society and non-governmental organisation which clearly set out the overall political commitments, aims and intentions with respect to any developmental issue, including climate change; and, second, *national legislation* that typically creates a set of rules that governs the conduct of individuals within the State, and also the relationship between individuals" (Ministry of Public Works and Meteorological Services, 2015:10). These two legal tools are still yet to be enacted in Swaziland. Once in place, both national policy and legislation become useful and effective tools of mitigation, which prescribes human and state conduct.

A number of national policies and legislation have been developed in the country in an effort to address sustainable growth and development, food security, poverty eradication and environmental protection, for instance, the National Development Strategy (NDS, 2007) and the Poverty Reduction Strategy and Action Programme (PRSAP, 2007). All other policies and strategies reflect the vision expressed in the NDS. The NDS covers the period till 2022, the PRSAP till 2015. Some of the policies and legislation contain some fragmented elements addressing climate change indirectly, however, there is a lack of a climate change

policy and legislation to integrate all existing policies and legislations that currently undermines all national efforts to address climate change.

In actual fact, "successful climate change adaptation and mitigation require appropriate knowledge, skills and behavioural change that education can provide" (Anderson, 2010:2). As such, "education is a key component that causes individuals and communities to make informed decisions, and to take action for climate resilient sustainable development" (McGinnis & McDonald 2011:23). However, it is unfortunate that policymakers in countries like Swaziland have not fully engaged the education sector, despite the global existing climate change frameworks which are already in place. For instance, as stated earlier in this discussion, there are two major climate treaties, the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, which have articles calling on governments to support education for climate change. This is complemented by the focus on education and knowledge as a priority for risk reduction within the Hyogo Framework for Action: of 2005-2015.

The literature attests that in the global education community, several stakeholders, such as "UNESCO, UNEP and UNICEF, are incorporating components of the climate change agenda in education and helping schools and communities integrate climate change education and environmental stewardship into the curricula" Anderson, 2010; DES, 2008; Ekpoh, 2009; Hansen, 2009). Others, like "Save the Children and Action Aid, are focused on building the skills of communities and learners to adapt to climate change through integrating risk reduction in education curricula and systems" (McCaffrey, 2013:27). According to Ozor (2009:18) "at regional and international levels, networks and inter-agency platforms, such as the Asia Preparedness Disaster Center, the Global Coalition for School Safety and Disaster Prevention Education, the IASC Education Cluster, the Children in a Changing Environment coalition, and the ISDR Thematic Platform on Knowledge and Education, are focused on sharing lessons learned and codifying them in programming tools focused on risk reduction through education". However, this education work remains ad hoc, and is not yet widely recognised by, nor integrated into the efforts of the climate change community.

In conclusion, it remains a fact that at both primary and secondary school level, climate change education has the potential to play a crucial role in developing awareness and improving understanding of this important issue. According to debates by the (UNEP, (2006) and UNESCO, (2009), "this in turn could drive important environmental value, attitude and behavior changes, which may contribute toward climate change mitigation". This view is supported by (Olivia, 2013:13), who points out that "climate change education may equip learners to better adapt to the predicted social and projected environmental impacts of climate change". Lastly, climate change education may generate learner support for, and awareness of, key mitigation policies and legislation put in place by local governments (UNEP, 2006).

2.5 Enhancing learners and teachers' understanding of climate change through the SGCSE curriculum.

The discussion on the concept of climate change education have indicated that the SGCSE Geography national curriculum contains topics which addresses climate change, unfortunately both learners and teachers do not have a clear comprehension of this set up. The US Global Change Research Council (2009:1) observes that Climate Science Literacy needs to be understood by both learners and teachers because of the following important reasons:

- Climate change is one of the 'grand challenges' facing society, which has implications for many facets of life. Therefore it is imperative that citizens gain an understanding of the climate system and the impacts that changes to the system will have.
- Climate science can be a taught in different courses - life science, physical science, earth science but also economics and mathematics just to name a few. It can also be taught across all grade levels.
- There are misconceptions and myths surrounding climate science that are important to correct.

- Climate change is already impacting students' lives across the nation - with extreme weather events, raising sea level, expanding growth season, droughts, fires, and other real-world phenomena.
- Decision-making about climate change impacts takes place on a personal level but also at the level of the community, nation and world".

Lowe (2010:436) argues that "climate change education effectiveness can only be realised if transformation and action competence are clearly integrated in the instructional and learning process". Actually, any person that knows how to assess scientifically credible information about climate change will always communicate about climate change in a meaningful way. This observation is supported by UNESCO (2005:8), where it states:

> "climate change education consists of a wide variety of learning experiences allowing individuals, communities and organizations to acquire competencies, knowledge and predispositions for becoming/being active participants in choices and activities leading to a sustainable future in terms of global and local environmental sustainability, economic equity and social justice".

Therefore, based on this observation, one can argue that Geography as a discipline of natural science discipline can provide both learners and teachers with intellectual, practical and life skills to comprehend the world. As climate change literate individuals, learners and teachers can transform their own societies by developing mitigation programmes to minimise the impact of climate change. That is to say they can make informed and responsible decisions with regards to actions that may affect climate. More importantly, Geography teachers have the potential to influence the level of knowledge and understanding, which learners have regarding a particular topic. This argument is supported by Boon (2010), who asserts that it "is extremely crucial that teachers have a clear knowledge of any topic they teach, as it is likely that any misconceptions or inaccurate understandings which they hold will be passed on to learners". Based on the current situation which is prevalent in schools in the Swaziland, one can propose that an integrated teaching approach ought to be put in place. According to (UNEP, 2011) such "a programme will ensure that learners are taught about

climate change adequately and accurately, which may ultimately stimulate environmental attitude, behaviour and value changes and provide learners with the knowledge to successfully adapt to and mitigate climate change".

It is unfortunate that both learners and teachers have not yet realised that the SGCSE Geography curriculum can be utilised to address climate change issues. For example, the curriculum constitutes topics such as weather and climate, agricultural systems, tourism and industries which can be manipulated to address climate change issues currently affecting the country. Aladag (2010:3) argues that "teaching learners about issues of global climate change is a challenge for them, because the traditional teaching and learning strategies which dominates in every lesson". Traditional teaching methodologies are inappropriate if one intends to incorporate climate change education. It has been mentioned in a variety of literature that traditional ways of teaching, are largely based on the transmission of knowledge. In the process learners are not able to use the knowledge learned to understand issues applicable to everyday life. Therefore, new innovative instructional approaches and approaches as well as techniques should be in every class lesson in the quest to fully address climate change issues. For instance, Dlamini (2011:5) points out that:

> "using problem-solving, decision-making strategies to develop, refine and redirect the thinking and the learning. For this, instruction in hands-on and computer based classroom activities, field trips, project work can be helpful".

One can argue that the core of the SGCSE Geography curriculum contain topics and themes which are engaging and intellectually challenging, and focus on a depth of understanding rather than the breadth of content. It also provide opportunities for teachers to connect with young people's present and future lives, as well as to encourage learners to use their own experiences to become active agents in their own learning. The Geographical Association (2009:11) also maintains that "a Geography curriculum should develop understanding, and help students to relate new knowledge to existing knowledge, and provides opportunities for them to apply their understanding to questions and problems that they have not previously encountered". A number of researchers including (Hansen et al. (2007), Choi and Fisher, (2003), Fellman etal., (2005) and Botkin et al. (2007) also point out "that incidentally,

Geography is a study of human-environment interaction; one in which the environment is fast changing". As such, the content of the SGCSE Geography curriculum enlightens learners and teachers about contemporary facts on climate change and material that can be used to mitigate and adapt to its effects.

As a way of justifying the importance of the SGCSE Geography curriculum in enhancing learners and teachers understanding of climate change, it is important to highlight a few key facts about the major aim and assessment objectives of the syllabus. The Swaziland Senior Secondary Assessment Syllabus for Geography is designed to assess candidates who have completed a two-year course based on the Swaziland Senior Secondary Geography Teaching Syllabus. It is designed for examination at age 17 and over. The syllabus follows the general pattern of International General Certificate of Secondary Education (IGCSE) syllabus.

The syllabus aims to assess positive achievement at all levels of ability. "Assessment requires candidates to show knowledge, understanding, analysis, application and investigation skills" (Examinations Council of Swaziland, 2012/213). Performance in tasks differentiates candidates, rather than differentiation through tiered papers. The main aim of the syllabus is to "help candidates to have an understanding of social, economic, environmental and cultural issues in Swaziland" (Examinations Council of Swaziland, 2012/213). Another aim of the syllabus is to help candidates to have an understanding of the relationships and interactions of people and their environment in response to physical and human processes. In addition, the syllabus provides "a sense of place and an understanding of geographical and relative location on a local, regional and global scale, as well as an understanding of different communities and cultures throughout the world and an awareness of the contrasting opportunities and constraints presented by different environments" (Examinations Council of Swaziland, 2012/213) .

All these aims of the SGCSE Geography syllabus address the environment to a larger extent, and Geography candidates are expected not only to have attained environmental knowledge but also have developed environmental awareness by the time they complete their senior secondary school education. In addition, through these aims, it can be noted that "Geography is a focus within the curriculum for understanding and resolving issues about the environment and climate change" (Manyatsi, 2008:31). According to Morgan and Lambert (2006) "Geography is also clearly identified as playing a significant role in promoting climate change education, focusing on key concepts and skills, critical reasoning, the exploration of values and attitudes in relation to complex environmental issues".

Furthermore, these aims of SGCSE Geography clearly indicate that the Geography curriculum is focused on developing young children's knowledge and understanding of how the environment might be damaged and changed, as well as on how it can be maintained and improved. One can argue that this is a significant move towards recognising the importance of young people making a personal response to the issues raised and actively participating in working towards solutions. As such, this is supported by "the optional framework for teaching about citizenship, environmental, community and global matters, understanding personal responsibilities for the environment and in the community" (Olivia, 2013). Therefore, there is no doubt that this will always instigate learners to have an enquiry approach thus taking responsibility in an active way within and beyond school.

In another development, effective Geography teachers attempt to teach the subject in line with the aims of the syllabus and have always offered a variety of progressive learning experiences which enable pupils to develop their knowledge and understanding of an increasingly complex world and a range of skills. As such Manyatsi, (2008) observe the following key characteristics of geography teaching in embracing climate change education:

- Learners make use of high quality modern textbooks, maps at a variety of scales, workbooks, posters, slides and videos.

- Learners work collaboratively, notably in investigative projects, and use such activities to develop independent learning skills. They develop investigative skills such as map reading and interpretation progressively.
- Learners evaluate the information they research and question the assumptions and perceptions of people and place the world over. For example, geography teachers sometimes use role-play very effectively to develop pupils' decision making skills in an exercise on the potential benefits of eco-tourism to indigenous people.

On another note, one can attest that all the action themes mentioned in the SGCSE (2012/2013) Geography syllabus namely, "environment, water, rural development, sustainable consumption, sustainable tourism, intercultural understanding, cultural diversity, climate change, disaster reduction, biodiversity and the market economy" have a geographical dimension that proposes that the paradigm of sustainable development ought to be incorporated into the teaching of Geography at secondary school level.

Indeed, all these aims of the SGCSE Geography syllabus contain a balanced range of knowledge dimensions, process dimensions and applied dimensions, as well as the dimension of values and attitudes which can enhance the incorporation of CCE to the teaching and learning of school Geography. In addition, these aims portray Geography education as one discipline that is capable of contributing towards the achievement of the goals of the United Nations Decade for Sustainable Development. This vision of "education for sustainable development aims at a world where everyone has the opportunity to benefit from quality education and to learn the values, behaviour and lifestyles required for sustainable a future and for positive societal transformation" (Ogbuigwe, 2010). This is due to the fact that "Geography education provides relevant knowledge, skills, values and attitudes crucial for peaceful coexistence of individuals with nature on this planet" (Sharma, 2012:36). In addition, "Geographical education also ensures that individuals become aware of the impact of their own behaviour and that of their societies, thus be able to make environmental sound decisions and develop an environmental ethic to guide their actions" (Dlamini, 2011:60).

As such a closer analysis of the SGCSE Geography curriculum, it can be concluded that teaching and learning about the subject, learners and teachers, need to take cognisance of global warming and climate change.

2.6 Challenges of integrating climate change education into the school curriculum

It has already been deliberated upon that climate change education is meant to provide the youth with skills to adapt perfectly to the impacts and effects associated with climate change. "Climate change education attempt to increase awareness and create value, attitude and behavior changes" (Sauve, 2008:29). However, there are also a number of challenges associated with climate change education, as it is a topic which everybody has an opinion normal based on false knowledge and misconceptions. As such, it must be noted that in order to develop strategies for the effective teaching of climate change, it is important that teachers have an understanding of the different barriers and challenges that can be encountered. This will at least "guarantee a lasting change through education, which requires that teachers' attitudes, motivation and skills contribute fully to the effort" (UNESCO, 2010:9).

2.6.1 Lack of teacher knowledge and understanding

The lack of teacher knowledge and understanding remains the primary barrier to the effective implementation of climate change education into the school curriculum. However, it is imperative to note that general the barriers relate to learners, teachers as well to the wider society. Research by (Buhr and McCaffrey, 2008, Gautier et al, 2010 and Robinson, 2010) reveals that "effective climate change education requires the construction of new knowledge and understanding within learners' existing, usual well established and strong personal frameworks of existing beliefs". Robinson (2010:3) states that:

> "The influence of existing knowledge on learners' abilities to take on new understanding is significant and affects how information is perceived, how judgments are made about this information, and what students are able to understand and remember"

The conclusion emanating from this observation is that "teachers have a huge responsibility to deconstruct existing, partially incorrect information in the learners' minds, which formed extreme and alarmist perceptions of climate change, seeing climate change as a dangerous phenomenon" (Carter, 2006:15). Studies have also shown that learners, teachers and the general public may hold a large number of misconceptions about weather and climate change. This tendency acknowledges that "there is disconnect between actual climate science knowledge and perceived knowledge" (Robinson, 2010:3). This observation leads me to argue that there is a clear need for teachers to assess prior knowledge at an early stage of the education process in order to assess misconceptions that may provide a barrier to deeper learning.

Furthermore, the expectation that "teachers integrate climate change into classroom topics has become increasingly pressing" (UNESCO and UNEP, 2011). However, this has posed a major challenge to a number of teachers as "climate change is a new and scientifically complex set of phenomena to understand, which proves even more difficult to teach to learners" (UNESCO and UNEP, 2011).

2.6.2 The influence of mass media

Research shows that one of "the growing barriers to effective climate change education results from the ever increasing and usual poorly representative, coverage by the media on climate change issues" (Antilla, 2005, Gautier et al., 2006, Robinson, 2010). "No matter what technology scientists and researchers may find to fight against global warming, any meaningful change requires legislative action, which in turn needs the support of an educated public" (Hill, 2007:18). "Unfortunately the general public has been found to be extremely reliant on the mass media as a source from which to gather knowledge and information on scientific topics" (Lowe, 2010:437). The major forms of mass media comprises newspapers, television and radio, which play a crucial role in information diffusion to the public about climate change. While it is appreciated that media is a source of information for members of the public, the role of television and print media as an informal, yet influential educator about climate change can be problematic if it contributes

to the public's already poor understanding of this set of issues. “People who watch more than two hours of television a day are less likely to think that climate change is a threat to their lives, or believe that it is their duty to protect the environment” (Cox, 2006:190).

The conclusion from this argument is that the media will always play a large role in influencing the public’s perceptions and understanding of climate change. Hence it is imperative for climate change education to be incorporated into the school curriculum to provide an explanation for the climate change concept.

2.6.3 Lack of relevant resources

Lack of relevant resources that are available to Geography teachers to guide them in addressing climate change in their lesson is a major challenge to the success of climate change education in schools. The textbooks currently used in the schools do not fully address climate change issues. Instead, textbook content and quality varies widely, and each school can individually choose which textbook it will order. It is worth noting that topics on the environmental effects of global problems like climate change are covered in some textbooks, but to different extents. As such, teachers have to have two or more textbooks, because one is focused on each subject. As a result, both learners and teachers do not gain a clear, enhanced awareness and comprehension of climate change. Mohammad and Kumari (2007:23) point out that “a textbook need to be carefully structured in terms of adequacy, relevance and clarity of presented information”.

In Swaziland, it is a common practice that textbooks remain the key teaching and learning resource used by both learners and teachers. Therefore, the current content of the prescribed Geography textbooks in the country do not have the potential to foster teaching and learning in such a way that can enhance awareness and understanding of climate change education. This situation is lamented by Olivia (2013:167) who notes that:

> “Insufficient or incorrect understanding of climate change among learners may adversely affect the extent to which they are able to develop appropriate environmental attitudes, behavior and values which may contribute to reducing

the threat of climate change and reduce the extent to which they are able to effectively adapt to the impacts of climate change".

2.6.4 Time is running out to effect change

Another significant challenge facing climate change education is that the time to effect change is running out. Research has shown that "climate is a key causative factor in increased waves, flooding, droughts, intense tropical cyclones, rising sea levels and loss of biodiversity" (Anderson, 2010:3). For instance, "the average number of disasters caused by natural hazards has increased in the last 20 years from 200 a year to more than 400 today and this predicted to increase by as much as 320 percent in the next 20 years" (UNEP, 2011:13). The fact simply cannot be understated that learners who are currently in school represent a crucial generation, as they will have the ability to bring about vital change through their behaviour and values to the environment. As such there is "a need to develop communications materials to bridge the awareness gap in terms of education's role in reducing the multiple risks of climate change, disasters, environmental degradation, poverty and conflict" (Anderson, 2011:14). In addition, it is important that "educators involved in climate change education develop pedagogies, which equip students with the ability and skills to work towards curbing the threat of climate change" (Feierabend, 2010:181). Actually it is important to note that "educating the next generation of leaders about the importance of protecting our environment and combating climate change is a key investment for a sustainable planet and future for everyone on it" (UNESCO, 2014:7).

2.7 Conclusion

Swaziland is currently facing severe effects of climate change. It is therefore imperative for the education sector to integrate climate change education into the school curriculum. This initiative will yield positive strategies to cope with the effects of climate change. In order for the learners to have a clear comprehension of the causes and effects of climate change, it is important for teachers to be well trained on this issue. The next chapter will address the strategies of collecting data from teachers, school principals, environmental officers, curriculum designers, learners and geography inspectors.

Chapter 3

Research approach, strategies and methods

3.1. Introduction

Chapter Three, discusses the exploratory research approach and the reason why it is the suitable approach to establish how teachers and learners understand the inclusion of climate change in the Secondary Education Geography Curriculum in Swaziland. The aim of Chapter three is to explain the research strategies used to address issues raised in Chapter Two and in particular to address the questions that were raised in Chapter One. The chapter also focuses on data collection methods, sampling techniques and analysis methods. The research process and design is presented in Table 3.1.

3.2. Research process, design: Qualitative and mixed methods research

Conceptualisation of Research

- Formation of topic
- Structuring of research questions
- Formation of problem and purpose statement
- Development and Structuring of time line

↓

Operationalisation of Research

- Writing of literature review
- Construction of methodology
- Collection of data with questionnaires, semi-structured interviews and focus group interviews
- Data analysis through thematic content analysis
- Evaluation of textbooks

↓

Concluding Research

- Synthesis of results and findings

Table 3. 1: The research process which the study followed
The Research Process (Adapted from: Badenhorst 2010: 48)

The research questions for this study were:

1. What are the characteristics of climate change in Swaziland?
2. How are the elements of climate change captured in the curriculum?
3. How do teachers understand and interpret climate change in the curricula?
4. How do teachers teach climate change from the curricula?
5. How do learners learn and deal with climate change in the classroom?

Research is defined as "a systematic method consisting of enunciating the problem, formulating a hypothesis, collecting data, analysing the facts and reaching certain conclusions either in the form of solution towards the concerned problem for some theoretical formulation" (Peter, 2011:11). More importantly, every mode of research should add new knowledge to the body of existing data. "Research is a structured enquiry that utilises acceptable scientific methodology to solve problems and create new knowledge that is generally applicable" (Peter, 2011:14). Scientific methods consist of "systematic observation, classification and interpretation of data" (Mills, et al 2013). Cohen, Manion, and Morrison (2008:48) identify key characteristics of research as "systematic, controlled, empirical and self-correcting". Kothari (2010:4) attests that when undertaking research it implies that the process:

- is being undertaken within a framework of a set of philosophies,
- uses procedures, methods and techniques that have been tested for their validity and reliability; and,
- is designed to be unbiased and objective.

To ensure a strong research design, this research used the constructivism research paradigm. When it comes to defining this paradigm, constructivists are noted to "believe that human beings are influenced by their history and cultural context, which in turn shape their view of the world, the forces of creation and the meaning of the truth" (Jane, Bonner and Karen, 2006:1). According to Mills et al, (2013:23) "constructivism is a philosophy of learning founded on the premise that when people reflect on their experiences, they construct their own understanding of the world in which they live." Mills, et al (2013) and Charmaz, (2006)

also note that "constructivism focuses on how people construct reality through interacting with the environment and this implies that people are active in making meaning of their lives and those realities are social constructions of the mind which play out in the many constructions as there are individuals". So, social constructivism in this research was employed as a way of understanding how everyday interactions shape the way humans view themselves and their world. This research understood "reality to be inherently unique and a social construction of individuals according to how they experience it" (Krauss, 2005:765).

Jane et al. (2006:2) have noted that "consciously subjecting such beliefs to an ontological interrogation in the first instance will illuminate the epistemological and methodological possibilities that are available". Meanwhile, according to McCann and Clark, (2005:10) "constructivism denies the existence of an objective reality, asserting instead that realities are social constructions of the mind, and that there exist as many such constructions as there are individuals." Further to this, Larochelle and Bednarz (2010:3) maintain that "epistemologically, constructivism emphasises the subjective interrelationship between the researcher and participant, and the construction of meaning." Researchers, in their "humanness," Laws and McLeod, (2006:13) have noted, "are part of the research endeavor, rather than objective observers, and their values must be acknowledged by themselves and by their readers as an inevitable part of the outcome." In seeking a research methodology that would provide an ontological and epistemological fit with this paradigm it was important to explore the concept of a simple investigation into the way teachers teach climate change education. Charmaz (2010:15) has explained, "ontologically relativists and epistemologically subjectivists, reshapes the interaction between researcher and participants in the research process and in doing so brings to the fore the notion of the researcher as author".

Since the study is founded on a social constructivist epistemology, a qualitative methodological paradigm was suitable in guiding this research study. Krauss (2005:768) says "qualitative research is defined as inductive, interpretive methods applied to the everyday world, which is seen as subjective and created". Meanwhile, Peter (2011:36)

attests that "qualitative research seeks to understand a given research problem or topic from the perspectives of the local population it involves". Peter (2011:38) also points out that "qualitative research is especially effective in obtaining culturally specific information about the values, opinions, behaviours, and social contexts of particular populations".

Qualitative research is thus fundamental in interpreting and understanding meanings individuals have about their experiences and constructed world. Ranjit, (2005:23) puts it that "qualitative research employs an interpreted and naturalistic approach to the world, which means it seeks to compile a detailed account of the phenomena in its natural setting and makes a comprehensive interpretation of human experiences from the perspectives of the participants."

This study has employed an exploratory design comprising sequential mixed methods like questionnaire, interview schedules, as well as document analysis in the form of secondary records. The quantitative questionnaire will preceed the qualitative interviews. The exploratory design involves collecting data on some participants in a standardised form; for instance a questionnaire, from a representative sample of the population. Nsingwane (2011:14) notes of the questionnaire that "it thrust is to describe a prevailing phenomenon without explaining casual relationships." Ranjit (2005:34) has, further, explained that "exploratory research is used to learn about people's attitudes, beliefs, values, demographics, behaviour, opinions, habits, desires, ideas and other types of information."

The use of an exploratory research design approach in this study was motivated by the fact that teachers and learners' understanding of the inclusion of climate change in the SGCSE Geography curriculum in Swaziland has not been studied. Therefore, to make a contribution and close the information gap, there was a need to consider sixteen high schools from all the four administrative regions of Swaziland namely Hhohho, Manzini, Shiselweni, and Lubombo. These schools consisted of two urban and two rural schools from each of these

regions. This helped to undertake an in-depth qualitative analysis and explanation of the issues to be investigated.

3.3 Data collection through documents review, questionnaires and interview

3.3.1 An overview of data collection methods used in this study

Three methods of data collection were used for this study; focus group interviews, questionnaires, and an in-depth review of documents, as well as literature study. The review of documents and literature study enabled this researcher to collect data from the Swaziland Education Policy, the SGCSE Geography Syllabus, the Swaziland National Climate Change Strategy, prescribed Geography textbooks and research articles on climate change education. In fact, any resource that was found to be relevant in providing information for the main research question as stated in Chapter One was used.

3.3.2 Data collection through literature and document review

One of the important components of this research was the critique evaluation of SGCSE Geography prescribed textbooks available to both learners and teachers for climate change education. However, it is important to note that textbook content and quality differs widely and each school can individually choose which textbook it will order. As such teachers have a tendency of presenting the material in a variety of ways, but many of the textbooks that do cover climate change consider it an unlikely scenario. The following textbooks were selected for evaluation and analysis in this study:

- Junior Secondary Geography for Form I-III.
- Oxford Modern Geography Book 3 for Form III.
- Macmillan Geography For Southern Africa for Form IV-V.
- H/IGCSE Geography Module 1 for FormIV-V.
- H/IGCSE Geography Module 2 for FormIV-V.
- H/IGCSE Geography Module 3 for FormIV-V.
- H/IGCSE Geography Module 4 for FormIV-V.

- The New Wider World for FormIV-V.

These are the prescribed textbooks SGCSE Geography teachers use as either reference sources or learners' books. These books were chosen for analysis and valuation based on the questionnaires responses of geography teachers. One of the questions on the questionnaire asked teachers to mention which textbooks they use in their classes. As such the selected textbooks were found to be the most frequently used in the schools. The table of content in each book helped the researcher to identify the topics that could be used by the geography teachers to integrate climate change education.

The textbooks were evaluated and analysed according to a set criteria based on an equivalent study conducted by Choi (2010). I would also explain why one decided to use the criteria. More importantly, the criteria used for the textbooks evaluation was developed in line with the objectives of integrating climate change education into the SGCSE geography syllabus. As a result, the criteria used in this research provided a critical assessment of the contribution of the prescribed textbooks to climate change education.

1	Textbooks which enhance the understanding of climate change education	Textbooks which do not enhance the understanding of climate change education.
2	Textbooks with topics which specifically address climate change education	Textbooks which do not have topics that specifically addresses climate change education
3	Textbooks which embrace climate change education to the fullest.	Textbooks which do not embrace climate change education to the fullest.
4	Textbooks which address climate change education in the context of Swaziland	Textbooks which do not address climate change education in the context of Swaziland.

Table3. 2: Criteria for textbook evaluation

3.3.3 The use of questionnaire as a data collection tool for this study

The second data collection method comprised questionnaires which were completed by 16 school principals, and 32 Geography teachers from the sampled schools in all the four administrative regions of Swaziland: Hhohho, Manzini, Lubombo and Shiselweni. The other three questionnaires were completed by the Senior Inspector of Geography, Environmental Information Officer from Swaziland Environmental Authority and Senior Geography Curriculum Designer.

The questionnaire was structured and guided, giving respondents a specific set of actions to rate. This also implies that a respondent with little familiarity with the subject matter could still complete the questionnaire and perhaps still answer some questions correctly. Cohen (2008:322) has stated, "dichotomous questions are useful, for they compel respondents to take a specific stance on an issue, and make it possible to code responses quickly." There were few questions that were closed or structured, and a provision for unanticipated responses for example, "any other, specify". The questionnaire was structured in a way that it covered the background of the respondents, their qualifications, experience, and then their understanding of climate change education.

According to Moore, (2010:11) "questionnaires, when used as instruments are relatively quick to collect information, the responses are gathered in a standardized and objectives format, where potential information can be collected from a large portion of a group." Nsingwane (2011:24) meanwhile argues that "the questionnaire is "efficient and practical, and is widely employed in educational research". Cohen (2008:330) adds, that "a questionnaire provides access to what is inside a person's mind, hence making it possible to know what they like, dislike or think, without any outside influence". The questionnaire was chosen because it is easy to fill out, takes little time, keeps the respondent on the subject, is relatively objective and is easy to tabulate, analyses and it also minimises the risk of misinterpretation.

3.3.3.1 The reliability of data collected through the questionnaires in this study

Due to the fact that the study was conducted using purposive sampling, in part, the researcher had to consider certain measures in the process of quality control. For the purpose of this study, five characteristics were considered applicable to ensure trustworthiness when validating data (Cresswell, 2009: 199-200):

- **Member checking.** Report back on findings with participants to make sure they understood and agreed on the outcomes of the data to be analyzed. This was more applicable to focus group interviews which took place in the form of follow up interviews.
- **Triangulation of dat**a. Data was collected through multiple sources like questionnaires, focus group interview and document analysis.
- **Long-term observations and documentation at the various research sites**. In this case the researcher as a Geography teacher was able to analyse and determine whether the current SGCSE curriculum included climate change education or not.
- **Clarification of researcher bias**. Bias was articulated in writing.
- **Thick descriptions.** One of the primary strategies employed in ensuring the validation of data is to ensure that the feedback takes the form of rich, thick and detailed descriptions of climate change education in order to lay a solid foundation and framework for the transferability to other situations.

Trustworthiness had been a key characteristic of this study. As such the reliability of the questionnaire was tested through a pilot survey in a school which was not part of the sampled schools. In the pilot school, four teachers were given the questionnaires to complete and two other questionnaires were completed by the principal and deputy principal. Changes were effected to the questionnaire for final usage and the following categories were included.

- *A consent form which informs the Geography teachers, principals, Senior Curriculum Designer, Senior Geography Inspector and Environmental Officer of*

their right to privacy and informs them that they provide information on a voluntary basis as well as inform them that their participation is confidential.

