Constraints and contributing factors to implementing Climate Change Education as an emerging curriculum area at the basic education level in Cape Coast Metropolis, Ghana.

Michael Odoom

June 2020
Thesis for a MS-degree in Environment and Natural Resources
Faculty of Subject Teacher Education
Constraints and Contributing factors to Implementing Climate Change Education as an Emerging Curriculum area at the Basic Education level in Cape Coast Metropolis, Ghana.

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This thesis is 60 ECTS credits towards an M.S.-degree in the Environment and Natural Resources Programme.
Faculty of Subject Teacher Education,
University of Iceland, School of Education.

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Preface

This thesis is a 60 ECTS credits towards an M.S.-degree in the Environment and Natural Resources Programme. This is another milestone in my life, yet I believe it could not have been possible without certain selfless personalities in the whole process.

I would like to render my sincere appreciation to my supervisor Dr. Auður Pálsdóttir for her endless support and constructive comments throughout every stage of this study. I say thank you. I am immensely grateful, and I say God bless you for everything.

I would also like to extend my heartfelt appreciation to my mentor, Dr. Mariana Lucia Tamayo, I say thank you for your encouragement.

Now I say thank you to Cape Coast Metropolitan education director, Mr. Nkoom and the headteachers who opened their doors for me to interview their teachers. Teachers, I say thank you a lot for the immense information provided. I am most grateful to you all.

Finally, I say, thank you to my beloved wife, Helena Ampah and my son Larry James Odoom for standing firm behind me through all this time. May God bless you all.

This thesis was written solely by me, the undersigned. I have read and understood the University of Iceland Code of Ethics and have followed them to the best of my knowledge. I have correctly cited to all other works or previous work of my own, including, but not limited to, written works, figures, data or tables. I thank all who have worked with me and take full responsibility for any mistakes contained in this work.

Reykjavík, June 1st 2020

Michael Odoom
Abstract

Ghana adopted the United Nation’s 2030 Agenda and introduced a new educational curriculum in the September 2019/2020 academic year for primary schools to educate her citizens on climate change as Article 6 and 12 of UNFCCC demand. The present study sought to explore the constraints and contributing factors that primary school teachers encounter in implementing climate change education curriculum. The purpose of the study is to investigate the constraints and contributing factors the primary school teachers in Cape Coast Metropolis encounter when implementing the climate change education curriculum in a bid to identify the support the teachers required to support their work with CCE as an emerging curriculum is in basic education level in Ghana.

The study employed a qualitative research approach involving semi-structured interviews with 20 teachers from 10 randomly selected schools out of the 69 schools within the metropolis. One school was at least selected from each of the 6 circuits within the metropolis.

The results suggest that teachers limited understanding of the concept of climate change education, students parental background and the lack of teaching resources are the constraints the teachers encounter in implementing the curriculum. However, the establishment of a professional learning community (PLC), teachers’ positive attitude towards the curriculum and teachers general understanding of the focus of the curriculum, are the contributing factors facilitating the implementation of the curriculum.

Almost every teacher agreed that there should be training with regards to the tenets of climate change education to enable them to fully implement the curriculum as required. Key recommendations include that the PLC should be strengthened, essential teaching and learning resources are provided, resources persons with expertise in climate change education be invited to PLC sections to train teachers in the tenets of CCE, and CCE is factored in the initial teacher training courses.
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1 Introduction

The environment makes provision for the resources and energy required to meet the needs of humanity (Owusu et al., 2017) and therefore well to note that human sustainability depends on a healthy and well function environment (Roth, 1992, p. 10). One thing worth noting is that the continuous provision of ecosystem services by the environment to humankind depends on how the robustness the environment is. However, our behaviour towards the environment in the pursuit of our daily activities and the decisions we take affect the productivity of the natural environment either negatively or positively (Owusu et al., 2017). The uncontrolled use of natural resources – most at times resulting in depletion of the resources – for human and economic development and our negative attitudes towards environmental sustainability is increasingly and simultaneously resulting in global environmental challenges and weakening the robustness of the ecosystem - the very foundation for human existence on Earth – over the recent decades.

Climate change is an evident depicting that the earth system is in crisis. Climate change is a major threatening issue of our time which is redefining the earth system to the detriment of the human race. This can be the talk of as a consequent result from the uncontrolled use of natural resources and our negative attitudes towards the environment. Due to the repercussionous nature of climate change, it has become the most talked-about problem both in the local and international community and this can be seen through the recent flurry of conferences, international treaties and research we are witnessing today. The reports and the current catastrophes being experienced in sections of the globe are attributed to climate change hence makes it an overarching issue worth paying attention to. Climate change is a problem that requires global attention. Resolving climate change problems requires a concerted effort from both local and from a global perspective.

1.1 International emphasis on climate change

The international community through its agencies has always been drumming home the need to take climate change issues seriously. United Nations (UN) together with the World Meteorological Organization (WMO) put in place the Intergovernmental Panel on Climate Change (IPCC) in 1988 to serve as the hub of credible scientific information on climate change (Whitmarsh, 2005, p. 15). It was categorically confirmed through the release of the fifth assessment report by IPCC in 2013 that, climate change is non-fictional and anthropogenic activities are the major influential factors of the recent accelerated climate (United Nations, n.d.; IPCC, 2013, p. 15).
United Nations, a body made up of nations around the world has been spearheading in efforts to saving the planets from a tipping point. Being steadfast to its commitment to saving the world, borne out the United Nations Framework Conventions on Climate Change (UNFCCC), Kyoto Protocol and Paris Agreement as its legal instruments to bring the member nations in one accord to chart a common path to fighting climate change in local and global perspective (Bathke et al., 2014, p. 2; Congressional research service, 2020). In 1992, United Nations through the Earth Summit formed the UNFCCC with the sole aim of inhibiting the unhealthy anthropogenic activities which interfere effective functioning of the natural climate system as the first step in the global effort to combating climate change prevalence (United Nations, n.d.).

To further strengthen the effort in combating climate change, greenhouse gas emission reduction international treaty named the Kyoto Protocol was adopted in 1997 for developed member states of the United Nations. This adoption resulted from a launched negotiation aimed at strengthening the worldwide response to the climate change in Japan, Kyoto in 1995 (United Nation, n.d.). The premise based on which the developed countries were obliged to this treaty was the belief that they have the largest share in historical and current greenhouse gas emissions. The Protocol had its maiden commitment period, 2008 to 2012. However, its second commitment which began 2013 is yet to end in 2020.

Relentlessly, parties to the UNFCCC (2015) witnessed a landmark agreement, Paris Agreement, in Paris to expedite actions on how the effects of greenhouse gas emissions on the climate can be mitigated and the changes in climate can be adapted to. In this agreement, there was also a pledge to invest in ‘low carbon future’ and support the developing countries to build on their capacity to adjust to climate change mitigation and how its effect can be coped with (United Nations, n.d.). This act indicates how important the climate change menace is to the international community and has therefore gone a long way to help in deliberations in resolving the climate change crises in several ways. Through its discussions and stipulated articles, education was recognized as an efficient tool that could help address climate change and therefore call on the parties to consider using education in their capacity building (UNFCCC, 2015) to the promotion of knowledge and skill development on mitigation and adaption of the climate change. The stance of the international community in matters relating to climate change issues signifies how important it is to concert to bring the climate change menace under control.

1.2 In the context of Ghana

Ghana is a country in accord with the international community on matters concerning climate change. According to Tamakloe (2004), Ghana has long been protecting its environment from
abuse through legislation and Environmental Protection Agency (EPA) since its inception in 1994. However, the agency has its challenges that need to be addressed for effective functioning in controlling the overexploitation of Ghana’s diverse rich natural resources to contribute to solving the climate change crises.

The climate change influence on humanity is global, however, it is predicted that the developing countries, especially in Africa, will suffer more impact of these dreary crises than the developed countries. Ghana as a developing country in Africa stands at risk to suffer the impacts of climate change. The Ghana Government does foresee the potential challenges the climate change poses in undoing the attained millennium development goals and efforts towards sustainable development goals (Anderson, 2010, p. 3) and the economic implication to the Ghanaian economy and thereby work to incorporate climate policies into the national development plans (Dazé & Echeverría, 2016, p. 1). To counteract the anticipated climate change menace on the nation, the government of Ghana in 2006, began consultation with climate experts to develop a ten-year National Climate Change and Adaptation Strategy (NCCAS) policy for 2010–2020 to be integrated into national development (NCCAS, 2012, p. 3). According to NCCAS policy (2012, p. 2), Ghana’s interest in integrating climate change policy into her development plans in addition to her economic fragility has also been influenced by her commitment to UNFCCC as a party. This implies that Ghana’s National Climate Change Policy (NCCP) was prepared to react to the climate change crisis which requires a global concerted effort. The policy which was orchestrated within Ghana’s sustainable development priorities according to National Climate Change Policy (NCCP, 2013) gives a clear roadmap on how the challenges of the climate change crisis poses to the country’s socio-economic development could be addressed (NCCP, 2013, p. ix).

Stanturf et al. (2011, p. 36) noted that the general climate change policy development, coordination and implementation in Ghana is placed under various government agencies with different delegated responsibilities. As explained by Stanturf et al. (2011), Environment and Natural Resources Advisory Council (ENRAC) works at the Cabinet-level and liaises with the various ministries whom climate change issue may concern at a time. The EPA is an institution which works within the Ministry of Environment, Science and Technology (MEST) and coordinates and implements climate change policies taking into consideration national and international development priorities. In essence, all climate change activities in connection with UNFCCC and other United nation environmental conventions ratified by Ghana have been worked on under the auspices of EPA whilst the activities concerning preventing and minimizing of deforestation and degradation of the natural forest has been coordinated by the Ministry of Lands and Natural Resources (MLNR) (Stanturf et al., 2011).
With regards to these many activities concerning climate change in Ghana, in my opinion, Ghana should have been one of the countries with high climate change awareness level among its citizens and should have been far ahead of measures in alleviating climate change and adapting to its effects, yet findings of few studies on climate change awareness point to the opposite (Owolabi, et al., 2017).

Nonetheless, Ghana as a signatory to United Nations and one of the many countries which adopted the 2030 agenda and its associate 17 goals for a sustainable world, is not relenting on its effort to turn things around. In June 2018, Ghana announced for implementation of a new educational curriculum in September 2019/2020 academic year in primary schools to fulfil her obligation to educating her citizens on climate change issues through the mainstream education as has been stipulated in Paris agreement of UNFCCC. The content of this new curriculum as stated by the education minister, Mathew Opoku Prempeh, incorporates the 13th goal on Climate Action to initiate critical response to tackle climate change menace and its negative influence worldwide.

Now that the new pre-tertiary education curriculum incorporates the 13th goal to forestall climate change education with aim of improving upon learners’ climate change awareness, measures in climate change alleviation and strategies for coping with its effects, the invaluable roles of teachers become critical in this educational campaign. This implies that the primary implementors of the curriculum at the classroom level which happens to be the teachers need to have appropriate requisite skills in delivering environmental and climate change lessons in education for sustainable development (ESD) context to achieve the desired objective of the curriculum. This research work, therefore, sought to investigate into the constraints and contributing factors to implementing climate change education in cape Coast Metropolis as an emerging curriculum area in basic education level in Ghana with a fundamental aim of identifying how the teachers can be supported to implement the curriculum successfully.

1.3 The problem
A new kindergarten and primary education curriculum have just been rolled out which according to the education minister was designed to meet national and international development goals and to facilitate the development of foundational and lifelong skills. Ghana as a signatory to the United Nation positioned the curriculum’s framework in sustainable development goal 4 and also, incorporated into this new curriculum, the 13th goal on climate action of the sustainable development goals to promote and fulfil her commitment to the sustainable development (NaCCA, 2019a). This, according to Fullan (2007, p. 85) will consequently trigger an alteration in “instructional material and teaching beliefs” or understanding about the underlying principles of the curriculum and its application practices. The implementation phase of
the curriculum is critical because it serves as the vehicle to achieve the desired objective, hence places the teachers at a critical position as implementors of the curriculum in the classroom. In this view, teachers’ competence in delivering environmental and climate change lesson under education for sustainable development is paramount for successfully implementing and institutionalizing the climate change component and the curriculum as a whole. To help equip the teachers with competencies necessary for implementing the curriculum, the teachers were given a five day training course about the whole curriculum (Prempeh, 2019a).

However, considering the limited period in which the teachers were oriented towards the rolling out of the new curriculum, and the fact that education for sustainable development specifically not being part of teacher professional development in Ghana, teachers may not have adequate knowledge for successfully implementing and sustaining the curriculum in connection with climate change and the general curriculum under the tenets of education for sustainable development. A personal discussion the researcher had with a couple of teachers revealed that they have little understanding of the concept of CCE. It, therefore, becomes pertinent to study into the constraints and the contributing factors teachers in Cape Coast Metropolis encounter when implementing the curriculum in a bid to identify how the teachers can be supported to effectively implement and sustain the curriculum with regards to the climate change education component. Hence this study is sought to start to address this need.

1.4 The personal story behind the study

The pursuance of this thesis has been influenced by as part as my background as a teacher (through the observations I have made in my teaching career) and as part by been a student of environment and natural resources (through the courses I pursued, especially sustainable futures).

During my national service at Kwakudum a village in the central region of Ghana and later at Asuansi Technical Institute, I became keenly aware of how continuous professional support is important in one’s teaching career. At Kwakudum I observed most of the teachers were Middle school and Secondary school leavers who had not gone through any initial professional development necessary for the conduct of their duty as teachers. To make matters worse, these teachers were left alone to their faith to teach without being oriented towards their new profession nor given training support as they journey through their teaching profession. As a teacher, I have also witnessed a time where changes were made in Ghana’s basic education curriculum where teachers were not oriented towards those changes and even if they did, it was not throughout the whole country as far as I can remember. For instance, the restructuring of Pre-Technical Skills to Basic Design and Technology in 2010/2011 curriculum reformation took place without giving the teachers any in-service training concerning the change.
I feel these are issues which need to be taken seriously and addressed since it affects the quality of education delivery in school.

At Asuansi Technical Institute I became the head of Graphic Communication/Technical drawing Department, two years after my appointment. In the capacity of the head of the department, I had the chance to sometimes go round to monitor the department staffs’ punctuality and sometimes observed their classroom activities as my initiatives to maximize time efficiency and help improve students’ academic performance. It is within this monitoring exercises that I realized the need for training support for the department. This experience engendered my sharp interest in training support and queried myself for answers how the staffs of the department could be supported to help improve upon our knowledge and affect our students’ academic life effectively. Through approval from the headmaster, I, together with my staff members gathered data, and with the provision of the needed resources, we instituted a two-day refreshment course for ourselves which later became a routine in every reopening of the school term. This initiative helped boosting the confidence of the staff members’ lesson delivery and we started seeing some positive results in students learning.

The second part of the story emanated from a course I took as an Environment and Natural Resources student at the University of Iceland. Though I had a prior interest in environmental protection, I, however, developed so much interest in environmental protection and climate change when I took a sustainable future course during the second semester of my first year in the University of Iceland. This course dwells so much on empowering students how they can contribute to building a better world. I quite remember the last day of the course when the course coordinator (Professor Kristin Vala Rangsdottir) said to all of us: I hope you have gained something worthwhile from this course, go out there and use all the resources at your disposal and contribute to making the world sustainable. Her statement generated my passion to chart on a path of which I can contribute to building a sustainable world. Her admonishment together with my previous observations in Ghana education service hence has provided a starting point for the research presented here.

1.5 The aim of the study

Implementation of every curriculum comes along with its challenges yet; those challenges do not render the curriculum a failure when those challenges are identified and addressed on time. There is a saying that goes that, a problem known is a problem half solved. It, therefore, becomes important to identify the constraints and contributing factors that might be associated with the implementation of Ghana’s new basic education curriculum with regards to schools and the teachers’ capacity in implementing the new curriculum. This implies that we need information about how teacher understands the new curriculum in general, how they...
understand the concept of climate change education, how they perceive their capacities and roles concerning curriculum changes for climate change education, both in terms of subject content and teaching strategies, and finally the forms of individual and collective supports required by the teachers to assist their work with climate change education. The aim of the study, therefore, is to investigate into the constraints and contributing factors the primary school teachers in Cape Coast Metropolis encounter when implementing the climate change education as an emerging curriculum is in basic education level in Ghana.

1.6 Significance of the study
The study has several significances in education and policymakers in general. The study was designed to identify the constraints and contributing factors that primary school teachers in Cape Coast Metropolis may encounter when implementing the new curriculum with the sole aim of identifying how they can be supported with their work with CCE. Given this, the findings of this study may have great significance to policymakers. This could inform them of the strengths and the weaknesses in the implementation so that appropriate remedies are designed to arrest the situation. Thus, it can inform them of the training and development needs of teachers within the Cape Coast metropolis. This will serve as bases for them to sculpt out appropriate and effective training and professional development to support the in-service teachers to implement the curriculum effectively.

The study will inform and influence training education policy on the need to include education for sustainable development and climate change education in professional development in the initial teacher training schools.

The study will be in a better position to contribute to the limited literature on the awareness and perception of teachers in Cape Coast Metropolis and Ghana in general with regards to climate change and climate change education.

1.7 Organization of the study
The thesis has six chapters with chapter one introducing the background and rationale for the study. This chapter discusses the international emphasis on climate change and climate change in the context of Ghana. It also looks at the statement of the problem, aims and significance of the study to policy implication.

Chapter two explains the contextual framework of the study, i.e. the educational system in Ghana, its stakeholders and the newly issued curriculum for kindergarten and primary school education.

Chapter three of the study focuses on reviewing the literature that is related to the topic of sustainability education, a theory of educational change, curriculum implementation, the
concept of climate change and climate change education and the adequacy of Ghana’s new curriculum on climate change education for sustainable development.

The fourth chapter introduces research methods, aim and research questions, research design, the study area, sampling procedures and finally the ethical issues.

Chapter five presented the results and analysis from the interviews.

The final chapter, chapter six discusses the findings of the questions posed. Conclusions on the constraints and the factors influencing the implementation of the curriculum were drawn from the discussion and recommendations based on the conclusions were presented. This final chapter is followed by a list of references used in the thesis and the five appendices.
2 Contextual framework

2.1 The education system in Ghana

Ghana is a West African country which covers a land mass of 238,535 km$^2$. Ghana has a population of about 28.3 million. Ghana shares borders with three west african countries, i.e. at the east, west and north with Togo, Cote d’Ivoire and Burkina Faso, respectively. It is however, bordered to Atlantic Ocean in the south. Ghana gained independence from Britain in the year 1956 and was the first country in Sub-Saharan region to gain independence. Figure 1 shows map of Africa depicting Ghana.

![Map of Africa showing Ghana](image)

The education system in Ghana is under the political responsibility of Ghana’s ministry of education (MoE). The ministry regulates various agencies which include, Ghana education service (GES), the Ghana Library Board, the Bureau of Ghana languages, the Ghana Book Development Council, the National Service Secretariat, National Commission for UNESCO, National Council for Tertiary Education and National Accreditation Board. The national council for ter-
tiary education and national accreditation board are responsible for management and approval of courses and certification of higher education. However, the GES service mandatorily manages the pre-tertiary section of education in the country (GES, n.d.; Nudzor 2014, p. 6). The curriculum research and development section of GES deals with the development of curriculum and assessment of national curriculum. The Ghana ministry of education is represented by all the regional and all the metropolis/municipal/districts education offices to carry out its mandate (Nudzor, 2014).

Ghana uses two-six-three-three-four (2-6-3-3-4) structure of education system (NaCCA, 2019a, p. 6), though some authors fail to include the first two of kindergarten education in the structure (Adu-Gyamfi et al., 2016, p. 159). The two-six-three-three-four (2-6-3-3-4) structure as indicated in the literature means, two years kindergarten education which starts at age four, six years primary education (consisting of the lower primary and upper primary which is class one to class three and class four to class six respectively), three years in junior high school (JHS), three years in the senior high school (SHS) and four years higher education (bachelor’s degree).

However, there are other diploma or specialised courses offered at the higher education level of which the course duration might be less than four years. In the year 2000, the structure was changed from two-six-three-three-four (2-6-3-3-4) to two-six-three-four-four (2-6-3-4-4) by the then president, John Agyekum Kuffour, it was however changed back to six-three-three-four (2-6-3-3-4) in the year 2008 by president Evans Atta Mills when the country saw a change in government (Adu-Gyamfi et al., 2016, p. 159).

Usually, the first two-six-three (2-6-3) in the structure is referred to as basic education whilst the four-four (4-4) in the structure is secondary and tertiary education respectively (Bingab et al., 2016). However, the current educational reform combines basic education and secondary education to form basic education (NaCCA, 2019a, p. 7).

Figure 2 provides a visual representation of the structure of the education system in Ghana.
2.2 Educational change initiation in Ghana

Educational change as proposed by Fullan (2007) involves three main phases. The first phase, initiation which involves conception and preparation to the last step in rolling out the idea of the change can be started by any of the stakeholders or the agent of change as termed by Fullan in the educational change process. However, as in the case of Ghana, it has always been the case of the government. The initiation stage as in the case of the present study can be referred to as when the cabinet ministers anticipated the need for change, initial consultations of experts, development and eventual approval by the parliament for implementation. This was later followed by awareness creation in the regional, district education directorates and the general public domain. Training of experts including regional, municipal/metropolis/districts education officials and teachers are also done at this stage to facilitate the implementation of the curriculum (Prempeh, 2019a).

Numerous educational reforms have been initiated and implemented in Ghana since the country attained its independence in 1957 and it has always been initiated by the government.
of the day who saw the need to change the educational system to suit the nations development agenda (Fullan, 2007, p. 88). For example, 1961 initiation by Dr Kwame Nkrumah (first president of Ghana) (Act 87); 1974 educational reforms by Ignatius Kutu Acheampong (the then president); 1987 educational reforms by Flt. Lt Jerry John Rawlings (the then president), 2007 educational reforms by John Agyekum Kuffour (the then president) were the changes made by the respective government at the time when the need to change to reflect on the national agender were identified (Adu-Gyamfi et al., 2016, p. 159). These reforms began with the general conception of the idea for the need to effect changes in the education system to fit in to current national and international aspirations (Fullan, 2007, p. 88) and it normally resides in the government in the case of Ghana as literature on the history of education in Ghana demonstrates (Adu-Gyamfi et al., 2016, p. 159). Such conceptions of need for educations by governments are normally necessitated based on findings of studies that, the particular education policy being practised is ineffective or due to its failure or recognition of the policy being less useful (Nudzor, 2014, p. 5).

Though the general public occasionally does talk of the failure of the education system in performing its core mandate, however, as expatiated above, curriculum initiation has always been political decision (Mutaka, 2012), which were guided by high professional experts in the field of education in government and or Curriculum Advisory Committee comprising of professionals, the clergy and other groups of concerned stakeholders. However, Fullan (2007, p. 67) notifies that, the concept of initiation is left open to the question of who initiates a change as teachers may or may not be critically involved in the decision to proceed on a change in the educational system. The next section of the discussion will look at the new kindergarten and primary school curriculum.

2.3 Stakeholders and their roles in curriculum implementation

The usual practice in curriculum development involves several stakeholders as well as its implementation. The development process more recently involves public inputs through consultations and discussions with policymakers, curriculum experts, practitioners and on a larger sense the society (UNESCO, 2009). The curriculum implementation process in Ghana involves four main levels in a hierarchical structure: the government, regional, municipal/district and at the school level (Nudzor, 2014, p. 5).

2.3.1 Government/Ministry of education

The government carries out educational policy implementations role through the Ministry of Education (MoE) headed by the education minister who sees to and reports on all education issues to the president. The MoE under powers of the government formulates, plans, moni-
tors, evaluates and coordinates all educational policies in the country. Budgeting and coordinating duties of educational policies are also performed by MoE. Thus, every nationwide activity in the education sector takes place under the auspices of MoE (Nudzor, 2014, p. 6). The MoE has the power of which initiating and seeing to it that initiated education policy comes into fruition. The MoE houses different units with different responsibilities for the effective running of educational matters in Ghana.

The Tertiary level education is managed by a Governing Council whilst GES headed by the director-general of education manages education issues at the Pre-tertiary level. GES is the entity charged with legal responsibility of implementing all education curriculum at the Basic and Secondary level (GES, n.d.; Nudzor, 2014, p. 6). GES carries out its mandate of implementing education policies through the regional directors, mission schools’ general managers with their regional managers, the municipal/district education directors, headmasters and classroom teachers in private and public schools (Nudzor, 2014).

2.3.2 Regional directors of education

In each region in Ghana, the regional directorate of education headed by the regional director is charged with the responsibility of implementing educational policies introduced by the MoE throughout the region. As explained by Nudzor (2014), the regional director of education has the responsibility of attending to every issue concerning education under his jurisdiction and as result collaborates with the municipal/district education directors and general managers responsible for mission schools with regards to the introduction of any national curriculum. The regional director reports to the director-general of education. The regional education director, from the government, makes available financial and educational resources including human resources needed for curriculum implementation to all the municipals/districts within his/her boundary (Nudzor, 2014, p. 6).

2.3.3 The district director of education

The implementation of curriculum or education policy within every district is mandated by the education directorate in the district with the District Director of Education (DDE) as the head. The DDE oversees all issues concerning education within the district. The DDE assisted by other officials within the directorate has the responsibility of implementing education policies introduced by the government and any other GES programs within the district. The DDE accounts to the Director general of education through RDE. DDE attends to all issues concerning education, however, in the realms of curriculum implementation, DDE supervises and monitors the implementation of the curriculum in schools, disseminate information with regards to curriculum implementation to headteachers and teachers, organizes educational training for both
the headteachers and teachers, provides resources needed for implementation of the curriculum (Nudzor, 2014, p. 6). Representing the government at the district level, they monitor and demand accountability through circuit supervisors and inspectorate teams, provide support to their staffs and the headteachers and teachers in the various schools under their jurisdiction.

2.4 Ghana’s new kindergarten and primary school education curriculum

Education is globally acknowledged as the ground for civilization and development and as such, every country strives to improve upon its education system to meet its national and international goals. On 25\textsuperscript{th} June 2019, Dr Mathew Owusu Prempeh, the Ghana education minister, in a press release, stated that starting from September 2019 (the 2019/2020 academic year), a new Kindergarten and Primary School Curriculum will be introduced to all schools. This marked a significant change from the current curriculum in use in Ghana. According to Fullan (2007) and his theory of change all stakeholder of schools must be provided with all important information right at the beginning of the change implementation. This must also include ample advocacy from the central stakeholders to the regional and district levels, creating proper awareness amongst the citizens. All these were done according to the minister of education before the new curriculum was put to practice and thus meets the criteria presented in the theory of change by Fullan (2007).

This new curriculum, according to Prempeh is designed and orchestrated to meet the new and long term national and international development goals and to facilitate the development of foundational and lifelong skills with the sole aim of accentuating pupils critical Core Competencies. Given Prempeh (2019a) statement above, it is apparent that the new curriculum touches on the development of pupils’ knowledge and skills on environmental and climate change being part of the 17 Goals for Sustainable Development. The concept of sustainable development demands identification and resolution of factors associated paucity of information regarding the climatic change in Ghana. Several authors have indicated that there is little education on how living responsibly can contribute to a safe environment with everyone free from panic on the occurrence of a natural disaster. It is notable that starting from September 2019, Ghana Education Service has put in place adequate effort at kick-starting extensive creation of public awareness on living responsibly to forestall the negative effect of climate. Prempeh (2019b) indicated that the new curriculum will commence extensive education on climate change at the basic level so that as these children grow, they will be responsible citizens fully aware of the impact of damaging the environment through a lifestyle that engenders pollution of the environment.
This also means at the basic level children will be sensitized on why sand excavating at the beach, illegal mining, deforestation, littering the ground with food waste, or other things such as take-away nylon, could be detrimental to everyone within the society. Moreover, children should also be aware that they can greatly contribute to the intense discourse on climate change raging around the world. They can learn much from Thunberg (2019) a Swedish young girl, who sets out with her father to the United States for a conference on Climate Change. Among other things, she stated that her goal is to do everything she could, to tackle climate change which she feels is a “very big problem”. However, certain countries and individuals claim that people are not committed to climate change initiatives. Some countries are apathetic to the whole concept and have withdrawn from the treaties on climate change. For instance, the United States which contributes greatly to cause climate change due to their coal industries has withdrawn accusing that the treaty favours other countries such as China and implying that it is an attempt to cripple the economy of United States (Climate Analytics, 2017).

During the school year of 2019–2020 the new curriculum has been at its implementation phase. However, at the initiation stage which involves extensive preparation for the new curriculum seems to have been well executed. Such preparation involves in-depth and extensive collaboration between the national council for curriculum development and assessment (NCCDA) and GES with the sole aim of formulating a roadmap or methodology for the implementation of the curriculum in the next academic year. Such preparation also entails the creation of needed awareness regarding the change to all stakeholders in education, especially at the grassroots level.

Prempeh (2019b) explicated that preparation had been made because 186 master trainers (national level) were selected and trained by NaCCA within 2 months. At the regional level, 3900 trainers were selected and given training with the sole objective of training other stakeholders within their region. At the grassroots, all classroom teachers and another relevant agent of change within the school system are the present receiving training till the end of August 2019.

This preparation is underpinned by Fullan (2007) theory of change that at the initiation phase, appropriate communication between all stakeholders in education should be established so that ample awareness and training can be raised to facilitate the second phase of educational change – Implementation. However, this seems to be the opposite in the current curriculum implementation. In Figure 4, it was shown that part of the initiation process requires professional training of all the stakeholders to fast track the adoption of the change in curriculum.
The level of awareness and knowledge of each of the stakeholders regarding the new curriculum is paramount, especially classroom teachers, who are at the forefront of disseminating or implementing a vital component of the curriculum to students. Since the level of teacher’s knowledge and understanding of the new curriculum will aid both the implementation and Institutionalization phases of Fullan’s theory, it is pertinent to ascertain teachers’ understanding regarding climate change and climate change education which in recent time has become an invaluable aspect of education.

NaCCA (2019a) indicates, the curriculum is structured to meet the 13th goal on environmental and climate change. This means the teachers need to receive ample training on environmental and climate change within the framework of sustainable development goals. Such knowledge will facilitate teachers’ ability to adequately develop students’ skills in effectively promoting and supporting critical actions to forestall climate change and maintain a sustainable approach to the environment for a better tomorrow. Much is required of Ghana Education Service to raise appropriate awareness and train teachers so that the next phases of implementing and sustaining the curriculum on environmental and climate change issues will be enhanced. In other words, thorough and adequate efforts at the initiation stage will spell success at the implementation and continuation stages. As discussed in the implementation stage (see pages 45 & 46), the implementors need to be monitored and offered the required support to implement the curriculum as required. It is therefore as monitoring exercise important to find out how teachers understand the curriculum to identify how they can be supported in implementing the curriculum, both in terms of content and teaching methods.

At this juncture, it is pertinent to inquire how adequately the new curriculum deals with Education for sustainable development (ESD) and climate change, hence the next section of the review focuses on the new curriculum, “Our World Our People” (OWOP).

2.5 Adequacy of Ghana National Curriculum on ESD and Climate change
A careful study of the new curriculum for Our World and Our People Curriculum for Primary Schools, according to NaCCA (2019a), revealed that the main aim of the curriculum in this area of study was to nurture learners into honest, creative and responsible citizens. It is expected that learners will be exposed to pertinent areas in the formulated curriculum to imbue in them, positive attitudes, values and requisite skills to address certain social challenges involving climate change and environmental degradation. Through the curriculum, learners will also be helped to develop skills to address unhealthy living and non-compliance of civic responsibilities.
The new curriculum will help learners explore their immediate world, their homes and other parts of the world facilitating their ability to recognize how the entire world is interconnected and their critical role in it. It is also expected that the curriculum will help learners develop pertinent skills in reading, creativity, writing and arithmetic via thematic and creative methods of learning.

The philosophy of the new curriculum (NaCCA, 2019c, p. vi) is to imbue learners with competencies in making an independent and healthy decision in connection with their personal development and sensitive awareness of the people within their immediate environment and the society at large. When properly implemented, the new curriculum will equip learners with the needed impetus to take responsibility for the climate and the environment. The curriculum will impress on learners’ mind that there are other human beings around them whom they are required to relate within a loving and kind manner through responsible living.

The new curriculum for Our World and Our People (NaCCA, 2019b, p. vi), succinctly summarized what learners would acquire when the curriculum is properly implemented by teachers as follows:

1. “critical thinking and problem-solving skills to be proficient in comparing and contrasting, analysing, evaluating and to be able to apply geographical knowledge with little or no supervision”
2. “creative thinking skills to be able to reconstruct important information confidently”
3. “digital literacy skills to be able to use IT tools and resources efficiently for investigations and project works”
4. “effective communication skills to be able to share information at various levels of interaction”
5. “values to live as global citizens capable of learning about other people and cultures of the world”.

(NTCA, 2019b, p. iv)

In the new curriculum (page vii), teachers are supposed to effectively implement the stipulated arrangements of classroom activities and assessments by taking of the following opportunities:

- “adopt thematic and creative pedagogic approaches such as talk for learning, project-based learning, games, modelling, questioning, songs, storytelling and role-play necessary for achieving learner-centred classrooms”.
- “nurture and develop learners into creative, honest and responsible citizens”.
- “provide learning situations that will engender development of the learners’ skills in the 4Rs – Reading, cReativity, wRiting and aRithmetic – through thematic and creative
approaches to learning. Learning and learning progression is central to the Our World and Our People curriculum”.

- “adopt collaborative approaches to lesson preparation within and across disciplines and grade levels to develop communities of OWOP learners”.
- “use various methods simultaneously to build dossier systematically on learners’ understanding and ability to help guide the teaching and learning of OWOP”.
- “Put necessary arrangements in place to provide feedback to both learners and parents.”

(NACCA, 2019b, p. v)

A closer look of curriculum reveals that the curriculum lends credence to the principles of education for sustainable development which encompasses “social learning, empowerment of communities and citizens, engagement in societal key issues such as human rights, poverty reduction, sustainable livelihoods, environmental education and gender equality and support changes in behaviour to enhance the creation of a more sustainable future” (Anderson, 2012, p. 191). The curriculum aims at filling the students with knowledge of their physical world and surroundings alongside an understanding of several concepts in nature. Critically analysing, the curriculum, brings into the discourse the kind of education Sterling (2001) advocates for. Thus, education should influence feelings, attitude, emotions, appreciation, ideals and values and, it should foster inquisitiveness or earnest desire to acquire knowledge via the application of what is learnt to the real world (Sterling, 2001). This tally with NACCA (2019a) that environmental and climate change studies are designed to imbue in students with requisite skills, improve the standard of living and fast track technological and socio-economic growth in Ghana. Most importantly, the subject is designed to equip learners in the needed skills for responsible living cognizant of the physical world around them as well as their interrelatedness to other human beings, thus making them a global citizen.

NACCA (2019a) expatiates the use of creative approaches such as role play, inquiry and investigation, storytelling, games and talk for learning in delivering the curriculum. This implies an environmental and climate change studies teacher should be adept at facilitating knowledge construction. One paramount tool in teaching practice, according to Eshun and Mensah (2013) and Sterling (2001) that could promote critical thinking is the use of thought-provoking questions. Thus, question that strikes a responsive chord from learners. Such questions should seeks to develop the learner's view of the world from a holistic perspective.

Scrupulous consideration of propositions from Sterling’s Sustainable education, the environmental and climate change studies’ teacher will facilitate his or her ability to adopt an effective pedagogical approach to influence implementing the new curriculum effectively.
Considering the various aspects of the new curriculum on environmental and climate change studies encapsulated in the Our World and Our People, along with its focus and orientation as designed by the NaCCA under the supervision of GES, revealed that the strategies, approaches and assessment techniques stipulated by the MoE effectively address the affective domain. The curriculum follows a top-down approach so that there can be a gradual but progressive development of relevant topics from the Primary to the Junior High School. The curriculum’s cardinal focus is to prepare the learners as good citizens who comprehend the environment they live in, appreciate Ghanaian culture and way of life, problem and strength of the Ghanaian society, its values, hopes and aspirations as well as appreciate other cultures around the world so that they can grow up as responsible adults and in effect become a global citizen (NaCCA, 2019a). The rationale behind the curriculum is to speed up the rate of personal and collective competencies in environmental and climate issues, national growth and citizenry education.

Hence, several sections of the curriculum gave much attention to knowledge, skills, values and attitudes acquisition which falls under the three domains of learning were captured. It was clearly shown that the subject is integrative and comprises several subjects such as sociology, environmental and climate change studies, psychology, economics, and civic education. In effect, the new curriculum, according to Eshun (2013) and NaCCA (2019a) is adequate to provide learners with requisite skills and knowledge on environmental and climate change issues. Prempeh (2019b) and NaCCA (2019a) indicated that the curriculum was designed with an emphasis on students’ needs of developing into a responsible citizen, equipped with a positive attitude and critical thinking relevant to fast-tracking both national and international growth and sustainable development. However, what remains as a puzzle is the ability of the teachers to deliver the curriculum in a framework of reference to education for sustainable development as intended due to the minimal training and professional development with regards to this curriculum. This makes it important to find out how the teachers understand the new curriculum to enhance its proper implementation. Having discussed what is entailed in the new curriculum with regard to its content in this section, it is pertinent to discuss the differences between the new curriculum and old curriculum. Hence the next section of the discussion is dedicated to looking at the differences between these two curricula.