The consent section was included because an informed consent is a vital step to any research project. Consent is the process by means of which a participant consents to participate in a research project after being informed of its procedures, risks and benefits (Bulger, 2011:3).

- *Demographic information such as school name, gender, age, qualification, position, experience in terms of years.*

In the questionnaire participants were required to disclose their highest academic qualification. With hindsight, this was an important consideration, as this factor could potentially have played a crucial role in developing teachers' understandings of climate change. However, the majority of the information which participants may have gained during university study is most probably outdated, and their knowledge is more likely to be influenced by current discussions in the media and in textbooks they used to teach.

- *Curriculum information such as awareness and understanding of climate change education.*

UNITAR (2013:5) asserts that "to ensure effective learning and deep understanding of the subject matter, climate change education should be integrated across school curricula at all levels." In this study participants were asked to demonstrate their awareness and understanding of climate change education. The level of the participants' awareness and understanding of climate change education helped this research to establish the strengths of teachers and educators' capabilities to deliver accurate information and take action on climate change mitigation and adaptation.

- *Open questions for the participants to provide information or to give more detail on the choice of answers they given.*

The open-ended questions were included in the questionnaire for this study in order to discover the responses that individual participants give spontaneously on climate change

education. The literature also suggests that open ended questions produce a much more diverse set of responses to a given question. More importantly, "open-ended questions are ideal to establish knowledge and it becomes easy to distinguish between more and less informed respondents to enhance the understanding of opinion formation" (Ballou, 2011: 47).

The following questions formed the core of data collection among the participants.

1. As a Geography teacher are you aware of climate change education?
2. Which topics in the SGCSE Geography curriculum cover climate change education?
3. What are your views on climate change education within the school Geography curriculum?
4. How much do you understand CCE as a Geography teacher?
5. How much do you use fieldwork in the teaching and learning of Geography?
6. Do you think the use of practical approaches in the teaching and learning of Geography has a role in enhancing learners' understanding of climate change education?
7. What is the role of school environmental clubs in promoting CCE?
8. Do you think CCE should be taught as a separate subject?
9. What are the teaching methodologies you use in the teaching of Geography?
10. Do the books you use in teaching the SGCSE Geography curriculum address CCE?

3.3.3.2 Validity of phrasing the questions as depicted in the questionnaires

Question 1 and 2 were included in the questionnaire to get an overview of the comprehension of climate change by the participants. This question was based on the fact that a number of definitions of climate change have been debated over the years by researchers. For instance, the IPCC (2007:30) defines climate change "as any change in climate over time usually decades or longer, whether due to natural variability or as a result of human activity".

This definition of climate change differs from that provided by the UNFCCC, where climate change refers to "a change in climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere" (UNFCC, 2010:28). The IPCC definition is widely used as "a benchmark from which to explore the extent of accuracy of teachers' understanding of the term climate change" (Tubiello, 2007:43). These questions were meant to establish the general understanding of climate change by Geography teachers, principals, Senior Curriculum Designer, Senior Geography Inspector and Environmental Officer as key informants in the study.

Questions 3 and 4 were motivated by the fact that world's climate is changing and will continue to change into the coming century at rates projected to be unprecedented in recent human history. According to the Press Association (2011:15) "the risks associated with these changes are real, but also highly uncertain". Anderson (2010:47) meanwhile attests to the fact that "societal vulnerability to the risks associated with climate change may exacerbate ongoing social and economic challenges, particularly for those parts of societies dependent on resources that are sensitive to changes in climate." Literature points out that "risks are apparent in agriculture, fisheries and many other components that constitute the livelihood of rural population in developing countries." For instance (Flannery, 2006:10) points out that:

> "All societies are fundamentally adaptive and there are many situations in the past where societies have adapted to changes in climate and similar risks. But some sectors are more sensitive and some groups in society more vulnerable to the risks posed by climate change than others. Yet all societies need to enhance their adaptive capacity to face both present and future climate change outside their experienced coping range. The challenges of climate change for development are in the present, observed climate change, present day climate change variability and future expectations of change are changing the course of development strategies, development agencies and governments are now planning for adaptation challenge".

This philosophical world view has motivated the researcher to look into the SGSCE Geography curriculum contribution to teachers and learners' understanding of climate change education in the context of Swaziland. These questions were considered core to this study, because the "concept climate change has frequently been reported as controversial" (Hestness, McDonald, Breslyn, McGinnis and Mouza, 2013:10). There is a great deal of debate that has been going around the globe as to how climate change education should be presented in schools. Therefore, in this study it was imperative to establish the SGCE geography teachers' comprehension of climate change education and the teachers' attempts to integrate this concept into Geography lessons.

Question 5 and 6 were devised to establish the role of fieldwork in enhancing the understanding of climate change education. Manyatsi (2008:23) states that "this is a method of planned discovery, involved the teacher preparing situations from which pupils learn geographical facts and ideas for themselves." Fieldwork can be done anywhere, in any kind of landscape or townscape, and does not necessarily involve long journeys or large amounts of time to make it worthwhile. Dlamini (2011:30) has asserted that "fieldwork must be designed in order to teach pupils about spatial relationships." Furthermore, Ranjit, (2005:32) argues that field excursions are used inorder to provide opportunities for principles already known to be applied and tested. Also, this method can be used to present a collection of facts for analysis.

Manyatsi (2008:24) attests that "fieldwork supports the Geography curriculum by promoting geographical knowledge and understanding." This argument is echoed by Fuller (2006:45) who argues that "fieldwork helps to bridge the divide between the classroom and the real world as it reinforce students' understanding of geographical terminology and process". Therefore, one can strongly argue that CCE is enhanced through fieldwork, where it exposes learners to have a clear understanding of their surroundings. As such, literature has shown that "education for the environment emphasises the development of an environmental ethic based upon sensitivity and concern for environmental quality" (Peter, 2011:47). In addition, a study of local environmental issues, with which pupils can engage directly, will help them

make sense of issues at regional, national and global scales. In fact, studying environmental issues, pupils should develop awareness that environmental issues are invariably complex and their solution involves weighing environmental considerations alongside social and economic factors. According to Sauve, (2008:48) the "principles of CCE are enhanced in the sense, where the learners tend to develop respect for evidence, an informed and critical understanding of different views and values and a growing realisation that choices are seldom clear". Therefore, through fieldwork Geography pupils are trained to be responsible citizens and effective contributors to sustainable development in their communities. Dlamini, (2011:63) argues that "learners' experiences in Geography and aspects of environmental education, sustainable development and climate change education make a significant contribution to developing knowledge, understanding and skills, which help pupils to make sense of an increasingly complex world and humankind's place in it". In fact, as Nsingwane (2011:40) noted "fieldwork helps in raising pupils' awareness of political, social and economic issues at home and abroad, and helps to put these issues into context."

Question 7 was devised in order to establish the role of environmental clubs in schools in sensitising learners about climate change issues. Some schools through initiatives taken by Environmental or Eco Clubs, have put a lot of emphasis on making the school buildings more green, with solar power panels, recycling systems, water conservation measures and tree planting around the school (Prahald, 2009:45). Photograph 3.1 shows a water harvesting programme in one of the schools participating in this research.

Photograph 3.1: Use of harvested water in a school

Source: Mhlatane High School fieldwork 2015

Again, one can argue that such initiatives are only valuable for students' education if they are planned as student projects. As such, it is possible to evaluate the quality of school's work with climate change education initiatives from a picture of a school. I argue that Environmental Club initiatives promote CCE, in gaining increasing publicity as the picture of environmental degradation, energy shortage, climate change, and increasing poverty mixed with increasing wealth and overall picture of globalisation becomes more evident. Rosenburg (2008:28), points out that "the Eco-School projects have the ability to address the effects of poverty on the local environment, the community and the learners, as its most valuable feature." Through school vegetable gardens and soup kitchens, Eco-School projects address hunger among learners and community and flower gardens are an opportunity to restore pride in downcast neighbourhoods. Ottosson (2008:34) argues that Eco-Clubs provide schools with the following important benefits:

- Improves to the school environment.
- Creates a unifying sense of community and pride in the school.
- Increases environmental awareness through education and activities.
- Brings a sense of democracy to the management of the school in respect of decisions that directly affect the students.
- Provides students with the education and tools to make decisions on environmental issues for themselves.
- Fosters relationships and improves language skills.
- Involves the local community, gains business support and local publicity.
- Extends support through education and literature".

Question 9 was devised to establish the teaching methodologies used by SGCSE Geography teachers, with the view of evaluating their relevance in enhancing learners understanding of climate change education. Teacher preparedness to address climate change in the classroom relates to their ability to integrated technology into their teaching (Hestness e tal., 2013:16). Aladag and Ugurlu (2011:5) observe that:

> "Educating students about issues of global climate change is a challenge for educators because the traditional didactic strategies are inappropriate and so new innovative instructional approaches and techniques should be created. Traditional ways of teaching, which are largely based on the transmission of knowledge, are inappropriate as they do not help pupils to use the knowledge learned to understand real issues from everyday life".

UNICEF (2007:10) attests that "teaching methodologies used by teachers should be child friendly with the following principle: interactive teaching methodologies, child participation, teachers as learning facilitators, group cooperation and positive competitions as well as activity based learning methods." While there is much debate around the world about the means and mechanisms for achieving this transition, as Dlamini (2011:20) has noted, "there seems to be wide spread agreement that education has an important role to

play in transforming values as well as empowering individuals and groups to participate in environmental improvement and protection." Selby (2007:17) writes "permanent scientific, technological innovation and practical approaches necessitate that climate change education exists in some form of dynamic equilibrium." As such, Pitt and Lubeben (2009:32) have differentiated between educating learners 'about' climate change education, 'for' climate change education and 'through' climate change education, stating that:

> "teaching 'about' climate change education refers to the provision of knowledge and understanding about the concepts involved. Teaching 'for' means teaching to empower learners to take action and be active participants in working towards achievement of sustainable development, whereas teaching 'through' climate change education denotes the use of teaching approaches that indicate a changed frame of mind with a requirement to think critically about alternative solutions and an intention to prompt action due to changed values".

As such, an engagement with activities that feature technological resources such as those noted by Swarat, Ortony, and Revell, (2012:530) namely: "visualisation tools, interactive games, modeling, simulations, digital probes and virtual experimentation among others can promote student learning as well as interest in technology."

Question 10 attempted to establish the textbooks commonly used by SGCSE Geography teachers and learners.

3.3.4 Data collection through focus group interviews

Focus group interviews were another data collection method used in this study. Maree (2008:90) has noted "the focus group interview strategy is based on the assumption that group interaction will be productive in widening the range of responses, activating forgotten details of experience and releasing inhibitions that may otherwise discourage participants

from disclosing information." Peter (2011:13) observes that "in focus group interviews, participants are able to build on each other's ideas and comments to provide an in-depth view not attainable from individual interview." Cohen et al. (2008:2888) meanwhile point out that focus group interviews are useful for:

- Orientation to a particular field of study.
- Developing themes, topic and schedules for subsequent interviews.
- Generating hypotheses that derive from the insights and data from the group.
- Generating and evaluating data from different sub groups of a population.
- Gathering feedback from previous studies.

The following steps were followed for data collection through focus group interview

Steps before conducting the interview

- Develop focus group interview guidelines
- Discuss with supervisor
- Pilot focus group interview guidelines in a school
- Sample participants
- Request permission from sampled participants
- Ask participants to sign consent form

Steps during focus group interview:

- Appreciate participants for availing themselves for the interview
- Introduce myself and explain the purpose of the interview
- Seek participants for their permission to record the proceedings
- Ask participants questions as per the focus group interview guidelines
- Allow participants to make their own contributions
- Thank participants for their time and contributions

Steps after the interview:

- Listen to the interview records and transcribe them
- Reread the transcripts to determine if they make sense
- Analyse the transcript using categories
- Record the findings using descriptive analysis
- Save the record and write it to a CD for safe keeping

3.4 The research sample that applies to this investigation

3.4.1 Research sample for questionnaires and focus group interviews

Purposive sampling was used in this research. This is, one of "the most common sampling strategies, grouping participants according to preselected criteria relevant to a particular research question" (Nsingwane, 2011:16). Peter (2011:21) meanwhile notes that, "sample sizes, which may or may not be fixed prior to data collection, depend on the resources and time available, as well as the study's objectives." Therefore, due to the availability of time and resources, this research sampled participants (teachers and students) using purposive sampling.

The participants in the study and sample size have been identified as:

- 16 high schools in total (four per region that is two urban, and two rural)
- 32 Geography teachers (sample size of two teachers per school).
- 16 principals,
- For learners the Slovin sampling method was applied to determine the number of learners to participate in the investigation

  $n = N/1+Ne^2$

  Where N = population size

  n = sample size

  e = the desire margin of error

- The Senior Inspector of Geography from the Ministry of Education and Training.
- The Environmental and Information Officer from Swaziland Environmental Authority (SEA).
- Senior Curriculum Designer

3.5.1 Data analysis approach applied in this study

Best and Khan (2006:65) have stated that "data analysis involves the translation of information collected during the course of the project into an interpretable and manageable form." According to Maree (2008:183) "data analysis in a statistical form helps to provide more precise and unambiguous information about the characteristics of the information in a form that can be easily communicated to other people." Thus the "statistical procedures like descriptive analysis and inferential application enabled the researcher to reduce, summarise, organise, evaluate, and interpret in order to communicate numerical information" (Peter, 2011:13). Responses from open-ended questions were analysed both quantitatively and qualitatively. The quantitative analysis used statistical methods such as descriptive analysis, inferential statistics, levels of significance, mean, frequency tables and then represented by means of graphs.

Bitsch, (2005:76) has noted that "qualitative data analysis is a systematic process of selecting, categorising, comparing, synthesising and interpreting data to provide explanations of the single phenomenon of interest." In addition, Fereday (2006:86) states that "qualitative research methods move data from particular to general codes and themes." Interviews were firstly transcribed: moving audio recordings for logical analysis into the form of text. Focus group interview schedules were transcribed immediately after each group interview. Qualitative data analyses were employed on the questionnaire's open-ended questions, interview transcript and archival findings. The aim was to recognise the data into categories in order to identify patterns and relationships emerging from the data.

Triangulation was used during data analysis to determine whether the data collected through document study, questionnaires and focus group interviews provided the same results, provided different results or resulted in new data. Karim (2007:10) has commented that "triangulation is a strategy for increasing the validity of evaluation and research findings".

3.5.2 Data analysis of the responses retrieved from the questionnaires

Thematic content analysis was used to analyse open ended questions from the questionnaires, which were distributed to principals, Geography teachers, the Senior Inspector of Geography and the Environmental Information Officer. Mills, Durepos and Wiebe (2013:2) define thematic analysis as a:

> "systematic approach to the analysis of qualitative data that involves identifying themes or patterns of cultural meaning; coding and classifying data, usually textual, according to themes; and interpreting the resulting thematic structures by seeking commonalties, relationships, overarching patterns, theoretical constructs, or explanatory principles".

Braun and Clarke (2006: 86) meanwhile note that "research has shown that thematic content analysis is mostly used as a qualitative analytic method" and go on to add that thematic analysis is defined as "a method for identifying, analysing and reporting data patterns within the data." Kuckartz (2014:104) conceptualises thematic qualitative content analysis as "a basically inductive process". Thematic analysis was important to this research because it ensured a flexible research analysis that provided a rich and detailed explanation of the data from both questionnaires and focus group interview transcripts. Thematic analysis was used to develop themes that reported experiences, meanings and the reality of the participants, which further examined the ways in which meanings; experiences are influenced by the range of discourse operating within a particular social context (Braun and Clarke, 2006:87). A realist approach to thematic analysis was adopted where teachers' own unique understandings and perceptions of climate change have been captured.

Research Sub-questions	Data Collection Strategies	Data Analysis Strategies
1. What are the major current effects of climate change, global, in southern Africa and in Swaziland? 1.1 What is the historical trend of the effects of climate change in the country? 1.2 To what extent are the Swaziland sectors exposed to the impact of climate change? 1.3 What has been done by the education sector to create public awareness about the impact of climate change in the country?	- Text and document analysis - Text, document analysis, archives and historical research. - Document analysis - Individual interviews, document analysis and questionnaires	- Coding classification - Coding classification - Data analysis - Coding, classification creating categories
2. How does the SGCSE Geography curriculum enhance the teaching of climate change? 2.1 Which topics in the SGCSE Geography syllabus addresses climate change? 2.2 How Geography teachers integrate climate change in all the topics? 2.3 How does the integration of climate change knowledge and skills into the existing	- Individual interviews focus group interview, questionnaires. - Individual interviews and syllabus analysis - Individual interviews and questionnaires. - Interviews, questionnaires and focus group interviews.	- Categories - Statistical frequency - Categories - Coding classification, categorisation. - Coding classification, categorisation.

education systems represents both immediate and longer term challenges for responding to climate change?		
3. What other learning and teaching methodologies are used to enhance learner's Awareness and understanding of climate change? 3.1 What are the initiatives undertaken by schools to promote public awareness of environmental issues like climate change? 3.2 What are the basic sets of learning and teaching resources on climate change that geography teachers use to design their own lessons?	- Questionnaires, individual interviews, Observation. - Observations, individual interviews, focus group interviews. - Interviews, text analysis and questionnaires	- Coding, classification - Coding classification, categorisation. - Statistical analysis, frequency analysis - Inferential application

Table 3.3: Research question, data collection strategy and data analysis strategy

3.5.3 Coding of the interview transcripts to enable analysis of responses retrieved from focus group interviews

In attempt to present a logical methodology of this study, the following phases from Braun and Clarke (2006) were adapted. Phase one expect the researcher to be familiar with the collected data. Fereday, (2006:87) indicates that "this can be attained through transcribing

data, reading through the data set repeatedly, writing down initial ideas, and identifying any new emerging patterns or themes." In the analysis of the voluminous data, "inductive thematic analysis is important for the researcher to engage in a systematic, comprehensive and iterative process of data coding and theme identification" (Braun and Clarke, 2006:43; Charmaz, 2006:39; Fereday, 2006:88). "The iterative systematic process of inductive thematic analysis allowed the researcher to trail back and forth between new data constructs and raw data where in the process themes were identified" (Fereday, 2006:83).

The second phase involves the researcher creating codes from the collected data. Codes refer to any part of the data which the researcher finds particularly interesting or important, and in addition pertains to "the most basic segment, or element, of the raw data or information that can be assessed in a meaningful way regarding the phenomenon..." (Braun and Clarke, 2006:88). Coding was employed as part of analysis that involved organising raw data into meaningful categories (Fereday, 2006:76). Thus, the process of coding allowed for the researcher to arrange data into meaningful set.

The third phase of content analysis was undertaken after the researcher had coded the data. By this stage, the researcher ideally had a lengthy list of codes, which have been documented from across the data set. In the third phase of thematic analysis the different codes are examined in relation to how they may form a dominant theme or sub-theme (Braun and Clarke, 2006:94). Coding involved identifying concepts and categories that appeared interesting and could be analysed in a meaningful way (Boyatzis, 1998; Saunders et al. 2003). Coding was employed as part of analysis that involved organising raw data into meaningful categories (Tuckett, 2004:34). Accordingly, "coding involved recognising (seeing) an important moment and encoding it (seeing it as something) prior to a process of interpretation" (Boyatzis, 1998).

In the process of coding the researcher worked systematically through the whole data set to capture what Boyatzis (1998:1) refer to as a 'good code', which captures the qualitative richness of the phenomenon. The potential codes were highlighted from the transcribed data and assigned labels in the form of words and or short sentences extracted from the data. Braun and Clarke, (2006:87) have noted "whilst coding the data, deviant accounts were

noticed from the data pattern referred to as disconfirming evidence." This also encouraged a richer and deeper understanding of the phenomenon and lends credibility to the study.

The coding and theme identification process was not linear but iterative and recursive (Charmaz, 2010:14). It also trailed back and forth during the stages of analysis to accommodate new insights from the data sources. Mills (2013:2) explains "the interactivity applied throughout the analysis was the overarching principle of goodness which contributed to generation of themes that were strongly embedded in the data and expressing the view points of the participants." Once the potential themes were identified, the potential themes were reviewed so as to ascertain compatibility with the transcripts to identify those that needed to be brought together, separated or refined. Moreover, a review of the potential themes was undertaken so as to ensure relevance to the research questions.

3.6 Limitations of the study

All schools, in which data was conducted, were chosen from only sixteen Secondary schools in the country, yet Swaziland has more than two hundred secondary school. As such this research cannot claim to be representative of all the views of geography teachers, principals and students' understanding and learning of climate change in Swaziland. Nonetheless, it will provide relevant evidence to determine whether educators especially teachers do have an understanding of climate change education. Moreover, it was not possible for the researcher to sit with all educators while they completed questionnaires, and a follow-up was not possible, because of the confidentiality clause, which encouraged educators not to provide their names.

3.7 Conclusion

The chapter presented the research design that was followed, along with a research methodology with sampling of population, and data collection sources, where completing of questionnaires, and focus group interviews were conducted. For secondary data sources,

related literature reviews were conducted using books, journals, policy documents and conference reports so as to answer sub-research questions.

Chapter 4

Analysis and discussion of the results

4.1 Introduction

In Chapter Four, data collected through questionnaires and focus group interviews are displayed, analysed and discussed in depth to determine whether they addressed the main research question as stated in Chapter One:

> *How do teachers and learners understand the inclusion of climate change in the Secondary Education Geography Curriculum in Swaziland?*

The chapter explores the Swaziland General Certificate of Education Geography Syllabus (SGCSE) as it provides themes which addresses climate change as a major environmental issue affecting the country. This study has discovered that the SGCSE Geography curriculum as one that conforms to the expectations of an environmentally inclined subject. According to Anderson (2010:6) "the content of Geography as natural science subject, provides knowledge and skills needed for making informed decisions about how to adapt individual lives and livelihoods as well as ecological, social and economical systems in a changing environment."

The chapter also presents the attempts, programmes and teaching as well as learning resources that have been initiated by the key environmental educators in the country to ensure that climate change education is integrated in the teaching and learning environment. The Kingdom of Swaziland in 1996 ratified and adopted the United Nations Framework Convention on Climate Change (UNFCCC) of 1992 (Dlamini, 2011:34). As noted by Anderson (2010:15) "this sets out a framework for action aimed at stabilising atmospheric concentrations of greenhouse gases to a level that will avoid dangerous anthropogenic interference with the climate system." In that regard, the country conforms to Article 4 of the Convention (Manyatsi, 2010:4) to:

- Formulate and implement programmes containing measures to mitigate climate change.
- Promote education, training and public awareness on climate change.
- Take climate change in to account in social, economic and environmental policies and actions.

In Chapter One, it was discussed that Swaziland is currently suffering from severe effects caused by climate change. Specifically, the country is affected by E1 Nino, which has caused the normal patterns of precipitation and atmospheric circulation being disrupted leading to a prevailing drought (FAO, 2014:1). Climate change has caused an economic crisis in the country, seen in soaring food prices, which has compelled the poorer amongst Swazis to sell their assets. The current situation has forced the majority of the rural population to decrease food consumption. This has lead to a reduction in the Swazis dietary diversity and access to safe and quality food. According to FAO, (2014:2) "natural disasters like climate change create poverty traps that increase the prevalence of food insecurity and malnutrition."

The presentation of data in this chapter was done in line with addressing the main research question and followed by a sequence of the sub-questions as outlined in Chapter one. Data collected through questionnaires were presented, analysed and discussed to determine whether the findings addressed questions and a conclusion was given. Data collected through focus group interviews was presented and analysed using descriptive analysis techniques. Triangulation was also used to determine the understanding and teaching of climate change in Swaziland.

4.2 An analysis of data collected to address sub-question 1, 2, 3, 4 and 5:

What are the characteristics of climate change in Swaziland?
How are the elements of climate change captured in the curriculum?
How do teachers understand and interpret climate change in the curricula?
How do teachers teach climate change from the curricula?

How do learners learn and deal with climate change in the classroom?

These sub-questions were meant to establish how much understanding the Swazis have when it comes to climate change effects. A clear understanding of climate change effects in the country implied that education stakeholders would be able to re-orient the curriculum offered in school so that mitigation, adaptation and disaster risk from climate change are clearly addressed. In fact, this question was intended to sensitise teachers as to what and how to teach climate change, so that in future the learners would in turn influence their communities on how to respond to the threat and play a part in reducing the scope and severity of climate change. As such, a strong and clear future-oriented focus in the curriculum is vital in this regard (UNESCO, 2013:8).

These questions were also meant to help teachers to undertake a comprehensive review and inventory of existing tools, materials and methodologies in the teaching and learning of climate change. Anderson (2010:9) attests to the fact that a central function of education is to foster learning about new subjects, including strategies regarding how to adapt to and mitigate climate change. The study assumes that the topic of climate change in Swaziland has not yet been effectively integrated into existing curricula and as such, that a coordinated approach is needed. Therefore, it is important to obtain more resources regarding where gaps may exist, where teachers are able to access these easily in both rural and urban areas.

4.2.1 An Analysis of data collected through literature and policy documents

In Chapter One, Engeströms' Activity Theory was discussed as a framework for this study. The components of the Activity Theory include: outcomes, tools, rules, subject and division of labour. As already discussed in Chapter One, all the components were considered important for this study. For instance, the object represents learners who have been investigated in attempt to establish their understanding of climate change inclusion in the SGCSE Geography curriculum. Outcomes represent the learning and assessment objectives of the SGCSE Geography curriculum, which will be evaluated to establish if they do address climate change. Rules represent the curriculum with all its components, that is, the topics which expose teachers and learners to the concept of climate change.

Tools refer to the teaching strategies and methodologies employed by geography teachers in their classes. This investigation assumes that there are certain strategies and methodologies possible to raise awareness, for example, media campaigns, field excursions, assignments, topical events messaging through youth radio programmes, theatre and music, conferences, environment day celebrations, and other events and programmes within and outside of school can complement formal curricula and significantly strengthen learning. The geography teachers were investigated in this study in an attempt to establish their understanding of climate change.

A number of reports and public statements have been made to the effect that climate change in Southern Africa is a security threat (Institute for Security Studies 2010:1). The Institute for Security Studies (2010:2) reports that:

> "Higher temperatures, the drying up of soil, increased pest and disease pressure, shift in suitable areas for growing crops and livestock, increased desertification in the Sahara region, floods, deforestation and soil erosion are all signs that climate change is already happening and represents one of the greatest environmental, social and economic threat facing Africa."

In Swaziland, the Ministry of Public Works and Meteorological Services is working closely with the World Meteorological Organisation, United Nations and other international partners to facilitate E1 Nino forecast. According to the Ministry of Public Works and Meteorological Services Report (2015:2) "advanced forecasts, coupled with high levels of awareness has enabled the government of Swaziland, the commercial sector and humanitarian agencies to develop contingency plans to boost resilience and limit the socioeconomic impact in key sectors such as agriculture, water management, health and energy." In Chapter One, it was highlighted that Swaziland has typically received below normal rainfall over the past ten years. The shortage of rainfall has lead to adverse effects on food security.

The Ministry of Natural Resources in the country has put in place a Water Rationing Policy of 2016 in anticipation of reduced rainfall. This policy has given the Swaziland Electricity Company (SEC), which is responsible for hydro-power generation and supply, and the Swaziland Water Service Cooperation (SWSC), which is responsible for water supply, to ration electricity and water usage in the country, especially in the urban areas where consumption is high.

The United Nations Institute for Training and Research (2013:4) attests that "by raising awareness and promoting knowledge and skills-development, education is an essential component and a catalyst for responding to global climate change." This is supported by Article 6 of the UN Framework Convention on Climate Change (UNFCCC), which encourages Parties to promote, develop and implement educational, training and public awareness programmes on climate change and its effects (UNITAR, 2013:5).

According to the Ministry of Education and Training National Policy Statement of Swaziland (1999:3):

> "The Ministry of Education shall offer a wide range of practical subjects so that more pupils would be made aware of their value. This would help change attitudes toward these subjects and develop the intellectual, moral, aesthetic, emotional, physical and practical capacities that are needed to shape and adapt to a fast changing complex and uncertain socio-economic environment."

The Policy Guide on Planning and Climate Change (2011:1) recommends "a policy framework to assist communities in dealing with climate change and its implications. In 2015, Swaziland prepared the country's Third National Communication (TNC), which was presented to the Conference of the Parties (COP) of the United Nation Framework Convention on Climate Change (UNFCCC)." The TNC contained details of the country's compliance obligations to the UNFCCC. For instance, the TNC focuses on Greenhouse Gas emission scenario and climate change mitigation activities, especially identification and

characterisation of important mitigation options (Swaziland's Intended Nationally Determined Contribution, 2015:3).

More significantly, the literature has revealed that to adjust educational planning to climate change, it is also important to take into account the impacts of climate change on migration patterns and school enrolment, infrastructure maintenance and personnel, as well as disaster risk management (UNESCO, 2012:12).

After ratifying the United Nation Framework Convention on Climate Change, Swaziland has developed a series of notable climate change actions, namely the establishment of a multi-stakeholder National Climate Change Steering Committee in 2011. This Committee spearheaded the development of Swaziland's 2014 National Climate Change Strategy and Action Plan, and the National Climate Change Policy. The goal of this policy is to support the development of a sustainable, resilient and inclusive low carbon green growth economy in line with vision 2022 which expects the country to receive first world country' status (The Policy Guide on Planning and Climate Change, 2011:11).