2.6 Differences between the new curriculum and the old curriculum

In September 2019/2020 academic year, a new curriculum was issued in Ghana (NaCCA, 2019a). The old curriculum according to NaCCA, is an objective-based type of curriculum design model which is defined by the various subject syllabuses. The objectives of the curriculum are spelt out in each syllabus. The activity-based teaching approach is emphasized as a mode
of delivery for the curriculum, however, according to NaCCA, upon implementation of the curriculum, the classroom activities or practices often turned out to be quite teacher-centred. So much emphasis was placed on the product of learning than the process of learning and therefore encouraged rote learning. Learners cognitive competence and personal qualities and social skills development necessary for becoming competent and responsible citizen became less concern with regards to the old curriculum (NaCCA, 2019a, p. 14).

Unlike the old curriculum, the new curriculum is a performance standard-based curriculum design model and it emphasizes on the holistic development of the child’s core competencies (NaCCA, 2019a). It has as its core four skills development: Reading, writing, creativity and arithmetic (4R). The delivery approach in the new curriculum is much focused on the child and hence placing the child at the centre of teaching and learning processes (NaCCA, 2019a, p. 2). The new curriculum tasks teachers to create a learning atmosphere in the classrooms that solely focus on the holistic development of the child through reading, writing, creativity and arithmetic. Unlike the old curriculum where the content and structure on the curriculum placed so much emphasis on the passing of examinations, the new curriculum shifts from that ideology to developing key competencies of the child necessary for lifelong learning. As implementation principles the new curriculum shifts post form passing of examinations to the building of character, nurturing values, raising literates who are confident in themselves and engaged citizens with critical thinking capabilities (NaCCA, 2019a, p. 14).

As a guiding principle for development, both the old and the new curriculum make use of the 1992 constitution and the Education Acts, however, the new curriculum further includes the United Nations (UN) Sustainable Development Goals (SDGs) and UNESCO Education 2030 Framework for Action as its guiding principles for its development (NaCCA, 2019a, p. 9–10). The new curriculum is built on UN’s SDGs which incorporate climate change education and delivery of education to the citizenry in the framework of education for sustainable development.

The new curriculum gives some level of autonomy and flexibility for individual schools in implementing the curriculum. Unlike the old curriculum where the implementors have little room to operate, the new curriculum concerning ESD (UNESCO, 2005, p. 20; Pálsdóttir, 2014, p. 33) require the individual schools or the community schools to implement the curriculum within their local conditions. This includes taking into consideration the aim, vision and the philosophy of the curriculum. The curriculum encourages the incorporation of the priorities of the community in which the schools are situated into the curriculum whilst meeting the larger aim, vision and the philosophy of the curriculum (NaCCA, 2019a, pp. 1, 25). This implies that teachers must be competent enough to select relevant information within the topical area and relevant teaching approach to achieve the proper implementation of the curriculum.
There is an emphasis on inclusive and diversity education in the new curriculum. The right of every child in equal access to quality education is mentioned as one of the guiding principles for implementation. The curriculum admonishes teachers to include every child in the class in lesson delivery. They are supposed to use different teaching and learning style to get the learners involved in lessons by instance linking the learning process to the child’s background, involving learners in the selection and organisation of learning experiences, aligning learning to the child’s ability (NaCCA, 2019a, p. 24).

In structure-wise, the old curriculum (syllabus) is structured into five columns on top of it is the section of the subject and general objectives of that subject section to be taught. These five columns encompass unit, specific objectives, content, teaching and learning activity and evaluation. The unit column covers divisions within various topics to be treated in a linear structure. The specific objective column spells out the specific objectives to be achieved for each unit. The third column, content, exhibits selected information necessary in teaching each unit whilst the fourth and the fifth columns covers the teaching activities and the evaluation respectively (MoE, 2012, p. 1).

However, the new curriculum has terminologies: Strands and Sub-strands written on top, beneath it are four columns. The four columns cover the content standards, indicators, Exemplars and Core Competencies and specific practices (NaCCA, 2019b, p. 21; NaCCA 2019c, p. 2). The strands define the broad areas/sections of the subject content to be covered in studies whilst the sub-strands deal with the topics each strand encompasses within which the content is organised. The content standards column specifies a pre-determined level of knowledge, skill and/or attitude that a learner needs to attain after going through required experiences.

The content standard comes with indicators with which the learner needs to exhibit in each grade level to affirm the attainment of expected standard in the second column. The exemplars column explains the expected outcome of an indicator and inexhaustive suggestions on the teaching activities that can be used in delivering the curriculum. Thus, teachers are not limited to these suggestions but should be innovative as much as possible in delivering the curriculum (NaCCA, 2019a, p. 21). However, the Core Competency column gives the competencies to be developed in the learner after going through the learning experiences (NaCCA, 2019b, p. 2).

However, looking at these terms holds meanings parallel to the terms used in the old curriculum. Only that these terms give an open space for many activities to fit in.

2.7 Summary
This chapter has provided a brief background of Ghana, its educational system and a review of the just introduced curriculum. It was noticed from the review that educational change in
Ghana has always been influenced by the political leaders rather than the citizens. However, the citizens are represented by the parliamentarians and the clergy and other non-governmental organisations (NGO’s) at the initiation stage of the curriculum change as these groups are consulted during the planning stage.

Ghana’s new curriculum on “Our World and Our People”, which encapsulates environmental and climate change education at the basic education level, was thoroughly reviewed concerning its adequacy and relevance to the objectives of education for sustainable development and climate change education. It was seen from the review that the curriculum adequately lent credence to educational sustainable development.
3 Literature Review

This part of the study reviews the literature and theoretical approaches relevant to this study. It starts with an introduction to the concepts of sustainability, sustainable development and education that enhances such development. Then the concept of climate change education was explained and put into context of transformative learning model and theory of change. Then the implementation of the curriculum was explained and factors influencing such implementation were reviewed. Also, issues of professional development and professional learning community were explicated. Then, the concept of Climate change education, its meaning and content, required teaching methods and teaching and learning resources were presented. These were put into context of teachers knowledge, their perception of climate change and the sources of information teachers have access to. This chapter is concluded with a chapter summary.

3.1 The concept of sustainability and sustainable development

Sustainable development (SD) concept underpins education on climate change focusing on a basic educational level with increased emphasis on creating awareness of these tender minds on the relevance of contributing to a clean and enabling environment in their little way. Sustainable development is a complex phenomenon which deals with issues affecting the sustainability of the planet. It is known to have no universal model for its application. Though scholars and practitioners agree on the principles of sustainability, however, various approaches are employed in achieving the required goals based on the context, problem and priorities (Pálsdóttir, 2014, p. 33). Thus, the principle of SD does not follow a top-down procedure in its application. It is based on individual community or country needs which works it out to fit into the acceptable norm of SD. In literature, sustainability is sometimes used synonymously to sustainable development, nonetheless, a thin line can be drawn between sustainability and sustainable development.

Sustainability is the state where humanity lives within the boundaries of the Earth’s regenerating capacity. However, this can only occur through the application of prudent strategies. Sustainability often represents the long-term goal to be achieved from the processes of sustainable development (prudent strategies). Sustainability is a way of thinking and putting the future into the perspective of achieving harmony or equilibrium state between – three dimensions normally refer to as the pillars of sustainability or sustainable development – environmental, societal and economic factors to advance human wellbeing (UNESCO, n.d).

The concern of sustainability is about achieving balance or equilibrium among various systems through sustainable development (Pálsdóttir, 2014, p. 33). Newman (as cited in
Karuppanna & Sivam, 2009, p. 2) also sees sustainability as a worldwide process which results in the creation of a future capable of supporting humanity through balancing simultaneously the three pillars of sustainable development.

Sustainable development has the goal of attaining sustainability of the earth systems, and as such sustainable development represents the various processes and roadmap employed to achieve this goal (Pálsdóttir, 2014, p. 33). Thus, the means of sustainability is sustainable development.

UNESCO (2005) recommends that the goals, emphasis and roadmaps towards sustainability should be locally defined to reflect the conditions and the culture of a given community whilst taking into global consideration a broader picture. This emphasis the assertion of sustainable development having no universal models and achievement of its goal basing on the context, problem and priorities.

Choguill (2007) noted that, whichever stance sustainable development is assumed, it is developmental practices which take into consideration of meeting the needs of the present-day generation devoid of actions that can limit the capacity of the generation yet unborn meeting their developmental expectations (Karuppanna & Sivam, 2009, p. 2). Choguill’s explanation takes inspirations from the definition of Our Common Future’s definition otherwise called Brundtland Report, (Choguill, 2007; WCED, 1987). WCED (1987) emphasized on application of developmental strategies which satisfy the aspirations of the current generation without sacrificing on the abilities of the yet unborn to satisfy their aspirations. In essence, Brundtland report advocates for the need to the application of system thinking by balancing the three factors – which normally refer to as the pillars of sustainable development: environmental, social and economic factors – in development.

According to Choguill (2007, p. 144), the emergence of sustainable development concept was initially to deal with macroeconomics, however, its relevancy in the application has recently crept into human development especially in areas of climate change issues.

Scrutinizing the definitions of the concept now reveals its application to issues of all human endeavour taking into consideration how environmental crises can be minimized to make it conducive for human sustenance. Thus, it plies on concertizing humanity on their influence on the natural environment and the need to live apt life concerning the earth to forestall human-induced disasters for good of all. Sustainable development is now considered in the perspective of educating people on living in harmony through communal responsibilities, respect to rule of law and prudent economic activities at the local level (UNESCO, 2012). In essence sustainable development also concerns about encouraging everyone especially from the grass-roots to live responsibly to create an enabling environment via reduction of pollution, support of initiatives for clamping down climate change menace and sensitization of the general public
on why climate change could mar human existence. Deducting from the explanations, it implies that, the teacher or tutor should not only be concerned about educating pupils to know about climate change and how it affects the economy, human life and later existence of mankind as an aspect of education in sustainable development. There is also a need to appeal to the conscience of these children and their friends in inquiring whether they are living social and psychological satisfactory life to other people within their community. The students need to be given learning situations which provoke their conscience to keenly consider on their actions towards the environment and their neighbours whether it encourages or contribute positively to the maintenance of the earth and peaceful living with their neighbours. However, stakeholders both in an educational setting and in the political arena need to see to it that result-oriented policies are implemented to curtail activities abusive to the environment.

3.2 Concept of sustainability and education

Given the increasing complexity of sustainability-related issues, the interest of incorporating sustainability across all the levels in education sector keeps growing, incorporating the topic of sustainability across all major and research areas (Hopkinson & James, 2010, p. 366). In agreement to Hopkinson and James (2010) assertion, Pálsdóttir (2014, pp. 36–37) gives evidence on the integration of sustainability education in the national curricula of European countries. Interestingly there is a continuous debate about what the concept means, and the connected terms normally used to represent the kind of education of which it centres on and for the sustainability of the environment, social and economic set up (Taylor et al., 2019, p. 103). However, all the conceptual goals aim at sustainability attainment in environmental, social and economic set up of the society and therefore agree on the basic principles of sustainability (Pálsdóttir, 2014, p. 36).

Sustainability in education emerged through the conceptual emphasis on environmental education where the attention was drawn to the human impact on the natural environment and uncontrolled use of the natural capital and the need to protect ecological systems through education (Pálsdóttir, 2014, p. 33; Taylor et. al., 2019). Within sustainability and education literature, it is common to come across concepts; education for sustainable development, education for sustainability, sustainability education and sustainable education which are used synonymously. Pálsdóttir (2014), explains that the scholars who normally use the term sustainability education are those who do not prefer to be using education for sustainable development but concur to sustainable education concept by Sterling (Pálsdóttir, 2014, p.36).

Three categories of terms associated with Education for Sustainable Development can also be identified in Chalkley et al. (2010, p. 103) and these are Education about sustainability, Education for sustainability and Education as sustainability. According to Chalkley et al. (2010),
education about sustainability involves knowledge awareness creation with regards to Sustainability whilst Education for Sustainability deals with equipping students with understanding of issues, expertise, and values to effect positive change in our day to day activities. Education as sustainability is a learning process which emphasizes addressing issues in cognizance of how they are interdependent, thinking of how they are interconnected, democratic practices, citizenship, different cultural understanding, and acquisition of knowledge related to different study fields.

Sterling (2009, p. 111) distinguishes his concept of sustainable education from how education for sustainable development process takes place. In his insightful exposition, Sterling (2009, pp. 115–116) delineate sustainable education as being broad, deep and to a greater extent, a redefined form of education distinct from education for sustainable development. Sterling (2009) argue that, since the UN conference in Stockholm 1972, education has continuously been echoed as the best tool to address environmental and development crises, yet unsustainability of the earth systems keeps accentuating to a critical point. This implies education has not contributed so much in addressing these crises if any as purported. He further claimed that formal education in some other way contributes to the unsustainability problem. In his view, there is a need for the education system to be re-oriented. Sterling (2001, p. 14) proposed sustainable education as the needful education for the world. A proposed paradigm changes in education delivery which incorporates both the principles of humanism and the value of ecosystem services. Sterling (2001, p. 22) defines sustainable education as

a change of educational culture, one which develops and embodies the theory and practice of sustainability in a way which is critically aware. It is, therefore, a transformative paradigm which values, sustains and realises the human potential to the need to attain and sustain social, economic and ecological well-being, recognising that they must be part of the same dynamic. (Sterling, 2001, p. 22)

From the definition above, he proposes a holistic shift in the educational system for the type which grooms and incorporates principles and practices of sustainability. Thus the type of education which seek to transform an individual in equipping them with critical thinking to reflect on the interdependent relations of humanity with the earth systems and the earth systems themselves hence the need to achieve and maintain, socioeconomic and healthy ecological systems taking them as part of the whole system.

Sterling (2001) expatiates that the current forms of education are first-order learning which does not question the basic values hence being adaptive, but the concept of sustainable education goes beyond first-order learning to incorporate second and third-order learning. It
is further explained that sustainable education deals with critically reflective learning where assumptions underpinning the first-order learning are examined, using transformational learning principles which allows one to assume different perspective and patterns. It engenders creativity, conscience awakening and viewing the world in different perspectives (Sterling, 2001, p. 15). It is clear from his expositions that, his sustainable education concept is deeper and has the prospect to result in transformative education products relevant to the current study. Having known what sustainability and sustainable education concept concern with, the next attention is turns the attention to the concept of climate change.

3.3 Concept of Climate Change and Causes

Though there are numbers of definitions with regards to climate change in literature yet the commonly used is the one that captures the “long-term change in the earth’s climate” particularly resulting from the increment of the earth’s surface average temperature. This definition forms the basis of the global debate surrounding the need to avoid increment of the earth’s temperature to a certain degree. Climate change is alteration in the status of the climate which culminate from an increase in temperature and manifests in “the mean and or variability of its property lasting for decades” (IPCC, 2012, p. 557; Shanahan et al., 2013, p. 14). Unlike weather which is the short-term (hours, days, or weeks) atmospheric conditions as in temperature, precipitation, humidity, cloudiness, wind and air pressure, climate change is long-term in nature lasting for decades (Bathke et al., 2014, p. 3; Shepardson & Hirsch, 2019).

According to Ekphoh and Ekphoh (2011, p. 106), climate change is out of normal variation in the earth’s climate which occurs over a longer period. These definitions imply that change must occur in the global climate and the change must last for a longer period for it to fit to be described as a climate change. Climate change is a phenomenon encompasses various environmental changes having different causes and effect. It occurs through either natural process or as a result of persistent human activities which result in the changes in the composition of the atmosphere or land use (IPCC, 2012, p. 557). Thus, climate change occurs in regional or global climate either from human activities or natural forcing leading to deviation in the ordinary weather conditions for a longer period not less than decades.

The climate is shaped by internal and external forcing. The internal forcing occurs through the natural process within the climate system, for instance, the El Nino and La Nina. These terms are used to describe the rise and fall in the ocean’s temperature around the central and eastern equatorial pacific resulting in the changes in the atmosphere and consequently impacting on the climate in the various part of the world (WMO, 2014, p. 2). Simplistically it can be referred to as the natural exchange of heat between the deep ocean and the atmosphere which result in average temperature around the globe (Donkor, 2018, p. 15). However, the
external forcing can either occur through, changes in the Earth’s orbit around the sun, natural catastrophes such as volcanic eruption or human activities which leads to greenhouse gases increment in the atmosphere (UNESCO & UNEP, 2011a, p. 11; IPCC, 2014, p. 4; Donkor, 2018, p. 15).

The greenhouse gases create a greenhouse effect making it possible for the earth to be habitable however, their importance is negated when they become superfluous in the atmosphere. The earth is kept warm for human habitat through natural greenhouse effect caused by greenhouse gases, water vapour, carbon dioxide, methane, nitrous oxide, solar radiations and the ozone. The earth’s average temperature would have been -18°C without these gases and thereby would have rendered the planet earth unconducive for human habitat (Harris et al., 2015, p. 5; Whitmarsh, 2005, p. 14). On the other hand, the excess or saturation of these greenhouse gases in the atmosphere aggravates the earth’s temperature, altering the global climate and eventually affecting the living organisms. Svante Arrhenius predicted years ago that, continuous use of coal will increase the concentration of carbon dioxide in the atmosphere and consequently increase the earth’s surface temperature (Harris et al., 2015, p. 5).

Geological studies indicate that, though the earth had ever gone through major climatic change through natural forcing, however, the changes occurred through the long stretch of period or short-lived (Bathke et al., 2014, p. x). The current trend of climatic change is attributed to human activities as it does not fit into the description of the natural forcing climate change. The fourth and the fifth assessment report of IPCC emphasis a strong relationship between human-induced GHG emissions in the atmosphere and the increase in global temperature (UNESCO & UNEP, 2011b, p. 11; IPCC, 2014, p. 4). Evidence in literature indicates 0.6 increase in global mean temperature. This increase in the warming of the earth according to IPPC assessment reports is as a result of higher saturation of greenhouse gases in the atmosphere triggered by human engagement in burning of fossil fuel, land use and deforestation (IPCC, 2014, p.4; Ekpoh & Ekpoh 2011, p. 106).

In her speech titled “Concept Note” on Monday 22 April 2019, Maria Fernanda Espinosa Garces (2019), a member of the United Nations Trusteeship Council Chamber, considered climate change as one of the 21st century crises having a gruesome threat on sustainable development worldwide. Unfortunately, these threats are as a result of the impunity and unsustainable actions of man and his neighbours. In a similar position to this statement, Anderson (2010, p. 3) posits that climate change can undo the success achieved by Millennium Development Goals (MDGs) and threatens the effort in reducing global poverty. This has severe implications on the future of children in basic schools and unborn children. IPCC report (2018, p. 6)
revealed that over time, specifically between 2030–2052, accumulated emissions from hydrocarbons and fossil fuels is estimated to increase global warming beyond the pre-industrial levels of 1.5 degree Celsius.

The IPCC (2018) report indicates a dreary future for mankind. The panel reported that at present, due to the unsustainable actions of humankind several portions of the marine and terrestrial ecosystem is already altered culminating in serious problems for millions of people around the world. Considering these developments, the UN convened in March 2019 with a Resolution on Climate and Sustainable Development for All to halt and possibly reverse this unfavourable trend in human history. The convention was also meant to unlock economic, social and environmental opportunities for members’ states and their citizens.

United Nations member states have positioned themselves to address climate change issue through the empowerment of people through education directed towards possible ways of responding effectively to the structural causes of environmental and climate change. Such empowerment is meant to provided people with practical means for transitioning from unsustainable actions to sustainable consumption, support political decisions for climate action, production patterns, recognition of common and shared responsibilities on climate change, equity and respective capabilities based on national circumstances (IPCC, 2018).

Notable among the resolutions by the United Nations was the SDG No. 4. which proposes the use of quality education as an approach to tackle the environmental and climate change issues. The need to use quality education to encourage children, youth and the entire society to see the reason for which they should live in harmony with nature, the necessary procedure for which we can live by to reduce high-emission which has a greater toll on the climate (UNDP, n.d.; Anderson, 2010, p. 3). It is believed that education can assist the society to live a sustainable life which has a greater benefit to humanity. Sustainable Development Goals No. 4 aligns with Sustainable Development Goals No. 13 which encourages the realization of the remaining Sustainable Development Goals. Both resolutions (No. 4 and 13) emphasizes the need for a stronger and positive response on climate change worldwide through practical climate change education, inter-disciplinary dialogue, capacity-building, and grass-root (involving several communities) approaches towards increasing the number of engaged stakeholders (UNDP, n.d.). This will help explain and aid understanding of the intricates and sometimes mind-boggling interconnectedness of the earth systems. UN resolutions were meant to encourage a forum or synergistic approach to environmental and climate change issue which allows serious engagement in discussions around the globe centred on transfer of knowledge from several cultures with in-depth experiences on issues involving how to address climate change in natural and more realistic ways.
The recent General Assembly of the United Nations’ dialogue on Harmony with Nature encourages all and sundry to be a force for good in issues pertaining to making use of climate change action. It was convened in the faith to concretize the need to consider climate change action in every opportunity related to the current and future policies to prevent further aggravation of climate change challenges (United Nations, 2018).

Unequivocally, in recent times environmental and climate change education is currently being emphasized by the UN not only with the Sustainable Development Goals but through other recent conventions and resolutions.

Climate change education as part of education for sustainable development implies that climate change education should take place under the tenets of education for sustainable development. Sterling (2014) proposes a model which he believes when applied devoutly will engender transformation as required for the 21st century literate. The discussion in the next section will be centred on Sterling’s transformative learning model.

3.4 Sterling’s transformative learning model
Sterling (2014) proposes a transformative learning model (framework of human knowing and experience) which put the world from a different perspective. This framework which is applicable at the individual, institutional and societal level consists of three elements which need to be applied holistically to engender transformative learning. The elements of Sterling’s transformative learning model include: Seeing – (Affective domain), Doing – (Intentional domain) and Knowing – (Cognitive domain).

![Diagram of Sterling’s transformative learning model]

**Figure 3 Sterling’s transformative learning model**
Source: Sterling, 2014 (p. 5)
According to Sterling, the seeing – perception (or affective/normative domain) deals how one perceives the world, interpret it and how the understandings influences ones perceptions. The knowing – conception (or the cognitive/descriptive dimension), talks about how one understands the world and represent it to others whilst the “doing” – practice (or the intentional/applicative dimension) concerns with how one actively engages in the world with regards to making decisions, planning, capabilities, skills, tools, ways of approaching issues, designing, and communicating ideas. In sum, this relates to how one acts on and in the world, and with others.

Sustainability thinking requires enough and whole system response in each of the three elements in the transformative learning model. In this view, further advancement to sustainability is deemed pertinent at three differential levels which include “personal, organisation, and social”. This demands the creation of interconnected world economically, technologically, and ecologically. However, our cultural worldview position with regards to affective (seeing), cognitive (knowing) and intentional domain (doing) according to Sterling is problematic. Thus, our default worldview orientation in reference to the way we see things, the way we do things and the way we conceive ideas are at variance with the reality of the world.

In the areas of “seeing”, challenges of “boundaries, egocentrism, lack of awareness” or care for or affection for others and limited spatial and temporal inclusion are the issues associated with our worldview. Fostering urgency for “responsibility”, thus having the moral desire and urgency in acknowledging that the individual components (individual, organisation/institution, community etc) forms part of the whole system is essential in addressing the problem of seeing domain apropos to our worldview.

Sterling explains the problem in the area of “knowing” to be associated with a specialism and lack of understanding and failure to think or recognise the systemic nature of the world. Thus, failure to think in parallel with the system, pattern, connectivity consequences, interconnectedness, interdependence of the world and its individual entities. It was however asserted that, the problems associated with of “knowing domain” can be addressed through fostering the need for acknowledgement of correspondence, thus seeking for and recognizing knowledge patterns in line with the systemic real world.

The problem in the area of “doing” according to Sterling has to do with our inability to design, create, decide and guide in a manner that encourage behaviour and actions in systemic principles that enhances “systemic wellbeing”. Addressing this issue according to Sterling requires the need for responsibility, i.e. improving our capability to take integrative and intelligent actions in context of the real world.

Sterling (2014) further explains that this three-part model of paradigm change holistically finds its application in various ways. In terms of the educational system, it implies an overhaul
in education system with its “purpose, policy and curriculum and pedagogy and practice” whilst in terms of individuals as a teacher deals with “respecting and nurturing the heart, the head and the hands”. In effect when these elements are incorporated holistically in learning will have influence on learners’ feelings, attitude, emotions, appreciation, ideals and values and, will foster inquisitiveness or earnest desire to acquire knowledge and directly apply what is learnt to the real world. The learners’ cultural worldview will be shaped and hence take considerations of their actions and inactions whether deemed fit into the larger perspective of the world.

About the transformative learning model, Sterling (2009, p. 82) suggests that learning situations should proffer transformative learning experience and address issues in holistic, critical, appreciative, inclusive, creative and ethical thinking perspective depict the following thought-provoking characteristics.

Thus, learning experiences should seek in provoking thought as:

1) Addressing issues holistically: How does one action relate to the other? How do they relate in the larger perspective here? Is there any part not being taken into consideration?

2) Addressing issues from a Critical thinking perspective: Why things look the way they are? Are they looking the way they are in the interest somebody?

3) Addressing issues appreciative: Is this action good or is it good to act this way? and does it work perfectly here?

4) Addressing issues Inclusive manner: Is this allowing all to be heard? Who is not being engaged? Is this suppressing someone from being heard or listened to?

5) Addressing issues Systemic perspective: What could be the eventual result of this action? Will this action disconnect the other part?

6) Addressing issues from a creative perspective: What could be the needed innovations? Can this innovation improve upon the situation? What is needed to be changed about this innovation to work perfectly?

7) Addressing issues in ethical perspective: How must ones action relate with the other? Is this an appropriate way to do it? In what way can we operate together to benefit the unit as a whole?

Adopting sustainable education as proposed by Sterling requires an educational change process to orient all the stakeholders to the required change to enhance the adoption. It is, therefore, important to discuss the theory of educational change (Fullan, 2007) hence the following section is dedicated to the theory of change specifically, Fullan’s educational theory of change.
3.5 Theory of Change

Scholars, researchers and educationists are divided in their opinion of what constitutes Theory of Change because everyone sees it from a different perspective based on their immediate need and context (Vogel, 2012; Bours et al., 2014). TOC is inherently outcome-based. This means the context of the scholar or evaluation experts influences the desired change or outcome.

3.5.1 Defining the theory of change

It must be noted that even though there is no consensus among experts on what constitutes a theory of change, there are fundamental principles that run through the vast array of definitions and perspectives on a theory of change. These principles are as follows: 1) theory of change requires critical and logical thinking ability, 2) Most scholars agrees on the basic feature of the theory of change, 3) a change theory is not rigid in framework, nor is it prescribed (Fullan, 2007, p. 64), 4) theory of change often engender and create a sustainable path for innovation and improvement in initiatives or programmes, 5) To maintain flexibility and forestall uncertainty, adequate room for performance management approaches is needed in disseminating the theory of change (Vogel, 2012, p. 5).

Defining theory of change, Stein and Valters (2012) and Bours et al. (2014) viewed it as a methodology or roadmap designed to facilitate the logical sequence of a programme or design from input to outcome. Stein and Valters (2012) and Bours et al. (2014) defined a theory of change as a methodology involving critical thinking regarding program design, evaluation and monitoring which are very instrumental to international development. These authors conception of the theory of change agrees with Fullan’s educational change theory as explicated below.

In his insightful work Fullan (2007) gave primary attention to the educational field by underscoring the changes that occur within this field from time to time (Ellsworth, 2000; Tarosa, 2013). Several experts have propounded theories on the educational change process. Such works include, but not limited to Kurt Lewin (Adelman, 1993) the three-step process of educational change, Senge (1990) five assumptions of educational change and Hiatt and Creasey (2003) principles instrumental to individual change within the educational field. However, Fullan’s (2007) work captures the essence of educational change from the preliminary stages to the permanent stages. Fullan’s work summarizes previous works on educational change and categorized it into three broad phases or stages.
As depicted in Figure 4, these phases are 1) Initiation, 2) Implementation and 3) Institutionalization or Continuation. The three processes must be observed before a positive change can be attained in the educational field or a school. A closer look at Figure 4 reveals that Fullan views everyone involved in education as agents of change.

3.5.2 Initiation Stage/Phase

According to Fullan, Initiation Phase refers to the preparatory stage or the stage of creating needed awareness for a change. Initiation is the process of deciding on introducing innovation and committing to efforts towards achieving the anticipated innovations. For the conceived innovations to translate into a reality, initiators must ensure that human resource, skills, strategies, tools and resources needed to make the innovation happen are made available. The human resources needed to implement the innovation are trained at this stage to equip them with requisite skills for the implementation. Thus, personnel needed for the implementation should be taken through experiences that will enhance their knowledge in the required innovation to be implemented. This phase of the change also requires giving adequate information to the general public to prepare their minds to avoid shocks and eventualities. This stage, initiation means preparing the grounds for successful implementation to proceed (Fullan, 2007, p. 69). Fullan (2007), states that the change process should be treated as a cyclical or as the process which has the flexibility of moving back and forth since information at one stage can

Figure 4 Fullan’s Theory of Change
Source: Adapted from Fullan (2007, p. 66)
influence the need for changes in a decision taken in the previous stage. The next section looks at the second phase – the implementation – of Fullan’s model of educational change processes.

3.5.3 Implementation stage

The implementation stage according to Fullan (2007) refers to the phase where the change or proposal is actualized or put into practice. The actual change or innovation as purported is put into practice. It is the stage where participants move to the new state of doing things. At this point, participants reorient their thinking and abandoned the status quo of the old ways. Smeed et al. (2015, p. 5) describe this stage as “Cognitive restructuring”. It involves the application of skills and the appropriate curriculum material to make the anticipated innovation happen. At this stage, the required skills acquired during the training or awareness creation sections are practised. The resources required for the smooth application of skills and teachers’ ability to utilize relevant method to implement the change is vital at this stage.

Roy (2013, p. 20) clarify that participants require a constructive and supportive response and favourable climate to continuously learn to finetune their experiences and improve upon their results. Roy (2013, p. 20) further explained that clarity on the intended result is essential for avoidance or if not reduce confusion and inconsistency in practice. Hence, the innovation’s intended results should consistently be put with precision. However, the instructional coaches should be flexible and also insist on doing it right. As in the quote of Albert Einstein, learning of a new practice is associated with making a mistake. Thus, people are bound to mistakes when transitioning from one state to another.

However, if those mistakes happen, we should accept and try to make amends. Effective implementation of a new curriculum takes a considerable period. This is because the involved teachers need to become acquainted with practices and become confident in using the new curriculum (Marsh & Willis, 2007, p. 215). However, this should not pass by without monitoring and insisting on doing things right or strengthening the good practices and correct were gone wrong. The following section discusses the last phase of the educational change process in Fullan’s model.

3.5.4 Continuation/Institutionalization

The continuation of the institutionalization stage according to Fullan (2007) entails how the already concretized change can be sustained and continually improved over time. To Marsh and Willis (2007, p. 215) and Roy (2013 p. 20), institutionalization is when the innovation has fully been implemented and has, therefore, become a routine in practice. Institutionalization
of an innovation or a curriculum is reached when participants seem to have grasped and therefore have sunk themselves into the new way of doing things and therefore teaching the curriculum (Marsh & Willis, 2007).

Roy (2013), however, admonishes that, the lead implementors require to monitor the implementation, assess the accuracy of use of the innovation and also observe the frequency of application by the participants and give the right support to help correct anomalies in the implementation before sustenance of practice.

The agent of educational change or curriculum change has a different task to play in the process of the change. Each must play its role diligently to make the change a successful one. It is therefore worthy of it to discuss curriculum change and the roles of the players in the change. The next section, therefore, discusses the curriculum and its implementation.

3.6 Curriculum implementation

Curriculum emerges as a plan and can only be realized when teachers put the planned curriculum into practice under real setting (Marsh & Willis, 2007, p. 213). Voogt et al. (2019, p. 5) also see curriculum as a plan of learning. In consonant with this Læsseø and Mochizuki (2015, p. 28) assert that introduction of curriculum change does not translate into the intended change in classroom practices but the extent to which the frontiers of the implementation processes are pushed is the key to intended classroom practices.

3.6.1 Planning the implementation

According to Marsh and Willis (2007, p. 213), meticulously planning and development is important to realize a good curriculum, however, it remains as bad if teachers to implement the curriculum are not well informed about the intentions of the curriculum and how it could be realized in the classroom. In the view of Fullan (2007), curriculum implementation connotes what is practised with regards to the innovation. However, Marsh and and Willis consider curriculum implementation as the process of adopting the planned curriculum. They otherwise explained it to be a process of converting the written curriculum into classroom practices. This connotes that the curriculum is a written abstract intention that needs to be concretized. It is obvious to note from the definitions that curriculum implementation involves certain actions to bring into life the abstract intended plan of the written curriculum. Marsh and Willis (2007, p. 214), explained that converting the written curriculum into classroom practices is complex and problematic.

In contrast to “Maxim Precision in planning, flexibility in execution”, Marsh and Willis (2007, p. 214), stated that it is impossible for a planned curriculum to be exactly replicated in the classroom. They suggested that the planned curriculum and the enacted curriculum could
be viewed as a text of the play and a real production on stage which gains different interpretation by the play director and the actors altogether. In this analogy, teachers act as the directors and the actors of the play and the planned curriculum as the text’ to interpret (Marsh & Willis, 2007, p. 214).

The contention of implementing curriculum as exactly as planned or as making alterations to fit local context brings into a discourse of fidelity implementation and mutual adaptation implementation paradigms (Snyder et al., 2001). Under the fidelity implementation assumption, the teacher is expected to implement the curriculum strictly as planned. He/she follows directions to implement the curriculum as having knowledge parallel to the curriculum designers themselves. The extent to which the teacher can implement the curriculum strictly as planned determines the success of the curriculum. Thus he/she plays a critical role as deliverer of the curriculum to the learners as intended. Because the curriculum needs to be implemented strictly as the way they are intended, adequate training before implementation, clarification of specific features of the curriculum, support and monitoring during the implementation is deemed a very important strategy for accomplishing the success of the curriculum implementation (Fullan, 2007; Marsh & Willis, 2007; Roy, 2013; Snyder et al., 2001).

However, from the mutual adaptation perspective, the teacher is more active in adapting the curriculum to suit the local context. The teacher shapes the curriculum taking into consideration the aspirations of the local community in which the curriculum is being implemented (Snyder et al., 2001, p. 429). Nonetheless, the proponents of the fidelity implementation partially subscribe to this role of the teacher but strictly applied within the confinement of the curriculum to maintain the integrity of the curriculum. For extremist mutual adaptation proponents, the teacher input in shaping the curriculum is central for accomplishing the success in delivering the curriculum with regards to the setting of implementation (Marsh & Willis, 2007, p. 214; Snyder et al., 2001, p. 429). However, it must be recognized that a teacher’s role is eminently interwoven with curriculum implementation since there could not be a curriculum without the teacher and student. In essence, be it fidelity or mutual adaptation implementation approach the critical role of the teacher cannot be discarded and therefore need to be equipped and supported to implement the curriculum effectively. The following subsection looked at a brief discussion on the roles of higher educational authority in curriculum implementation.

3.6.2 The roles of the government/regional/district directorate in curriculum implementation

After an initiated curriculum at central government, it is implemented either through the national, regional and the districts depending upon the country of which the education change is taking effect. The government here as described in Fullan (2007) can be referred to as the
officals managing the ministry of education, regional education directorate or district education directorate. According to Fullan (2007, p. 236), the government has the role of seeing to the success of the change and therefore has to provide incentives in a form of pressure and support, promote capacity building to their staffs, headteacher and teacher in the implementation of the educational innovation and eventually demand accountability. Fullan however, argued that the government most often put all their efforts in only one or two of the three roles which and therefore fail in achieving their objective in rolling out an innovation. Sometimes when the objectives of the change or the innovation are even achieved to a certain degree, the change do not last.

Fullan (2007) and Tarosa (2013) agreed that educational change can be sustained if accountability, incentives and capacity building functions are provided by together. They therefore admonish the government to ensure the provision of these roles together with other resources such as the curriculum material, infrastructure to enhance the success of curriculum implemented. However, the government’s role can only come to fruitful when the actors at the school level also provide their roles assiduously, hence in the next section of the discussion, the two actors at the school level whose function in the curriculum cannot be disregarded will be considered.

3.6.3 The roles of the headteacher and the teacher in curriculum implementation

The actual implementation of curriculum developed takes place at the school level and this involves two essential actors, the headteacher and the teacher (Nudzor, 2014, p. 7). The intended result of the curriculum which is to impact the students gets to be accomplished through these two actors.

The headteachers as described by (Fullan, 2007, p. 74), act as “gatekeepers of change” in the school. They control what comes in and out of the school through their influence as heads of school. The headteacher is the manager of change at the school level, he/she serves as the bridge between the education directorate and the school community (Tarosa, 2013, p. 28). As the controller of what comes in and exit the school, he/she becomes the pivot of the systemic change effort (Tarosa, 2013, p. 28; Vandenberghe, 1984, p. 14). Thus, the school as system experiences and adapt to change through the headteacher.

Tarosa (2013, p. 28) explained that headteachers in their capacity as custodian of parents’ wards, normally seeks to build rapport between the parents and the school community The headteacher, on the other hand, provides an opportunity for professional community growth in the school and a healthy relationship among the teachers. The headteacher or principals of
A school also accounts to the district director of education and hence the provision of incentives and the professional capacity building gets to the teachers through the headteacher and therefore demand accountability from teachers as well.