Teachers and learners have misconceptions and misunderstanding about climate change, due to the complexity of the science involved, the uncertainties and the controversies surrounding it. (Fortner and Corney, (2010), Hestness, MacDonald, Breslyn, McGinnis & Mouza (2013), Papadimitriou (2004). Climate change education offers many opportunities and benefits to learners, educators, institutions and to wider society Hestness, et al. (2013:8). In general, people with a basic understanding of science are more concerned with addressing climate change (Leiserowitz, 2010, 2011 and Miller, 2010). Climate Change Education has been developed by researchers as a key element in moving towards a sustainable future (Manyatsi 2008, Dlamini 2011, UNESCO 2010, Wals 2010). Education offers the best opportunity for young people who are future leaders of tomorrow to be empowered to be able to sustain their livelihoods and that of the future generations (UNESCO, 2010:14).

The next section will present data obtained from respondents and participants.

4.3 An analysis of Geography teachers' data collected through questionnaires

4.3.1 Part A: Demographic and Social Information

Part A displays the participants' profiles which consist of gender, age group and qualifications. This information was essential as it helped to determine any variable that might affect the results. Geography teachers' gender ratio was included in order to gain a perspective on the general understanding of climate change education by males and females who participated in the study. In addition, gender information was meant to validate the much discussed fact that women are more vulnerable to the effects of climate change than men, primarily as they constitute the majority of the world's poor and are more dependent for their livelihood on natural resources that are threatened by climate change (Lambrou, 2010:2) . For instance, in the rural communities of Swaziland, women are charged with the responsibility of securing water, food and fuel for cooking and heating, which becomes a huge challenge under adverse or unpredictable climatic conditions. The results as shown in Figure 4.1 indicate that the majority of teachers participating in this study were males (66 percent), where females made up only 34 percent.

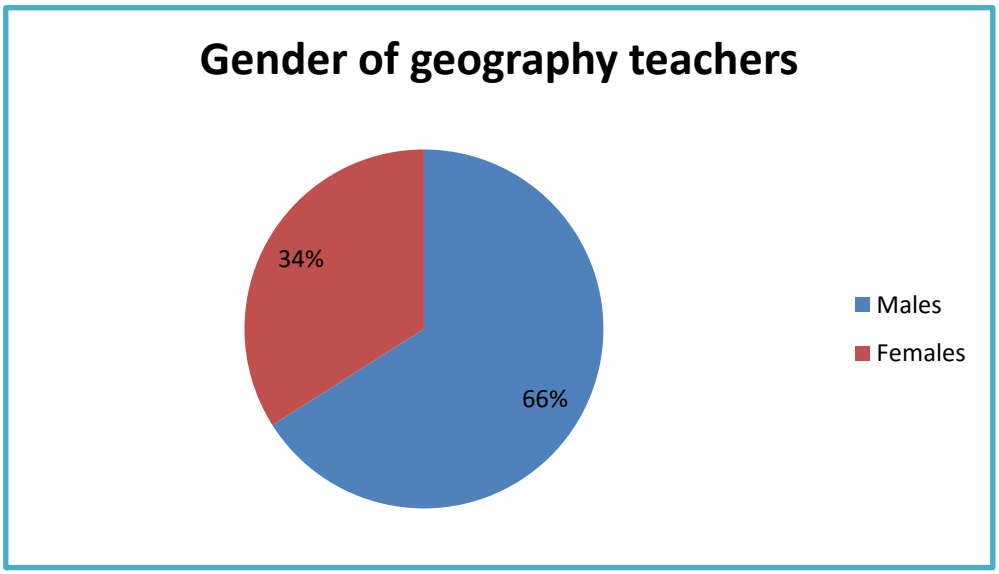


Figure 4.1: Graphical display of the gender group of geography teachers in Swaziland

4.3.1.2 Geography teacher's age group who participated in the study

Research has shown that age is a critical predictor of individual familiarity with climate change issues (Robinson, 2011:34). According to a study conducted by Saroar and Routray (2010) there is a positive correlation between age and familiarity with extreme weather events. Robinson (2011:34) attests that "it is assumed that older people are more aware of climate change than younger people are". However, this is not a rule. Surveys conducted in Europe revealed that younger people are more aware of environmental problems including climate change (Patchen, 2006:15). This debate lead me to conclude that the older generation are more worried about the impact of climate change in their society than are the youth who are merely familiar with climate change as an abstracted environmental topic. As such, it was important for this investigation to determine the age group of the geography teachers who participated in this research, with the view that if the majority are young, then the level of climate change education awareness will be high. The age group of the geography teachers who participated in the study were shown to be 31 percent in the age group 31-35, while 25 percent were in the 26-30 age group, and 22 percent were in the 36-40 age group. The 41-45 age group had nine percent. Only six percent of the geography teachers were in the age group above 45.

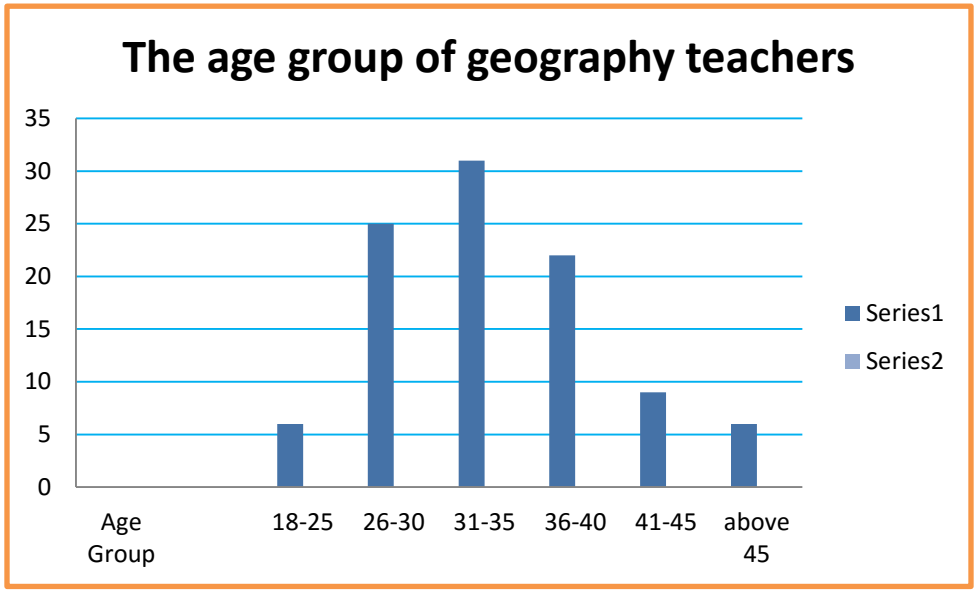


Figure 4.2: Graphical display of the age group of geography teachers

4.3.1.3 Discussion on the importance of geography teachers' age in the understanding of climate change education.

Recent studies have revealed that the understanding of climate change varies with age (Poortinga, Spence, Whitmarsh, Capstick, and Pidgeon, 2011, Mower, 2012). Young adult teachers are believed to be more exposed to CCE at their tertial education than older generations. Therefore, the young adult teachers are likely to understand climate change concepts better than their colleagues, who graduated at least a decade ago from university or college level (Mower, 2012:5). The adult geography teachers may not been exposed to CCE at college level, due to the fact that this concept has been poorly addressed for a long time. The results of this study indicate that the young geography teachers are more confident in teaching CCE in their geography lessons. One can argue that if the geography teachers were not exposed to CCE at tertial level, it is likely that they would have serious misconceptions about climate change, hence a lack of confidence to teach the topic well. From the results of this study as shown in Table 4.1 it can be noted those teachers who were exposed to CCE at university level were more comfortable to teach climate change. Exposing teachers to CCE at university level would mean they would have a clear understanding of the causes, dynamics and impacts of climate change through a holistic approach. According to UNESCO (2013), this would help teachers to "develop future-oriented and transformative capacities in facilitating climate change mitigation, adaptation and disaster risk reduction learning."

The question on teachers' understanding about climate change was included in this research to establish the Geography teachers' confidence in teaching climate changes education if it is included in the curriculum. The results shown in Table 4.1 below generally support each other. Most teachers agreed that in as much as CCE is an important concept that should be integrated or be part of the Geography curriculum, they were not confident to teach it. The results show that 13.9 percent were confident, while 38.9 percent fairly confident, and 47.2 percent not confident.

	Frequency	Percent
Confident to teach CCE	5	13.9%
Fairly confident to teach CCE	14	38.9%
Not confident to teach CCE	17	47.2%
	36	100.00

Table 4.1: Geography teachers' confidence to teach CCE

4.3.1.4 The qualifications of geography teachers who participated in the study

The results of the geography teachers' qualification in Figure 4.3 show that 25 percent had diplomas, while 44 percent of the teachers had a first degree followed by a Post Graduate Certificate in Education (PGCE). Teachers with a B.Ed degree totaled to 19 percent. MA holders counted 6 percent. There were 6 percent M.Ed degree holders and only 3 percent of the teachers had other qualifications.

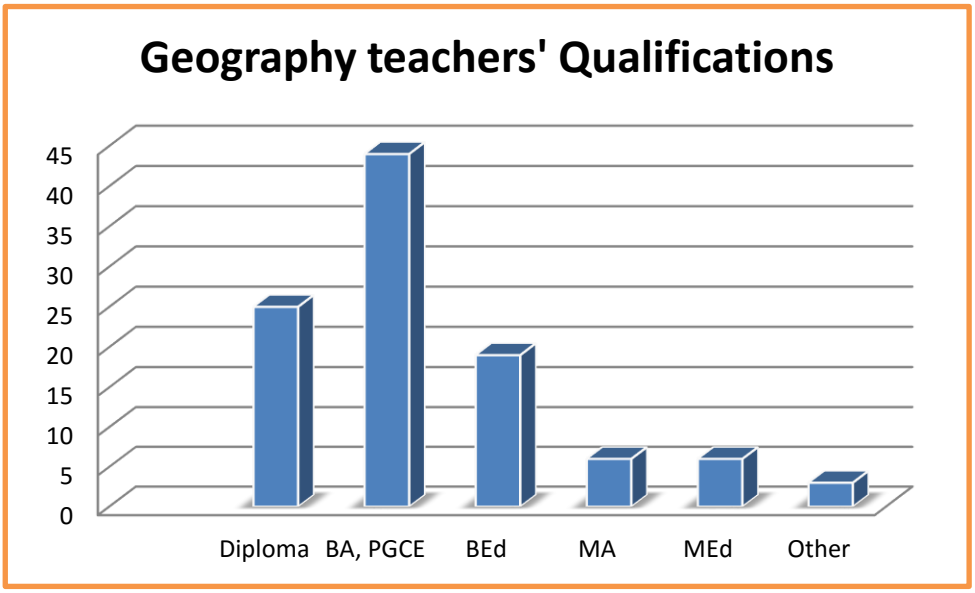


Figure 4.3: Graphical display of geography teachers' qualifications in Swaziland

The next section will focus on the curriculum information meant to establish whether respondents were aware of climate change education, and to determine the relevance of the

SGCSE Geography curriculum in the understanding and teaching climate change in Swaziland.

4.4. Part B: Curriculum Information

4.4.1 Geography Teachers Awareness of Climate Change Education

Data for this sub-question was collected through a questionnaire distributed to 36 Geography teachers from the 16 sampled schools for this study. The teachers were asked if they were aware of climate change education. This question was meant to create a wave of conscious awareness among the teachers so that they could stimulate thinking about climate change. The chart below indicates the responses and displays the information in percentages. The results in Figure 4.4 shows that 96 percent of the participants were aware of CCE and only four percent were not aware of climate change education.

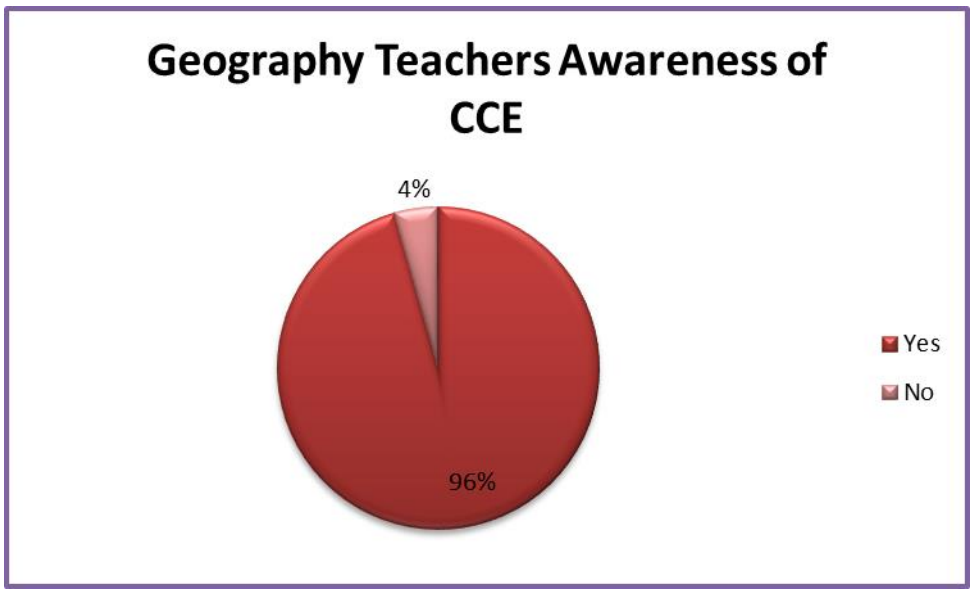


Figure 4.4: Graphical display of geography teacher's awareness of CCE in Swaziland

Asking this question was based on the assumption that if geography teachers were aware of the importance of climate change education, it means they had climate change adaptation and mitigation capacity to make informed decisions about climate change. This assumption is supported by Anderson 2010:14:

> "Educators have long traditions of educating for social change and can use their expertise on knowledge, skills, and attitude and behavior change to help reduce greenhouse gas emissions."

As already discussed in Chapter Two, children are powerful agents of change, therefore, this study hoped that once taught about climate change, the learners would minimise their own contribution to the causes of climate change and also contribute significantly in changing the attitude of their communities towards climate change.

4.4.2 The main topics which cover climate change education

The SGCSE Geography curriculum does not include climate change as a specific topic, instead it is presented as a cross cutting theme. The study indicates that there are several topics that are indirectly related to climate change, namely; Climate Regions of the World, Weather and Climate, Flooding and Drought, Human Influence on the Ecosystem, Desertification, El Nino and Lanino, Global Warming, Tourism, Population Dynamics, Settlements, Weathering, Soil and Land Degradation, Agricultural Systems, Energy and Water Resources.

4.4.3. Time allocated for Geography teaching

This study established that approximately 19.4 percent of the Geography teachers surveyed are allocated 160 minutes per week for Geography, approximately 30.6 percent is allocated 200 minutes per week, while only 50 percent are allocated 240 minutes. The results are shown in Figure 4.5 below. This question was included in the study in an attempt to establish the possibility of integrating CCE in the already crowded curriculum. Regarding the available time to enable the integration of CCE, some of the respondents commented by stating the following:

A respondent (8) commented:

> *The syllabus is too long; as such it is not possible to integrate Climate Change Education.*

Another respondent (13) replied:

> *The SGCSE Geography syllabus is brief about CCE issues, hence it would be difficult to teach it based on the teaching and assessment objectives of the syllabus.*

A respondent (20) commented:

> *The syllabus mainly focuses on the impacts of climate change which are also not discussed in details.*

Another respondent (36) had the following to say:

> *I think CCE should not only be integrated into the SGSE Geography syllabus but in all subjects.*

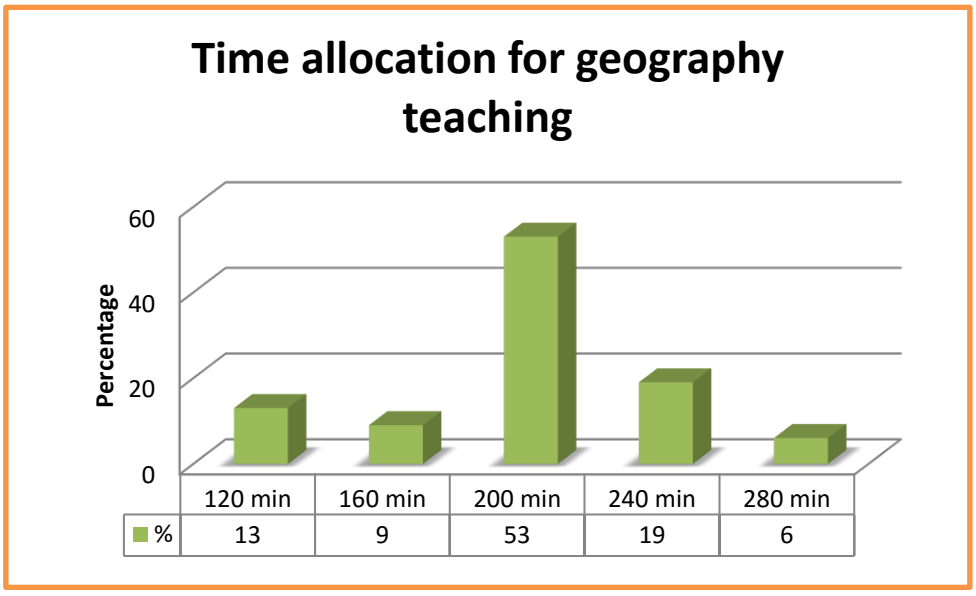


Figure 4.5: Graphical display of time allocation for teaching Geography in Swaziland

In view of the time allocation for Geography lessons in the schools, one can conclude that for effective teaching of CCE, all subjects in the school curriculum should allow the integration of climate change. By so doing, a majority of the learners in the school system

will gain a complete understanding of climate change. This observation is supported by UNESCO, 2013:12 that:

> "a science teacher might explore the chemistry of the impact, clean up and disposal of oil spills at sea at an appropriate point in the curriculum while the social studies teacher might address the ethics of oil-based consumerism as the opportunity presents itself. The infusion of sustainability across the curriculum at each grade level can be charted and the cumulative student exposure to sustainability understanding and ethics can be monitored. The more thoroughly this is done, the closer the approach comes to an interdisciplinary approach whereby all subjects are contributing insights on sustainability through their own disciplinary lens."

This observation by UNESCO is not supported by the findings of this study. The integration of CCE into the existing curriculum was rejected by a number of the respondents. For instance, T21 commented:

> *Our Geography curriculum is too long, so I think it will be very unfair to force the integration of CCE into the lesson, instead CCE should be taught as a separate subject.*

A majority of the Geography teachers felt that CCE should be taught as a separate subject as opposed to being integrated into the SGCSE Geography curriculum. The results show that 88% of the participants felt that CCE should be part of the Geography curriculum and only 12% felt it shouldn't be integrated. The results are shown in Figure 4.6.

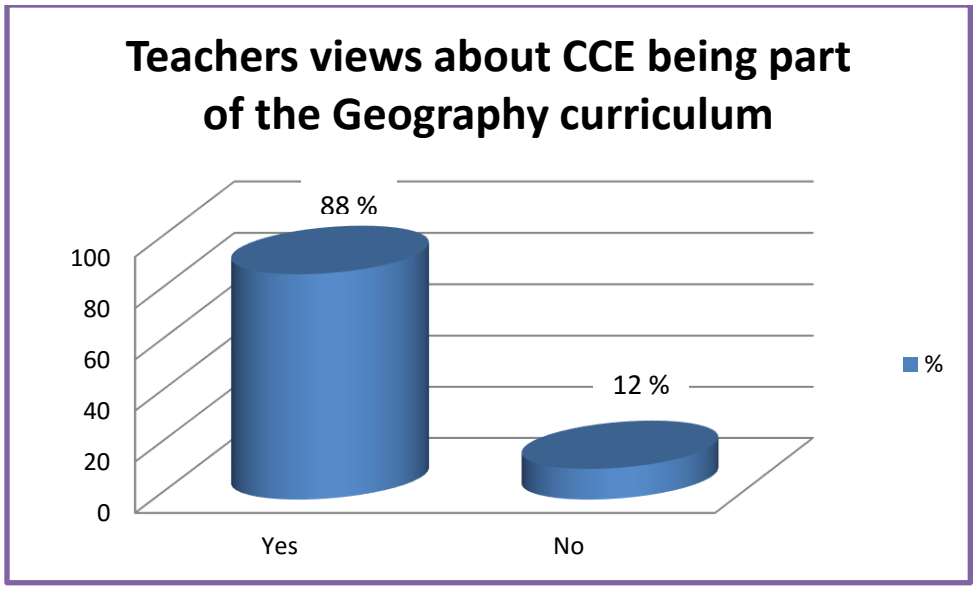


Figure 4.6: Graphical display of teacher's views about CCE being part of the Geography curriculum in Swaziland

4.4.4 Teachers knowledge and understanding of climate change education

Teachers have the potential to influence the level of knowledge and understanding learners have regarding a particular topic. As such, it is extremely important that teachers have a sound knowledge of any topic they teach, as it is likely that any misconceptions or inaccurate understandings which they hold will be passed on to learners (Boon, 2010:23). With the above discussion in mind, it could be argued that to ensure ultimate success of climate change education in schools, it is vital that teachers' conceptions and understandings of climate change are assessed.

This question was motivated by the fact that a course on CCE at college level would have given teachers confidence in facilitating CCE both inside and outside the classroom. This could help learners to understand the causes and consequences of climate change, bring about changes in attitudes and behaviours to reduce the severity of future climate change, and build resilience in the face of climate change problems or threats that are already present (Fumiyo, 2011:1).

The results of this study on this sub-question indicates that a majority of the teachers, namely: 66 percent, did not have CCE as part of their course of study, and 34 percent had CCE forming part of their course of study, as indicated in Figure 4.7. Based on the results, one can argue that in practice, teaching climate change education will always be problematic, as long as teachers lack proper training in CCE.

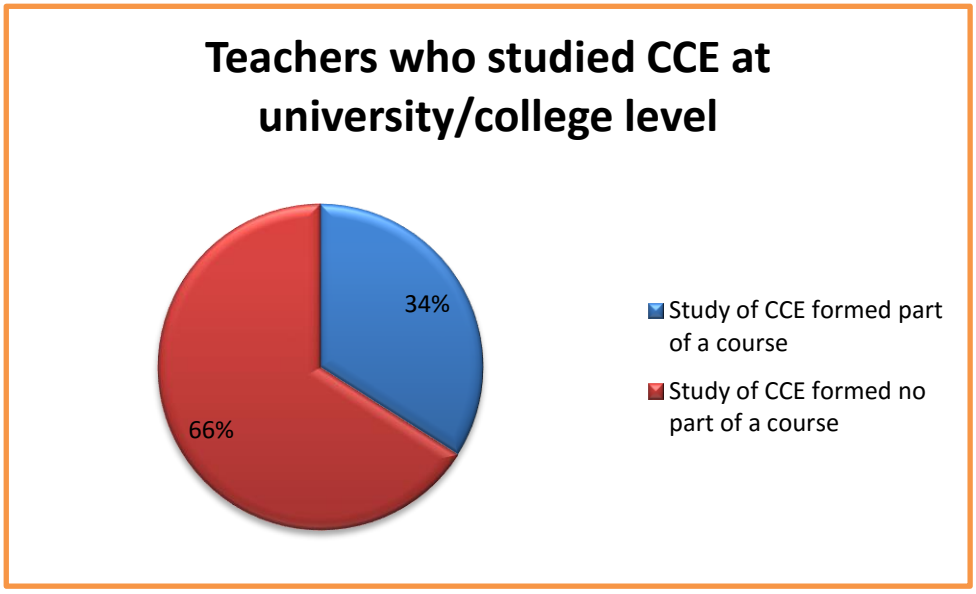


Figure 4.7: Graphical display of geography teachers who had CCE at college/university level

4.5 The use of practical approaches in enhancing the teaching and learning of CCE

The question of the use of practical approaches was meant to establish the extent to which teachers expose learners to real life situations. Real, hands-on experience brings learning alive. This observation is echoed by UNESCO, 2014:13 that:

> "developing knowledge of local seasonally based cultural and farming practices or of local flora and fauna and how these have fed into cultural and religious story and symbolism, and further exploration of how these might be lost as a consequence of climate change can give root to feelings of responsibility and action in the local setting."

Dlamini (2011:30) further attest that practical approaches programmes like field excursions must be designed in order to teach and expose pupils to spatial relationships. For instance, when learners are exposed to a severely degraded area, they would be able to associate land degradation with the effects of climate change. By taking sustainability learning out of the classroom and into the community, students can work alongside community members in thinking through and implementing local initiatives for climate change mitigation, adaptation, and disaster risk reduction (Manyatsi, 2008:23). The use of practical approaches in the teaching and learning of secondary school Geography in the schools under the study indicates that 88 percent of the use practical approaches, while 12 percent do not think the use of practical approaches can enhance CCE. The results are shown in Figure 4.8.

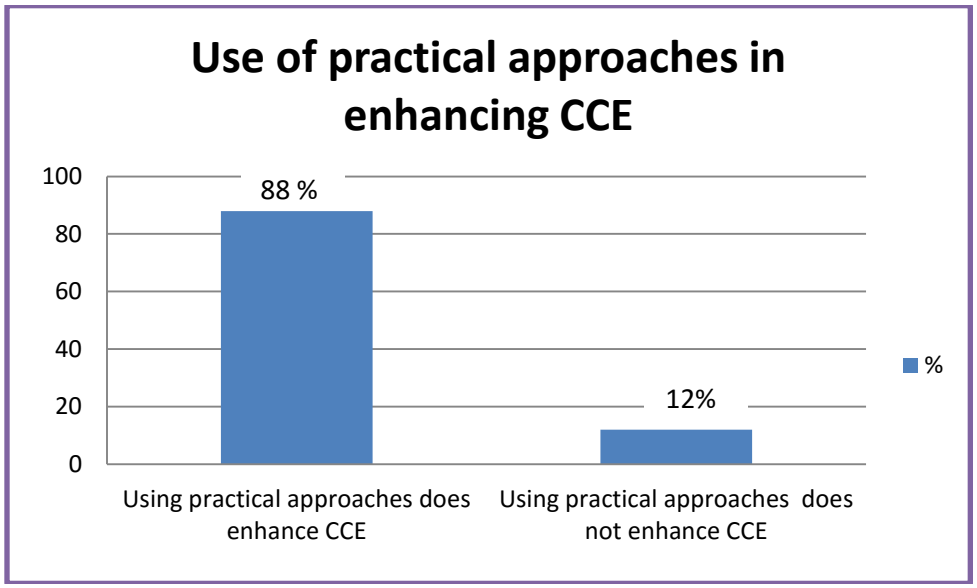


Figure 4.8: Graphical display of the use of practical approaches in enhancing CCE in Swazi schools

In conclusion, it is possible to conclude that climate change education as already discussed in Chapter Two, has a strong practical orientation. That is to say, CCE exposes learners to concepts which are best understood after practical experiences. For example, learning about land degradation can best be explained when literally referring to a visible piece of degraded land. In other words, CCE calls for hands-on engagement by both learners and teachers. In addition, CCE is also marked by diversity of teaching and learning approaches. As such it is imperative for the geography teachers to use practical oriented methodologies in their

classes. The use of practical methodologies should also be linked to learning programmes which are required to help learners engage with the full seriousness of the climate change threat, search for new meanings and values, and move into personal and collective empowerment and action (UNESCO, 2014:10).

4.6 The role of environmental clubs in promoting CCE

Out of all the sixteen schools that participated in the study, there was only one school with an environmental club. The results are shown in Figure 4.9 below.

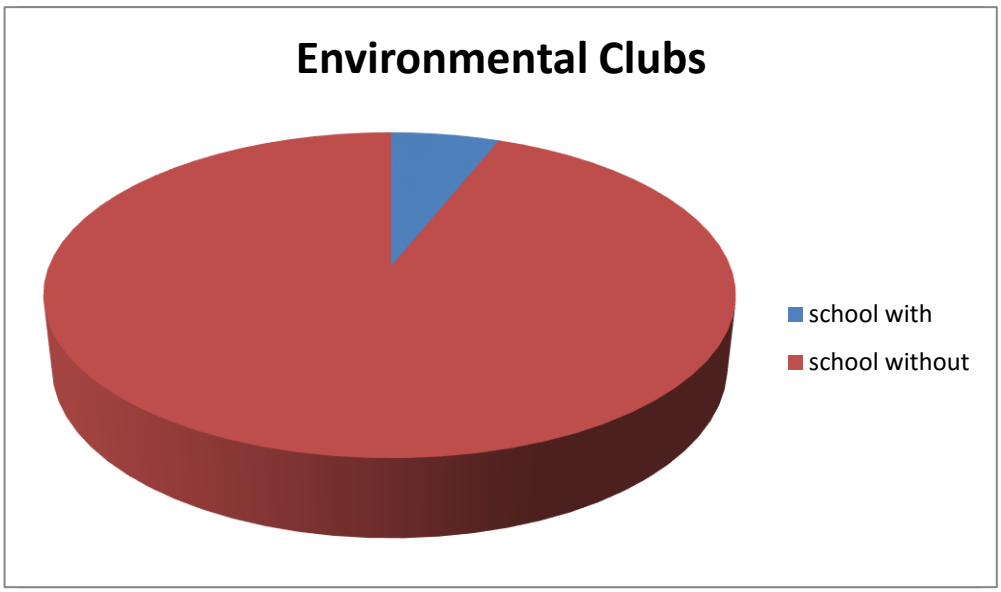


Figure 4.9: Environmental Clubs in the schools

4.6.1 Discussion on the role of Environmental Clubs in enhancing CCE

The presence of Eco or Environmental Clubs in schools helps the learners to acquire an education that seeks to balance human and economic well-being with cultural traditions and respect for the Earth's natural resources. It emphasises aspects of learning that enhance the transition towards sustainability, including future education; citizenship education; education for a culture of peace; gender equality and respect for human rights; health education; population education; education for protecting and managing natural resources; and education for sustainable development. For instance, from the group discussions, students who were part of the School Environmental Club showed more understanding of

environmental issues. From the focus group discussions, students revealed that a lot still needs to be done in creating awareness among pupils about CCE. Even though the learners were able to give a general overview of the concept after a lengthy discussion, it can still be concluded that CCE is not emphasised by Geography teachers in their lessons. Nonetheless, environmental management strategies, especially on already degraded areas, tend to dominate geography lessons.