The role of a teacher in curriculum implementation involves teachers practicalizing the theories in the curriculum to students through teaching and learning. This include both the content of the subject matter and the teaching and learning strategies the teacher applies within the classroom. The teachers have the responsibility of breaking down the curriculum into bits accessible by students. Change takes place depending on the support and commitment of teachers to the change process or the curriculum implementation (Vandenberghe, 1984, p. 14). However, any educational change affects the teaching and learning processes and consequently affects the output of a teacher either negatively or positively (Razzaq, 2012, p. 28; Fullan, 2007, p. 85). Teachers are the primary implementors in the classroom and as Schmidt and Datnow put it, they are the pivot of educational change (Razzaq, 2012). In affirmative assertion to Razzaq (2012), Vandenberghe (1984, p. 14) stated that failing to recognize the correlation between educators and school improvement process can eventually culminate in failure to achieve the desire school improvement we seek for. It is therefore eminent to note that, the critical role of teachers in curriculum implementation or school improvement is important and therefore needs to be accorded with attention in curriculum implementation.

The curriculum intends to affect students and can only be realized through the expertise, strategies and skills of a teacher in conveying the information encapsulated in the curriculum to the students. Thus, the learners can benefit from the curriculum through the purposeful planning and delivering by the teacher, the intentions of the curriculum. This implies that change is hardly to occur if a teacher lacks the relevant expertise, strategies and skills needed to implement the curriculum (Tarosa, 2013, p. 29).

According to the European Commission (2012, p. 15), teachers occupy a high position on the determinants of learner’s performance or achievement list within educational set up. It could be said that the educational enterprise of a nation is decided by teachers. However, effective implementation of the curriculum depends on how teachers can apply their expertise under the right environment to achieve the intended result of the curriculum. It is said that the knowledge of the teacher, what he/she does and what he/she cherished matters a lot in the academic life of students. Notwithstanding, this critical task is played intelligently by teachers who have the requisite competencies in his or her field of work as well as the competencies required to be called as the 21st-century educator.

Under this notion, it is important to have a brief discussion on teacher competence hence the next section of the discussion will consider the requisite competencies required to function well as a 21st-century educator.
3.7 Teacher competency

Competent professional environmental and climate change studies teachers combine appropriate strategies in lesson delivery. Competence can be regarded as a set of characteristics including knowledge, skills and dispositions which enhance one to approach teaching effectively (Crick, 2008, p. 313; European Commission, 2013, pp. 7–8). Teacher competence according to European Commission (2013, p. 8) is not about the acquisition of a rigid set of skills but building on teaching principles where theory and practices with the ability to juxtapose one’s own and other’s practices enlighten one another.

Rychen and Salganik (2003, p. 44) gave extensively description of what the concept of competence in teaching constitutes. Rychen and Salganik (2003) explains that the teacher competence encapsulates dimensions of knowledge, cognitive skills, practical skills in addition to dispositions (motivation, ethics, value orientations and emotions). All these need to be considered in implementing the new curriculum – Our World and Our People – to foster realization and attainment of its rationale, objectives and philosophy.

This implies that a competent professional environmental and climate change studies teacher possesses efficient teaching qualities which altogether ease lesson delivery and facilitate an absolute grasp of content knowledge by students. However, Shulman (1987) identifies a competent teacher as the one knowing a subject in the context, its content and how it is made accessible to students, knowledge and skills in methods of lesson delivery, knowledge of students and their characteristics and dispositions.

In consonants to Shulman (1987), European Commission (2012, pp. 25–26) stipulates that a teacher with requisite competencies for effective teaching in our present-day should possess under the category of knowledge and understating competency; “subject matter knowledge and pedagogical knowledge”. Under the skills competency category, a teacher should be able to plan, manage and coordinate teaching. A teacher with the required skill competency should be able to use curricula materials and information and communication technologies (ICT), manage learners and group, monitor, adapt and assess teaching and learning objectives. However, a teacher with the requisite disposition competency for 21st-century education should be able to promote students’ democratic attitudes and practice as a responsible citizen. (European Commission, 2012, pp. 25–26)

As explained in the European Commission (2012, pp. 25–26), the subject matter knowledge involves the pedagogical content knowledge which implies the adept knowledge in content and structure of the particular subject. Content knowledge refers to the consumable information teachers present to the student. However, the pedagogical knowledge deals with knowledge in teaching and learning methods.
The world is rapidly changing hence the need for teaching to follow suit to match the demands of the changing world. A pronouncement made at World Summit on Teaching urges teachers not only to help their students in the acquisition of easy to test skills but should provide opportunities that seek to improve the critical thinking skills, democratic capacities, tools manipulating skill and responsible citizenship in students (European Commission, 2013, p. 7).

Environmental and climate change studies teacher professional competency essentially impacts the entire environmental and climate change studies class as the benefit trickles down to the learners in immeasurable ways and also add quality and depth to environmental and climate change studies and learners’ sustainable development knowledge. The competency of environmental and climate change studies teacher appears in combination with the use of appropriate pedagogy and pedagogical resources and enhanced information from the internet and other relevant media.

As the educational orientation changes so do the role of teachers. Teachers are being encouraged to deliver lessons in classrooms with students of diversifying background, integrate learners with different educational needs, make good use educational resources, partake in school improvement processes, and communicate to guardians and parents of their wards learning (European Commission, 2013, p. 7) all in the essence of education for sustainable development.

In building competencies necessary for the 21st century, UN-designated DESD to support UN member states to build capacity in five areas of competencies that contribute to sustainability. These five areas of competencies as identified essential to help accomplish the aims of ESD include: “Learning to be; Learning to know; Learning to do; Learning to live together; and Learning to transform oneself and others” (Pálsson, 2014, p. 32).

UNECE (2011) agreeing with Sterling (2009) notes three core features of ESD: “Holistic Approach”, “Envisioning Change” and “Achieving Transformation”; and a four-competency framework (out from the UN’s five areas of competencies). To accomplish the objectives of ESD, these three characteristics must be observed in the pursuit of ESD. Thus, these three characteristics must be encapsulated in the competencies of ESD for one to successfully achieve the aims of ESD. The four clustered competencies proposed include: “Learning to know” which addresses the understanding of the local and global problems the society encounters and the likely role the educators and learners are supposed to assume; “Learning to do” is also concerned with the development of practical skills and the capacity of the individuals to act in a way that engenders sustainable development; whilst “Learning to live together” considers recognition of how life on earth and ecosystems are interdependent and the need to “develop partnerships, pluralism, mutual understanding and peace”; and “Learning to be”
deals with one’s own ability to act responsibly, ability to take initiatives with regards to sus-
tainable development (Il tus, n.d., p. 21).

European Commission (2013, p. 9) explicates that, teachers’ continuous professional de-
velopment has a critical role in educational performance improvement and effectiveness and
in strengthening teacher’s commitment and job satisfaction as well. It was further asserted
that, though students’ achievement is interwoven with constraints of communal and climate
of national education systems, a significant measure of these effects on students’ achievement
can be attributed to teacher competency (European Commission, 2013, p. 9). This implies that
as the OWOP curriculum is being implemented, it becomes pertinent for teachers to receive
training periodically to enhance their competency.

It is from this background that I want to investigate into the training and development
need of basic education teachers of Cape Coast Metropolis to find how they can be supported
to effectively work with Ghana’s new education curriculum, “Our World, Our People” which
encapsulate climate change education. However, curriculum implementation is influenced by
several factors not limited to only teachers’ competency. Given this, the next section will duel
on other factors which influences curriculum implementation.

3.8 Factors influencing curriculum implementation
Curriculum improvement or educational change alters believe, curriculum materials and
teaching practices (Fullan, 2007). Curricula is meant to be implemented to have an impact on
the students and the society as a whole, yet most end up having no or little impact on the
students meant to influence either they were not assiduously implemented or not imple-
mented at all (Marsh & Willis 2007, p. 215). Teachers may fail to implement an introduced
curriculum not because they don’t want to but most often as a result of lack of capacity stem-
ing out from their knowledge, skills, personal and other resources required for smooth im-
plementation of the curriculum (Spillane et al., 2002, p. 393). Thus, even if they grasp the in-
tentions of the curriculum, they most often lack the necessary skills to work out the intents of
the curriculum as required of them. Curriculum implementation is influenced by several fac-
tors. The more the factors that are in favour of the implementation, the likelihood there will
be a successful implementation (Adelman, 1993; Fullan, 2007). Two broad sets of factors in-
fluencing curriculum implementation are found in literature, namely external and internal fac-
tors.

External factors include the socio-cultural, political or administrative issues. These factors
emanate from outside the classroom and as such teachers may have little or no influence in
controlling them. Studies find external examinations (test), resources support (teaching re-
sources, infrastructure, in-service training) as the factors which most influence teachers curriculum implementation (Alderson & Wall, 1993; Everard et al., 2004; Pálsdóttir, 2014). Other sets of external factors that could influence curriculum implementation are students background, parent and community. Everard et al. (2004) noted that parents and community’s readiness for curriculum reform and their continuous support for it has a great consequence of the success of the implementation.

Internal factors are those which are inherent in teachers themselves. They are associated with the teachers’ beliefs, knowledge, understanding and involvement in curriculum innovations. This category of factors which influences teachers’ curriculum implementation may include teachers’ willingness to participate in the development, lack of knowledge, perception of the need to make change are some of the examples of the internal factors find in the literature (Pálsdóttir, 2014). The next section considered empirical evidence on barriers to curriculum implementation.

3.9 Empirical evidence of barriers to curriculum implementation

Analytical study (Fullan, 2006) on the failure of heavily funded reform initiatives in Milwaukee, Chicago and Seattle reveals that the failure of the initiatives was due to lack of consideration on what needed to be changed about instruction strategy and the measures required to bring about those changes in the instructional practice. According to Fullan, every needed resource to make the initiative work seems provided, however, what they failed to recognize was the appropriate changes in instructional practice needed to bring about the change. This implies that appropriate instructional practices needed to bring about change in a student cannot be downplayed in the implementation of an innovation. It could be deducted that the teachers were not given training on instructional strategies needed to have effected changes in the students which the program revolved around or little conversant with the needed instructional strategy for effective working out of the initiative.

Gross, Giacquinta and Bernstein expressed that curriculum implementation, in general, is problematic hence mapping a success to curriculum implementation should not be limited to overcoming initial resistance to educational change (Snyder et al., 2001, p. 405). In studying the barriers and obstacles to the implementation of a catalytic role model in Cambire School, Gross, Gracquinta and Bernstein revealed that clarity about the innovation, skills and knowledge necessary for conformity to the innovation, instructional material unavailability, poor arrangement with innovation and coupled with lack of motivation are the factors that militated against the implementation of the catalytic role model (Snyder et al., 2001).

In investigating into factors that influence the implementation of sustainability education in Icelandic compulsory schools, Pálsdóttir (2014, pp. 108, 135), identified “professional and
collegial support”, “lack of available teaching material”, “remuneration issues and teachers’ professional role” and “lack of knowledge on sustainability issues”. Furthermore, “teachers willingness to participate in developmental training”, “sustainability inclusion in the curriculum”, “lack of support”, “students unaccustomed to working autonomously” and many others were identified as the factors influencing the implementation.

Nevenglosky (2018) study on barriers to effective curriculum implementation using concern-based adoption model revealed inadequate information to teachers before the expected implementation, demands on personal time of teachers, lack of professional development, lack of peer collaboration as barriers to implementing curriculum effectively. However, the study of barriers that militate against curriculum implementation in Nigeria identified teachers’ motivation and lack of curriculum knowledge as most influential factors that contributed to failures in curriculum implementation (Yeke et al., 2018).

According to Zaifuddin (2015, p. 103), several studies on the implementation of English Based-School curriculum in Indonesia in the year 2006 claimed that teachers’ low competence in the using of the program and inadequate provision of information on the program to teachers led to improper implementation of the curriculum. As cited in Zaifuddin (2015, p. 103) Suharto reported on the English School-Based program that teachers got confused with the meaning of certain concepts found in the curriculum, such as “Communicative Competence”. This could be due to the teachers’ low knowledge on the course they were supposed to implement in the classroom to the students. On the other hand, Mampuni on the same program according to Zaifuddin (2015) identified teachers’ inability to organize instructional materials that could last teaching-learning period for a lesson as another problem that militated against effective implementation of the program. Zaifuddin (2015, p. 104) concluded that teachers found it difficult to implement the curriculum because teachers had had training in implementing curriculum designed and developed by an external agent in their professional development and not in designing, developing and implementing their curriculum based on their local community needs as the program demanded of them.

Snyder et al. (2001, p. 407), posit that result from studies on implementation of innovation suggests that teachers have varied level of concerns with regards to innovation implementations. In view of this, adoption of innovation should always not be presumed that it is being implemented across all classrooms as required. To this finding, Marsh and Willis (2007, p. 215) explain that those teachers who reluctantly embrace the new curriculum willingly adopt and use the curriculum as planned. However, the section of teachers who unreluctantly accept the change use the curriculum making considerable changes in the curriculum either to suit their
capabilities or beliefs. It was further explained that in extreme situations, those teachers pretend using the curriculum as planned whilst resisting or rendering the new curriculum ineffective (Marsh and Willis, 2007, p. 216).

Marsh and Willis (2007) explain a commitment to change on the part of the participants or the teachers is a factor which influences implementation and institutionalization a curriculum. They explain that not all teachers will embrace the idea of switching to a newly proposed curriculum. These teachers would like to stick to their comfort zone and consequently will choose to maintain the status quo if given the chance (Marsh & Willis, 2007, p. 215; Razzaq, 2014, p. 51). On the contrary, Fullan (2007, p. 75) expressed that teachers have the will to adopt change in their working environment but will only occur when there is the right climate. For instance, when the district education directorate and headteachers are supportive, when there is an opportunity for inter-teacher communication when innovation is clear and practical, they help to do away the fear of failure and therefore build up their confidence to embrace any proposed innovation. At a school climate where there is an opportunity for inter-teacher communication breed building of rapport among teachers and headteachers to share ideas on the use of the curriculum or innovation to help them lessen the ordeal of dealing with or practising new idea in isolation.

Affirming Fullan’s expression Marsh and Willis (2007, p. 165) stated that teachers’ euphoria for rejecting or accepting an innovation or curriculum most often depends on the capability of the teachers in dealing with the innovation, communication among teachers themselves and instructional coaches or the policymakers. Hargreaves (2005, p. 967) also noted that there are variations in how teachers respond to educational change. He identified, gender, ‘subject speciality’ and ‘personal orientations’ as factors which influence variations in teachers’ response to educational change. He noted that age and the stage of a teachers’ career impact heavily on the way teachers respond to change hence requires to be looked at when dealing with teachers and education change.

This implies that there is the need to give ample information underlying the curriculum, encourage communication among teachers taking into consideration their age, gender, subject speciality, and the instructional coaches and policy initiators (district directorate officials). From the discussion above one could notice that the factors that militate against or influences curriculum implementation include; the age of a teacher, career stage of a teacher, clear directions about the curriculum, teachers’ competencies, funding, commitment on the part of the teachers and instructional coaches, communication among teachers and opportunity for professional development.

As cited in Zaifuddin (2015, p. 104), Barbar and Mourshed assert that the quality of teacher correlate with the quality of education, hence the quality of education cannot go beyond the
quality of a teacher. This makes it pertinent to the primary factor in teachers when considering the successful implementation of an innovation. Providing continuous teacher professional development periodically in schools can go a long way to build upon teachers’ knowledge base and boost upon their confidence in using the curriculum and consequently improve upon teacher quality which will percussively improve upon student learning. Teacher reaction to change is another factor which has a great influence on curriculum change. Hence the next discussion is tuned to reaction to change.

3.10 Reaction to change

Humanity has the tendency to react to change (Lunenburg 2010, p. 4) either in agreement or disagreement. It is therefore essential to note that there could be a positive or negative reaction towards introduction of change by the educational stakeholders particularly teachers to an introduction of an innovation (Lunenburg 2010, p. 4; Tarosa, 2013, p. 33).

As noted by Marsh and Willis (2007, p. 215), teachers would not like to change from a curriculum they are already familiar and comfortable with for a proposed curriculum they don’t know their faith in. They will prefer to maintain the status quo as the innovation will affect them to change their routine operations (Fullan, 2007, p. 85; Razzaq, 2012, p. 52). Lunenburg (2010, p. 4) support this assertion by stating that teachers’ resistance to change is as a result of the fear of how the change might affect their work life. Thus, the change creates perceived uncertainty in their job. On the other hand, Snyder et al. (2001) and Marsh and Willis (2007, p. 215) have made it clear that teachers have a level of concern with regards to curriculum implementation which needs to be addressed to avoid rendering the implementation ineffective.

Literature indicates that peoples’ resistance to change is natural in the sense that people become accustomed to their way of doing things and as such introduction of any innovation that changes the status quo which are not in their favour are not usually welcomed (Tarosa 2013, p. 34). This implies that teachers are likely to oppose the introduction of any innovation, especially where they are uncertain and have little knowledge of the innovation. Tarosa (2013, p. 34) alluded that if people are not well oriented to the change, they will psychologically hold on to their status quo and consequently contribute to likelihood collapse or ineffective implementation of the innovation. This is because they hold on to their old beliefs, it will serve as a stumbling block to the change and hence affect the level of use of the introduced innovation.

In this view, it is critical to take into consideration how teachers will react to the introduction of the curriculum. The teachers’ desires are important to be considered in the change process to prevent eventualities which can undermine curriculum (Marsh & Willis, 2007, p. 215). Thus, is beneficial to be aware of the teachers’ reaction towards the introduction of the
new curriculum to put in place the right measures to dissipate any negative reactions towards the implementation of the curriculum. When teachers have greater professional knowledge about innovation or a new curriculum, it helps to dissipate uncertainty and eventually prevent negative reaction towards the introduction of a new curriculum. Hence the following section will discuss professional development.

3.11 Professional development and Support for Headteachers and Teachers

Initial teacher development alone cannot serve the lifetime teaching needs of the teacher (Mandukwini, 2016, p. 28; NaCCA, 2019a, p. 90; OECD, 2009, p. 49). Continuous update of knowledge and skills is important for garnering success in a professional lifetime. Curriculum change in educational setup requires a correspondent update in knowledge and skills by the primary implementors to fit the demands of the changes in the curriculum (Mandukwini, 2016, p. 28; Bakah et al., 2011, p. 68). OECD (2009, p. 49) expounds that development of teachers besides their initial training is based several objectives which include to re-equip individuals’ knowledge in discoveries or advances made in a subject area. It is also about furnishing individuals with new skills, attitudes and approaches to develop new teaching techniques. It can also culminate from objectives arising from new worldview or educational research, building the capacity of the individuals to be able to work with changes made to curricula or other aspects of teaching practice.

OECD (2009) sees professional development as any activities that teachers engage in to develop their “skills, knowledge, expertise and any other characteristics” as teachers. Thus, any activity that teachers engage with the purpose of improving upon their competences as teachers. It can be noticed that definition is broad enough to accommodate so many ways through which the teachers’ competencies can be improved ranging formal to informal. Professional development can be provided through external or internal resource persons in the format of short courses, workshop or programmes in educational institutions or alliance between educational institutions or educators across educational institution with common vision (thus, visiting schools for educational observations, sharing of good practices) in the same jurisdiction or different jurisdiction (OECD, 2009, p. 49).