4.7 Teaching resources used in the teaching and learning of geography

Teachers and educators need relevant materials to support their learning activities on climate change. Examples of relevant materials include manuals, teachers' resource guides, lesson models and training modules, but also books, cartoons and videos (to name a few) to guide, inspire and empower students (UNESCO 2013:6). The results of this study indicates that geography teachers rely on the prescribed textbooks shown in Table 4.2

Class	Textbook
Junior Level	• Junior Secondary Geography for Form 1-111. • Oxford Modern Geography Book 3 for Form111.
High School Level	• Macmillan Geography for Southern Africa for Form IV-V. • H/IGCSE Geography Module 1 for FormIV-V. • H/IGCSE Geography Module 2 for FormIV-V. • H/IGCSE Geography Module 3 for FormIV-V. • H/IGCSE Geography Module 4 for FormIV-V. • The New Wider World for FormIV-V.

Table 4:2: Textbooks used in geography as resource materials in Swaziland

4.7.1 Discussion on teaching resources used in the teaching and learning of geography

The SGCSE Geography curriculum textbooks do not include climate change as a specific topic. This study has discovered that several topics are indirectly related to climate change, such as Industries and Environmental Impacts, Weather and Climate, Population Studies, Urbanization, Power Production and Management, Trends and Impacts of Tourism, Coastal Processes and Erosion. One can also argue that in as much as there is great interest in further incorporating climate change and related issues into the curriculum, teachers are constrained by a lack of audio-visual resources related to climate change. To promote climate change education in schools, teachers must have access to more local audio-visual resources such as posters and, books, and school libraries should be furnished with adequate material on climate change education.

It can also be concluded that in Swaziland there are certain resources like textbooks as already noted, video and pamphlets on environmental issues prepared by NGO's, available to help Geography teachers integrate climate change education more comprehensively into their lessons.

4.8 Learners' understanding of climate change and global warming

The common definition of climate change is that it refers to any change in climate over time usually decades or longer, whether due to natural variability or as a result of human activity (IPCC, 2001:30). This definition by IPCC is widely acknowledged to be the current authority on climate change. As such, the definition by IPCC has been used as a benchmark from which to explore the extent of accuracy learners' understanding of the term climate change. The following table shows some of the definitions given by the learners. The different focus group interviews from the learners were listed as GA, GB,GC, GD, GE, GF, GG, GH, GI, GJ, GK, GL, GM, GN, GO and GQ. It is important to note that there were a number of similar definitions given by the learners, hence the importance of identifying the most varying definitions.

Focus Group	Basic concept of climate change and global warming
A.	• *I think it includes global warming which is the gradual warming of the atmosphere. As such these days we either experience extremely high or low temperatures in both high and low altitude areas which is something that was not happening some years ago.*
B.	• *To my understanding climate change is the depletion of the ozone hence the prevailing high temperatures.*
C.	• *I think that climate change is when the earth starts to act in a different way. For instance, temperatures become very high or extremely cold. As such the country sometimes experience floods and periodic drought.*
D.	• *What I can say is that climate change is the slightly change of temperature that is happening due to some causes like smoke that is produced from some industries.*
E.	• *I think climate change is the increasing and decreasing of the temperature.*
F.	• *In my own understanding climate change is the changes on the observed climate cover a short period of time maybe it might be caused or it can be influenced by the reusable resources like in the factories the smoke that are deposited in the atmosphere also cause climate change, and I also think climate change can be also controlled by using reusable sources like using solar geysers.*
G.	• *I think it is the gradual rise of the earth's temperature caused by accumulation of greenhouse gases.*

Table 4.3: Focus groups responses showing basic understanding of climate change and global warming among Swazi learners.

Group	Causes of climate change and global warming
A	• *It is caused by people through the burning fossil fuels. In addition, I think the burning of grass and vegetation also cause climate change.*
B	• *According to my understanding it is caused by industrialization. The manufacturing and processing factories emits sulphur dioxide, and cars which are a result of industrial work produce carbon monoxide and sulphur dioxide which destroy the ozone layer.*
C.	• *The main causes in Swaziland are the industries. For example, in Matsapha, the temperatures there are so different in such a way that you may think that area is in the Lowveld of Swaziland which is known to be the region with high temperatures.*
D.	• *Technology causes climate change in the sense that these days a lot of people use refrigerators, spray perfumes which produce chlorofluorocarbons gases which build a layer which traps radiation from the earth and this lead to global warming. In addition, the cutting down of trees also contribute to climate change as a lot of carbon dioxide is released to the atmosphere which is one of the key greenhouse gases.*
E	• *I think that climate change is caused by pollution as a result of certain gases which are released to the atmosphere. The atmospheric gases end up destroying the ozone layer hence the rise in temperatures received by the earth.*
F	• *There's one cause of global warming which is common in our country, Swazis keep a lot of cattle as part of the culture. These animals release methane which is a greenhouse gas which has a drastic effect in global warming.*

G	• *I think it is caused by deforestation and overgrazing.*

Table 4.4: Focus groups thoughts on the causes of climate change and global warming among Swaziland learners.

4.8.1 Discussion on learners' basic understanding of climate change and global warming

As shown in Table 4.4, learners have limited knowledge or understanding of the causes of climate change and global warming. These participants stated during the interview that due to insufficient knowledge, they could only give general knowledge of climate change and global warming, thus displaying inadequate knowledge regarding the process of the greenhouse effect. The majority of these learners had gaps in their conceptual understanding of the processes that result in global warming. This was seen in the response to questions pertaining to the causes of climate change and global warming. These flawed responses included participants incorrectly linking ozone layer depletion to the greenhouse effect, and in some cases, labeling pollution as a primary contributing factor to the process.

These results suggest that Geography learners are not well-informed or sufficiently engaged with climate change education. When asked about their understanding of causes of climate change as well as that of global warming, the learners referred in general to our human tendency to be greedy, selfish, and not take nature into account when going about our daily lives and business, or undertaking large scale developments. Some referred more specifically to pollution, cars and other transport as factors leading to climate change, but only two (both children) mentioned the process of burning fossil fuels or other sources of carbon. No one mentioned or tried to explain the greenhouse effect. For instance, one learner from GD stated as follows:

> *Technology causes climate change in the sense that these days a lot of people use refrigerators, spray perfumes which produce chlorofluorocarbons gases which build a layer which traps radiation from the earth and this lead to global warming. In addition, the cutting down of trees also contribute to*

climate change as a lot of carbon dioxide is released to the atmosphere which is one of the key greenhouse gases.

Another learner from GF explained that:

There's one cause of global warming which is common in our country, Swazis keep a lot of cattle as part of the culture. These animals release methane which is a greenhouse gas which has a drastic effect in global warming.

The responses of the learners, sharing their understanding of CCE, shows that Geography teachers need to increase and diversify their climate change teaching. This will significantly help the learners to improve their knowledge and understanding of climate from the current mediocre levels as seen in their responses already presented in Table 4.4 above.

GROUP	Impacts of climate change to the live hoods of Swazis
A.	• *Swaziland is experiencing climate change these days as such it is very difficult to practice crop cultivation especial maize which requires adequate rainfall for good productivity.*
B	• *I think it affects the livelihood Swaziland economically, as Swazis depend on agriculture, so if there is drought, it means no rain, and poor water for farmers to irrigate their crops hence food shortages in the country which also leads to decline on agriculture related job opportunities hence, high rate of unemployment.*
C	• *Considering the consequences of climate change like drought and flooding which leads to crop destruction. As such the current climate conditions in the country are affecting the livelihoods of the people e.g. the sugar cane industry is reducing its employees because of water shortages to irrigate*

	large fields. This implies high level of unemployment in the country.
D	• *It affects the tourism industry. For instance, in the country there is the Maguga dam which is usually visited by numerous people especially when it is in full and spills but these days due to the effects of climate change which has lead to decline in rainfall, the level of the dam is very low hence few people had interest to visit the dam.*
E	• *The climate change has greatly affected the biodiversity in the country hence people are no longer able to harvest sufficient forest food products to supplement their diet.*
F	• *I think the livelihoods are affected because people are unable to cultivate their farms as we know that Swazis rely on farming and livestock rearing hence poor yields and it brings poverty into the country. Just this year 2015, farmers have lost more than 200,000 cattle which is a major setback to the country' economy.*

Table 4.5: Focus groups responses showing views of learners about the impact of climate change to the livelihoods of the Swazi people

Overall, the focus group interviewees all appeared to have a basic and seemingly sincere concern for the environment and how it is being impacted by human activities. Almost all were familiar with the term 'climate change' itself, and most had a basic understanding of some of its general causes, but demonstrated little understanding of the processes involved. Similarly, interviewees had a very generalised understanding of climate change education. According to Manyatsi (2010:34) it is possible to suggest that "all education stakeholders in the country need to put together sound programmes on CCE that will equip all learners with the knowledge and skills they need to act upon an apparently well-established sense of concern for their environment".

4.9 Key Informants

The key informants in this research included the Environmental Information Officer, Senior Inspector of Geography, and School Principals of the sampled schools and Senior Curriculum Designer.

4.9.1 Environmental Information Officer (EIO)

In Swaziland, there is one major organisation that is involved in environmental management issues such as coordination of environmental policy formation, sensitisation of the public on environmental management controls. This organisation is the Swaziland Environmental Authority. The information required from this institution included objectives of the institution, awareness and understanding of climate change education, major role of the institution in the implementation of climate change education in the country, strategies that the institution has put in place to ensure that CCE is integrated into the school curriculum and future plans of the institution to ensure that every school going child has an understanding of CCE.

The Environmental Information Officer indicated awareness of climate change education. In defining climate change education, the EIO said:

> *It is the formal and informal way of disseminating information about climate to the people.*

The EIO was asked to mention policies that the SEA has already put in place to address climate change in the country. The response was that so far the country has crafted a Climate Change Strategy which also includes climate change education is still in a draft form. The major stakeholders in the formation of the policy were cited as all Swaziland Government Ministries, Municipalities, SWADE, KOBWA, SNTC and the Meteorology Department being the focal point for climate change issues in Swaziland.

The EIO was asked to highlight some of the SEA activities in schools in an attempt to intergrate climate change education into the school curriculum. It was revealed that SEA is actively involved in tree planting and clean-up campaigns in schools.

From an environmental perspective, the EIO was asked to state what would be the best way for schools to integrate CCE into the school curriculum. The EIO pointed out that:

> *In English language they can have passages on climate change, poetry. In mathematics they can develop Mathematical problems on climate change. In siSwati they can incorporate when discussing indigenous knowledge. Other subjects such as Science and Geography can easily incorporate climate change issues. So long as climate change education is not treated as a separate subject or a burden to teachers. Teachers should be involved in the initial stages of the process.*

When responding to the question as to whether SEA has had an opportunity of meeting teachers in schools in an attempt to sensitise them about the importance of CCE as means to minimise environmental problems, the EIO responded in the negative.

The question regarding the future plans of SEA with regards to ensuring that every school going child has a basic understanding of climate change education, the EIO mentioned that:

> *As an institution they are looking at the integration of environmental issues into the school curriculum and such talks are already on going with the National Curriculum Center.*

4.9.2 Senior Inspector of Geography

According to the Senior Inspector of Geography in the country, the current Geography syllabus has certain topics which address CCE from Form I to Form V. These topics are: Agricultural Systems, Tourism, Environment Risks and Benefits-Resource Conservation and Management, Renewable Energy Resources and Non-Renewable Resources.

The inspector also revealed that although the subject does not have books which address CCE in details; the current textbooks do contain topics which can be ideal for climate change education. Moreover, the geography teachers have not yet been trained on CCE except for some who might have had an opportunity to learn about climate change concepts at college or university level. In another development, the inspector identified the following reasons for the importance of integrating CCE into the Geography Syllabus:

- The environment is the mainstay of our economy and learners have to learn about sustaining it and have it in every topic.
- In this chapter, (section 4.9.1), it has already been discussed that CCE can be used as poverty reduction strategy, and what the learners practice at school can be transferred home, where, with the global trends of climatic change learners need to learn about mitigation and adaptation methods as integrated into their lesson and coursework.

4.9.3 Senior Geography Curriculum Designer

The Senior Geography Curriculum Designer was a key informant for this study. The curriculum designer is responsible for development of Geography teaching material like textbooks. Therefore, the study assumed that the development of SGCSE Geography teaching should be developed in line with climate change education. Developing climate change education textbooks would foster and enhance the understanding and teaching of climate change in Secondary Education Geography Curriculum in Swaziland.

The senior geography curriculum designer acknowledged the challenges faced by the Swazi people as a result of climate change. As such the National Curriculum Centre is currently reviewing the school curriculum which has been silent on climate change education: The senior Geography curriculum designer pointed out that:

> *As a center, we have realized that the effects of climate change are daily threatening the livelihoods of the Swazis. So the incorporation of climate change education into the school curriculum will ensure that the learners are*

equipped with relevant skills and knowledge to minimize the effects of climate change in the communities.

Children, who are taught about climate change education, play an important role in saving lives and protecting members of the community from the effect of climate change (UNISDR, 2006:45). Meanwhile Fumiyo (2011:67) attests that the "inclusion of climate change education into the SCGSE geography curricula fosters awareness and better understanding about the immediate environment in which children and their families live and work".

The Curriculum Designer stated that the NCC is currently working with the Ministry of Education and Training Geography Inspectorate in the development of a new syllabus that will include climate change education.

4.9.4 Principals of schools

4.9.4.1 Personal information

The results show that there were 11 males and five female principals. None was under the age of 41, four were in the 41-45 age group, and a majority (12) of the principals were above 45 years of age. In terms of qualifications, there was no principal with a Diploma, or an MA degree, eight principals had a first degree and a Post Graduate Certificate in Education (PGCE), five had B.Ed degrees, and only three principals had M.Ed degrees. The results of the principals' experience indicates that four had less than two years, five of the principals had between 2-5 years as principals, two had been principals between 6-10 years while three had 11-15 years' experience as principals and only two principals had more than 15 years' experience. The questions on personal information were included in attempt to establish emerging variables of potential significance in the study.

4.10 Characteristics of Schools

Three of the schools are government-aided schools known as missions. The other 13 schools are government central schools. In terms of enrolment, three of the schools have between 301 to 400 students, eight of the schools have between 401 to 500 students, one of the schools have between 501-600 students and four of the schools have more than 600 students as displayed in Figure 4.10. Concerning the number of teachers in the schools, two of the schools have 21 to 30 teachers, eight schools have 41 to 50 teachers, three schools have 41 to 50 teachers and three schools had more than 51 teachers. The mission schools tend to have more infrastructures as compared to the central government schools. For example, the mission schools have adequate classes as opposed to central schools. This is an advantage because it enables the provision of diverse curriculum.

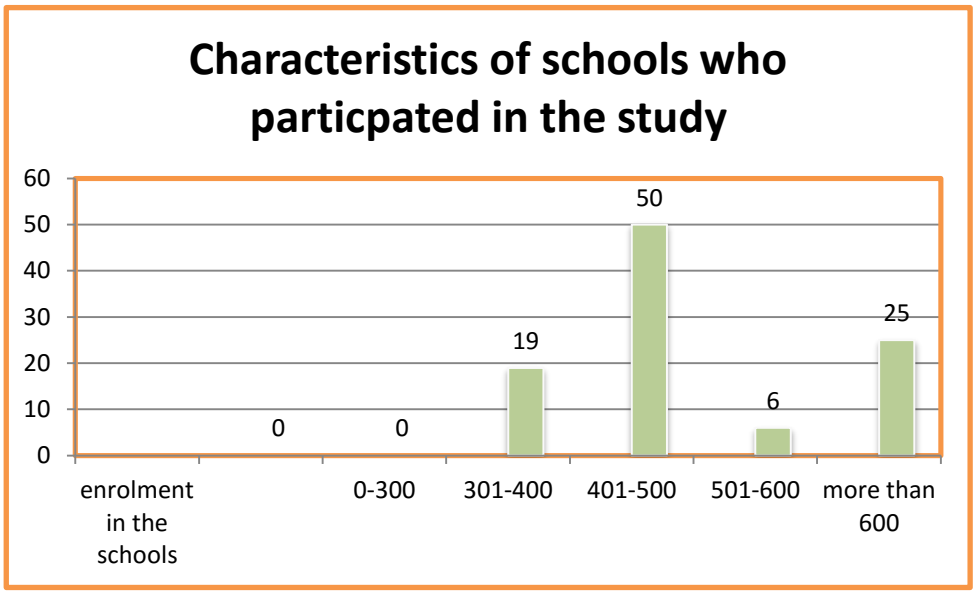


Figure 4.10: Graphical display of the characteristics of schools in Swaziland

4.11 The effects of climate change to the schools.

School principals observed that subsistence farmers in the country are faced with a major challenge in crop and livestock farming, due to the prevailing climate variability. The majority of parents of school going children are farmers, who depend, entirely on their

agriculture for employment and income from which they earn money to pay school fees. Unfortunately, the current climate variability in Swaziland has resulted in a number of parents failing to pay fees for their children. As a result, a large number of learners fail to complete their education due to lack of fees. This has had a great impact on the operations of the school. Schools are no longer able to sustain its activities like sports, maintain buildings, purchase learning and teaching material.

Principal (P2) had this to say:

> *The failure of parents to pay fees for their learners is really affecting the smooth running of the school. For instance, we have been forced to pull out of some of the sporting codes because the school cannot afford to transport and feed the students when attending the activities.*

The school principals also observed that the major devastating effect of climate change especially in the rural areas which are severely affected by drought is the lack of water which forced schools to close early for the 2015 academic year. Principal (P5) commented:

> *We had hoped that the El Nino events in the country would last for a few months, unfortunately the situation seems to be getting worse day by day.'*

Another respondent P13 commented:

> *A number of schools in the country will soon close permanently when one consider the effects of climate change in the country. For instance, in our community, a number of families have lost their cattle due to drought yet the families have always relied on their cattle as a source of income.*

Respondent P16 observed that:

The climate variability prevailing in the country these days has seen a number of schools been blown away by heavy storms, which is always difficult for the schools to do repairs on time.

A number of principals P1, P3, P4, P6, P7, P8, P9, P10, P11 and P14 observed that the climate variability in the country ought in fact to be declared as a national disaster. Once declared the results of climate change to be a national disaster, where it will be vital for the Government to make certain provisions to ensure that the schools in the country are maintained on a regular basis.

These comments by the principals provide adequate evidence that indeed, effects of climate change are affecting the operations of schools in the country. These responses are significant, where, in the literature review it was mentioned that climate change has negative effects on the operation of schools.

The following were the major effects of climate change cited by the school principals.

- High temperatures during school hours
- shortage of food supply especial agriculture products by local farmers
- huge water bills
- dusty grounds
- decrease in the number of students
- poor performance of students

4.11.1 Discussion on the effects of climate change on the schools.

According to Das (2010:17) “children are always the hardest hit by the increasingly frequent and severe weather events, desertification and flooding brought by climate change”. For instance, Anderson, (2010:4) has argued that:

> "Disasters caused by hazard-induced climate change can damage or destroy school facilities and educational systems, threatening the physical safety and psychological well-being of communities and interrupt educational continuity. The economic impacts of disasters reduce school enrollment, as children are kept out of school to help with livelihoods".

It is important to note that a number of schools in the country are not constructed to be disaster resilient, hence, the schools are easily blown away by heavy winds and storms which the country experiences these days. For instance, Photograph 4.1 shows roof of classes that have been damaged by storms in 2015. I can therefore propose that it is essential for all schools in the country to integrate disaster risk reduction programmes in the schools. I believe that this will create emergency preparations by both learners and teachers. More importantly, one can argue that it is a matter of urgency for the Ministry of Education and Training to initiate regional school disaster committees, which will promptly attend to any school in the event it has been affected by heavy storms. In addition, it is imperative for the Government of Swaziland to re-assess school buildings to ensure that they remain stable whenever struck by storms. Otherwise, the economic effect of climate change to the education sector is the resultant rehabilitation costs, which drain the already constrained education budget.

Photograph 4.1 Roof of classes damaged by storm

Source: Times of Swaziland, 23/10/2015

4.11.2 Climate Change mitigation measures undertaken by schools

As already mentioned, while schools are threatened by climate change, they still have an important role to play in contributing to mitigation efforts. Anderson, (2010:11) has noted:

> "Climate change can increase water stress caused by erratic rainfall patterns and create a need for alternative sources of water. Programs for harvesting rainwater can be integrated into schools so that children have a safe and ready supply of drinking water and basic sanitation facilities at school. School-based water and sanitation programs also have the benefit of encouraging parents and the community to support children going to school."

In fact, one is bound to argue that the knowledge and skills attained by learners in school is a major vehicle to transport climate change mitigation and adaptation measures beyond the school boundaries. Therefore, exposing learners to practical mitigation and adaptation measures to climate change automatically benefits the wider community.

Respondent P5 commented:

> *In our school, we are trying our best to encourage the learners to conserve water. For instance, cups are provided next to taps around the school so that learners use the cups when drinking from the taps.*

P6 pointed out that:

> *As a school we sometimes invite experts from the Swaziland Environmental Authority and City Council to come and educate our learners about the importance of conserving our environment. In most cases, these environmental educational talks have worked to the school advantage as our learners have developed skills of protecting the environment which in the process reduce the effects of climate change.*

P1, P2, and P9 commented that it is a matter of urgency that all stakeholders in the country join hands to embrace mitigation and adaptation strategies to the effects of climate change, which seem to be drying out all the major water reservoirs in the country. They observed that people might die due to the severe drought in the country. For instance, for the first time in the history of the country, people are buying water at the very high price of E450 to E500 for 5000 litres of water.

The scarcity of water in the country has a great impact to schools. P4 mentioned that:

> *As a school we are forced to encourage our learners to bring water bottles from home because as a school we are not able to provide enough water to the learners yet the temperatures are high here and the learners require a lot of water to drink. To make things worse as a school we have been forced to build pit latrines in attempt to cope with the scarcity of water.*

This comment is linked to P8 who proposed that:

> *Maybe the ideal strategy to save water these days, schools should build pit toilets which their learners can use especially during dry periods.*

The study discovered that the following were the major mitigation and adaptation measures which school principals felt should be adopted by schools towards the effects of climate change in schools.

- Water harvesting: the shortage of rainfall
- Have school garden with botanic garden
- Educate local communities about human activities which leads to climate change
- Do a forestation
- Embark on environmental strategies

4.11.3 Discussion of climate change mitigation measures undertaken by schools

One of the operationalised objectives of the study was to identify the initiatives undertaken by schools to promote public awareness of environmental issues like climate change. According to Anderson, (2010:4):

> "Since the causes of climate change are at least partly linked to human actions, these actions need to be identified and changed. This involves learning to change consumption patterns, such as using renewable forms of energy and designing greener technologies. Thus, mitigation requires education geared toward learning how to change lifestyles, economies and social structures that are based on excessive greenhouse gas production."

This observation leads one to argue that in Swaziland, there is an urgent need for climate change proofing of educational infrastructure in order to minimise the risks and associated costs of weather-related damage. As a matter of fact, this is clearly an important starting point. According to DES, (2008:34) this would "entail better risk assessment in making decisions about school location and improved building design and maintenance to better withstand severe weather events as well as slower incremental deterioration." UNESCO, (2012:14) points out that:

> "This may include building school and community water catchment systems. A concerted focus on school design and upgrading offers opportunities both to reduce environmental impact in terms of material use (e.g. minimizing use of burnt bricks and tiles in construction, utilizing more energy efficient cooking apparatus), and also to incorporate design elements, which create improved learning environments (e.g. levels of natural lighting, sanitation facilities, reduced noise from rain impact, spaces conducive for learning".

Robinson (2011:35) points out that this observation suggests that "climate change proofing of educational infrastructure in order to minimise the risks and associated costs

of weather-related damage is clearly an important starting point." DES, 2008:19 had the following to say:

> "This would entail better risk assessment in making decisions about school location and improved building design and maintenance to better withstand severe weather events well as slower incremental deterioration".

My view on this literature deliberation is that Swaziland schools should be constructed under the supervision of a structural engineer, who will ensure that the building is strong enough to withstand the effects of climate change. In the rural areas where classrooms are usually blown away by strong winds as shown in Photograph 4.1, construction is usually only be able to be undertaken by parents, with the help of ordinary bricklayers.

4.12 Principals views of having CCE across the school curriculum

Effective leadership is always regarded as the most important factor in a school's success. However, "the school leadership becomes effective if properly integrated with the work of teachers, the organisation of the school and relationship with parents and the wider community" (Miller, 2010:27). This leadership principle motivated this study to consider the role of school principals in understanding and teaching climate change in the Secondary Education Geography Curriculum in Swaziland. My experience as a teacher is that any innovation to be effectively integrated into the school curriculum, it has to be fully understood and supported by the school leadership. The responses of the principals about the inclusion of climate change education across the school curriculum revealed that 81 percent were in agreement for the integration, while 19 percent proposed that CCE should be taught in subjects such as Geography, Agriculture and Integrated Sciences. The results of the principals' view about CCE being incorporated across the school curriculum are shown in Figure 4.11.

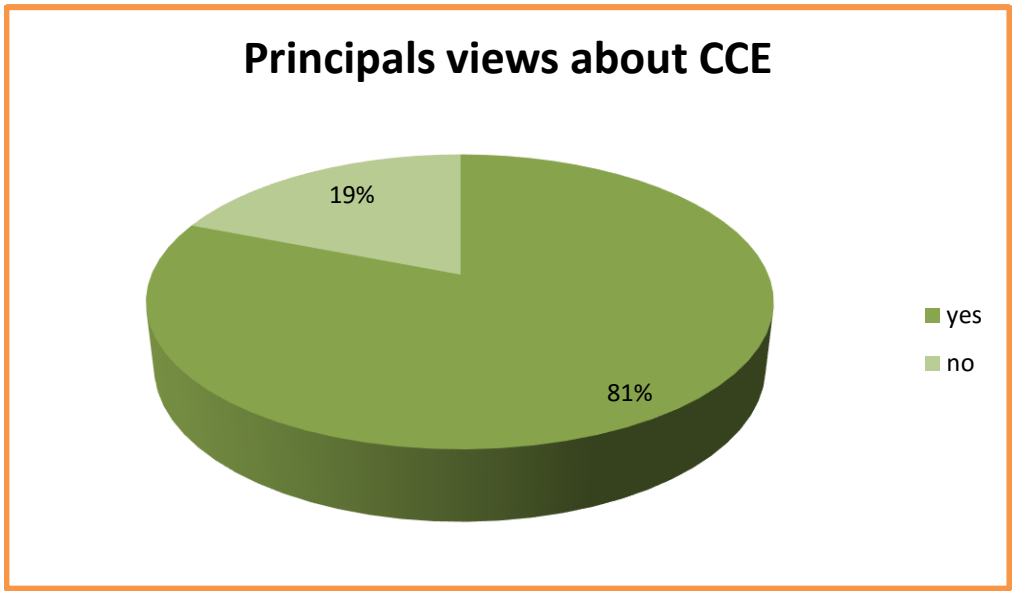


Figure 4.11: Graphical display principals' views about the introduction of CCE across the curriculum

In terms of the research problem, the school principals' responses indicate a high level of awareness of climate change education. This level is significant in the sense that it shows that the school principals are willing to support the fully integration of CCE into the school curriculum.

4.12.1 The general comments of principals related to the inclusion of climate change education across the school curriculum

Although the questionnaire requested respondents to answer by selecting either 'yes'/ 'no', they were further asked to make additional comments at the end of the closed-ended question that relate to sub-question 3.

A respondent (P2) commented that:

> *I think it is imperative to have CCE integrated into all the subjects offered in the school curriculum to enable a majority to know about climate change.*

A respondent (P5) had the following to say:

> *I wish all corners of the school should have posters about CCE so that the learners are convinced about the effects of climate change.*

Another respondent (P8) replied:

> *Hey, climate change is an emerging issue which is affecting our communities, just in this country (Swaziland) a lot of farmers have lost their cattle and towns are running short of water as dams are drying up. Therefore CCE will expose learners to information about climate change hence be able to develop mitigation measures.*

A respondent (P10) commented:

> *The effects of climate change are visible to anyone, therefore it is important to introduce CCE into all the subjects in the school especially because some learners are not doing Geography as assumed to be the most relevant subject.*

A respondent (P11) commented:

> *The inclusion of CCE across the curriculum will ensure that all learners are exposed to climate change issues daily, as they move from one class to another.*

The data from these comments provides evidence that school principals are ready to support the Ministry of Education and Training in its attempt to have CCE integrated across the different school curricula. What is strongly evident from these comments is that they provide relevant evidence that the school principals as major stakeholders in curriculum development will support the re-orientation of the subjects' curricula in order to include climate change education. The principals' responses are in line with the multi-disciplinary and interdisciplinary curriculum frameworks, which have been identified in literature to as

ideal through which climate change can be best taught and learned (UNESCO, 2014:6). In fact, the infusion of CCE across the curriculum levels can be charted and the cumulative learner exposure to climate change concepts and understanding and ethics are motivated (Selby, 2007:57). One can therefore argue that the closer the approach comes to interdisciplinary levels, a wider exposure is opened for the learners to gain greater insight about climate change.