The role of the implementers cannot be overemphasized as it is through their role that the intended results of the curriculum could be achieved. As indicated in Borko (2004, p. 3), Sykes lamented on how seriousness inadequacy professional development is detrimental educational set up and how urgent it is to be resolved in policy and practice. Borko (2004, p. 3) states that there is research evidence indicating a correlation between teachers’ professional development and student learning and as such should be strengthened.
Fullan (2007, p. 85) and Razzaq (2012, p. 36), explain that curriculum reformation or provision of resources does not automatically change the way teachers teach. It demands concerted effort to intervene in re-orienting teachers’ belief, values, expectations, roles and power structure as well. If a teacher would be productive in their work in implementing a curriculum then it is required for them to acquire new knowledge or new technique relevant to the curriculum (Tarosa, 2013, p. 32). Carless (1998), identified continuous and locally instituted in-service training as an important element of teacher support for successful curriculum implementation.

Investigation into the method used in implementing National Diffusion Network found that the innovation to be successful because of adequate training on the use of the innovation, and provision provision of needed resources to the implementors. It was found that, direct leadership, monitoring and consistency or clarity of information for dissemination were the factors that lead to the success of the innovation (Snyder et al., 2001). It was emphasized that teachers developed a stronger commitment to the innovation during the implementation stage rather than the pre-implementation conditions.

Basson et al., (1991, p. 646) and Fullan (2007) states the headteachers play an essential role in any change that occurs in the school. Fullan terms them in this regards the ‘gate-keepers’. It must, however, be noted the headteacher can only play his/her roles effectively when they are trained to be a supporter or initiator of the curriculum. Fullan (2007) stipulates that it is important to keep the implementers aware of a conceived innovation and initial training for the implementation to take off. However, Brindley and Hood (1990), MacLaughlin (2002, p. 187) and Roy (2013) remark that the training of teachers in the implementation of the curriculum should not be one time. It should rather be continuous and not be concentrated only at the initial stage.

Teachers according to Guskey (2002, p. 382) have an affinity to professional development which expands their knowledge and skills to be effective in their student’s academic life. Given this designing professional development for teachers should address specific issues of their interest. Thus, teacher professional programs should address issues that make teachers stay relevant in the academic activities of their students. Concerning this, Razzaq (2012, p. 36) is also of the view that teachers learning should not be treated as a short-term intervention for problem resolution but should be a habitual activity in educational set up. In her view, it could facilitate the initiation and implementation of innovation in schools because teachers may deem it as part of their ongoing learning. It can be noticed from the discussion that; professional development and teacher support contribute significantly to the implementation of a curriculum and general academic improvement of a school. It is therefore pertinent to ensure that adequate opportunities are provided for teachers to advance in their respective field of
study in their respective curriculum material and appropriate teaching skills (Fullan 2006; Borko 2004; Nevenglosky, 2018; Snyder et al., 2001). OECD (2009), sees professional development as any activity that seeks to develop the “skills, knowledge, expertise and other characteristics of the teacher” to function effectively in their respective field of teaching. A critical look at the definition implies that professional development can be provided through various avenues ranging from formal to informal. It can be workshops where experts facilitate for participants to acquire knowledge, a collaboration between schools where teachers go on observational visits, coaching or mentoring and sharing of good practices among teachers.

It worth noting that effective training of headteachers and teachers will not only facilitate the implementation but will help in the institutionalization of the curriculum hence all effort should be put to achieve effective training of teachers to enhance implementation and continuation of the curriculum and eventually improve academics in the school. Schools need to foster the culture of learning to help teachers improve teachers practice and increase the students’ achievement. Given this, the professional learning community (PLC) which has been identified as one of the structures in the educational system with a sense of purpose in fostering learning culture is discussed in the next section.

3.12 Professional learning community (PLC)

While the topic professional learning community (PLC) can be dealt with as full these, the idea here is just to give a brief review of what it is and its relevance in the educational set up with regards to this study. Whilst Huffman et al., (2016) traces the beginning of PLC to 1990s, Teague and Anfara Jr. (2012) trace its root to the work of Judith Little in the 1980s. However, Wines (2019, p. 11) clarifies that studies on PLCs became explicit in the late 1980s and early 1990s. Regardless of whichever time it started, they all agree on the importance of PLC to the educational sector. The concept of PLC has been explored and delineated as a positive organisational tool which helps teachers to collaborate and support each other in enriching their knowledge as they work to improve their students’ achievement (Huffman et al., 2016, p. 328). PLC is defined as by Huffman et al. (2016) as “Communities in which educators collaboratively engage to foster a culture that enhances teaching and learning” (Huffman et al., 2016, p. 332). The goal of PLC is to provide a learning platform for teachers to ameliorate their classroom practices and students learning achievement and consequently result in school improvement. However, DuFour (2004, p. 6) criticized how the term has in recent time been used to describe almost any meeting of teachers that has little or no reference to improvement of teachers practices and student learning. In view of DuFour (2004), these acts put the term on the verge of losing its meaning.
Schaap and Bruijn (2018, pp. 109–110) sees PLCs as effective learning environment when it impacts positively on professional learning and morale of teachers, students’ achievement and on all other people who matters to it. The groundwork to developing or instituting PLCs to bring about the desired outcome depends on several factors. Developing and sustenance of PLC demands leadership and direction. Teague and Anfara Jr. (2012, p. 58) and Scribner et al. (2007, p. 72) are of the view that, the successful development and sustenance of PLC in educational system lend credence to Senge’s and Wenger’s learning community and community respectively characterised by the idea of “shared vision”, “shared purpose”, and “trust”. PLCs are multifaceted and complicated. They vary in features and dimensions with regards to their names and context (Dogan & Adams, 2018, p. 634; Schaap & Bruijn, 2018).

In Huffman et al. (2016, p. 332), “culture of teacher collaboration on professional practice and student outcomes”, “shared leadership”, “reduction in teacher isolation”, and “need to establish common values” were identified as the common characteristics of thriving PLCs.

Schaap and Bruijn (2018) studies on the element that affects the development of PLC, identified in literature five elements characterizing PLCs as “shared values and norms”, “focus on students’ learning”, “de-privatisation of practices”, “focus on collaboration” and “reflective dialogues”.

Concerning these elements, Teague and Anfara Jr. (2012, p. 59) explain that Judith Little identified teachers engagement in the talk about their teaching, frequent observation and provision of constructive critique about their teaching, collaborative planning, designing, evaluating and preparation of teaching and learning material and peer teaching practice as an element that sustains professional development that is continuous in schools from her studies on examination of school as a workplace. Bonces (2014, p. 311) also asserted that the organizational principles of PLCs commonly found in the literature include: “supportive and shared leadership”, “collective creativity/responsibility”, “shared values and vision”, “supportive conditions” and “shared personal practice”.

Because education systems do not have common settings across countries, it makes it difficult in instituting standard improvement endeavour that satisfies all context in meeting all teachers and students needs in the development of PLCs. However, scanning through the literature on PLCs, the common elements that permeate through organization and sustenance of effective PLCs regardless of the name and context revolves around dialogue, collaboration, shared vision, supportive conditions, shared authority/leadership.

Reflective dialogue – this is the medium through which the participants exchange knowledge and ideas. The literature explains that effective PLCs make good use of reflective dialogue through which the participants exchange knowledge and develop to enhance under-
standing and problem-solving skills. In these activities the participants share experiences, access, conceptualize and learn from problems by practising teaching (Huffman et al. 2016, p. 331; Schaap & Bruijn, 2018, p. 111).

Collaboration among the participants. Collaborative activities can be referred to as the general activities among the participants where all the participants willingly cooperate to produce a result. The participants exchange experiences, access, conceptualize and learn from problems in teaching practice (Schaap & Bruijn, 2018; Teague & Anfara Jr., 2012; Bonces 2014). Schools that lack consensus results in isolation of teachers in their classroom and therefore negatively affect the professional learning community. The school administrators or the headteachers have the responsibility of nurturing cordial relationships among the teachers and the professional learning community (Teague & Anfara Jr., 2012, p. 59).

Shared vision – this is about the group having a common vision and commitment to improving student learning together with the community itself (Bonces, 2014). PLCs, where the participants have common understanding about the vision of the learning community, results in improvement of the school.

Supportive conditions – they are the structures provided to promote the learning community. They may include providing time-space, policies, funds, teaching and learning materials and physical rooms for the organisation of the programme (Huffman et al., 2016, p. 334; Bonces, 2014, p. 312; Teague & Anfara Jr., 2012, p. 60).

Shared leadership – this is where administrators nurture share responsibilities with teachers in PLCs. PLCs in schools that allow for sharing of authority with participants thrive well and result in school improvements (Teague & Anfara Jr., 2012, p. 61). Scholars implicitly capture distributed leadership as appropriate leadership style for the organization of PLCs (Huffman et al., 2016, p. 338).

It could be deducted from the review that success of PLC result through having a sense of purpose, effective dialogues, dedication, good leadership structure and intentional effort which culminate from concerted effort among the participants. This explained what PLC is, its characteristics and its relevance in the education sector. The next section of the discussion turns to the climate change education.

3.13 Climate change education

IPCC emphasise in their report that climate change is a pervasive risk to the society and therefore requires effective responses to help curb it (Anderson, 2010, p. 3; UNESCO, 2015, p. 9). Despite all the massive scientific facts and predictions of climate change, there is a gap in effectively translating these facts in a way that influences peoples' behaviour and attitudes in
their daily activities. Education is therefore seen as the viable variable because of the transformative function teachers and education institutions can play in the preparation of students towards sustainability (UNESCO, 2005). Education is considered an important instrument towards the promotion of knowledge and skills-development alongside the raising of increased awareness on how to respond effectively and in a positive manner to environmental and climate change issues around the world. The relevance and instrumentality of education are emphasised by UN’s Paris agreement (Article 6 and 12) of the United Nations Framework Convention regarding Climate Change (UNFCCC) which urges the UN member states to actively promote, formulate, develop, encourage and implement educational, training and public awareness programmes with reference to environmental and climate change and the associated dreary effects on man and his environment. It believed that mainstreaming climate change education in the formal education system could also be the best way to reach the masses of the society due to its multiplier effect (Mochizuki & Bryan, 2015, p. 8). Læssøe et al. (2009), presented three scenarios as to where CCE could belong; where it could be treated as independently as a major theme in science; where could be developed as an integral element of ESD and therefore be treated as interdisciplinary and the last scenario as a fusion of the two scenario treated independently under the umbrella of ESD. Nonetheless, the underscoring purpose of climate change education is to advancing sustainability and therefore fit under the broader umbrella of ESD.

Within the UNESCO’s climate change initiatives, climate change education in the framework of education for sustainable development is one of the four core programmes (UNESCO, 2010, p. 4). This is an innovative education which make use of relevant educational strategies to help people in a larger spectrum (though with keen interest in the youth), understand, tackle, alleviate, and adapt to the impacts of climate change, stimulate the need for attitudinal and behavioural changes essential for realizing a sustainable world, and raise a generation conscious of their influence on the changing climate (UNESCO, 2010, p. 4; UNESCO, 2015, p. 9). Thus, it is the kind of education which helps the learners to recognize the causes and effect of climate change, prepares them to adapt to its impact and empowers them to take informed decisions to live a sustainable lifestyle. CCESD embraces systemic learning of which interconnectedness with regards to nature is critical. According to UNESCO (2013), the role of CCE for sustainable development (CCESD) is in three folds. Firstly, CCESD has a role in empowering the individual and the society at large to acquire the attitudes for alleviating climate change to prevent the looming threat of climate change crises in the future. Secondly, it has the role of developing the skills, capacities and dispositions of the individual and the society at large to be able to stand to the face of the evidence and lurking climate change impacts and lastly, the
role to arouse the interest and reinforce the understanding and alertness to the realities of the changing climate.

Climate change requires a change of mind or self-transformation (Wals, 2014; UNESCO, 2013, p. 5). CCESD has the role to engender self-transformation by awakening our thinking that our ‘business as usual’ way of doing things is in no way going to help avoid the threat of changing climate but rather going to aggravate the global warming with its repercussive effects on humanity and as such, each person should play his or part in helping to avoid this looming threat. The three dimensions are entwined making it possible for continuous engagement and repetitive reflection as a learner navigates through them and hence underscores transformation (UNESCO, 2013, p. 5). Figure 5 depicts the dynamics and content materials for transformation. Thus, these three roles must occur simultaneously for transformation to occur. The underscoring goal for self-transformation to CCESD is to affect personal and societal transformation to promote a sustainable world.

Figure 5  The dynamics of transformation
Source: (UNESCO, 2013, p. 4)

From the explanations given, in climate change education should help learners become aware of the causes of climate change. It should also appeal to their conscience and make a conscious effort to avoid engaging in activities that contribute to climate change. It should also be in a position to equip learners with competencies necessary for mitigating climate change mitigation and measures for adapting to its impact. Climate change education should also aim
at enhancing learners’ capability in climate-resiliency and community vulnerability reduction for future uncertainty. Having discussed what CCE is, it is pertinent to understand what the content of CCE is, hence the next attention is geared towards the content of CCE.

3.13.1 Content of climate change education

According to Anderson (2012), climate change education is most often defined narrowly focusing on climate literacy and environmental education in science class. Anderson (2012) asserts that climate change education for sustainable development is not limited to “relevant content knowledge on climate change and environmental education, social issues, disaster risk reduction and sustainable consumption and lifestyles”. He explains that it should also focus on the “institutional environment within which that content is learned to ensure that schools and education systems themselves are climate-proofed and resilient as well as sustainable and green” (Anderson, 2012, p. 194). Thus, the institutions in which climate change education is advocated should stand for what it advocates for. It should serve as a model of what it advocates for or it trains. However, UNESCO (2013) and UNESCO (2009) identifies three-dimensional roles for CCESD which include mitigation, adaptation and understanding and attentiveness.

Climate change mitigation focuses on developing learners knowledge on the causes and effect of climate change, developing dispositions and the skills necessary for rectifying the causes (Anderson, 2010, p. 4; Anderson, 2012, p. 192; UNESCO, 2013, p. 5). Basically, human-induced climate change is caused by human activities that involve greenhouse gas emissions. This implies that, education on mitigation must involves development of knowledge and skills on activities that prevent or limit greenhouse gas emission. It must also promote activities that serve as carbon sink.

Learners are encouraged to engage in activities that limit the overall concentration of greenhouse gases in the atmosphere (Shanahan et al., 2013, p. 15). These activities may cover energy consumption, avoidance of pollution, the shift to green energy use, energy conservation, environmental conservation, reforestation, afforestation. In a deeper sense, it encompasses the critical analysis of greenhouse gas emissions in relation to “economic systems, social structures, cultural patterns, lifestyle expectations, consumerism, wealth distribution, inspirations and value systems” for reshaping and reorientation for sustainable world (UNESCO, 2013, p. 5).

Adaptation involves capacity building to enhance resiliency and lessen the degree of vulnerability of the individuals and communities at large to counteract the impact of climate change. These may include disaster risk reduction education, drought resistance farming systems and flood management behaviour (Anderson, 2012; UNESCO, 2013). Thus, learners are
equipped with knowledge on activities which when engaged in reduces the vulnerability of people, ecosystem and the built environment to the impact of climate change (Shanahan et al., 2013, p. 15). Climate change adaptation is based on the notion that, there is greenhouse gases saturation in the atmosphere hence the impact of climate change is abound despite mitigation efforts. It therefore becomes pertinent to reduce the individual and communal vulnerability to the impact. Climate change adaptation development may extend to re-orienting of cultural practices and traditions.

Understanding and alertness dimension of CCESD involves helping learners to understand what is happening to the climate, understand the driving force behind the changing climate and conscientizing the learners to be alert and mindful of the changes occurring (UNESCO, 2013).

Succinctly, the relevant content knowledge for climate change education classroom should include the causes (natural and Human-induced), effect (economic, social, health), mitigation (personal and societal actions to reduce greenhouse gas emission), and adaptation and disaster risk management measures (Anderson, 2012; Field et al., 2019; UNESCO, 2013). CCE can be effective when it occurs within an appropriate teaching and learning method. Several authors have written extensively on how CCE could be delivered. The next section, therefore, discusses on teaching and learning methods in CCE.

3.13.2 Teaching and learning methods in climate change

CCE involves attitudinal and behavioural change, selection of teaching strategy is of great concern. Lotz-Sisitka et al. (2017) note that procedures of education in climate and sustainability are often geared towards transition and conversion, often involving the development of fresh types of human operation. However, little is understood of how the teaching methods application assists in attaining those changes or how they add to the transformative agency growth in group environments. With this Boakye (2015, p. 3), in the words of Filho explained that, the focus of any educational campaign with regards to climate change should be learning and not teaching.

However, Pruneau et al. (2003), in the quest of searching for appropriate methods in educating in climate change, identifies three pedagogical processes for learning climate change: “local observation of phenomenon”, “conceptual change theory” and “experiential learning” (Pruneau et al., 2003, p. 431).

The local observation of phenomenon, concerns with creating appropriate platforms for the learners to observe a phenomenon in order to construct or shape their ideas. The conceptual change theory involves conceptual development where initial ideas held by students are
shaped into the more scientific notion. During this process, the initial idea or conceptions are enriched and restructured. Thus, the initial idea is either strengthened or replaced.

With the experiential learning, it involves learning by interacting with the environment. It is defined as the process by which the learner constructs knowledge bias affective and cognitive interactions with the biophysical and the built environment (Pruneau et al., 2003, p. 431). However, these three pedagogical processes complement each other.

According to Pruneau et al. (2003), the processes in applying these pedagogic processes which could serve as the content of professional development for climate change educators must include the following activities:

- letting student to engage in a local study on climate change in their environment, through observation of concrete signs and their origins, and envisioning their possible effects
- motivating them to come out with their personal opinions on climate change issues
- letting them watch them videos and still-images of various aspect of climate change
- providing them with a platform to realize cooperate activities fashioned to promote “climate equilibrium”
- encouraging learners to have sense of appreciation of the natural elements in their immediate environment (to motivate them to have the desire to conserve these elements instead of having resentful longing for the constituent of a warmer climate)
- encouraging and giving them the chance to present their new knowledge on climate change
- observe, on-site, the status of ecological, economic, urban and health systems of their communities and reflect on the possible repercussions climate change have on these components of the society.
- Giving the opportunity to inquire into phenomenon and share the ideas that result from their inquiry as a group
- Providing the platform for learners to juxtapose their ideas to scientific ideas for verification
- Giving learners the chance to present and apply their constructed ideas or knowledge

Bryan (2011) relating to Sterling’s transformative model of learning explained that, because CCE involves attitudinal change, the teaching and learning should touch both the mind (that is the knowing area involving conceptual) and the heart (that is the seeing area which involves perceptual). Thus, teaching and learning of climate change should gear much towards the affective and the cognitive skills. However, the psychomotor skills (kinesthetics/doing) of
the learner is not left behind since the learner engages in physical activities to support the manifestation of cognitive or affective domain (Sterling, 2014; Wilson, n.d., p. 6). The use of stories and videos in teaching climate change has also practically been proven effective (Cherry, 2011; Beach et al., 2019). Cherry (2011) made use of motivational stories and videos on climate change where children were passionately involved in climate change combating activities to impact on the minds and heart of student to act on mitigation measures and ultimately live a sustainable lifestyle.