4.13 Control of water wastage by learners in the school

Tubiello (2007:92) explains that "the major impacts of climate change include the alteration of ecosystems, disruption of food production and water supply, damage to infrastructure". The shortage of water has adverse effects on the livelihoods of communities. Water is the most valuable natural resource, which supports all system of human life (Farolfi, Mabuza, and Ntshingila 2007:157). For instance, the operation of a school depends on the availability of water. Therefore, if there is no water in a school, this compromises learning, as the learners will suffer the inconvenience of not being able to use toilets and drink water during the course of the day. As such, this sub-question was designed to establish the water conservation strategies in the schools. The data shows that a number of schools are doing something in attempt to sensitise the learners about the importance of water conservation. The results as displayed in Table 4.6 indicate that 88 percent of the schools do sensitise their learners about the importance of saving water. Although none of the schools provide cups for learners to use, the learners are punished when found to be misusing water. The results show that 12 percent of schools do punish learners who misuse water, while 88 percent do not punish learners. It was interesting to note that the majority of the schools where learners are not punished for the misuse of water are located in urban areas. One may observe that learners in these schools live in households where every drop of water counts as their parents pay bills for water. This means that the learners develop cautious attitudes when using water, as opposed to their counter parts in the rural areas, where water is drawn from nearby streams for free.

Control Measure	**Percentage of schools with water management policies in place**
Learners are sensitized about the importance of saving water	88
Learners are not sensitized about the importance of saving water	12
Students are provided with cups to get water from the taps	0
The school punishes students who misuse water	12
The school does not punish learners for misuse of water	88

Table 4.6: The control of water wastage by learners in the schools

Research has shown that climate change can increase water stress caused by erratic rainfall patterns and create a need for alternative sources of water (Lenglet, 2009, Olivia, 2013, Ozor, 2010, Selim, 2011 and Dlamini, 2011). It is therefore imperative for schools to integrate water harvesting programmes so that learners have a safe and sufficient supply of drinking water while at school. According to Selim (2011:8) "actually school-based water and sanitation programmes also have the benefit of encouraging parents and the community to support children going to school".

4.14 Textbook Evaluation

In order to critique the value of textbooks for climate change education, the extent to which textbooks provide relevant, accessible and accurate information was analysed. Textbooks were categorised according to a set of developed criteria as presented in Chapter Three, Table 2. To strengthen understandings of CCE, textbooks need to provide sufficiently

detailed information. If textbooks were found to include content on climate change education related topic, its content was then evaluated based on the extent to which the key components of the book might enhance climate change education. The textbooks contents are presented in the following Table 4.7. A detailed discussion follows on whether they address climate change education shall be presented in Chapter Five.

Textbook	**Table of content with CCE**
• Junior Secondary Geography .	1. Weather and climate 2. Weathering and soil erosion
• Oxford Modern Geography Book 3 for Form III.	No topic on climate change education
• H/IGCSE Geography Module 1 for Forms IV-V.	No topic for climate change education
• H/IGCSE Geography Module 2 for Forms IV-V.	1. Weathering, mass wasting and slope formation. 2. Availability of water 3. Atmospheric processes 4. Ecosystems and soil
• H/IGCSE Geography Module 3 for Forms IV-V.	1. Agricultural systems 2. Food production 3. Leisure and tourism 4. Industrial systems 5. Energy 6. Water 7. Environmental benefits and threats 8. Resource conservation and management
• H/IGCSE Geography Module 4 for Forms IV-V.	No topic for climate change education
• The New Wider World for Forms IV-V.	1. Farming 2. Industry

	3. World climate 4. Ecosystems 5. Drainage basins and rivers 6. Coats 7. Glaciations
• Macmillan Geography for Southern Africa for Forms IV-V.	1. Weathering 2. River action 3. Marine processes 4. Weather 5. Climate regions 6. Arable farming 7. Pastoral farming 8. Range management 9. Mining and industries 10. Tourism 11. Water resources

Table 4.7: The content of SGCSE Geography textbooks

4.15 Conclusion on the empirical data collection to determine the understanding and teaching of climate change in the Secondary Education Geography Curriculum in Swaziland

The discussions in section 4.4.1 indicates that the consolidated 96 percent of the geography teachers were aware of climate change education, while the discussions in section 4.3.1.3 indicates that only 13.9 percent of these teachers were confident to teach CCE. This analysis provides important evidence to argue that SGCSE geography teachers do have a general understanding of climate change education as a concept. However, the level of understanding with regards to climate change education among the teachers does not provide them sufficient confidence to teach and integrate CCE in their SGCSE Geography lessons. These results lead one to conclude that it is imperative for the teachers to be properly trained on climate change education. This will enable the geography teachers to

identify topics within the SGCSE Geography curriculum, which are ideal for climate change education.

Chapter 5

Analysis, Interpretation and discussion of data

5.1 Introduction

The data is analysed, interpreted and discussed in this chapter following the explanation of the research design explained in Chapter Three. The purpose of the data analysis that is presented in this chapter is to answer the research question that is stated in Chapter One, namely "how do teachers and learners understand the inclusion of climate change in the Secondary Education Geography Curriculum in Swaziland". This study selected a qualitative research approach, which was discussed in Chapter Three, while the rationale for selecting this approach was also explained in the same chapter. The research design and methodology were also dealt with in Chapter Three.

The researcher employed the following data collection methods: interviews (See appendix F) and document analysis as indicated in Chapter Four. Presentation, analysis and interpretation are dealt with in this chapter.

This chapter deals mainly with the significance of the study and its implications for curriculum change regarding the understanding and teaching of climate change in the Secondary Education Geography Curriculum in Swaziland. The target is to re-examine the research questions and the conceptual framework discussed in Chapter One as per the data presented and discussed in Chapters Two and Four. More importantly, this chapter will provide a detailed narrative interpretation in attempt to explain and describe the contribution this study has made to the already existing academic body of knowledge about the inclusion of climate change education into the school curriculum.

The main research question of this research was to explore the way in which teachers and learners understand the inclusion of climate change in the Secondary Education Geography Curriculum in Swaziland. This main research question was divided into five sub-questions:

- What are the characteristics of climate change in Swaziland?
- How are the elements of climate change captured in the curriculum?
- How do teachers understand and interpret climate change in the curricula?
- How do teachers teach climate change from the curricula?
- How do learners learn and deal with climate change in the classroom?

In an attempt to address these sub-questions, data was collected through document analysis, focus group interviews and questionnaires. Data collected through focus group interviews and questionnaires was triangulated in line with data obtained from literature review to determine whether there any similarities or differences as recorded in Chapter Four. The findings and recommendations based on the significance and implications of the study is elaborated in the final chapter of the study

5.2 Summary of the problems motivating the study

In Chapter One, Section 1.3, it was stated that the world is currently challenged by climate change which has adverse effects on the livelihoods of all countries. This is a concrete problem in Swaziland. In an attempt to intensify mitigation and adaptation strategies to minimise the impact of climate change in the country, this study holds that both teachers and learners need to understand the importance of the inclusion of climate change in the Secondary Education Geography Curriculum in Swaziland. The study focuses on the SGCSE Geography curriculum. Dlamini (2011:10) argues that "geographical education ensures that individuals become aware of the impact of their own behaviour and that of their societies, thus be able to make environmentally sound decisions and develop an environmental ethic to guide their actions".

Climate change education in schools has increasingly been recognised as an important approach to address the issues of climate change (UNESCO, 2009:14). It has already been discussed in Chapter Two that "climate change education aims to increase awareness and understanding of

climate change and its related aspects" (UNESCO, 2009:15). Meanwhile, UNEP (2006:16) maintains the following in this regard:

> "Through improved awareness and understanding, climate change education seeks to inspire meaningful changes in behavior, values and attitudes relating to the environment. In addition, climate change education seeks to ensure that learners are equipped to make informed decisions which aid climate change mitigation and to encourage awareness of and support for mitigating strategies and policies put in place by various governments."

A final objective of climate change education is to provide learners with the tools to successfully adapt to the predicted effects and impacts of climate change (UNESCO, 2009; UNESCO and UNEP, 2011).

A theoretical framework for this research was discussed and developed in Chapter One Section 1.8, in line with Engeström Activity Theory. The framework outlined all components that contribute to the understanding and learning of climate change. The components as illustrated in Figure 2 are: learners; learning and assessment objectives of the SGCSE Geography curriculum; topics relevant to climate change; the teaching strategies and methodologies employed by Geography teachers in their classes; teachers, and were cross-examined and tested through textbooks analysis, questionnaires and focus group interviews.

5.3 Summary of the research question and sub-questions

The first sub-question was concerned with the characteristics of climate change in Swaziland. The respondents were asked whether climate change has an effect on the livelihoods of the people of Swaziland.

The second sub-question enquired about elements of climate change education captured in the curriculum. The respondents were asked to identify topics in the SGCSE Geography curriculum which address climate change.

The third sub-question was concerned with the understanding and interpretation of climate change in the curricula. In the questionnaires and focus group interviews, participants were asked to state their understanding of climate change, its causes and effects. Respondents were also asked to highlight the major causes of climate change. The question further challenged respondents to explain climate change education and its importance. Literature sources were visited to set a benchmark for accuracy in the definition of climate change, global warming and climate change education.

The fourth sub-question involved exploring teacher's confidence in teaching climate change education as part of the SGCSE Geography curriculum. The Geography teachers were asked to state their confidence level in teaching climate change education. The results were shown in Table 3.1.

The fifth sub-question established learners understanding of climate change and climate change education. The learners were asked to identify environmental problems faced by their communities as a result of climate change. During the focus group interviews learners were asked to suggest strategies, which could be adopted by their communities to minimise the environmental problems.

5.4 Summary of the aim and objectives of the study

Chapter One, introduces the main aim of the study, which was to establish the understanding and teaching of climate in the Secondary Education Geography Curriculum in Swaziland. Literature was interrogated on climate change education and in the process numerous concepts emerged which lead to the development of sub-questions. The sub-questions ensured that the problem of the study as stated in Chapter One Section 1.3 was comprehensively addressed. Hence, the following objectives were outlined and operationalised as part of the investigation:

- Review documents and other literature to identify effects of climate change in Southern Africa and Swaziland.
- To explore the historical trend of climate change effects in the country.
- To determine the extent at which the Swaziland sectors are exposed to climate change.
- To determine how the SGCSE Curriculum and other regulatory structures make provision for teaching learners about climate change.
- To determine the topics in the SGCSE Geography curriculum that addresses climate change.
- Determine the instructional design strategies that are used to enhance learners' understanding and awareness of climate change.
- To identify the initiatives undertaken by schools to promote public awareness of environmental issues like climate change.
- To establish the basic sets of learning and teaching resources on climate change that allow geography teachers to design their own lessons.

Chapter Six gives a summary of the key findings of each of these objectives.

5.5 Findings of literature review on the contribution of education

According to Anderson (2010:6) "education is a critical component of adaptive capacity, along with health, assets and governance". Anderson (2010:7) goes on to argue that "the way people are educated and the content of education provide the knowledge and skills needed for making informed decisions about how to adapt individual lives and livelihoods as well as ecological, social or economic systems in a changing environment".

In an attempt to address the first sub-question, Dlamini, (2011:21) states that "Swaziland has been experiencing consecutive drought seasons over a continuous period of five years since the 2001/02 rainfall season to the present, with a forward shift on the start of the season and spatial distribution of the rainfall, resulting in an abnormal condition becoming normal". The Government of Swaziland Report (2008:10) points out that "household livelihood vulnerability baseline surveys conducted in 1998, 2002 and 2006 show that

ecological zones of Swaziland have become vulnerable to the effects of drought". Researchers such as Mhazo (2010), Manyatsi (2010), Nsingwane (2011) and the Ministry of Tourism Climate Change Report (2012) points out that Swaziland is currently affected by the effects of climate change. McCaffrey (2013:1) identifies the contribution which education can make in improving society's climate change literacy which should be a top priority addressed through science education and through a range of other education, communication, and outreach strategies.

According to Manyatsi (2008:45) "the Government of Swaziland has crafted National policies and implemented some legislation in an effort to address sustainable growth and development, food security, poverty eradication and environmental protection." Examples of these policies include: the National Development Strategy (NDS, 2007) and the Poverty Reduction Strategy and Action Programme (PRSAP, 2007). All other policies and strategies reflect the vision expressed in the NDS. The NDS covers the period up to 2022 and the PRSAP up to 2015. It is important to note that some of the policies and legislation do address climate change in some fragmented aspects, but indirectly, and it is put forward here that the lack of a climate change policy and legislation to integrate all existing policies and legislations greatly undermines all national efforts to address climate change.

In conclusion, literature attests to the fact that in "the global education community, several stakeholders, such as UNESCO, UNEP and UNICEF are incorporating components of the climate change agenda in education and helping schools and communities integrate climate change education and environmental stewardship into the curricula" (Anderson, 2010:4). According to UNESCO (2012:2) other stakeholders, like "Plan, Save the Children and Action Aid, are focused on building the skills of communities and learners to adapt to climate change through integrating risk reduction in education curricula and systems". Meanwhile Anderson (2010:5) attest that "at regional and international levels, networks and inter-agency platforms, such as the Asia Preparedness Disaster Center, the Global Coalition for School Safety and Disaster Prevention Education, the IASC Education Cluster, the Children in a Changing Environment coalition, and the ISDR Thematic Platform on Knowledge and Education, are focused on sharing lessons learned and codifying them in programming tools focused on risk reduction through education". However, "this education

work remains ad hoc and is not yet widely recognised by nor integrated into the efforts of the climate change community" (Selim, 2011:13).

The second sub-question looked at elements of climate change education captured in the SGCSE Geography curriculum. In terms of climate change education, it is vital for teachers to develop a sound pedagogical content knowledge for a number of reasons (McCaffrey and Buhr, 2008:34). It could be argued that if teachers develop a robust PCK, their own misconceptions will be corrected. It is therefore important that teachers hold minimal misconceptions regarding climate change, as there is a danger of teachers passing on such misconceptions to learners, thereby exponentially increasing their prevalence (Archambault and Crippen, 2009:11). As highlighted earlier, "PCK provides teachers with the knowledge base from which to do this." (McCaffrey and Buhr, 2008:37). However, it is also important that teachers are able to extend education regarding climate change beyond the scientific facts, to give learners the relevant tools and practical knowledge to successfully adapt to, and mitigate against, climate change (UNESCO, 2010 and UNEP, 2011).

One of the components of the Theoretical Framework in Chapter One, "rules" has been cited as representing the curriculum with all its components, that is, the topics which expose teachers and learners to the concept of climate change. However, as pointed to earlier in the discussion regarding teaching the geography topics, climate change education has always been ignored. According to the Geography Association (2009:5) this has been attributed to the fact that "there are barriers to the effective teaching of climate change education." For instance, "the 'over-saturation' from media and curriculum coverage, existing misconceptions, incomplete knowledge, and difficulties with threshold concepts and areas of troublesome knowledge such as timescales, systems thinking, interdisciplinary and scientific uncertainty" (Robinson, 2009:24).

As such, through the SGCSE Geography curriculum, "teachers are provided with opportunities to move students from awareness phase into taking action phase, assuming that the values are well learnt" (Examination Council of Swaziland, 2012/2013. Swaziland General Certificate of Education Geography Syllabus). The SGCSE Geography curriculum

as observed by Manyatsi (2008:45) "can address beyond the knowledge and skills of geography into the values we desire our students to develop so as to take action to ensure sustainable development in the future". Sellan, Chong and Tay (2006:149) argues, that if "we desire our geography students to be informed critical citizens, then a skill required must be the ability to evaluate information surrounding a geographical issue".

The third sub-question was concerned with the understanding and interpretation of climate change in the curricula. The Geographical Association (2009:11) attests that a Geography curriculum should develop understanding, and help students to relate new knowledge to existing knowledge, and provides opportunities for them to apply their understanding to questions and problems that they have not previously encountered. Researchers such as (Hansen et al. (2007), Choi and Fisher (2003), Fellman etal. (2005), Botkin et al. (2007) state that incidentally, geography is a study of human-environment interaction, in which the environment is rapidly changing. Therefore the content of the SGCSE Geography curriculum enlightens learners and teachers about contemporary facts about climate change and material that can be used to mitigate and adapt to its effects.

The fourth sub-question queried teacher's confidence in teaching climate change education as part of the SGCSE Geography curriculum. It emerged from the data that Geography teachers who had climate change education as part of their course at college or university level were confident to teach climate change education. As such, it is imperative for the Ministry of Education and Training to provide in-service training for teachers on climate change education as a emergency issue. This move will be in line with UNICEF (2009:15) which observes that "all governments should commit to teacher training and curriculum development to support large-scale teaching of disaster risk reduction." Meanwhile according to UNICEF (2009:7), teacher training approaches include:

- Pre-service: formal teacher training through institutes, training colleges and others; use of face-to-face lectures and activities, and usually leads to certification of teachers.

- In-service: teachers taught for a short period of time or on weekends, after school or in vacation time; and process repeated for a series of workshops or face-to-face training.

As already deliberated in the Theoretical Framework in Chapter One, "climate change is a new phenomenon in Swaziland, and hence most teachers and other trainers lack adequate capacity to implement the concepts and thus will require capacity building" (Manyatsi, 2010:11). This is evident in the results shown in Table 3.1. Based on these results, one can argue that the Ministry of Education has an obligation to develop curriculum support materials which can help the teacher and the learner to efficiently and effectively achieve the set objectives of climate change education. Actually "the curriculum support materials should include teachers' guide, learner's manual and other print and non print materials; all these make a complete package of the curriculum" (Lenglet, 2009:12).

The fifth sub-question established learners understanding of climate change education. Research by (Buhr and McCaffrey (2008); Gautier et al. and Robinson (2010) reveals that "effective climate change education requires the construction of new knowledge and understanding within learners existing, usually well established and strong personal frameworks of existing beliefs". There are certain indications that emerged from the interviews that learners do have an understanding of climate change. For instance, a student in Group B defined climate change education as:

> *I think is the type of education which teaches that everyone in the country has to be educated about the effects of climate change and this will mean global warming is reduced because the people will know about the effects of climate change on the economy as it affects the growing of grows like sugarcane.*

5.6 Findings of the empirical investigation

In Chapter One it has been outlined clearly that Swaziland, like all other countries is seriously affected by climate change. As a result of the variations in the amount of rainfall

received in the country, a number of households in rural areas have since stopped crop cultivation and cattle rearing. To make things worse, homesteads who attempt to grow crops using small-scale irrigation have stopped too, because the water resources are no longer reliable, due to lack of rainfall. The result is "chronic food shortages in the entire country" (UNDP, 2010:8). It has been pointed out in Chapter Two that education has a significant role in creating public awareness of the effects of climate change on the livelihoods of communities.

Climate change education scholars such as Robinson (2009), Hestness et al (2013), Johnson (2011) and Haigh (2005) point out that climate change education serves three primary purposes: to build understanding of why change is occurring, to help people learn how to reduce emissions of climate change gases, and to increase knowledge and skills to adapt to changing climate impacts.

As discussed in Chapter Three, both quantitative and qualitative strategies were used to collect data for addressing the main research questions. The quantitative data were collected through questionnaires distributed to 32 geography teachers, 16 principals, one Senior Inspector of Geography, one Senior Curriculum Designer and 1 Environmental Information Officer. The qualitative data collection strategy adopted for this study was through focus group interviews with geography students from the 16 sampled schools. The qualitative data collection was complemented by document analysis of policy publications and some scholarly work as discussed in the previous section of this chapter. The participants provided important evidence, complemented by other data collected through questionnaires and document analysis.

5.6.1 The importance of demographic and social information

Concerning gender, the data collected revealed that male teachers were the majority. The information on gender was meant to establish the general understanding of climate change education by both males and females. Based on a study by (Lambrou, 2010) which attests that women are more vulnerable to the effects of climate, one would expect the females

teachers to be more confident to teach CCE than the males. However, the results presented in Chapter four, Table 4.1 revealed that a majority of both female and males teachers were not confident to teach CCE.

The data collected on the teachers' age as shown in Chapter Four, Figure 4.2, revealed that a majority of the geography teachers were between 31-35 years of age, closely followed by teachers between 26-30 years of age. This implies that a majority of the teachers had just completed college or university. It was interesting that the majority of the geography teachers were young and more likely to be aware of CCE. For instance, surveys conducted in Europe revealed that younger people to be more aware of environmental problems including climate change (Patchen, 2006:15).

Concerning qualifications, the degreed teachers (B.Ed, BA and M.Ed) were confident to integrate climate change education in their lessons. This is in line with the claim by studies that individuals with high levels of education are more likely to be aware of climate change (Acquah, 2011; Hasan and Akhter, 2011).

5.6.2 Findings of the study on teachers understanding of climate change education

For this section, it is important for one to look at each question in isolation and consider the variables emerging from discussions. The first question, which looks at the demographic and social information of the Geography teachers who participated in the study reported in Chapter Four, that in terms of gender 34 percent were females and 66 percent were males. Gender is an important predictor of climate change awareness. Studies have revealed that men are more aware of climate change than women (Patchen, 2006, Acquah, 2011, Olajide, Owolabi, Oospore, Unlade, & Omobuwa, 2011, Ekpoh and Ekpoh, 2011). This is mainly due to the fact that men have relatively high access to information through print and electronic media (Ekpoh and Ekpoh, 2011). However, women are more likely to perceive climate change as a serious threat. This was confirmed by a study of public perception of climate change done by Semenza et al (2008), which found that women in both Portland and Houston were significantly more concerned about climate change. This perception pattern

reflects the fact that women are more vulnerable to climate change given their homemaking role in the society, which also forces them to directly interact with the environment. For instance, women fetch water and collect firewood from the forests.

The second question of part one looked at the age group of those Geography teachers who took part in the study. The results show that 31 percent of the teachers were in the 31-35 age group, 25 percent in the 26-30 age group, 22 percent in the 36-40 age group, nine percent in the 41-45 age group and only six percent were above 45 years of age. Age is a critical predictor of individual's familiarity with climate change issues. According to a study conducted by Saroar and Routray (2010), there is a positive correlation between age and familiarity with climate change/extreme weather events. It is thus expected that younger people would be more aware of climate change than older people (Robinson, 2010:4). However, this is not a rule of thumb. Surveys conducted in Europe revealed that younger people are more aware of environmental problems, including climate change (Patchen, 2006:35). Older people are, however, more likely to be worried about climate change (Saroar and Routray, 2010:56). However, it is clear that age has an influence on the public's level of awareness and perception of climate change, where it is difficult to say with certainty whether the correlation is positive or negative.

The third question of Part One was concerned with the Geography teachers' qualifications. The results of the Geography teachers' qualifications show that 25 percent had a diploma, while 44 percent of the teachers had a first degree and a Post graduate Certificate in Education (PGCE). Teachers with B.Ed degrees totalled to 19 percent. MA holders counted to six percent. There were six percent M.Ed degree holders and only three percent of the teachers had other qualifications. The level of education is an important predictor of the public awareness and perception of climate change. Studies have proved that individuals with high levels of education are more likely to be aware of climate change (Acquah, 2011; Hasan and Akhter, 2011). Contrary to that, people with less than 14 years of education are likely to perceive climate change as a threat, since they are likely to have less income and remain highly vulnerable to the impact of climate change (Brulle, Carmichael and Jenkins, 2011; Hasan and Akhter, 2011).

This question was included in the study in an attempt to generalise the results to the entire country. Geography teachers in Swaziland have one of the following qualifications: the Teachers Diploma, a first degree and a Post graduate Certificate in Education, B.Ed, MA, M.Ed Degrees or any other which could be BA in Social Science. Likewise, teachers from the schools under this study have such qualifications. As geography is seen as a natural home for climatology it might be expected that geography graduates would have received some academic background in CCE matters. This academic background might include, for instance, an exploration of the contested history of CCE, both of which are fundamental to understanding the complex concepts of CCE. Therefore, this research can be generalised to be a representation of the manner in which Geography is taught in secondary schools in the country. With that in mind, one can conclude that this was an important consideration, as such factors could potentially have played a crucial role in developing teachers' attitudes toward, perceptions and understandings of climate change.

The second part of the Geography teachers' questionnaire looked at curriculum information about CCE. The questions on curriculum information were meant to establish teachers' awareness, knowledge and understanding of climate change education. This assumed that teachers who had exposure to climate change education at college or university level were better equipped to teach learners about CCE. This assumption is supported by Lenglet, (2009:14):

> "For climate change education to be effective, insights into and understanding of climate change in all its dimensions are not sufficient. Climate change education effectiveness is considered to reside in the 'positive' outcomes and results of the behaviour, choices, decisions and actions of human beings as a result of having been exposed to climate change education, instruction, training or capacity building. In other words, climate change education effectiveness will only take place if 'transformation' and 'action competence' are explicitly included in the instructional and learning process. It is this same transformative action competence that is central to ESD".

When it comes to awareness, the results indicate that 96 percent of the participating teachers were aware of climate change education and only four percent were not aware of CCE. As for knowledge and understanding, the results indicate that 66 percent did not have CCE as part of their course of study and 34 percent had CCE forming part of their course of study. The question on knowledge and understanding was mainly meant to establish the misconceptions, personal frameworks of existing beliefs, incomplete knowledge and understanding of climate change education by the Geography teachers (Boon, 2010:34). This question assumed that Geography teachers have had an opportunity to study climate change education during their university or college degrees. A study by Wise (2010:298) notes that "few teachers take college level courses related to climate science and generally report learning about climate change on their own". In fact, research has shown that the wider public may hold a large number of misconceptions about weather and climate (Robinson, 2011:3). According to Fullan (2007:21) "teacher beliefs have a profound influence on the implementation of innovations in the curriculum". The study assumed that teachers who had CCE forming part of their course of study at university or college level would have a better comprehension of climate change education. UNESCO (2014:10) points out that "the dimension of CCE is about understanding what is happening to the global climate, and the driving forces behind the variations in climate change, thus creating a mind-set of alertness and mindfulness to changes that are already occurring".

In conclusion the data collected through the questionnaire was crucial, but also had certain shortfalls. For instance, it may have been advantageous to conduct an interview with the Geography teachers and the key informants. This could have helped to obtain deeper insight, rather than limiting the responses to 'yes' or 'no' answers. However, it still remains crucial for this study to have the type of statistical information which can be used to justify literature findings.

The results also proved that the level of climate change awareness among the educators sampled in this study is significantly high. Geography teachers recorded 96 percent level of awareness on climate change education. This figure shows that teachers have a modicum of understanding of climate change education, but that gaps exist in their knowledge. For

instance, the results in Chapter Four Figure 4.6, shows that 66 percent of the teachers had not done CCE at college level and only 34 percent had an opportunity to do CCE forming part of a course at college. Therefore, it can be argued that a majority of the teachers lack the technical understanding of CCE. This is justified by the findings of the study as indicated in Chapter Four, Table 4.1, which shows that 47.2 percent of the teachers indicated that they were not confident to teach CCE, 38.9 percent were fairly confident and only 13.9 percent were confident to teach CCE. Factors such as gender, age and qualification showed some level of influence on teachers' awareness of climate change education though the influence remained insignificant in this study.

Finally, the results show that Geography teachers overwhelmingly support the inclusion of climate change education into the SGCSE Geography curriculum. The move by the teachers to agree for the integration of CCE into Geography lessons is in line with the arguments raised by this study, namely that Geography has been picked by numerous researchers as the most appropriate subject for climate change education integration (Aladag, 2010., Ogbuigwe, 2009, Offorma, 2006, Lowe, 2010, The Geographical Association, 2009). Again it remains a fact that for appropriate integration, the teachers need professional training on climate change education, as already discussed in the previous paragraph. Actually it remains imperative that in preparing learners to make scientifically informed decisions related to climate change, "teachers must be able to address complex scientific constructs" (Hestness, e t al. 2013:5). For example, topics such as the relationship between greenhouse gases and radiation in the atmosphere, as well as the effects of fossil fuel combustion on atmospheric greenhouse gas concentration, must be well-captured and understood by teachers.

More importantly, one can argue that the teachers who participated in this study can therefore be counted upon in the implementation of the policy on climate change education knowledge transfer. It has already been revealed by the EIO in Chapter Four that, SEA is currently working on a policy strategy that will ensure the inclusion of climate change education into school curriculum. What is more significant with this proposal is that, all subjects in the school curriculum will be considered for CCE integration. However, it is

imperative that climate change education awareness campaign be carried out among all school teachers so as to improve their understanding of climate change and enhance their capacity as agents of climate change education knowledge transfer in the classroom. This observation emanates from the results as presented in Chapter Four, namely that for 66 percent of the Geography teachers, the study of CCE formed no part of a course at college level. Therefore it can be argued that the majority of the Geography teachers still lack extensive knowledge on climate change issues, and remain uncomfortable regarding how to fully address climate change science in their lessons (Lenglet, 2009:16).

Needless to say, studies in teacher education and professional development need to be undertaken in order to help Geography teachers to effectively incorporate climate change as a topic into the SGCSE Geography curriculum. Hestness, McGinnis, Riedinger, Marbach-Ad, 2011; Matkins and Bell, 2007; Lambert et al. (2012) have suggested that "interventions in pre-service teachers' science content and science methods courses can improve teachers' preparedness to address climate change in the classroom". This observation is supported by UNESCO (2012:10), namely that "educators at all levels will also need support and training so as to deliver quality education about complex, climate related topics in ways both relevant to local environmental, social and political contexts, and which meet wider educational targets which includes literacy, numeracy, and employability".

5.6.3 Findings of the study on teacher's views about the inclusion of CCE into the SGCSE Geography curriculum.

The inclusion of CCE into the SGCSE curriculum is a matter of urgency, as it will serve the specific climate change problems faced by Swaziland as already discussed in Chapter One. The most significant argument that can be discussed here is that CCE give teachers the opportunity to work with children exploring the nature of scientific enquiry. CCE also introduces concepts of sustainability and global citizenship (Anderson, 2010:8). The study discovered that a majority of the Geography teachers who took part in the study agreed that CCE should be infused into the curriculum. However, the teachers highlighted that they were not confident to teach it. The results presented in the previous chapter shows that 47.2

percent were not confident, 38.9 percent were fairly confident and only 13.9 percent were confident. Hestness et al. (2013: 6), have noted that "few teachers take college level courses related to climate change education, and generally report learning about climate change on their own". As already been discussed in Chapter Two, "teachers may derive environmental knowledge from media sources that do not reflect a scientific viewpoint" (Wise, 2010:12). According to UNESCO (2012:10) to make matters worse, in secondary schools, tension exists "between a centralised curriculum and the need to promote locally-based and locally appropriate knowledge". Attempts by teachers to cope with the demands of a centralised curriculum are also compromised due to the overloaded curricula, which frequently presents additional challenges (Manyatsi, 2008:15).

Despite the challenges deliberated in the previous paragraph, the study still maintains that empowering the youths to acquire skills and knowledge on climate change issues will not only lead to the development of mechanisms for adaptation and mitigation, but will also cause them to become environmentally responsible (Ozor, 2010:15). Therefore, it is imperative that teachers acquire support and training to deliver quality education about complex, climate change related topics in ways which are both relevant to local environmental, social and political contexts, and which meet wider educational targets (Fortner and Corney, 2010:128). Teachers have the responsibility to inform learners about all major current affairs and surely the inclusion of climate change education into the SGCSE Geography curriculum is justified on this basis. The major conclusions from this study are that a majority of the teachers observed that the topic of climate change is not yet effectively integrated into the existing curricula, and that a coordinated approach is needed. Finally, one can argue that the exclusion of climate change education from the SGCSE Geography curriculum will be closing off opportunities available, as such, the learners will not be prepared for the world in which they are going to be living.

5.6.4 Findings of the study on learners understanding of climate change education

It is worth noting that though there is little recent academic literature specifically on the topic of learners' knowledge and engagement with climate change education, there are

numerous research studies that have been conducted specifically on environmental education (Said, Ahmadun, Paim, & Masud, 2009, Sauve, Mlipha & Manyatsi, 2006, Bolstad, 2007. As such, it is important to highlight that CCE education as an issue that has emerged in recent years as being developed by a number of countries as a link to Environmental Education and Education for Sustainable Development. Despite the lack of adequate literature on learners' knowledge and understanding of climate change education, it remained important for this study to establish learners understanding of CCE. This move was motivated by the fact that young people are key players in information diffusion as they always relay information gained from school to their parents (Cherry, 2011, Press Association, 2011). UNESCO (2010:15) gives an example of a seven year-old child who was able to save thousands of people from a Cyclone Sidr, due to knowledge gained from school:

> "when Cyclone Sidr hit Bangladesh in 2007 Lamia Akter, a 7-year old student from one of Action Aid's project sites, helped save the lives of her family and others by passing on a cyclone warning alert she had received at school to villagers in her community. Lamia went from door to door, telling people to store their valuables and go to the cyclone shelter. Lamia had learned what actions to take before, during and after a disaster and she told others in her community."

From this it is possible to argue that it is essential for schools to ensure that learners receive accurate and comprehensive information about climate change education whilst at school. This argument is supported by Mower (2012:7) in that this will not only benefit the learners, but also influence a much larger percentage of the population.

As already discussed in Chapter Two, "the children will be the hardest hit by the increasingly frequent and severe weather events, desertification and flooding brought by climate change" (Aladag, 2010:23). Research by UNICEF (2012), UNESCO (2012) and Aladag (2010) indicates that "the supply side consequences of extreme weather events include damage to education infrastructure and the resultant rehabilitation costs which drain constrained education budgets and disruptions to schooling have a significant impact on

learning impact". Therefore, this research hope that exposing learners to climate change education can make a significant contribution to climate change mitigation and adaptation measures. In the process, the impact of deteriorating livelihoods which may lead to a large number of children dropping out of school and increased levels of malnutrition will be minimized.

The results of learners definition and causes of climate change and global warming as shown in Chapter Four, Table 4.3, show that the learners understanding of climate change is confused with a range of other environmental issues such as pollution. The learners gave general responses with regard to the causes of climate change and global warming. For instance, a number of learners cited ozone depletion as a major cause of global warming and climate change. A learner from GB commented:

> *In my understanding, climate change is the depletion of the ozone, hence high temperatures.*

Another learner from GA said:

> *Climate change is caused by people through the burning fossil of fuels. In addition, I think the burning of grass and vegetation also causes climate change.*

These ideas held by the learners about the causes of climate change and global warming are too general to the commonly held idea in literature, which has existed for a long period, that "the hole in the ozone layer allows more solar energy to reach the earth, causing global warming and climate change" (Papadimitriou, 2004; UNESCO, 2009; McCaffrey, 2013; Leiserowitz 2010; Miller, 2010; Ozor, 2010).

Nonetheless, one can still appreciate that the responses by the learners shows that they are relatively-informed about the causes of climate change and its effects. They are also more informed about mitigation measures for climate change. However, it is worth noting that

there was uncertainty and lack of confidence in a number of the learners as their responses indicate that climate change education is not an area that the groups of learners were generally well informed about. Again, a closer evaluation of their responses on the knowledge of some key elements of climate change and their comprehension of other environmental issues indicates that they are capable of learning about these issues.

The study also found that the geographical location of learners had no influence on the learners' understanding of climate change education. Actually, this research concludes that climate change is a different environmental issue. Literature has shown that the daily lives experience and knowledge of climate change and ideas about the risks of climate change are not dependent on the learners' physical surroundings (Ozor, 2009:17). As such, the content of the textbooks which learners use are likely to have a significant influence on learners understanding of climate change education. This study revealed that children tend to have certain conceptions of climate change, such as the relationship between climate change and stratospheric ozone depletion, pollution (Robinson, 2011:12). They also exhibit a melding of other ideas of climate change, such as seasonal change and abrupt weather (Harrington, 2008:579).

This study posed a question with regards to climate change education with more emphases, on its definition, and identification of topics from the SGCSE Geography curriculum, which can be used to address CCE. The responses to the sub-question on learners understanding of climate change education revealed that most had a general understanding of CCE. Almost all participants (GA, GB, GC, GD, GF, GE, GF, GG, GH, GI, GJ, GK, GL, GM, GN, GO and GQ) defined CCE as the type of education that should create awareness of the causes and impacts of climate change on people. However, one participant from GB argued that CCE education should be pursued amongst all members of society, irrespective of their age. It is essential to mention that GB's observation is indeed well-documented in literature where all "community members need to have comprehensive understanding of climate change issues in order to develop mitigation and adaptation strategies" (Offorma, 2006, Knight, 2008, Greenhough).

In addition, learners were asked to identify environmental problems affecting their local communities. It is important to point out that participants from all the groups were able to identify common problems like drought, pollution, land degradation, and high temperatures. From these responses, it emerged that the learners had a general understanding of human induced environmental problems. For example, a participant from GD commented:

> *The majority of Swazis lack an understanding of recycling and proper waste disposal strategies, hence careless discharge of waste on the environment.*

The learners were also asked to suggest mitigation strategies for the mentioned environmental problems. The responses indicate a relatively high level of familiarity with mitigation strategies that were both consistent and inconsistent with scientific knowledge.

In conclusion, it is important to note that there is little recent literature specifically pertaining to the topic of young people's knowledge and engagement with climate change education. However there are numerous research studies that have been conducted specifically on environmental education. As such, it is important to highlight that CCE is an issue that has just emerged in recent years and in a number of countries, and is being developed as a link to Environmental Education and Education for Sustainable Development.

5.6.5 Findings of the study on EIO understanding of climate change education

The main objective of the Swaziland Environmental Authority is to act as a national coordinating agency for all environmental issues, set up environmental policy, standards, enforcement, public awareness and education. The responsibility of the Environmental Information Officer is policy development and information dissemination. SEA as the national watch dog on environmental issues is mandated to increase environmental awareness and participation amongst its citizens. SEA is also the custodian of basic environmental reading materials as well as the entire national environmental information registers. As a result, SEA coordinated the formulation of the First Draft National Education

for Sustainable Development Strategy 2005 together with different stakeholders including government, local government, parastatals, education, and institutions of higher learning, industry, youth, NGOs and professional associations as well as international agencies. The National ESD Strategy is expected to be fully operational by 2014.

Currently, SEA is active in the promotion of CCE through organising and participating in local and regional environment and sustainable development conferences and workshops as stated by the EIO. The National ESD Strategy 2005, among its intentions, is to provide guidelines on how to improve the quality of education through adoption of innovative methods of teaching/learning. The adoption of Information and Communication Technology (ICT) is significant in enhancing the quality of instruction and knowledge acquisition. Research plays a crucial role in recommending relevant innovation approaches to teaching/learning as well as appropriate ICT to utilisation. One can also point out that meaningful and relevant research is quite weak in the country, and effort has to be put in place to stimulate and sustain research. Institutions of higher learning need to forge partnership with technology generating industries so as to pursue a mutual agenda that benefits the implementation of CCE in the country.

Recently, SEA hosted the 2008 Environmental Education Association of Southern Africa (EEASA) Conference, and is instrumental in the introduction of the UNESCO Lens for Monitoring and Evaluating CCE activities and processes. The National Environmental Education (EE) network representation is provided by SEA, and continues to host the secretariat for the committee on Environmental Education and Public Awareness Programme (EEPAP). All environmental compliance issues are handled by SEA. With regard to the integration of ESD into the school curriculum, SEA hopes that with intensive workshops for teachers, training institutions and the National Curriculum Centre, the implementation process will be easy.

The EIO has indicated that the talks are at an advanced stage, with NCC for the incorporation of CCE into the school curriculum. In addition, SEA is currently working on a strategy that will ensure that Eco-Environmental clubs are launched and introduced to all schools in the country. With Eco-clubs in schools, SEA will be able to introduce a number of projects such as greening, water or energy conservation. The presence of Eco-clubs in the schools is hoped to strengthen environmental understanding among students, teachers and parents as well.

However, at the moment, SEA is faced with the challenge of the lack of teaching resources that address CCE. Therefore, SEA, in collaboration with the National Curriculum Centre, is in the process of producing CCE-oriented materials, which can be used in schools. Therefore, this study can conclude that with a strongly collaboration between SEA, NCC and local schools, the awareness and understanding of climate change education in Swaziland could be attained within a short period of time. Actually, the strategies being used by SEA seem to be attractive to learners. For instance, as already mentioned, SEA has launched Eco-Clubs in schools; the students are encouraged to be part of the clubs which also have a mandate to institute environmental campaigns in communities. Therefore, practical approaches in introducing any innovation always yield positive results so it is anticipated from the NCC approach too.

5.6.6 Findings on the role of environmental clubs in promoting CCE

Literature attests that an Environmental or ‘Eco’ club helps to promote, monitor and operate the environment activities of the school. The school environment club should be seen as the driving force behind all environmental and climate change education in the school. For instance, Prahald (2009:10) states that some schools have focused on the beautification of their school environment, which helps the prestige of the school’s in local society. However, this can only be helpful for CCE if it happens in the form of a learner’s project. In other words, school environmental clubs should mainly be dominated by the students. Prahald (2009:11), goes on to attest that, similarly some schools through initiatives taken by

Environmental or Eco Clubs, have placed a lot of emphasis on making the school buildings more green with solar power panels, recycling systems, water conservation measures and tree planting around the school. Actually, one can attests that Environmental club initiatives promote CCE in gaining increasing levels of social awareness as the picture of environmental degradation, energy shortage, climate change, increasing poverty, addition to increasing wealth and the overall picture of globalisation becomes more evident. Research by Rosenburg (2008:34), points out that the Eco-School projects have the ability to address the effects of poverty on the local environment, the community and the learners, as its most valuable feature. Through school vegetable gardens and soup kitchens, Eco-School projects address hunger among learners and community and flower gardens are an opportunity to restore pride in downcast neighborhoods.

Furthermore, Ottosson (2008:35) argues that Eco-Clubs provide schools with the following important benefits:

- "Creates a unifying sense of community and pride in the school
- Increases environmental awareness through education and activities
- Brings a sense of democracy to the management of the school in respect of decisions that directly affect the students
- improves to the school environment
- Provides students with the education and tools to make decisions on environmental issues for themselves
- Fosters relationships and improves language skills.
- Involves the local community, gains business support and local publicity
- Extends support through education and literature".

Likewise, this study has established that the Swaziland Environmental Authority is working on a proposed programme of awarding schools in the country, who will observe and promote environmental management ethics. This project will be similar to Eco-School

Program (so called 'Green Flag') introduced in Sweden in 1996. According to Ottosson (2008), "the Green Flag programme is a system for environmental management in schools, based on an ISO14001/EMAS approach". According to this approach as explained by Ottosson, (2008:25):

> "the school sets up five goals within one of the priority areas: water, recycling or energy. A school that successfully fulfils their goals and gets their report approved by the co-coordinator is awarded an Eco-Schools Green Flag. To keep the Green Flag, the school must keep setting new goals and reporting on their work. The Green Flag is a well-recognised and respected international eco-label for environmental education and performance. The students are encouraged to take an active role in the practical steps to reduce the environmental impact of the school. The idea involves to extending learning beyond the classroom and developing the student's responsible attitudes and commitment, both at home and in the wider community".

With that background established, I aver the presence of Eco-Clubs in schools helps the learners to acquire an education that seeks to balance human and economic well-being with cultural traditions and respect for the Earth's natural resources. As observed by (Manyatsi, 2008:46) "it emphasises aspects of learning that enhance the transition towards sustainability including future education; citizenship education; education for a culture of peace; gender equality and respect for human rights; health education; population education; education for protecting and managing natural resources; and education for sustainable consumption".

As for this study, the assumption was that a number of schools should have Eco Clubs, as the Swaziland Environmental Authority has always tried to sensitise schools about environmental conservation. Unfortunately this study discovered that only one school included had an Eco Club. The learners from the school with an Eco Club proved more

informed about climate change education. The researcher was able to identify some of the projects by the members of the Eco Club within the school. One of the major activities of the Environmental Club in this school (S13) is waste separation. The waste is separated into categories, such as plastic, paper, and cans. The waste is then collected by the local municipality environmental department, for recycling purposes. In the other schools, without Environmental Clubs, it was disappointing to note that the waste was being burnt. The burning of waste is a real environmental health hazard.

5.6.7 Findings of the study on the Senior Geography Inspector's understanding and role in implementing climate change education

The Senior Inspector of Geography in the country mentioned that the current SGCSE Geography syllabus has specific themes which can be used to address CCE. The following topics were listed by the Inspector as relevant in addressing CCE: Agricultural systems, Tourism, Environmental Risks and Benefits-Resource Conservation and Management, Renewable Energy Resources and Non-Renewable Resources. However, when responding to the question of whether teachers are compelled to integrate CCE in the lesson, the response was that Geography teachers are not compelled to do so because at the moment this content is not examinable. The tendency is for teachers to place emphasis on topics which are part of the assessment objectives. Nonetheless, it still remains the belief of this study that for effective teaching on environment issues, CCE should be integrated into all the themes in Geography as a subject.

As already indicated in Chapter Four, Geography does have books which contain topics that address CCE. Unfortunately, Geography teachers have not yet been trained on CCE except for some who might have had an opportunity to learn about CCE concepts at college or university level. This study can conclude that it is imperative for the Geography Inspectorate to ensure that all Geography teachers in the country are trained on CCE to enable integration into the curriculum. In previous chapters of this study it has been noted that Geography curriculum contains themes about the environment which is the mainstay of

our economy where learners are required to learn about sustaining it, and as I argue in this study, it must be discussed in every topic. This study points also to the fact that CCE can be used as a poverty reduction strategy, where the learners practice at school can be transferred home and, with the global trends of climate change, learners need to learn about mitigation and adaptation methods as integrated into their lesson and coursework.

5.6.8 Findings of the study on Senior Geography Curriculum Designer understanding of climate change education

According McGinnis and McDonald (2011:34) the "climate change topic has remained controversial despite of scientific debates on the prevalence and causes of increased global climate change". This has prompted debate over "how climate change should be presented in schools, similar to other topics perceived as controversial, such as evolution and sex education" (Harrington, 2008:579). According to the Senior Geography curriculum designer in Swaziland, public awareness and understanding of global climate change education is only now becoming a national concern. However, it is not yet fully incorporated into the public education system in a meaningful way. Hence, a number of Swazis who are aware of climate change education are learning about it from other mediums. This causes the general public in Swaziland to become passive concerning mitigation strategies to the threats of climate change, which are becoming increasingly severe. Stauffer (2005:5) points out that "the lack of knowledge on the causes and effects of climate change, has been shown to correlate strongly with lack of public concern".

The Senior Geography curriculum designer argued that, as long as the public receive climate change education information by television or print media, a majority of Swazis will lack comprehensive understanding of climate change particular, because only a few people have access to media sources. Cox (2006:164) points out that:

> *"although the environment may be an important concern, news media are pressured to underreport environmental problems or cover them in highly dramatized ways".*

Therefore, it is important for the education sector in the country to ensure that climate change education is incorporated into the school curriculum. Understanding and teaching climate change at school level will definitely help learners have a clear interpretation of the mechanisms involved in climate. This will counter the minimal nature of the education campaigns by the media and NGOs, which expose the public to terms like global warming and climate change but are sometimes insufficient regarding the mechanisms involved (Dilling and Moser, 2007; Roper, 2006).

The Senior Geography Curriculum Designer pointed out that in as much as the National Curriculum Center has a mandate to ensure that threatening issues on national scale, such as climate change, are integrated into the school curriculum, it is paramount that all stakeholders in the education sector are trained for effective implementation. As such, curricular compartmentalisation has prompted a re-imagining of science education in the climate change era, towards gradual abandonment of traditional discipline-based approaches to science teaching (Sharma, 2012:24). This will ensure that teachers are strategic in establishing ways of fitting climate change education into the already dense standards based SGCSE Geography curricula.

No curriculum exists in a vacuum, but the primary and secondary systems of education in the world today are precisely dependent on the strength and functionality of every component part of the system (UNISDR, 2006:10). I therefore, believe that if all education actors in the country can work collaboratively and adapt a curriculum that allows the integration of climate change education, learners, teachers and the entire country will have a clear understanding of climate change. Awareness and comprehension of the causes and effects of climate change can ensure that adaptive and resilient strategies are developed. This can eradicate the misconceptions about climate change, which have confused teachers. Anderson (2008:38) argues:

> "Teachers may fear that public controversy around climate change could cause disruption to their classroom. While public controversy around climate change was not focused on schooling at the time of this survey, anecdotal

> evidence exists that incidents of controversy at that time did affect school communities."

My impression from this observation is that, the presence of controversy has a great deal of influence in teachers' instructional choices for climate change education. Literature gives some valuable insights to the approach are likely to be taken by teachers in the case there is a controversial topic. The tendency is that, teachers are only prepared to teach topics required by their certification and clearly stated in the assessment objectives of the curricula (Hestness et al., 2013; Lambert, L., Lindgren, J., & Bleicher, R. 2012). Fortunately for Swaziland, the NCC, as mentioned by the curriculum designer is working on new teaching materials which will comprehensively incorporate climate change education. Ozor, (2010:36) argues, that a sustainable and climate change oriented curriculum should enable learners to:

> "explain some of the processes which contribute to climate change and discuss the possible impact of atmospheric change on the survival of living things. Identify the threats facing them a in climate zones, including climate change, analyses how these threats impact on the way of life and assess the impact and possible outcomes of climate change on a...region and can propose strategies to slow or reverse the impact."

If this is the case, one can hope that the new teaching materials being written by the NCC will provide the desired outcome of a climate change education curriculum. However, the significant point here is for the curriculum stakeholders to provide teachers with a detailed curriculum, accompanied by teaching materials which not allow teachers freedom to select convenient materials.

5.6.9 The evaluation of textbooks in addressing climate change education

Climate change can be linked to both natural processes (such as volcanic eruptions and sunspots) and anthropogenic activities associated with greenhouse gas emissions (IPCC, 2007).

However, with the onset of the industrial revolution and the associated rise in anthropogenic activities, human influences have been identified as playing a more pertinent role in current and future changes in global climatic systems (IPCC, 2007; Houghton, 2009). The IPCC (2007), states that many human activities have resulted in the increased release of a variety of greenhouse gases. The accumulation of these gases in the atmosphere has resulted in an overall warming of the climatic system (Houghton, 2009). In terms of enhancing learners' understanding of the causes of climate change education, it is important that textbooks highlight both the natural and anthropogenic factors which drive climate change.

In Swaziland, textbooks represent a crucial factor in the overall success of climate change education in schools. In this study it was found that textbooks constitute 100% of the resources used by both learners and teachers in Geography classes. Therefore, textbooks may influence teacher perceptions of climate change which may in turn be passed on to learners in the classroom. According to Jonhson, (2011:38) "textbook content and quality varies widely, and each school can individually choose which textbook it will order". Lessons on the environmental effects of global problems like climate change are covered in some textbooks, but to different extents. Some teachers have to have two textbooks, where each one is focused on a given subject. Teachers can present the material in a variety of ways, but many of the textbooks that do cover climate change consider it an unlikely scenario.

To critique the value of textbooks for climate change education, the extent to which textbooks provide relevant, accessible and accurate information was analyzed. Textbooks were categorized according to a set of developed criteria in Table 5.1

1	Textbooks which enhances the understanding of climate change education	Textbooks which do not enhance the understanding of climate change education.
2	Textbooks with topics which specifically addresses climate change education	Textbooks which do not have topics that specifically addresses climate change education

3	Textbooks which embraces climate change education to the fullest.	Textbooks which do not embrace climate change education to the fullest.
4	Textbooks which addresses climate change education in the context of Swaziland	Textbooks which do not address climate change education in the context of Swaziland.

Table 5:1 Criteria for textbook evaluation in terms of CCE

The evaluation criterion and parameters for the textbooks were entirely influenced by the researcher's understanding of CCE. The first criterion (Table 5.1) classifies textbooks according to the extent to which these resources enhance understanding of climate change education. To strengthen understanding of climate change education, textbooks need to provide detailed information, which can be used by both learners and teachers to have a clear understanding of CCE. To identity textbooks which contain topics that can be used to enhance climate change education, the topics on the table of content was used to identify the topics as shown in Chapter Four, Table 4.2. Textbooks considered to be relevant for CCE would contain topics that address natural phenomena and socio-economic themes. Another crucial component that was considered was whether or not were the textbooks included visual representations in the form of diagrams that can enhance climate change education.

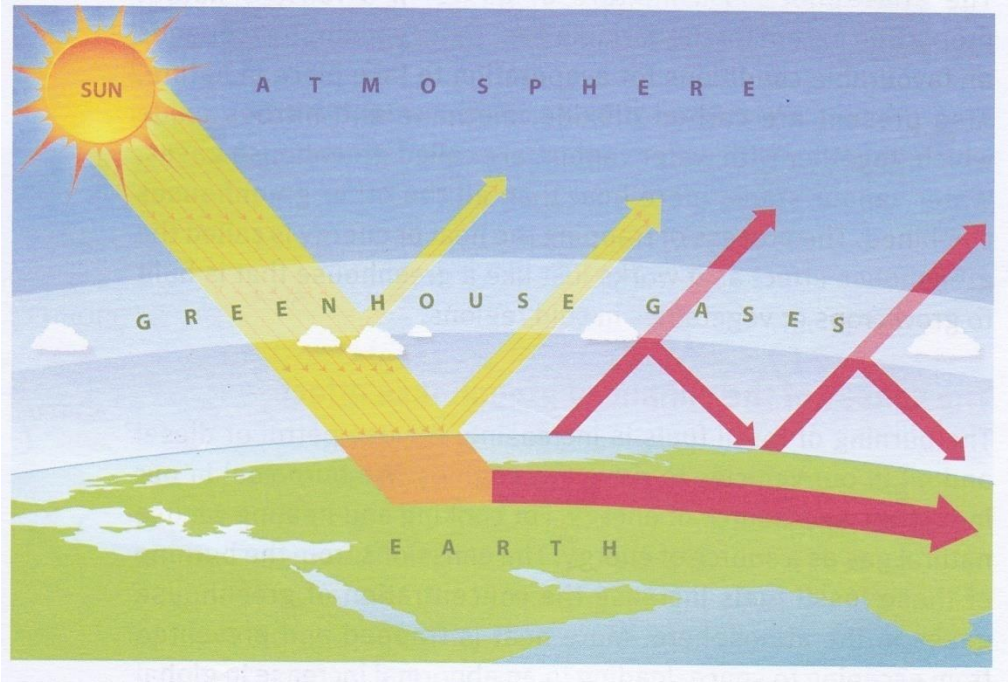
5.6.9.1 Coverage of topics related to climate change in textbooks

The first criterion for textbook evaluation classifies textbooks according to those books that enhance the understanding of climate change education, as well as those books which do not enhance climate change education understanding. One of the key topics which represent a foundation for both learners and teachers from which to grasp climate change is the greenhouse effect. As such the textbooks are expected to provide adequate information on the greenhouse effect. Therefore, this study undertook a closer evaluation of the Geography textbooks as to whether the books discuss topics which enhance climate change education or not. In order for a textbook to qualify as one that can be used to enhance climate change

education, it must contain topics like climatology, agricultural systems, and industries just to mention a few.

There were eight books that were selected for assessment: *Junior Secondary Geography for Form 1-3, Oxford Modern Geography Book 3, Macmillan Geography for Southern Africa,* H/IGCSE Geography Modules 1, 2, 3, and 4, as well as *The New Wider World.* There are only three textbooks that do not have topics which can be used to enhance climate change education. These are the *Oxford Modern Geography Book 3, H/IGCSE Geography Modules 1, H/IGCSE Geography Modules 4*. The other textbooks contain topics which can be used to enhance climate change education. The degree, to which each of these five textbooks may serve to enhance understanding of climate change education according to the already stated criteria, will now be outlined.

The Junior Secondary Geography contains topics that can be used to enhance climate change education. This book has topics such as: Weather and Climate, and Weathering and Soil Erosion. More importantly, this textbook gives a brief discussion on features of a climate changing environment, human activities that lead to climate change, the impact of climate change on the environment and the impact of climate change on human populations. Also, a diagram on the Greenhouse Effect, Photograph 5.1 below that is clearly illustrated in this textbook. Therefore, when properly explained to learners, this diagram can strengthen and enhance understanding of the process of greenhouse effect. In the process, climate change education will easily be incorporated into the lesson.



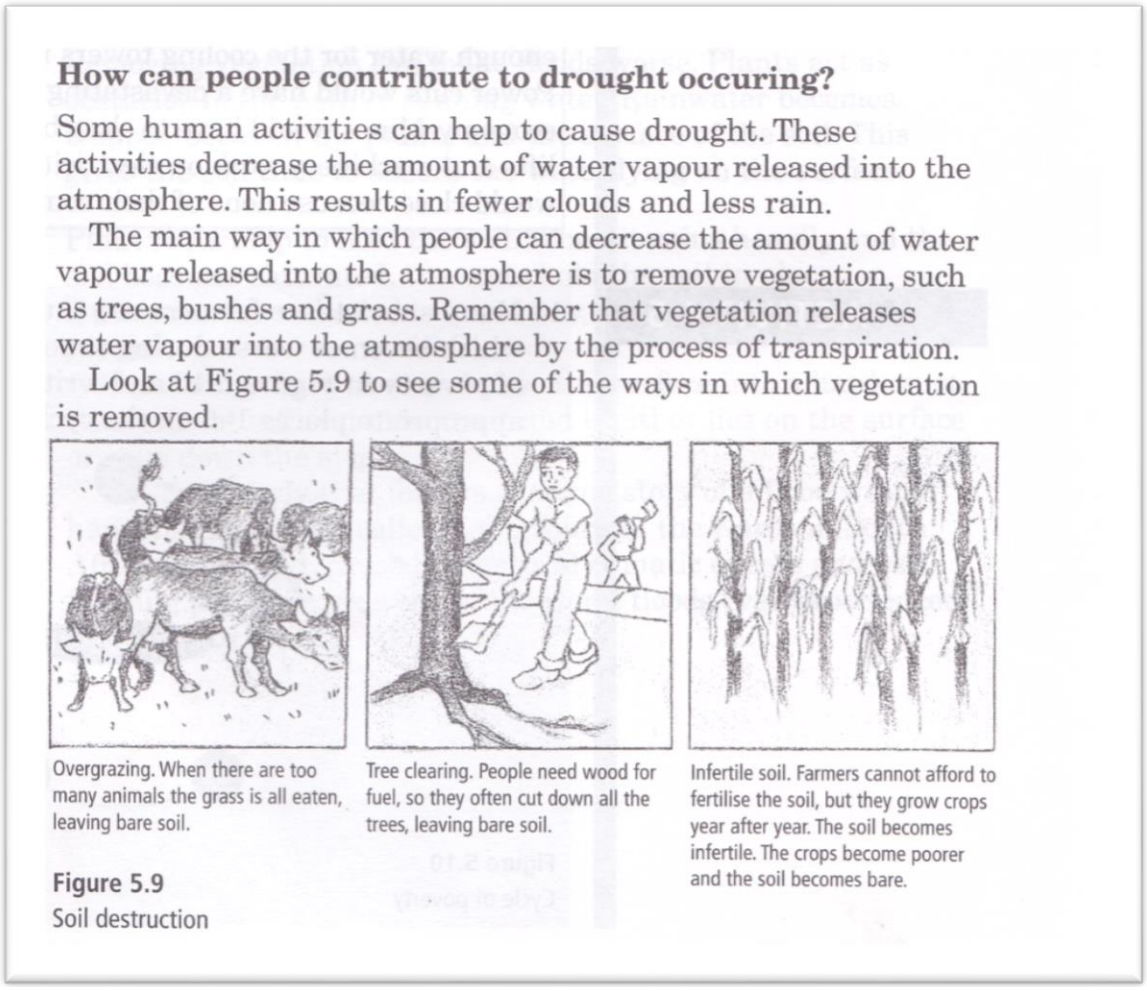
Photograph 5.1 The Greenhouse Effect

Source: Vilakati, S. (2012:152)

The H/IGCSE Geography Module 2 for Form IV-V has a section on how people contribute to drought. This section has a clear diagram as shown in Figure 5.1 which illustrates vividly the activities of human beings which lead to drought. Swaziland has been experiencing frequent droughts, especially in the Lowveld region. The area in Swaziland is categorised into three drought risk zones namely: little/none, moderate and severe. The Northwest Highveld region is in the little/none drought risk zone consistent with the statistics that show that the region does receive the highest amount of rainfall (1200–1500 mm per year). The South West Highveld, Middleveld and Lubombo regions are in the moderate drought risk zone, with annual rainfall values ranging from 700-1200 mm. The Lowveld region coincides with the severe drought risk zone, with annual rainfall values ranging from 500-700 mm. This region is characterised by short rainfall seasons, which last for four months, and is often hit by droughts even during years of high rainfall.