Climate change education thrives well in a child-centre school. A child-centred school is an educational set up which considers the child in every decision or activities that revolve around the school (MoE, 2013, p. 8). According to Iltus (n.d., p. 11) childcentre schools make use of “interactive teaching methodologies” which encourage learner “participation, teachers as learning facilitators, group cooperation and positive competitions, activity-based learning methods”. Using the democratic process, students can be engaged in the likely causes of climate change through debate for the students to establish their own conclusion on the causes (Field et al., 2019, p. 17).

Ultimately, the use of graphical representations and videos, stories, field trips, observation, project, and enquiry based teaching coupled with discussion and creating a platform for learners to engage in “democratic process of thinking, agreeing, implementing, and evaluating concrete changes individually and in a group” through debates is encouraged in teaching and learning of climate change (Boakye, 2015; Iltus, n.d.; Field et al., 2019; Beach et al., 2019). As in the discussion above on how climate change education needs to be organised, it could be noticed that teaching and learning materials play essential roles in climate change education. The next section, therefore, discusses on the importance of teaching and learning materials in teaching and learning processes.

### 3.13.3 Teaching and learning resources

Until the rapid development of technology, teaching and learning process was much of verbal and chalkboard text presentation (Bušljeta, 2013, p. 55). Though verbal communication remains critical in the teaching and learning process yet, it is unimaginable to witness teaching without modern teaching and learning resources. Bušljeta (2013) sees teaching and learning resources as tools used to present and transmit prescribed educational material. Moharken (2019, p. 6) also sees teaching-learning materials or resources as tools utilized by teachers in lessons to aid learners “learn concepts with ease and efficiency“. There seem to be divergent view on what teaching and learning material constitute in literature. Some scholars identify teaching and learning resources to be “any support material available for use by the teacher and reading materials for children”. On the other hand, others see it to be materials purposely
meant for classroom and other curriculum support material including “books, stationery materials and equipment, wall pictures, blackboards, audio-visual aids, globes, maps, atlases, concrete objects and classroom environment” available to the teacher (Bizimana & Orodho, 2014, p. 112). However, they all seem to agree on the importance of teaching and learning materials in teaching and learning process.

Availability of teaching and learning resources is claimed to have a correlational effect on improvement of schools’ achievement. Farrell and Oliveira (1993, p. 9) posit that there are number of studies which shows that provision of basic elements such as textbooks and basic instructional materials helps in improving school achievement, especially in the developing countries. Bizimana and Orodho (2014, p. 120) revealed that teaching without teaching and learning resource compromises the effectiveness of classroom management and content delivery. Amplifying Bizimana and Orodho’s (2014) revelation, Owoeye and Yara’s (2011, p. 71) proved that, students’ achievement is a function of school facilities such as school library, science labs and persons directly involved in pedagogy. Investigating into institutional factors influencing effective teaching of Agricultural subject in public secondary schools in Kenya, Muchiri and Kiriungi (2015, p. 503) identified teaching and learning resources as the factor having the highest influence on teachers’ effectiveness.

Teaching and learning materials have a wide range of advantage in teaching and learning process. It helps to concretize conceptual thinking and bring abstracts into reality. Thus, they provide a real experience to learners, thereby making learning more fun. However, the essence of teaching and learning material use boils down to facilitating the teaching and learning process. According to Bušljeta (2013), teaching resources has the goal of: (1) “motivating the learner “. The attention of the learner in teaching and learning process is critical. The use of teaching and learning materials secures the learners’ attention and motivate them to participate in the learning process (Kapur, 2019). (2) “developing the learners’ creativity “. Learners understanding is enhanced when they engage and manipulate teaching and learning materials. Thus, as they manipulate teaching and learning materials, they begin to scrutinize and synthesizes information which in effect improve their critical and creative thinking which may also develop their creativity. (3) “evoking learners’ prior knowledge “. Effective use of teaching and learning materials helps in revising the learners’ relevant knowledge they carry to the learning of new concept. This helps in advancing to the new concept easily as learners build on what they already know and hence influence their achievement (Hailikari et al., 2008). (4) “encouraging the process of understanding, decoding, organising and synthesising the educational content, logical thinking and reasoning, communication and interaction“ and (5) “contributing to the development of different skills and the acquisition of values of students, as well as the retention of desirable knowledge, skills and attitudes“.
From the above discussion, it could be deducted that, teaching and learning resource is a generic term” used to represent all the materials and equipment or facilities which are directly or indirectly used by teachers to facilitate teaching and learning process. It has been noticed from the discussions that teaching and learning resources are critical in effective teaching, however, teachers knowledge and perception about climate change is equally important to affect teaching. Hence the empirical studies on teachers’ knowledge and perception are discussed in the next section.

3.13.4 Studies on Teachers knowledge and perception about climate change

Quality education is the hallmark of CCESD and can be achieved through strengthening the teacher (UNESCO, 2010). European Commission (2012, p. 15) states that teachers play a critical role in student academic performance, however, this depends on the knowledge of the teacher in the relevant area of his work. The UN CC: Learn (2013, p. 5) state that strengthening teachers’ capacity in delivering accurate information, integrating local content, promoting critical thinking about and acting on climate change mitigation and adaptation is crucial in promoting CCE. It further explains that this must include the cultivating favourable grounds for educators to increase their understanding of climate change and sustainability issues and the required pedagogical skills support. Teachers are one of the population influencers especially when students are concerned (Dal et al., 2015, p. 2) and as such their knowledge and perception in climate change will have a greater impact on the population. However, the literature reveals that pre-service and in-service teachers as well as students holds various conception about climate change, low level of awareness and understanding about climate change (Papamiritiou, 2004; Ekph & Ekpoh 2011; Pruneau et al., 2001; Dike & Amadi, 2016; Dal et al., 2015; Lambert et al., 2012).

Papadimitriou (2004) revealed that pre-service teachers had little understanding of theory behind ozone layer depletion. The teachers misconstrued the greenhouse effect as thinning of the ozone layer. Global warming was explained to be occurring by the pre-service as due to the hole in the ozone layer, it is allowing sun rays onto the earth surface hence increasing the earth’s surface temperature. In the same study, it was also revealed that the prospective teachers had little clue on the appropriate climate change mitigation measures. A similar finding of teachers misunderstanding the science behind the greenhouse effect was made by Pruneau et al. (2001).

In Pruneau et al. (2001) it was also identified in the teachers’ responses confusing between climate change and the normal transition from one season to another. Lambert et al. (2012), also shown the misconception held by pre-service teachers on the causes and climate change. It was revealed from the study, the difficulty the teachers to be, had in differentiating between weather and climate.
Furthermore, Whitmarsh (2005, p. 48) confirmed the presence of lack of distinction between weather and climate in lay understanding in the public domain by referring media reportages which tend to discuss climate change in the context of local weather-related issues.

Ekpoh and Ekpoh (2011), assessed the awareness level of secondary school teachers in Calabar Municipality in Nigeria. The result of the study also revealed the low level of awareness on the causes and effects of climate change among the teachers. The study attributed the low level of awareness to inadequate access to information on climate change by the teachers.

Liu et al. (2015) realized that literature on teachers in the classroom are underrepresented with regards to climate change and therefore sought to investigate into the knowledge, attitudes, and classroom teaching of in-service teachers of global climate change. Data were collected both before and after organizing professional development for them. The result from the pre-test and post-test and the interview revealed that the teachers believe current cause of climate change to be human accelerated and show concern of its consequence on humanity. However, it was noticed from the study that teachers’ attitudes towards the concept of climate change had no strong link with their knowledge. Because teachers who show great concern also sometimes held some misconception of the concept.

Sometimes our observation and expectation in relation to weather through our personal experience leads to erroneous conclusion in relation to climate change. Though climate change is statistical base people sometimes rely on personal experience which could also lead to the erroneous conclusion (Weber, 2010). Weber (2010) argue that observations are spaced in time and memory of past events can be misleading. Due to this reason, climate change cannot be easily determine by personal experience as it could easily lead to erroneous conclusion.

Despite a large amount of literature concerning teachers and climate change in other parts of the world, studies on climate change concerning teachers in Ghana is rare. However, there are studies on climate change content in the pre-tertiary curriculum and on awareness level among students (Boakye 2015; Baker & Boadu, 2016).

Boakye (2015) conducted a content analysis of the pre-tertiary science curricular. The study aimed to find out the extent to which climate change education is integrated in Pre-tertiary education curriculum. The study found that, though climate change content was integrated in the curriculum they were found inadequate. Moreover, there were other science topical issues which could have been linked to climate change education but were not liked.

In a similar way Baker and Boadu (2016) analysed the response of the secondary school social studies curriculum to climate change. In this study, teachers view on the extent to which the social studies curriculum was sought through descriptive survey. Data were collected
through a questionnaire. The study, however, revealed that the curriculum somehow responds to climate change education in equipping the student with knowledge on climate change. This implies that the curriculum does not respond adequately to climate change issues and therefore call for the introduction of topics that align more to climate change in the curriculum. The next subsection looks at the possible sources that could be consulted for information on climate change.

3.13.5 Teachers’ Sources of information on climate change

Climate change and climate change education information come about from experts through scientific research from the scientist (meteorologists) and social science research. For instance, information on climate change can be obtained from IPCC, UNESCO, UNEP [United Nation Environmental Programme] and UNFCCC. This information is made available to the general public through documentaries on television, print papers and online resources. However, information on climate change can also be acquired through personal experience and observations from the past event as well as attending professional studies (Field et al., 2019; Weber, 2010). Field et al. (2019) revealed that teachers often access information on climate change through documentaries, conversations with peers and family as well as television and online news.

3.14 Summary of the chapter

This chapter presented the concept of sustainability education and sustainable development, which the world now need to embrace for the survival of the present and the generation yet unborn. Several concepts were used to explicate that the current education system has failed to contribute to sustaining the world. Hence there is a need for whole paradigm shift in education system. The concept of climate change which is now one of the most serious problem of the 21st century was discussed. It was established that it is characterised by a long term change in climatic conditions and it is either natural or human induced.

The focus was turned to the constrains and obstacles involved in educational change initiatives. Here, Sterling’s transformative learning model was used to explain how we can extricate ourselves from our current worldview for transformation to occur for a sustainable world. The chapter also reviewed underpinning educational change theory by Fullan. Several factors needed to take into consideration in educational change were depicted in the review.

Curriculum implementation and the associated problems that hinder its effective implementation were reviewed thoroughly. Clarity, motivation, continuous professional training and monitoring, teaching willingness to participate in developmental training, teaching and
learning resources, and several others, do influence curriculum implementation and its suste-
nance.

The review put forward a gap with regards to teachers’ knowledge on climate change ed-
ucation in Ghana and the need to bridge the gap. Several pieces of evidence were put for-
ward to support this assertion.

In conclusion, the review has shown that teachers play a pivotal role in the teaching and
learning of environmental and climate change studies. However, there is a gap in knowledge
regarding the extent to which teachers can effectively implement the new curriculum in view
of the complexity, limited resources and the short duration of professional training on the new
curriculum. It is paramount therefore to critically examine the constraints and the contributing
factors that the teachers encounter when implementing the curriculum in order to identify
how they can be supported to effectively implement the new curriculum “Our World and Our
People”. This curriculum which is a component of the national curriculum entitled “Curriculum
for change” encapsulates environmental and climate change education at the basic education
level in Ghana. This forms the raison d’etre of the next segment of the study.
4 Research Method

This chapter deals with the methods and procedures employed in achieving the objectives of the study. The rationale behind the selected research design, data source, data collection and analysis are presented here. This chapter also dealt with measures taken to ensure credibility and rigor of the study, ethical considerations and data analysis strategies.

4.1 The purpose of the study

Implementation and institutionalisation stages of educational change require continuous monitoring and coaching for a successful outcome. Monitoring serves as a diagnostic tool to help to identify within the implementation of the innovation any anomalies that may exist in order to offer correctional measures or support (Fullan, 2007; Roy, 2013, p. 20). As a monitoring step, the researcher interacted with primary school teachers in Cape Coast Metropolis on the implementation of the new curriculum, as a means of investigating into the constraints and contributing factors teachers encounter when implementing the new curriculum in a bid to identifying the support they may require to augment their work with the climate change education which is an emerging curriculum area into the basic education sector in Ghana.

4.2 Research questions

To achieve the purpose as stated above, one main research question was posed. This main question was informed by four sub-questions.

What are the constraints and the contributing factors the primary school teachers in Cape Coast Metropolis in Ghana encounter in implementing the CCE as an emerging curriculum area in basic education in Ghana?

a. How do teachers understand the new curriculum?
b. How do teachers understand the concept of CCE?
c. How do teachers perceive their capacity concerning curriculum changes for CCE?
d. What forms of individual and collective support are needed by teachers to support their work with CCE?

4.3 Research design

Research design or methodology is a set of rules and processes the researcher employs in the investigating a phenomenon or a situation (Dampson, 2015, p. 75). It serves as a framework
within which the study is pursued (Kothari, 2004, p. 31). It is a blueprint which aids the researcher to present to others how he/she intends to conduct the study. It tells the reader how the participants of the research may be selected, how the data for the study will be collected, means of the collected information may be interpreted and presented (Kothari, 2004, p. 32). Thus, research design tells how the data and the procedure relevant for achieving the aim of the study is conducted.

However, the selection of a particular research design does not happen in a vacuum. It is informed or influenced by a range of factors to the ontological and epistemological stance of the researcher (views of the world and knowledge). The ontological and epistemological issues deals with the conceptual belief or acceptance concerned with the existence of, and relationships with the various aspects of the society (ontology) and the way we look at the world and make sense out of it (epistemology) (Al-Saadi, 2014).

The ontological stance of a researcher influences his or her belief relating to existential and structure of reality or what it is possible to know about the world whilst the epistemological stance of a researcher influences his or her presumptions about the sort or nature of knowledge about the world (Al-Saadi, 2014, p. 1).

There are quite a number of ontological and epistemological positions in literature, however, the two dominant positions which influence how social research should be conducted are positivist (objectivist) and interpretive (constructionist) (Al-Saadi, 2014; Dampson, 2015, p. 75). The positivists epistemological position which focuses on the relevance of objectivity are of the view that, meanings and realities exist in objects independent of ones’ conscious awaiting to be discovered. To them the truth is static and objective (Al-Saadi, 2014, p. 2; Kasi, 2009, p. 75).

However, the interpretivist epistemological position with an opposing view, explains that, the ways of knowing or making meaning about the world is through perceptions and interpretations of things around us rather than direct observation. To them, knowledge is not static and is based on our understanding which results from our backscattering on events (Al-Saadi, 2014, p. 3). They are of the view that meaning or knowledge is subjective and is acquired through exploring and understanding of the social world of the people being studied. In positivist epistemological position, reality can be reached without being affected by the process used in reaching it, thus, the knower and the known are a separate entity and as such the researcher needs to distance himself or herself from findings. However, in the interpretive epistemology, the researcher also constructs meanings and interpretations based on the expressions, demeanour and perceptions of his or her participants in a study (Al-Saadi, 2014, p. 4; Kasi, 2009, p. 96).
The interpretive epistemologists are with the assumption that knowledge is not independent of the knower but are socially constructed. Thus, the knower and the known are combined into a single entity and their interaction leads to a certain findings (Shah & Al-Bargi, 2013, p. 257; Yilmaz, 2013, p. 316). These two positions, positivist and interpretivist respectively give rise to two research designs, namely quantitative and qualitative. However, there is another crop of a research design which combines the positivist and the interpretive approaches in a study design, which is known as mixed method research design. The qualitative research approach is useful when one wants to delve deeper into a problem whilst quantitative approach is appropriate when one wants to consider a problem in wider perspective (Dampson, 2015, p. 79; Yilmaz, 2013, p. 315).

The quantitative approach involves gathering data in a quantifiable form that can strictly be subjected to statistical, mathematical or computational operations (Kothari, 2004, p. 5) to uncover the reality. The quantitative approach involves generating data in countable and measurable numbers with the assumption of objectivity. Quantitative researchers (positivist) stresses the capability of numerical data being objective, avoiding researchers influence on findings in explaining reality. However, a qualitative approach involves “subjective assessment of attitude, opinion and behaviour” of research participants (Kothari, 2004, p. 5) and it is used to gain understanding or motivation of people’s behaviour, attitudes, and opinions.

The trump card of quantitative research approach is its capability of allowing for measuring a large number of participants at a time to a limited set of questions and as a result enhancing comparison and statistical aggregation of the data (Yilmaz, 2013, p. 313). It allows for generalizations and helps in revealing a broad trend of patterns in society or the world. Despite the general acceptance of quantitative research in its efficiency in the generalization of data or findings, qualitative research proponents do criticize the use of the quantitative research design. The critics of positivist or objectivist hence quantitative research approach criticize that though quantitative research approach allows for generalizing findings, yet it has a deficiency in its applicability with regards to cultural differences, beliefs, and human experiences (Yilmaz, 2013, p. 313; Shah & Al-Bargi, 2013, p. 256). They do not provide insight into the experiences of the participants individually. The positivists are criticized of their failure in differentiating people and social sciences and natural sciences thereby assuming human beings like any other natural objects (Shah & Al-Bargi, 2013, p. 256).

Qualitative research has the capability of providing a rich and contextual understanding of human experiences via intensive study of a particular case. They provide data which is flexible and accounts for the context in which it was generated (Dampson, 2015, p. 79; Polit & Beck, 2004; Yilmaz, 2013, p. 313). Qualitative research is not of trouble-free and positivists criticize that, whilst the qualitative research is sensitive to individual and contextual based, it lacks the
ideal of being generalized to other organisational settings (Shah & Al-Bargi, 2013, p. 259). Qualitative research is also said to be costly and time-consuming. Moreover, because the researchers’ views are also reflected in the processes, his or her subjectivity can influence the study’s results and compromise the participants’ privacy and autonomy which can lead to revelation of unintended secrets or lies (Shah & Al-Bargi, 2013, p. 259).

Looking at the above discussions on the ontological and the epistemological underpinnings of studies, it could be seen that, the present study fits perfectly in interpretive epistemology. Based on the nature and aim of the study, which requires interactions with the participants with regards to implementing the new curriculum, the study was conducted using qualitative method approach. The study involved a critical review of literature and collection of primary data needed from the participants for the study. The qualitative research approach was deemed appropriate because the study seeks to understand and interpret the narratives from the viewpoint of practitioners on the ground (Fraenkel, 2012, p. 10; Kothari, 2004, p. 5), what are the constraints and the contributing factors they do encounter when implementing the climate change education component of the new curriculum. The study sought to get a deeper understanding of the teachers hence the adoption of the qualitative design in order to avoid acquiescence bias. Thus, where the participants will tend to accept or agree to whatever options or statements presented to them (Ray, 1990). Using the qualitative approach could prevent preconceived idea overriding unearthing of possible fact about a situation or issue. To achieve this aim, data was gathered by exploring the understanding and the experiences of the teachers in implementing the curriculum through semi-structured interview questions. The literature review was used to understand the concepts with regards to sustainable development, sustainability education, climate change and also to identify empirical factors that militate against the implementation of curriculum.