Climate change has serious effects on crop cultivation in Swaziland (Manyatsi, et al. 2010:18). For instance, there has been a remarkable decrease in crop yields and a significant change in the ploughing season. During the second quarter of the 2015/16 financial year,

Swaziland recorded a significant yields decrease of 19.787 metric tonnes, compared to 101.41 metric tonnes in 2014 and 81.624 metric tonnes in 2015 (Ministry of Agriculture Report 2016:4). Therefore, the section on drought provided in *H/IGCSE Geography Module 2* is useful as it requires learners to consider mitigation strategies which can help to minimize human activities which lead to drought. Climate change is already impacting learners' lives across the Swazi nation. For instance, rural schools in the country are hard hit by extreme weather events like drought, which has led to serious water shortages. Figure 5.2 below give an example of the human-induced activities contributing to the occurrence of drought.



How can people contribute to drought occuring?

Some human activities can help to cause drought. These activities decrease the amount of water vapour released into the atmosphere. This results in fewer clouds and less rain.

The main way in which people can decrease the amount of water vapour released into the atmosphere is to remove vegetation, such as trees, bushes and grass. Remember that vegetation releases water vapour into the atmosphere by the process of transpiration.

Look at Figure 5.9 to see some of the ways in which vegetation is removed.

Overgrazing. When there are too many animals the grass is all eaten, leaving bare soil.

Tree clearing. People need wood for fuel, so they often cut down all the trees, leaving bare soil.

Infertile soil. Farmers cannot afford to fertilise the soil, but they grow crops year after year. The soil becomes infertile. The crops become poorer and the soil becomes bare.

Figure 5.9
Soil destruction

Figure 5.1 People's contribution to drought occurrence
Source: H/IGCSE Module 3

In H/IGCSE Module 3: Form IV-V, there is an extract shown in Table 5.3 which explains strategies that can be adopted by people in attempt to save water, which has become a scarce resource due to climate change in the country. It is therefore imperative for the learners to be exposed to water conservation strategies, which can be best attained through climate change education. Swaziland, like a number of countries globally, is hard hit by climate change, which has affected water resources in the country. Water is the lifeline for survival of human kind, and should be used sparingly and with caution, especially in drought seasons (Dlamini, 2011:23). In a socio economic sense, the scarcity of water would automatically result in the shortage of food, which would then have to be imported at very high cost in turn, inflating food prices.

Steps authorities could take to save water

- Introduce a realistic pricing system for water.
- Allow the use of rainwater tanks in urban areas.
- Introduce regulations which ban watering gardens in the heat of the day.
- Find and fix leaks in the municipal water supply.
- Make it compulsory to fit water-saving devices like dual-flush lavatories and low-flow shower heads in new buildings.
- Ban automatic-flushing urinals.
- Look at decreasing water pressure as a means of reducing consumption.
- Establish where 'grey water' can be used in industry and agriculture and introduce regulations accordingly.
- Tackle water wastage in agriculture, particularly in irrigation, and examine where drip irrigation can replace surface irrigation.

From *Cape Times*, 17 January 2000

Table 5.3 Authorized steps to save water

Source: H/IGCSE Module 3

In the same book, there is a section which discusses global warming which is shown in Figure 5.4 below. In this section the expansion of greenhouse gases (carbon dioxide, methane, nitrous oxide and chlorofluorocarbons) are discussed as the major causes of global warming which results in climate change. More importantly, the section clearly discusses the ways in which greenhouse gases are released into the atmosphere. For instance, the

burning of fossil fuels, farming, especially livestock rearing, and industry and waste breakdown are outlined as major players in global warming. On this basis, one can argue that this book has reasonable substance that teachers can use for climate change education purposes.

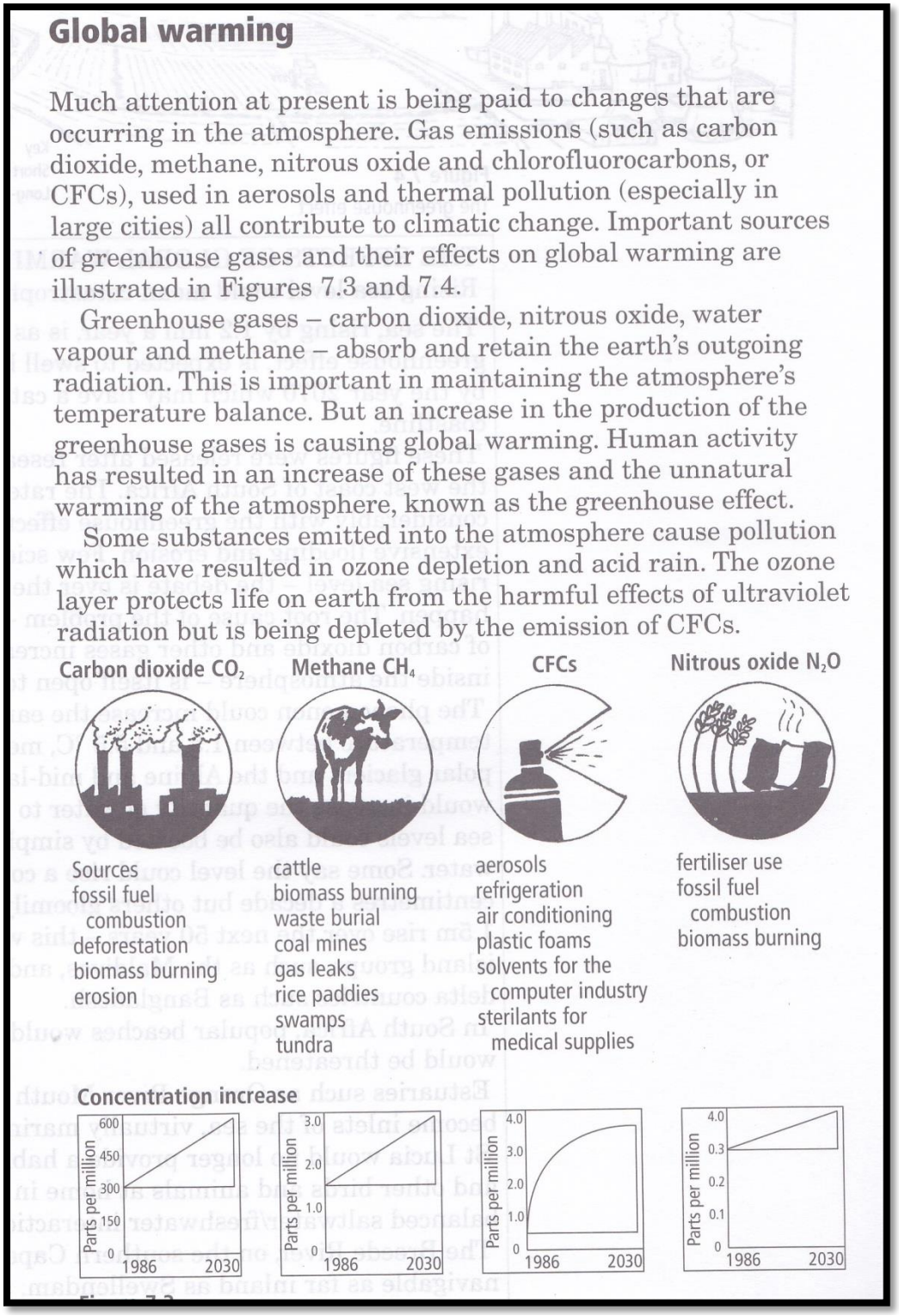


Figure 5.2: The causes of global warming
Source: H/IGCSE Module 3

The extent to which the textbooks selected for analysis in this research have the potential to usefully contribute to climate change education varied. A majority of the textbooks do not provide adequate details, which can be used for climate change education. However, three textbooks, namely the *H/IGCSE Geography Module 2 and 3* as well as *Geography for Southern Africa,* contain relevant and accurate information, which can be used to integrate CCE into Geography lessons. More importantly, it is worth noting that the textbooks do not provide consistently adequate explanations of all the key aspects of climate change. For instance, in some cases the textbook provided a detailed explanation of the causes of climate change, but limited coverage of climate change mitigation and adaptation. As a result, it becomes difficult to use such information for comprehensive climate change education.

Having been involved in Geography curriculum development in the country, it has been possible to observe that textbook content and quality vary widely, and each school can individually choose which textbook it will order. However, the Senior Inspector of Geography does provide a list of textbooks from amongst which teachers can buy for learners. The tendency is that schools will purchase one or two of the prescribed textbooks. As a result, this study discovered that a majority of the rural schools have only one textbook for learners while in the urban schools; learners have more than two textbooks accounted by the school fees of the latter.

5.7 The significance of the study to Swaziland's education system

After the whole process of conducting this study, I have no doubt that this investigation has yielded some new insights which contribute to the body of scholarly knowledge. The entire document starting from the problem statement, the literature review, research methodology, data collection and analysis, research findings and recommendations, highlights the significance of the entire study. For the purpose of this section, a few important, emerging and unique insights from this study will be discussed.

I have discovered that climate change education, as an emerging concept in the country's education system, requires prompt action from all education stakeholders. As already discussed in Chapters One and Two, the effects of climate change are already evident in the

country, hence it is imperative to expose both learners and teachers to key aspects of climate change education. This is more significant to learners, where they will be taught not only to identify the impact of climate change in their communities but it will also help them to be climate change ambassadors to their communities.

The most significant outcome to be achieved by learners upon learning about climate change is to develop awareness, adaptation and resilience. Being knowledgeable, it means the learners will be able to identify some of the human induced causes of climate change in their communities. The development of adaptation and resilience strategies will ensure that all members in the community will work hard to minimise activities which lead to climate change. By so doing, the entire country will be redirected into developing resilience, mitigation and adaptation strategies to climate change. For instance, the learners will help their communities to grow drought resistant crops, as opposed to maize, which is the current staple, nonetheless, requires sufficient rainfall. In addition, a climate change-oriented farmer will realize that it is important to rear livestock for commercial purposes. Commercial farming will ensure that the livestock are provided with fodder and other food supplements, hence the reduction of cattle death, due to drought.

The understanding and learning of climate change in the SGCSE Geography curriculum is essential in bringing a clear comprehension of this emerging issue in the country. The inclusion of CCE in the curriculum is meant to enable both learners and teachers, such that they might attain a holistic view of possible mitigation measures which can be adopted by Swazis to cope with the challenges posed by climate change. The Ministry of Education and Training, through the NCC, needs to collaborate in developing a curriculum which will ensure the inclusion of CCE in all the subjects. Actually, the interactions of climate with human systems and climate science would ideally be conveyed via an interdisciplinary instructional approach (Hansen, 2009; Rebich and Gautier, 2005).

Fortunately, as stated by the Senior Geography Curriculum Designer, the inclusion of CCE in subject curriculum is currently considered urgent. For instance, this concept is even

developed for lower primary learners. Therefore, one can propose another study, which might include the primary school-going learners to establish their understanding of CCE, for the curriculum does not exist in a vacuum, but the primary and secondary systems of education in the world today are precisely dependent on the strength and functionality of every component part of the system (UNISDR, 2006:10).

In conclusion, one can attest that learners should receive their information about climate change from a variety of sources, such as films, news reports, popular culture and their parents. This is because climate change in Swaziland is not yet learned in students' lived environments, and, as already stated, the current curriculum does not have much room for climate change education. This conclusion leaves room for public education efforts to teach children about climate change, and to dispel any common misunderstandings or confusions (Boon, 2010:115). More importantly, I appreciate that the SGSCE Geography curriculum exposes learners to climate change education. For the future, one can anticipate a full reorganisation of the curriculum with assessment objectives aligned to climate change education. This move will ensure that teachers consider CCE integration very seriously as it will be an examinable issue.

5.8. Transferring climate change education to communities

The key to effecting significant behavioral change and building community resilience is public ownership of CCE programmes (UNESCO, 2012:12). Alias, Tran, Nakashima and Shaw (2009:23) argue that communities are easily captivated into an innovation, when vital structures like participatory mechanisms are open to all irrespective of gender and age. Clover et al. (2010:17) observe that:

> "Community-focused projects should incorporate consistent participatory mechanisms. Local authorities, community leaders and members, project facilitators, all need to be given the opportunity to be genuine participants of CCE programs, from planning and implementation, to monitoring and evaluation".

Public participation on CCE programmes help the communities to be self-reliant and prepared, instead of waiting for government relief. The current situation in Swaziland communities is that Government should always provide food aid and water, due to the severe drought prevalent in the country. This may be attributed to the fact that in the country there is still lack of bottom-up communication from schools and communities to policy making authorities at a national level. Instead, the decisions to initiate, implement and monitor community based projects are always communicated top-down, from government level to local communities. By so doing, indigenous knowledge and local good practices have also not been sufficiently incorporated in community based activities. This approach is cited as a key factor behind the passive participation of the communities in the CCE activities (Ekpoh, 2009:24).

More importantly, teachers have a significant role to play in ensuring that climate change education is transferred from learners to communities. For instance, it is important for teachers to understand what and how to teach the complex forces driving climate change as well as its impacts on culture, security, well-being and development prospects (UNESCO, 2013:8). Even so it remains an obligation for teachers to lead learners on how they (learners) together with their communities can positively respond to the effects of climate change. Therefore, teachers should adopt and build upon participatory learning approaches which advocate that learning should be taken out of the classroom and into the communities. One can conclude that with a well directed curriculum which focuses on climate change issues, learners can come into terms with climate change threats and develop mitigation and adaptation measures in the process which will not only benefit the individual learners, but the entire community. Children are the disseminators, at home and in the wider neighborhoods (Das 2010:19).

In conclusion, one can argue that for effective participation in programmes meant to sensitise communities about climate change, Swaziland needs to put in place capacity building strategies. This argument is supported by UNESCO (2014:4):

> "Capacity-building and community-based educations are important for raising awareness of climate change impacts. "Soft" adaptation approaches, such as capacity building and education are important in the context of sustainable development. In contrast to "hard" (infrastructure) responses, "soft"' measures serve as a way to meet other community demands, including increased education and sustainable livelihoods."

My view from this literature is that family and community education can help increase the effectiveness of climate change education, and reinforce at home what is learned in the classroom. In the process, this move can increase a better comprehension of some of the gaps and weaknesses in climate change education and communication, as well as in community-level adaptation and how these gaps relate to, or are influenced by, climate change perceptions McCaffrey (2013:45).

5.9 The contribution of this study to climate change education globally

This research contributes to the literature that examines climate change education by indicating new and emergent themes about CCE that were not evident before. It also contribute to literature that examines the role of education in climate change mitigation by widening the range of responses and ideas of climate change education through the use of qualitative research methods.

Based on the findings of the study presented in Chapter Four, one can conclude that climate change has had serious effects on the MDG's to the entire global community. The discussion in Chapter One explicated hat Goal 1 of the MDG's is about crop production which is vital to guarantee food security and food reduction. Unfortunately, the attempts by countries to alleviate poverty are impossible, because of the prevailing E1 Nino. Therefore, this study argues that it is a matter of urgency for CCE to be integrated into a school curriculum across the grades. This observation has been justified by a number of research examples as discussed in Chapter Two. As such, I strongly believe that CCE education is

the relevant medium that can be adopted and integrated into all subjects curriculum to enhance the understanding of climate change by learners. Actually, I have realised that a holistic and comprehensive approach in the integration of CCE into all school subject areas is vital. I base this argument on the fact that there is no specific subject area that can provide clearly all the dimensions required by learners to understand the climate change concept. Therefore it is important that in primary, secondary and tertiary levels of education, climate change education should be included across different subject areas so that learners are empowered about the principles of climate change education for sustainable development. In Chapter Two, it was pointed out that climate change is one concept that people have misconceptions about. I therefore, believe that, integrating CCE into all subjects can help to enlighten learners about the causes and effects of climate change. This argument is echoed by Selby, (2006:58) that:

> "Exploring environmental, economic and social dimensions will inevitably lead into consideration of cultural, ethical, philosophical, political, scientific, spiritual and technological factors."

In Chapters One, Two and Four it was discussed at length that disasters caused by hazard induced by climate change can damage and destroy school facilities and educational systems, threatening the physical safety and psychological well being of communities and interrupting education continuity (Anderson, 2010:4). For instance, learners from some parts of Zimbabwe are reported to be staying out of school in large numbers, as E1 Nino induced hunger continues to plague Southern African countries (Swazi Observer, 12 March 2016: 30). The current effect of climate change in schools prompt the argument that CCE should be integrated across the school curriculum to ensure that all learners are equipped with the necessary skills to mitigate and cope with the impact of climate change. It has been observed by literature that an awakened and mobilised public can begin to implement change in its own communities and demand change as well (Finley, 2007:36).

This study also avers that learners should not only learn about climate change in the class theoretically, but that instead subject, curricula should be structured in a manner that practical session is offered. For instance, in Chapter One, Two and Four, it was presented that one of the major effects of climate change, is drought which leads to serious shortage of water. I thus argue that learners should be taught strategies of conserving water and harvesting rainwater. It has emerged from the findings of this study presented in Chapter Four that schools should embrace the rain water harvesting programme so that learners have a safe and ready supply of drinking water and basic sanitation facilities at school. I have no doubt that school-based water and sanitation programmes might have the benefit of encouraging parents and the community to support children going to school.

The results presented in Chapter Four on Geography teachers' understanding of CCE show that high quality learning on CCE can be attained through the use of appropriate approaches in the subject curricula. I believe that the application of active and participatory methodologies like debates, field excursions, and research on the causes, mitigation and effects of climate change can help learners to develop critical thinking and problem-solving skills. Actually research has shown that participatory action and solution focused approaches have the potential to empower people as agents of change (UNESCO, 2015:67).

I also believe that the Ministry of Education and Training in Swaziland has to drive climate change education knowledge from communities as discussed in Chapter Four. I strongly believe that an instructive move by education stakeholders to engage in climate change education programmes would benefit farmers who make food available to people. As discussed in Chapter One, climate change has led to food insecurity in the country. A well informed farmer will know which crops to cultivate so as to cope with the impact of climate change. This study observes that it is paramount for government especially in developing countries to place more emphasis on the challenges farmers encounter and how they can minimise them so as to increase their production.

Chapter Six presents the research summary and recommendations.

Chapter 6

Research Summary and Recommendations

6.1 Introduction

The main aim of this research was to explore how teachers and learners understand the inclusion of climate change in the Secondary Education Geography Curriculum in Swaziland. The presentation and analysis of data was dealt with in Chapter Five. The researcher developed topics and themes for interviewees, which were within a framework of flexible question structure, to enable both the researcher and the interviewees to answer the questions and develop possible themes. Six themes emerged from the analysis of data, as they were centered in the data collected. These are the themes: demographic and social information; curriculum information; the role of environmental clubs in promoting climate change education; learners understanding of climate change and global warming; the effects of climate change to schools; and the control of water wastage by learners in the schools. The data lead to the themes was presented in Chapter Four, Section 4.1 to 4.13.

The study was guided by the main research question, which read:

How do teachers and learners understand the inclusion of climate change in the Secondary Education Geography Curriculum in Swaziland?

The main research question was supported by the sub-questions, which were:

- What are the characteristics of climate change in Swaziland?
- How are the elements of climate change captured in the curriculum?
- How do teachers understand and interpret climate change in the curricula?
- How do teachers teach climate change from the curricula?
- How do learners learn and deal with climate change in the classroom?

Chapter 6 presents an overview of the investigation regarding the achievement of the research's aim and objectives. The questions had a direct link to the aims and objectives of the study outlined in Chapter One. The data that were collected by means of three methods of data collection, namely focus group interviews, questionnaires and document analysis. These methods were triangulated during data analysis in an attempt to answer the questions of the study. This chapter also provides the synthesis of the research. This chapter will discuss the research summary, recommendations, research limitations, guidelines, conclusions and areas of further research.

6.2 Summary of key research findings

A summary of the research findings on how teachers and learners understand the inclusion of climate change in the Secondary Education Geography Curriculum in Swaziland. The summary of the key findings related to the objectives of the study, which were outlined in Chapter One, and these are shown in Table 6.1 below.

OBJECTIVES	**RESPONSES**
1 Review documents and other literature to indentify effects of climate change in Southern Africa and Swaziland.	1.1 In Chapter One and Two it was discussed in details adequate literature. 1.2 Government has documented information on the effects of climate change as already discussed in Chapter Two and Four.
2 To explore the historical trend of climate change effects in the country.	2.1 Chapter One, gave a clear discussion on the occurrence of consecutive drought season over the past five years. 2.2 Prevalence of land degradation in all the physiological regions in the country discussed in Chapter One. 2.3 Livestock especially cattle, have declined significantly due to a contraction

	of rangelands and inadequate pastures as a result of successive years of low rainfall. The statistics on the declined of livestock in the country as a result of climate change have been discussed in Chapter One. 2.4 More than 60% reduction on annual agricultural harvest, where as a result, households are faced with high chronic food insecurity. Chapter One provides a detailed account on the impact of climate change on the annual agriculture harvest in the country.
3 To determine the extent at which the Swaziland sectors are exposed to climate change	3.1 Chapter One and Four provide a clear discussion on the role of private sectors and NGOs on environmental issues. 3.1 Media campaigns and programmes on environmental issues as stated in Chapter Two.
4 To determine how the SGCSE Curriculum and other regulatory structures make provision for teaching learners about climate change.	4.1 The NNC is currently developing teaching and learning materials to deal with CCE. A detail account has been given in Chapter four and five. 4.2 SEA provides outreach programmes to schools and communities to create public awareness of climate change as discussed in Chapter Two, Four and Five.
5 To determine the topics in the SGCSE Geography syllabus that addresses climate change.	In Chapter Four the following topics have been presented to be relevant in addressing climate change. 5.1 Farming, crop cultivation and livestock 5.2 Industry 5.3 Ecosystem 5.4 Weathering

	5.5 Weather and Climate 5.6 River systems 5.6 Range management 5.7 Tourism 5.8 Water resources 5.9 Utilisation of forests and veld products
6 Determine the instructional design strategies that are used to enhance learners's understanding and awareness of climate change.	6.1 Field excursion to areas affected by climate change. The importance of field excursion in CCE has been discussed in Chapter Two, Four and Five. 6.2 Video clips on the effects of climate change as discussed in Chapter Two.
7 To identify the initiatives undertaken by schools to promote public awareness of environmental issues like climate change.	A detail discussion has been presented in Chapter Four and Five on the following initiatives. 7.1 Rainwater harvesting. 7.2 Environmental Clubs establishment in the schools 7.3 Essay writing and debate competition on environmental issues. 7.4 Science fair projects on environmental concepts
8 To establish the basic sets of learning and teaching resources on climate change that allow geography teachers to design their own lessons.	A discussion on the value of textbooks in teaching and learning climate change has been discussed in Chapter three, four and five. 8.1. Textbooks 8.2 Pamphlets on environmental issues

Table 6.1: The key findings related to the objectives

6.2.1 Teachers Qualifications

The importance of teachers' level of education was discussed in Chapters Four and Five. The results in Chapter Four indicate that a majority (44 percent) of the geography teachers had Bachelor's Degree (BA) and Post graduate Certificate in Education (PGCE). Teachers with such qualifications are expected to have done courses on climate change education. Research has shown that having a framework with which to describe the learning outcomes of student learning about climate change issues, the subject knowledge about climate change itself has to be first understood by the teachers (Chang, 2013:2).

6.2.2 Teachers understanding and awareness of climate change education

The Geography teachers had an understanding of climate change education. The level of climate change awareness among the teachers was 96 percent. However, exist in their knowledge. For instance, the results in Chapter Four, Figure 4.6 indicates that 66 percent of the teachers had not done CCE at college level. This statistics causes one to conclude that the majority of the Geography teachers lack adequate training in CCE. Hence, the results in Chapter Four, Table 4.1 show that 47.2 percent of the teachers stated that they were not confident to teach CCE.

6.2.3 Views on the inclusion of CCE into the SGCSE Geography curriculum

The issues surrounding the views of teachers and school principals about the inclusion of CCE into the SGCSE Geography curriculum were discussed in Chapter Four and Five. The school principals and geography teachers strongly agreed that CCE should be included into the SGCSE Geography curriculum. The teachers observed that the climate change education concept should be included into the curriculum so that learners are well prepared about the threats posed by climate change.

6.2.4 Learners' understanding of global warming and climate change

In Chapter Four and Five, the issues of learners' understanding of CCE were discussed. The results in Chapter Four, Table 4.3 indicate that learners had general understanding of climate change. According to sub-question five as stated in Chapter One, it was important for this study to establish how learners learn and deal with climate change in the classroom. Therefore, learners were asked to state the causes and effects of climate change. The definition given by the learners proved that climate change as a learning construct is largely misunderstood at many levels as noted by Feierabend (2010:178). According to Chang (2013:29 "there is no distinction between learning about the science of climate change and how to mitigate its impact." For instance, a learner from GC defined this concept:

> *I think climate change is the unexpected change in the weather conditions that takes place in our area, not the normal climate we are expecting.*

Another respondent (GB) had the following to say:

> *To my understanding climate change is the depletion of the ozone layer hence, the prevailing high temperatures.*

The learner's responses were too general, where the literature has made clear for some time that the ozone hole allows more solar energy to reach the earth, causing global warming and climate change (Papadimitriou, 2004, UNESCO, 2009, McCaffrey, 2013, Leiserowitz 2010, Miller 2010, Ozor, 2010). Therefore, it is important for the learners to understand the causes of climate change, both human induced and natural, before one can appreciate how that change impact human lives (Chang, 2013:30).

6.3 Environmental Information Officer's understanding of climate change education

The EIO had a clear understanding of climate change education. The EIO as an officer responsible for environmental information dissemination within the Swaziland Environment Authority has coordinated workshops and seminars with government ministries, private sector and NGO's on climate change issues. More significantly, the EIO explained that the arrangement to have CCE incorporated into the school curriculum is at an advance stage. Programmes on CCE public awareness have been established on television and radio and in news papers.

6.3.1 Environmental Clubs

It was noted that the Swaziland Environmental Authority initiated a programme of awarding all schools in the country that promote environmental ethics. This initiative will surely

encourage schools in Swaziland to have environmental clubs which are currently missing as discussed in Chapter Four and Five.

6.4 Senior Geography Inspector

As noted in Chapter Five, workshops are being organised for geography teachers on climate change education. The SGCSE Geography curriculum has themes relevant to CCE. Teachers are encouraged to incorporate climate change education into their lesson. The inspectorate works closely with the Geography panel, association and National Curriculum Center in developing CCE teaching and learning materials.

6.5 Senior Curriculum Designer

Systems are in place to ensure that CCE is integrated into the school curriculum. The curriculum is being reviewed to ensure the inclusion of CCE assessment objectives. This will ensure that teachers take CCE seriously, as teachers have a tendency on concentrating only on examinable topics as discussed in Chapter Five.

6.6 Textbook Evaluation

Most textbooks did not provide consistently adequate explanations of all the key aspects of climate change. For instance, in some cases, textbook/s provided a detailed explanation of the causes of climate change, but limited coverage of climate change mitigation and/or adaptation.

6.7 Recommendation and Implications

The main aim of the study was to explore the understanding and teaching of climate change in the Secondary Geography Curriculum in Swaziland. The findings were reported in Chapter Four. The study focused on both learners and teachers understanding of climate change education as presented in the SGCSE Geography Curriculum. The study established

that both learners and teachers have some extent of knowledge and understanding of climate change education. For instance, it was discovered that teachers know about CCE, but that they do not integrate it into their lessons. It is therefore recommended that the current curriculum be reviewed and outcomes pertaining to climate change education be integrated into all the geography topics from junior to secondary level.

The study also discovered that the Geography teachers rely entirely on the prescribed textbooks for their lesson. This is a major setback in the attempt of infusing CCE into the curriculum. Some of the textbooks as already discussed do not have topics addressing climate change education. The conclusion here is that, the geography textbooks prescribed for the SGCSE Geography curriculum should be re written to include climate change education. In other words, climate change education should be included in the textbook development phase, as indicated by the Senior Geography Curriculum Designer. It is therefore strongly be commended that the NCC work in collaboration with the Geography panel and the Swaziland Examination Council to develop a comprehensive climate change education SGCSE Geography curriculum. In addition, as the climate change education curriculum is disseminated to schools, the teachers should be encouraged to seek partnerships with their colleagues in the science department in their schools. According to Dupigny-Giroux (2008:484) “this move is anticipated to help the Geography teachers to gain greater insight into pure science-related climate change concepts”. There is no doubt that the collaboration of the Geography and Science teachers can make a difference in the quality of climate change education in Swazi schools.

Below I discuss the recommendations and implications of this study for the higher education sector, ministry of education, stakeholders, communities and policy makers.

6.7.1 Recommendation to Higher Education sector

The higher education institutions in Swaziland should be at the forefront in the development of CCE. Institutions like the University of Swaziland, Swaziland College of Technology, Southern Africa Nazarene University, William Pitcher Teacher’s Training College, Ngwane

Teachers' Training College etc should operate closely with NGO's and private companies in spearheading CCE in the entire country.

It is recommended that CCE should be infused into all the different professions taught at tertiary level in the country. For instance, structural engineers should learn how to design and develop structures that can withstand climate change effects and medical professionals like nurses should know the effects of climate change on the health of Swazis. Teachers need to be well equipped regarding climate change concepts so that they are able to teach a curriculum that integrates CCE. One can argue that if the CCE concept is fully integrated into tertiary institutions in Swaziland, there is a hundred percent guarantee that the future generation will be well-equipped regarding the causes, effects and mitigations strategies of climate change.

6.7.2 Recommendation to the Department of Education

The study recommends the following which all stakeholders for climate change education in the country should embrace for implementation.

- The Swaziland National Curriculum Center together with the Inspectorate in the Ministry of Education and Training in conjunction with non government organisations should develop education and awareness materials on climate change and sustainable living for schools and the public. As the stakeholders work together they will enable the establishment of a mechanism for information sharing and networking focusing on the role of Government and NGOs in climate change education and awareness. This will also lay a strong foundation for reference on climate change education issues in the country. In the process this initiative will create opportunities for young people to learn more about climate change.

- The Government of Swaziland through the Ministry of Education and Training should embark on an empowerment exercise to equip all citizens of the country about climate change education. That is to say, it should be the priority of the

Government to provide training for teachers, learners, members of the public and environmental representatives in the entire country. In other words, it is imperative that all Swazis are sensitised about climate change issues.

6.7.3 Recommendation to stakeholders

The study recommends that the Government of Swaziland, together with non-government actors, should strive collectively in promoting public awareness on climate change education. The media, including television, radio and print should be pioneers in staging campaigns and events geared to promote climate change education. The Ministry of Education and Training has a valuable responsibility in leading all stakeholders for climate change education initiatives.

In 2012, Swaziland held the first National Stakeholder's Consultation Workshop over (24 and 25 September, 2012) at Esibayeni Lodge, Matsapha. Participants of this workshop included senior public and private technical persons; representatives of policy makers from key ministries and NGOs; international organization and funding agencies (COMESA, UNDP, UNICEF, FAO), National organization and institutions (Business communities, the Agricultural farmers union, Forestry, the National Disaster Management Agency, the Swaziland Sugar Association, Swaziland Water Services Corporation; Swaziland Environment Authority, the Swaziland Water and Agricultural Development Enterprise, the Town Boards and City Councils, the National Marketing Board, Swaziland Electricity Company, the Swaziland Civil Aviation Authority, the Smart Partnership, and the Federation of Swaziland Employers and Chamber of Commerce) social development programmes, Technoserve, NERCHA, World Vision, the Lutheran Development Service) educational organizations and institutions (University of Swaziland, William Pitcher College, the National Curriculum Centre, SIMPA, Ngwane Teacher Training College, the Institute of Development Management), and government ministries and departments (Royal Swaziland Police Service, the Ministry of Tourism and Environmental Affairs, the Ministry of Education and Training, the Deputy Prime Minister's Office, the Geology department, the National Fire and Emergency Services, the Ministry of Information, the Communication and Technology, the Ministry of Tinkhundla and Development, Ministry of Labour and Social Security, the Ministry of Natural Resources and Energy, Ministry of Agriculture, the Ministry of Housing, the Ministry of Health). A total of 102 people participated in the first national workshop over the two days period (Ministry of

Tourism and Environmental Affairs, 2013). In this workshop, the stakeholders were sensitised about climate change issues. My proposition here is that the following recommendations should be considered to enhance the deliberations of the stake holders' workshop.

- Media officers should be trained regarding how to develop interesting and locally-relevant stories about climate change education.
- The institutes of higher learning in the country should provide training for teachers, lecturers and environmental representatives in schools.
- Stakeholder/community involvement in decision making regarding climate change education, awareness & training at national and district levels should be promoted. Stakeholders would include NGOs, private sector, government agencies, community groups, and the youth.

6.7.4 Recommendations to communities

If some measures are not taken, global climate change will not be able to be averted. To stop the climate from changing and making our constituencies uninhabitable, society should be more aware of the facts of these changes. Cherry (2011:210) has noted that "education plays a very important role in increasing consciousness". Meanwhile (Boon (2010:105) attest that "teaching about the changes in global climate will increase the student's behaviour and attitudes towards environment in a positive way". As such one can propose that besides lessons, the Ministry of Education and some non-governmental organisations (NGO's) should be encouraged to carry out projects about global climate change in all the communities in the country.

It is therefore recommended that teaching about climate change education should aim at providing all community members with the appropriate problem-solving and decision making skills, inducing positive environmental attitudes, causing everyone in the community understand CCE.

6.7.5 Recommendations to policy developers

Swaziland, like many countries in the world, is already taking actions to adapt to climate change and policies on climate change are currently being crafted. In fact the Kingdom of Swaziland has signed and ratified international legal instruments to commit itself to a set of principles critical for the management of climate change (Manyatsi, 2010:5). Therefore two key legal tools are currently used to frame the national response to climate change: first is the *national policy* which is a legal and political document prepared by the State in consultation with stakeholders in both public and private sector, civil society and non-governmental organisation which clearly sets out the overall political commitments, aims and intentions with respect to any developmental issue, including Climate Change; and, second is the *National legislation* that typically creates a set of rules that govern the conduct of individuals within the State, as well as the relationship between individuals (Manyatsi, 2010:7).

McCaffrey (2013:14) has noted at present, "there are substantial gaps in the knowledge about climate change education, and hence, that there is an urgent need to improve the synthesis and dissemination of information to both decision makers and the general public". It is on this premise that Lowe (2010:440) points out that "climate change education policies should be put in place so that decision makers and the general public obtain improved and accurate information tailored in the field of climate change education". The following are recommendations that can help policy makers in the country ensure comprehensive CCE is integrated into the school curriculum.

- The government ministries should integrate climate change education into all sectoral policies and strategies, such as Energy Policy, Agriculture Policy, Education Policy, etc. This will provide opportunities for training in climate change education and related issues for media and other professionals involved in climate change issues.
- Establishment of a mechanism for information sharing and networking focusing of the role of the NCC in education and awareness.

- Empower community leaders, educators and mentors to share their knowledge, values and experience with different target audiences about climate change education.
- All policy makers in the country should be sensitized as to the importance of addressing climate change education.

6.8 Implications of the study on the understanding and teaching of climate change in the Secondary Education Geography Curriculum in Swaziland

The findings of this study have considerable implications for learners, geography teachers, the school principals, curriculum designers, textbook authors and publishers, as well as the general public. As such it is important to discuss the implications of the findings for stakeholders.

- Schools in the country should establish environmental peer educators among the learners in order to promote awareness of climate change among learners.

- Teachers should be taught CCE at tertiary level that is at colleges and universities.

- The National Curriculum Centre should organise workshops for all subjects in the country on climate change education. This will enable subject panels to develop their teaching materials which will fully address climate change.

- NGO's together with other educators should design CCE programmes which can be implemented at community level in order to reach all members of the society.

6.9 Shortcomings and limitations of the investigation

In this study two research strategies were used to collect data to address the research problem stated in Chapter One. The numbers of focus group interview participants and questionnaires respondents are not representative of all Swaziland secondary schools'

views; however, it should be considered that the literature review was done widely and could be representative of all scholarly publications and policy documents.

Another limitation of the study is that only learners who were doing Geography participated yet climate change education, as discussed in Chapter Two, Four and Five is required by all learners in a school. Also a closed-ended questionnaire was used to collect data from educators which was limiting in nature because the analysis shows that there is a need for an in-depth understanding of climate change education. Therefore, an in-depth interview would have yielded better results.

6.10 Summary of the investigations

In answering the main research question, data collected through the empirical study reveal that integrating climate change education into the SGCSE Geography curriculum and enhance the understanding of climate change by learners and teachers. Learning outcomes on climate change education in the curriculum will ensure that both learners and teachers are having access to adequate information about climate change. This will be beneficial in that misconceptions on climate change issues will be ratified.

This study discovered that teacher's responses displayed non-conformity with the scientific consensus on anthropogenic climate change education. However, teachers appeared to be aware of the causes, effects and mitigations of climate change in general, but also expressed a low of confidence to integrate CCE into their geography lessons. The analysis revealed that teachers' exposure to various media sources and use of the prescribed SGCSE textbooks has played a significant role as sources of their climate change education knowledge. Factors such as gender, age, highest level of education, school location, and current subject allocation showed some degree of influence on the respondents' level of awareness on climate change education.

The responses from the participants in this study have revealed an urgent need for close cooperation between curriculum developers, textbook authors and professional development

practitioners. The collaboration of these stakeholders will help to attend and address the misconceptions learners and teachers have about climate change education.

6.11 Suggestions for future research

Research into understanding and teaching climate change in the Secondary Education Geography Curriculum in Swaziland has not been done prior to this research. As such there is a feasible possibility for further research in this topic. This research is only based on 16 high schools in the country, yet the country has more than 200 high schools. This sample is actually small. Therefore, it may be important for future research to investigate the understanding and teaching of climate change in the SGCSE Geography Curriculum in a bigger number of schools. Such a research may provide a deeper insight into the level of understanding and teaching climate change in the SGCSE Geography Curriculum as it will cover a bigger number of both learners and teachers in the country.

The geography textbooks selected for assessment in this research were those written according to the guidelines of the SGCSE Geography Curriculum. Therefore, it is important that the National Curriculum Centre should revise these books so that climate change education contents are fully integrated.

6.12 Conclusion

This research revealed a number of inaccuracies, misconceptions and gaps in teachers' knowledge and perceptions of climate change education. It is likely that these will be passed on to learners in the classroom and will have ramifications for learners' understanding of climate change education. Insufficient or incorrect understanding of climate change among learners and teachers may adversely affect the extent to which they are able to develop appropriate environmental attitudes, behaviours and values which may contribute to reducing the threat of climate change and reduce the extent to which they are able to effectively adapt to the impacts of climate change (McGinnis and McDonald, 2011:40). Thus, it is important that the trends in teachers' knowledge and perceptions of climate change are sufficiently addressed so as to ensure the ultimate success of climate change education in schools.

Textbooks represent a key classroom resource which can guide both learners' and teachers' knowledge and views of a variety of topics, including climate change (Choi et al., 2010). In this research, the analysis of textbooks used most frequently by a sample of SGCSE geography teachers' for climate change education indicated that a prompt revision is required. This study noted that number of teachers rely entirely on the prescribed textbooks for their classes; therefore it brings one to conclude that textbooks which fully address climate change can be very useful for CCE.

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APENDIX A

The Government of the Kingdom of Swaziland

Ministry of Education & Training

Tel: (+268) 24042491/5
Fax:(+268) 2404 3880

P. O. Box 39
Mbabane, Swaziland

11 February 2015

Attention:
Headteacher:
Peak Central High
Ka-Boyce High
Timpisini High
Dvokolwako High
Swazi National High
Moyeni High
LaMawandla High
Duze High
Matsanjeni High
Siteki Nazarene High
Lomahasha High
Evelyn Baring High
Nhlangano Central High
Mankayane High
Osuthu Methodist High

Through:
Regional Education Officers – Hhohho, Lubombo, Manzini and Shiselweni

Dear Colleague,

RE: REQUEST FOR PERMISSION TO COLLECT DATA FOR UNIVESTRITY OF PRETORIA STUDENT – MR. MANDLENKHOSI NHLANHLA DLAMINI

1. Reference is made to the above mentioned subjects.

2. The Ministry of Education and Training has received a request from Mr. Mandlenkhosi Nhlanhla Dlamini, a student at University of Pretoria, that in order for him to fulfill his academic requirements at University of Pretoria, he has to collect data (conduct research) and his study or research topic is ***"How teachers and learners understand the inclusion of climate change in the Secondary Education Geography Curriculum in Swaziland"*** The population for

1

his study comprises of all learners, teachers and principals of the sample schools. All details concerning the study are stated in the participants consent form which will have to be signed by all participants before Mr. Dlamini begins his data collection. Please note that parents will have to consent for all the participants below the age of 18 years participating in this study.

3. The Ministry of Education and Training request your office to assist Mr. Dlamini by allowing him to use above mentioned schools in the Hhohho, Lubombo, Manzini and Shiselweni regions as his research sites as well as facilitate him by giving him all the support he needs in his data collection process. Data collected period is one month.

MINISTRY OF EDUCATION TRAINING 2015 -02- 11 BOX 39 MBABANE SWAZILAND

M.E. KHUMALO
ACTING DIRECTOR OF EDUCATION AND TRAINING

cc: Regional Education Officers – Hhohho, Lubombo, Manzini and Shiselweni
Chief Inspector – Secondary
16 Headteachers of the above mentioned schools
L.D. Beukes - Supervisor

Appendix B

Consent form (Geography teachers)

I,……. (your name), Geography teacher of…… Region, agree/ do not agree (delete what is not applicable) to allow Mandlenkhosi Dlamini to conduct research in the Region's schools. The topic of the research being: How teachers and learners understand the inclusion of climate change in the Secondary Education Geography Curriculum in Swaziland.

I understand that Geography adolescent students, teachers and principals will be interviewed about this topic for a time not exceeding an hour at a venue and time that will be agreed upon but do not interfere with school activities. The interviews will be audio recorded for verbatim transcription and analysis purposes.

I understand that Geography adolescent students in the selected schools will be interviewed outside class and the role of the researcher must at all times remain objective and non participant. The interviews will be recorded through field notes. I also understand that teachers, principals, students and their parents/ guardians will receive letters of information regarding this topic.

I understand that the researcher subscribes to the principles of:

- Voluntary participation in research, implying that the participants might withdraw from the research at any time.
- Informed consent, meaning that the research participants must at all times be fully informed about the research process and purposes, and must give consent to their participation in the research.
- Safety in participation; put differently, that the human respondents should not be placed at risk or harm of any kind e.g., research with young children.

- Privacy, meaning that the confidentiality and anonymity of human respondents should be protected at all times.
- Trust, which implies that human respondents will not be respondent to any acts of deception or betrayal in the research process or its published outcomes.

Signature……Date……

Appendix C

Consent form (Principal)

I,……(your name), Principal of…… Region, agree/ do not agree (delete what is not applicable) to allow Mandlenkhosi Dlamini to conduct research in the Region's schools. The topic of the research being: How teachers and learners understand the inclusion of climate change in the Secondary Education Geography Curriculum in Swaziland.

I understand that Geography adolescent students, teachers and principals will be interviewed about this topic for a time not exceeding an hour at a venue and time that will be agreed upon but do not interfere with school activities. The interviews will be audio recorded for verbatim transcription and analysis purposes.

I understand that Geography adolescent students in the selected schools will be interviewed outside class and the role of the researcher must at all times remain objective and non participant. The interviews will be recorded through field notes. I also understand that teachers, principals, students and their parents/ guardians will receive letters of information regarding this topic.

I understand that the researcher subscribes to the principles of:

- Voluntary participation in research, implying that the participants might withdraw from the research at any time.
- Informed consent, meaning that the research participants must at all times be fully informed about the research process and purposes, and must give consent to their participation in the research.
- Safety in participation; put differently, that the human respondents should not be placed at risk or harm of any kind e.g., research with young children.

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- Privacy, meaning that the confidentiality and anonymity of human respondents should be protected at all times.
- Trust, which implies that human respondents will not be respondent to any acts of deception or betrayal in the research process or its published outcomes.

Signature……Date……

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FACULTY OF HUMANITIES

Appendix D

Consent form (Regional Education Officer)

I,…….
…….(your name), Regional Education Officer
of…… Region, agree/ do not agree (delete what is not applicable) to allow Mandlenkhosi Dlamini to conduct research in the Region's schools. The topic of the research being: How teachers and learners understand the inclusion of climate change in the Secondary Education Geography Curriculum in Swaziland.

I understand that Geography adolescent students, teachers and principals will be interviewed about this topic for a time not exceeding an hour at a venue and time that will be agreed upon but do not interfere with school activities. The interviews will be audio recorded for verbatim transcription and analysis purposes.

I understand that Geography adolescent students in the selected schools will be interviewed outside class and the role of the researcher must at all times remain objective and non participant. The interviews will be recorded through field notes. I also understand that teachers, principals, students and their parents/ guardians will receive letters of information regarding this topic.

I understand that the researcher subscribes to the principles of:

- Voluntary participation in research, implying that the participants might withdraw from the research at any time.
- Informed consent, meaning that the research participants must at all times be fully informed about the research process and purposes, and must give consent to their participation in the research.

- Safety in participation; put differently, that the human respondents should not be placed at risk or harm of any kind e.g., research with young children.
- Privacy, meaning that the confidentiality and anonymity of human respondents should be protected at all times.
- Trust, which implies that human respondents will not be respondent to any acts of deception or betrayal in the research process or its published outcomes.

Signature……Date……

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FACULTY OF HUMANITIES

Appendix E

Permission Form for Parents

I, _____, consent to have my how teachers and learners understand the inclusion of climate change in the Secondary Education Geography Curriculum in Swaziland. I understand that my child will be asked to discuss his or her ideas and views of the inclusion of climate change in the Secondary Education Geography curriculum during school hours, under the supervision of a Geography teacher. I also understand that my child may volunteer to participate in one-on-one interviews during normal school time on school property. My child may also provide the researcher a drawing or a written reflection that will be kept by the researcher, and that is entirely voluntary and will not be used for assessment purposes. A summary of the findings will be sent to me by my child's school, and I may request a copy of the thesis in full.

Please return this form to your student's teacher by: _____

Please check one:

I DO [ ] I DO NOT [ ]

Agree to have my child participate in one-on-one interviews with the researcher, understanding that any data collected are strictly confidential.

Please check one:

I DO [ ] I DO NOT [ ]

Agree to have any submissions created by my child to be retained by the researcher and published (with my child's name and the name of his or her school removed) in future reports or presentations.

Signature

_____

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Appendix F

Questionnaire for Geography Teachers

Climate Change education

Good day, my name is Mandla Dlamini. I'm a PhD student with the University of Pretoria. I'm conducting a research on this topic "How teachers and learners understand the inclusion of climate change in the Secondary Education Geography Curriculum in Swaziland". Please help me by answering a few questions on this topic. Your answers will help us understand what learners already know about climate change education, as well as what kind of information they would like to learn and how they'd like to learn about it. You do not have to answer these questions if you don't want to. You can also stop answering at any time. If you decide to stop, no one will be angry or upset with you. It should take about ten minutes. There is no right or wrong answer. You should not write your name down; I just want to get your thoughts.

Part A: **Personal Information**

Gender: Male [ ] Female [ ]

Age: _____

a) 18-25 [ ]
b) 26-30 [ ]
c) 31-35 [ ]
d) 36-40 [ ]
e) 41-45 [ ]
f) Above 45 [ ]

Qualification:

a) Diploma [ ]
b) B.A. +PGCSE [ ]
c) B.Ed [ ]
d) M.A. [ ]

e) M.Ed [ ]
f) Other, specify_____

Part B: Curriculum Information

1. As a Geography teacher are you aware of climate change education?
   A. Yes [ ]
   B. No [ ]
2. If yes which topics do you think covers climate change issues?

   _____
   _____
   _____

3. How many minutes do you have for teaching Geography per class per week?
   A. 120 minutes
   B. 160 minutes
   C. 200 minutes
   D. 240 minutes
   E. 280 minutes
4. The time you have for teaching Geography, is it enough to enable to cover the Syllabus and emphasis climate change education.
   A. Yes [ ]
   B. No [ ]

5. What are your views on climate change education within the school geography curriculum?

	Very confident in teaching CCE	Fairly confident in teaching CCE	Not confident in teaching CCE
Junior Secondary level			
Senior Secondary level			

6. How much do you know and understand CCE as a Geography teacher?

Teaching experience in years	1. Study of CCE formed no part of the course at college or university	2. Study of CCE formed a small part of the course at college or university	3. Study of CCE formed a large part of the course at college or university
Less than 5 years			
6-10 years			
11-15 years			
Above 16 years			

7. How much do you use of fieldwork in the teaching and learning of Geography?

	Used in every theme	Rarely used in teaching	Not used at all
Junior Secondary level			
Senior Secondary level			

8. Do you think the use of practical approaches to the teaching and learning of geography has a role in enhancing CCE?

	1. using practical approaches does help to enhance CCE	**2. using practical approaches not does help to enhance CCE**

Junior Secondary level		
Senior Secondary level		

9. What is the role of school environmental clubs in promoting CCE?

	1. Doe the school have an environmental club.	2. Membership of the club	3.Major activities of the club(list)
Junior Secondary level			
Senior Secondary level			

10. Do you think CC should be taught as a separate subject?

A. Yes [ ]

B. No [ ]

11. In your lessons, do you integrate climate change?

A. Yes [ ]

B. No [ ]

12. Which scientific teaching methods do you normally use in your Geography?

Lessons?

_____

_____

_____

13. What are teaching resources being used in Geography?

_____

_____

_____

14. The books you use in Geography does it address climate change?

C. Yes [ ]
D. No [ ]

15. Do you think the SGCSE Geography curriculum is comprehensive to help learners understand climate change?

_____

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Appendix G

Questionnaire for School Principals

Climate Change education

Good day, my name is Mandla Dlamini. I'm a PhD student with the University of Pretoria. I'm conducting a research on this topic "How teachers and learners understand the inclusion of climate change in the Secondary Education Geography Curriculum in Swaziland". Please help me by answering a few questions on this topic. Your answers will help us understand what learners already know about climate change education, as well as what kind of information they would like to learn and how they'd like to learn about it. You do not have to answer these questions if you don't want to. You can also stop answering at any time. If you decide to stop, no one will be angry or upset with you. It should take about ten minutes. There is no right or wrong answer. You should not write your name down; I just want to get your thoughts.

Part A: **Personal Information**

(Please tick in the appropriate box)

Gender: Male [ ] Female [ ]

Age: (please tick)

g) 18-25 [ ]
h) 26-30 [ ]
i) 31-35 [ ]
j) 36-40 [ ]
k) 41-45 [ ]
l) Above 45 [ ]

Qualification:

g) Diploma [ ]
h) B.A. +PGCSE [ ]

i) B.Ed [ ]
j) M.A. [ ]
k) M.Ed [ ]
l) Other, specify_____

Experience as Principal in the present school?

a) Less than 2 years [ ]
b) 2-5 years [ ]
c) 6-10 years [ ]
d) 11 -15 years [ ]
e) More than 15 years [ ]

Part B: School Information

1. How many students do you have in this school?
   A. Less than 300 [ ]
   B. 301-400 [ ]
   C. 401- 500 [ ]
   D. 501-600 [ ]
   E. More than 601 [ ]

2. How many teachers are in this school?
   A. Less than 20 [ ]
   B. 21- 30 [ ]
   C. 31- 40 [ ]
   D. 41- 50 [ ]
   E. More than 51 [ ]

3. Swaziland like any other country in the world is greatly affected by climate change what is your understanding of climate change?

   _____
   _____
   _____
   _____

4. Will you give me an example of a cause of climate change?

   _____
   ____

5. What are the effects of climate change to the school give **two**?

6. Do you think schools can play a role in mitigating the effects of climate change in the live hoods of communities?

   A. Yes [ ]
   B. No [ ]

7. If yes give an example

   _____

8. Do you know anything about climate change education?
   A. Yes [ ]
   B. No [ ]

9. The SGCSE Geography curriculum contains topics which can be used to integrate climate change education; from an administrative point of view do you think your Geography teachers real understand climate change education?
   A. Yes [ ]
   B. No [ ]
10. Can you briefly justify your answer for question 5.

    _____

    _____

11. Do you think it is important for the diverse subject areas to introduce climate change education for sustainable development across the curriculum?
    A. Yes [ ]
    B. No [ ]

12. How does the school control the wastefulness of school water by students?
    A. Students are sensitized about the importance of saving water. [ ]
    B. Students are provided with cups to get water from taps. [ ]
    C. School always punishes students who misuse water. [ ]

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Appendix G

Questionnaire for Senior Inspector of Geography

Climate Change education

Good day, my name is Mandla Dlamini. I'm a PhD student with the University of Pretoria. I'm conducting a research on this topic "How teachers and learners understand the inclusion of climate change in the Secondary Education Geography Curriculum in Swaziland". Please help me by answering a few questions on this topic. Your answers will help us understand what learners already know about climate change education, as well as what kind of information they would like to learn and how they'd like to learn about it. You do not have to answer these questions if you don't want to. You can also stop answering at any time. If you decide to stop, no one will be angry or upset with you. It should take about ten minutes. There is no right or wrong answers. I'm not even going to write your name down; I just want to get your thoughts. Would you like to participate?

Gender: Male [ ] Female [ ]

Age: (please tick)

A.18-25 [ ]

B 26-30 [ ]

C.31-35 [ ]

D.36-40 [ ]

E.41-45 [ ]

F.Above 45 [ ]

Qualification:

A. Diploma [ ]

B.B.A. +PGCSE [ ]

C.B.Ed [ ]

D .M.A. [ ]

E M.Ed [ ]

Other, specify_____

Experience as Senior Inspector?

A.Less than 2 years [ ]

B 2-5 years [ ]

C .6-10 years [ ]

D.11 -15 years [ ]

Part B: Information about Geography Curriculum

1 As the Senior Geography Inspector are you aware of climate change education?

A. Yes [ ]
B. No [ ]

2. Does the Geography Syllabus address CCE across the themes that are from Form 1-5?

A. Yes [ ]

B. No [ ]

3. Which specific themes cover CCE in Geography?

_____
_____
_____

_____

_____

4. Are the Geography Teachers in the country compelled by the syllabus to integrate CCE in their teaching?

A. Yes [ ]

B. No [ ]

5. Considering the number of topics that geography teachers are expected to teach, do you think CCE should be offered as a separate subject or integrated into the existing Geography syllabus?

A. Must be offered separate. [ ]

B. Must be integrated [ ]

6. With CCE as the main concern for reorienting curriculum in the world, do you have any plans to restructure the current Geography syllabus to integrate CCE?

A. Yes [ ]

B. No [ ]

7. If yes when is going to be implemented?

_____

_____

_____

8. Are the prescribed geography textbooks address CCE?

A. Yes [ ]

B. No [ ]

9. Have you ever had a workshop for Geography teachers on CCE?

A. Yes [ ]

B. No [ ]

10. Do you consider CCE as an important concept that should always be incorporated in Geography lessons?

A. Yes [ ]

B. No [ ]

11. If yes, why?

_____

_____

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Appendix H

Interview Schedule for FormV Geography Students Focus Group

Group details:

Number of students:_____Date:_____Time:_____

Climate Change education

In-Person Introduction:

Good day, my name is Mandla Dlamini. I'm a PhD student with the University of Pretoria. I'm conducting a research on this topic "How teachers and learners understand the inclusion of climate change in the Secondary Education Geography Curriculum in Swaziland". Please help me by answering a few questions on this topic. Your answers will help us understand what learners already know about climate change education, as well as what kind of information they would like to learn and how they'd like to learn about it. You do not have to answer these questions if you don't want to. You can also stop answering at any time. If you decide to stop, no one will be angry or upset with you. It should take about ten minutes. There is no right or wrong answers. I'm not even going to write your name down; I just want to get your thoughts. Would you like to participate?

Focus Group Questions.

1. What do you understand about the concept of climate change?
    - *If needed, will use prompts like "Can you tell me more about this concept"*
2. What comes into your mind when you hear the word global warming?

3. Do you think Swaziland is experiencing climate change?
4. Can you give an example of a cause of climate change.
5. How will climate change affect the livelihoods of Swazis?
6. What is your understanding of climate change education?
7. As Geography students, which topics do you think are more relevant to CCE?
8. As geography students in this school do you have an environmental club? If yes, what are major activities if the club.
9. With the understanding and knowledge you gain in Geography about the importance of CCE, do you participate and share information with members of you community?
10. What are the major environmental problems faced by your community?
11. What strategies can you apply in attempt to minimize these problems

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Appendix I

Questionnaire for Professionals-SEA/Inspector/Curriculum Designer

Climate Change education

Good day, my name is Mandla Dlamini. I'm a PhD student with the University of Pretoria. I'm conducting a research on this topic "How teachers and learners understand the inclusion of climate change in the Secondary Education Geography Curriculum in Swaziland". Please help me by answering a few questions on this topic. Your answers will help us understand what learners already know about climate change education, as well as what kind of information they would like to learn and how they'd like to learn about it. You do not have to answer these questions if you don't want to. You can also stop answering at any time. If you decide to stop, no one will be angry or upset with you. It should take about tweny minutes. There is no right or wrong answers. I just want to get your thoughts. Would you like to participate?

1. Date_____

2. Name of institution:_____

3.Name of officer:_____

4.The position held in the institution:_____

5. The main responsibilities of the officer:_____

6. Are you aware of Climate change education?

A. Yes [ ]
B. No [ ]

7. What is your understanding of CCE?

_____
_____
_____

8. Your organization is responsible for the formulation of environmental policies, of which sustainable development is one of the major issues that need to be observed by all sectors, do you have any policy on CCE?

A. Yes [ ]

B. No [ ]

9. If yes, who are the major stakeholders in formulation of the CCE policy?

_____
_____
_____
_____

10. What is the specific role of your organization in the implementation of CCE in Swaziland?

_____
_____
_____
_____

11. Are you able to reach out to schools for environmental activities?

A. Yes [ ]

B. No [ ]

12. If yes, what are the major activities you do in the schools?

_____
_____
_____
_____

13. Do you think all schools should have Environmental Clubs?

A. Yes [ ]
B. No [ ]

14. How best can schools integrate CCE in their curriculum?

_____
_____
_____

15. Have you ever had a meeting or workshop with teachers in schools in attempt to sensitize them about the importance of integrating CCE as a means to minimize environmental problems?

10. Yes [ ]
11. No [ ]

16. If yes, what are the strategies that have been put by your organization to ensure that CCE is integrated into the school curriculum?

_____
_____
_____

17. What are the future plans does your institution have to ensure that every school going child has some form of climate change education?

_____
_____
_____

18. Which subject do you think is ideal for the implementation of CCE in the country?

_____
_____