4.4 The study area

This research was carried out in the Cape Coast Metropolitan Assembly (CCMA) in the Central Region, Southern part of Ghana. CCMA is a fishing community and coordinates 5°11’N 1°19’W at an altitude of 21m above the sea level. The Assembly is bordered by the Gulf of Guinea to the south, west and east by Komenda/Edina/Eguafo/Ebirem and Abura/Asebu/Kwamankese respectively and to the north by Twifo/Heman/Lower Denkyira district (CCMA, 2013). CCMA is known to be the smallest Metropolis in Ghana and has a population of 169,894 according to 2010 population and housing census (Ghana Statistical Service, 2013). Figure 6 shows the map of Ghana showing central region of Ghana and location of Cape Coast Metropolis.
4.5 Education in CCMA

Cape Coast, Ghana’s first capital city, is well known in the history of education in Ghana. It is among the cities in Ghana which enjoyed “castle schools” (schools established in the castles by colonial masters) during the colonial period (Adu-Gyamfi et al., 2016; Ansah, 2014, p. 19; Martin, 1976, p. 48) and the city as it stands, boasts of most of the best schools in Ghana. These schools which were later handed over to the indigenous people Cape Coast area and Ghana aas a whole were established to teach reading and writing for merchandise and also to propagate the gospel. The schools were also established in the light to train the “Mulatos” (children of the colonial masters with their Ghanaian mistresses) (Adu-Gyamfi et al., 2016, p. 158).

The provision of education in Cape Coast Metropolis involves both the government and the private entity. The schools in Cape Coast Municipal consist of 65 pre-schools, 69 primary schools and 63 Junior High Schools, 10 secondary schools and one Technical Institute, two health training institutions, one Polytechnic and a University. The Metropolis has Metro education office which handles pre-tertiary education issues on behalf of the MoE. The metropolis has six educational circuits: Aboom, Bakano, Cape Coast, Efutu, Ola and Pedu/Abura (Davis, et al., 2019).
4.6 Participants of the study

The study took place in public schools in the Cape Coast Municipal. The targeted participants for the study were the lower and upper primary teachers in schools in the study area. The study excluded the private schools with the reason that most of the private schools employees are non-professional teachers. Secondly, since the government organized the curriculum implementation seminar for only the teachers in the public schools, I assumed that the private school teachers if any not all have taken the new curriculum implementation training. Both lower and primary were targeted since the curriculum was designed to cover both stages of primary education in Ghana. The participants consisted of 18 teachers both females and males from 10 different schools in the metropolis.

4.7 Sample and sampling procedure

Selecting the study area, I used a purposive sampling technique. Purposive sampling technique is employed in studies when a researcher has a specific interest in the population or the participants of the research. However, to Creswell (2012, p. 206) purposive sampling is used for selecting the sturdy area or the participants based on the notion that, the selected area or participants can best answer or give the information we seek for. Thus, the study area or the participants are rich in the information to answer the research questions. I purposively selected CCMA for the study due to my familiarity with the area, its vulnerability to climate change impact and also its place in the history of education in Ghana. CCMA is bordered by the Gulf of Guinea to its south and likely to suffer sea level rise from the globally changing climate. CCMA also has a place in the history of education in Ghana.

The researcher used multistage proportionate stratified random sampling technique and select ten (10) public basic schools within CCMA. The six (6) education circuits within the metropolis were used as the strata for the sampling. Proportionate approach as stated in Ochieng (2014, p. 26) was used to determine the number of schools to be selected from each circuit into the sample frame with the formula: n/N, where n is the required sample size and N is the total number of schools in CCMA. With sample size 10 (10 schools) and 69 as the total number of public primary schools within CCMA as at 2019, the proportionate factor for selecting a school from each circuit into the sample frame was 0.14. The number of schools from each circuit to be selected was arrived at by multiplying the proportionate factor by the total number of schools in each circuit. This method was used to have proportional representative of the number of schools in each circuit as the circuits do not have equal number of schools. Simple probability sampling technique was then used to select the schools within the circuits to the number required from each circuit. Simple probability sampling was used to select the schools because the schools in each circuit have similar characteristics and all participated in
the curriculum implementation workshop. However, schools were further stratified where there appear to be obvious differences in the schools in terms of facilities or infrastructure within the same circuit. The schools were then randomly drawn from the stratified schools to ensure homogeneous representation. This method was used to select the schools since all the schools in the circuits participated in the curriculum introduction workshop and also to avoid bias or selecting a preferential school.

With a predetermined number, two teachers (a female and male), from each selected school, the teachers were selected or provided by each headteacher of the school as and when the teachers available during the researcher’s first time of visit. However, the basic criteria for selecting a teacher was based on their willingness to participate and their qualification as being certified teachers in Ghana Education Service. The reason for representing both genders in the sampling frame is based on the notion that females are more concerned about climate change issues than men (Semenza, et al., 2008, p. 481).

Table 1 The sample frame for the schools and teachers within the Metropolis
(Based on data from CCMED)

<table>
<thead>
<tr>
<th>Circuit</th>
<th>No. of schools</th>
<th>No. of schools sampled</th>
<th>No. of teachers sampled</th>
<th>No. of female</th>
<th>No. of male</th>
<th>No. of teachers participated</th>
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4.8 Ethical considerations

Ethical issues concern with the right processes in social, professional and legal obligations the researcher must heed to throughout the research processes. It is a philosophical perspective dealing with moral considerations needed to adhere to, in order to foster trust and to prevent a breach of one's right (Polit & Beck, 2004). In order not to breach the research ethics, the researcher adhered to all the following ethical protocols.

The researcher ensured that the participants were safe from harm that could occur as a result of the study. All the interviews were conducted in agreed and safe rooms provided by
the school which was convenient for both the researcher and the participants. The researcher made sure all the participants had enough information on what the study was about. The researcher upon coming into contact with the participants made them aware that, their identity would no be disclosed in any manner whatsoever and for that matter their identity would be safeguarded. The researcher further made sure that the data was gathered under mutual consent and not by deception and coercion.

As a male interviewing female participant, the researcher was always conscious of gender orientations (perception of gender inequality/ gender superiority) (Scheyvens & Leslie, 2000) in order not to run over responses but rather to give level grounds that encouraged effective engagement. In addition to this ethical adherence, there are other areas of ethical concern of which the researcher considered as discussed in the next sub-sections.

4.8.1 Gaining access
Every school has a gatekeeper and it is through only him or her that one can gain access to the internal structures of the school without being regarded as an intruder. As an ethical demand, the researcher first sent a letter of introduction from his research supervisor from University of Iceland to Cape Coast Metropolitan Education Directorate (CCMED) to grant me access into the various schools in the Cape Coast metropolis. Acting on the letter of introduction I sent to CCMED, the director of CCM, issued a letter of access to the headmasters of the schools concerned through which I was able to gain access to the schools (Appendix A and appendix B).

4.8.2 Request for interview and consent form
The research participants were adults and therefore the researcher obtained their voluntary consent in participating in the study by first explaining to them the objective and the purpose of the study when their headteacher informed and introduced the researcher to them. Due to the nature of the study, the researcher supplied to the participants the request for interview letter (Appendix C) and consent form (Appendix D) outlining the aim and objective of the study, the topical issues to be discussed in the interview, the confidentiality and anonymity options and the right to withdraw from the interview at any point in time with or without the justification of his/her decision just before each interview. The participants also made sure whether the study had the consent of the education directorate as some requested to see the permission letter from the education directorate before they participated.

4.8.3 Confidentiality and Anonymity
To Burns & Grove (2001) and Dampson (2015, p. 92) confidentiality and anonymity is about managing and protecting information shared to a researcher and the source of the information in such a way that the informants’ identity does not come to bear in the public domain unless
the informants consent to their disclosure. To abide by this ethics, the information provided by the participants in any form of copies available to the researcher were protected from unauthorized access and the only persons who had access to them were the researcher and the thesis supervisor. To cater for anonymity of the persons who participated in the study, pseudonyms were used. The names presented in giving report of the study do not in any way show the real names of the participants of the study. However, the names used reflect both males’ and females’ names in the Ghanaian context. For instance, Baasiwa, Adedzewa, Abayaa, Mensima, Pebiwa Asuama, Anaa and Kyerewaa as used in this study are female names and Amoah, Oduro, Darkwah, Asare, Kuntu, Amponsah and Nuamah are male names in Ghana.

4.9 Data collection

The main source of data for the study was primary data. To avoid the risk of making mistakes that could have been prevented, it was imperative piloting the data collection instruments (Dampson 2015, p. 126). This exercise helps in giving the fore information on what could happen during the actual data collection. As a novice in conducting interview and also to test the data collection instrument, a pilot face-to-face interview with two colleague Ghanaian teachers who are also offering their respective courses in the University of Iceland in December 2019 was first done before the actual interview. To have first-hand experience with on-field teachers, though not face-to-face as it should have been in the case of this study, an on-telephone interview was further conducted with two teachers in Ghana to test for the effectiveness of the instrument. The recorded interviews were discussed with the researcher’s supervisor who advised on areas needed to be strengthened and where to be corrected for better results with regards to the interview questions and the researcher’s skills in conducting the interview. Those corrections were made and re-conducted the interviews for approval which went well with the second trial. The actual data collection took place in CCMA schools in Ghana, in January 2020.

4.9.1 Research instruments

A semi-structured interview schedule was used on gathering the data and was designed based on the sub research questions (Appendix E) and therefore consisted of four main sections comprising:

A. Teachers’ general understanding of the new curriculum.

B. Teachers understanding of the concept of climate change education.

C. Teachers’ perception and their role in climate change education and their capacity to implement climate change education.

D. The individual and collective support they need to work with climate change education.
The interview questions in section A were used to elicit teachers’ general understanding and experiences in the curriculum they are working with whilst the items in section B were used to find out their understanding on the concept of climate change education. In section C the interview items were used to elicit from the teachers how they perceive their role as teachers in climate change education and their capacity to work with climate change education whilst the section D dealt with the support available and the kind of support they would like to have to help them work with CCE in their schools.

The interview schedule introduces the sub research questions, the actual questions posed to the interviewees and follow-up questions to get further clarification and a deeper view of interviewees understanding.

4.9.2 Conducting the interview
The headmasters from each school that was visited provided the researcher with two teachers. The researcher discussed with them the objectives and the purpose of the study. Some teachers readily scheduled a date with the researcher right after the discussion and with others, the researcher had to call them on the telephone to schedule a date. Because all the 18 teachers were not in the same school some of the dates for appointment were clashing with each other but upon deliberations with them, a consensus on convenient dates and time for the interviews were arrived at. In all cases, the headteachers provided us with the venue for the interview. Some of the interviews took place at the headmasters’ office whilst others took place at the staff common room of the respective schools at the convenience of the participants and the researcher.

At the very date for the interview, the researcher made sure he reached the schools 5 to 10 minutes earlier than the scheduled time to make sure the venue for the interview was ready. For assurance of safety and confidentialities of the participants, the researcher handed to them just before each interview a request for interview letter which spelt out the purpose of the study and consent letter for them to read and consent to the interview before it begun. Though it is stated in the request letter and the consent form, the researcher explained on the matter of confidentiality and anonymity verbally to the participants with regards to ethical consideration guiding the study on confidentiality and data protection. This was seen necessary to be done to gain the trust of the participants and also make them feel comfortable as the interviews were voice recorded. The researcher, therefore, invited the participants to ask questions they may have about the study or the interview before signing the consent form which signify the voluntary nature and the right to withdraw from the interview at any stage with or without justifying their decision.
During the interview, an interview guide was used to aid the flow and sequence of questions. Each interview begun with a brief introduction of the researcher himself and then followed up by the interviewee and all the interviews were audio-recorded for later transcription and analysis. During the interview, whenever the researcher found that the interviewee had misinterpreted a question, the researcher tried to paraphrase to make the questions clearer for the interviewee to answer based on the knowledge they have about the question. Problings were also made further for more details when the researcher felt the answer provided by the interviewee was incomplete as Minichiello et al. (1995) suggests. The researcher made sure to playback the recorded interview to the interviewee at the end of each session of interview for them to be sure of the information they had provided me and where necessary add more information or to correct a statement they might think it was wrong. However, none of the interviewees disagreed or corrected any of the statements made as being wrong.

A total of 18 teachers comprising of males and females were interviewed out of the 20 teachers initially planned to be interviewed from the 10 schools. Two teachers from two different schools could not be interviewed due to certain circumstances beyond the researcher’s control. One participant called and informed the researcher of being sick and had to visit the hospital on the scheduled day and requested if the interview could be rescheduled, but it was too late for the researcher to reschedule another date or day. In the case of the second teacher the researcher could not reach the premises of the school early due to transportation problem. The researcher tried rescheduling for another time, but it could not come on due to time constraints. However, at least a teacher was interviewed from each of the two schools. Out of the 18 teachers, only 7 were male teachers.

4.9.3 Transcribing, coding the recorded audio and analysis

To have a systematic methodology of the study, the inductive thematic analyses phases of Braun and Clarke (2006, p. 87) was adapted. Braun and Clarke (2006) thematic phases of analysis begun by the researcher familiarizing him/herself with the data collected. In doing this, the researcher transcribed and listened to the audio, read over the transcribed data repeatedly concurrently with the audio to ensure accuracy. This eventually got the researcher familiarized with the raw data. At this stage, initial ideas were noted down. In analysing the data, inductive thematic analysis was deemed important to allow for the trail back and forth between data constructs and raw data which in the process aided in themes identification (Fereday & Muir-Cochrane, 2006, p. 83).

The potential codes were highlighted and assigned codes or labels in the form of short sentences extracted out from the transcribed data. The codes represent the part of the data which were found interesting and are the basic segment of the whole raw data. The analysis begun through the coding and organizing the raw data into meaningful categories.
After having exhaustive codes across the transcribed data, the various codes were sorted into potential themes and collated all the coded data extracts under the identified themes. Here some codes were combined while others that seem irrelevant were discarded.

These themes were further reviewed to ensure compatibility with the transcripts and to identify parts they needed to be separated or combined and then redefined and named. The findings are presented in the next chapter.
5 Findings

The data gathered in this study was primary data. In this chapter, the findings that were obtained through inductive thematic analysis of the data collected are presented. The findings from the teachers’ narratives are presented in four thematic categories with each corresponding to each of the sub-questions. Also, within the categories, other themes emerged and are therefore presented respectively within those categories. Though the data were collected from both male and female, there were no obvious differences in views between male and female with regards to the results obtained. However, there could be lived experiences likely to be very different as a result of socially constructed gender norms that could impact on female teachers in their roles within the school.

5.1 Teachers’ experiences of training and support

One area of concern of the study to find out how the preparatory workshop impacted or influenced the understanding of the curriculum in general with regards to its focus and principles of its delivery and also to find out if there is any support available and how those support impacts on their understanding of the curriculum. All teachers were asked about their understanding of the new curriculum and their answers generally showed their in-depth understanding of the curriculum to be the one which has learner transformative focus and required of them to act as facilitators to actively engage the learners through inclusivity, collaborative and participatory teaching and learning processes. However, when asked of how the preparatory workshop impacted on their understanding of CCE almost all the teachers stated that the workshop was held to introduce them to the general overview of the curriculum. They were introduced to the changes made in the curriculum, and how to approach the curriculum in general but not detail into specific subject areas such as climate change.

For the August workshop, it wasn’t content-based workshop. It was rather a general overview of the new curriculum. The changes, we were taught the changes in the new curriculum, what the new curriculum was seeking to achieve, and the techniques that we are going to use in solving specific subject skills. So, we were taught new techniques, we were taught how to teach to get an effective result. It was not a specific subject that we went to look at. We looked at the whole curriculum. (Baasiwa)

With the workshop. It is I think the workshop did not give us in-depth knowledge on climate change but just gave us an overview of what is in the curriculum. It is something that we just glanced through and we just came to
our various school. Since the workshop took only 5 days. There weren’t enough
days so we couldn’t go deep into climate change. (Asuama)

Almost all the teachers said that the workshop dealt with the differences in the old curric-
ulum and the new one with regards to how to operationalize the curriculum in the classroom.
Specific subject details were not given but were taken through a general overview of the cur-
riculum.

The teachers were further interrogated to find out whether there has been another work-
shop with regards to the new curriculum apart from the curriculum introductory workshop.
Almost all the teachers responded: "No”. However, the responses from two teachers sug-
gested that there had been a workshop on climate change. Though the responses from the
two teachers suggest that there has been a workshop on climate change for the schools, fur-
ther interrogation revealed that the workshop was not attended by all the teachers in each
school but representatives from each school in the circuits attended so that they in turn do in-
service training for their colleagues in their various schools.

No. For this one, I will say no. Apart from that workshop, we did for the curric-
ulum introduction, the rest depend on the individual teachers and maybe the
teamwork that we do in the school. (Oduro)

... Aside from the new curriculum workshop that we went. When we came back
to school the Metro office had another workshop specifically on climate
change. ... but each school brought a representative to go for the workshop and
then you come back and do in-service training to the other teachers. So, all of
us didn't leave our classrooms to go to. Only a few went and then they came
back to do in-service training for other teachers. (Baasiwa)

The extracts from the interview as shown above show disparities between their responses
on whether there has been a workshop on climate change besides the introductory workshop
held in August.

The participants were further interrogated to find out of support available to them in work-
ing with CCE. From all the interviews conducted, every teacher did mention Professional
Learning Community (PLC) which held every week internally in their schools and a cluster-
based PLC held once every school term in the various circuits throughout the metropolis as
the support available to them.

Ok I will not say only climate change but when we went for the new curriculum
workshop, there were some days given off for workshops, it is called PLC that
is a professional learning community, on those days the children will not come to school, but only the teachers so that officers from Accra and the Metro office at Cape Coast come in and help us with the subject areas that we find difficulties but maybe as time goes on they will touch on climate change. And even apart from that, on Wednesdays, the director for Cape Coast Metro, that is Mr Nkum, has agreed that every school in Cape Coast must have PLC on every Wednesdays. We normally close school at 3 O’clock but on Wednesdays we close the children at 2 O’clock and have the internal PLC, that is from 2 to 3 o’clock. It involves only the KG and primary because JHS is yet to implement the new curriculum. And every 3 months we come for the general PLC were the officers from the Metro education office and those from Accra come and take charge. (Abayaa)

The participants were further interrogated at this point to find out, whether there has been any discussion concerning CCE in any of their PLC meetings. From all the interviews, none of the responders gave an affirmative response. When probed further why there has not been any on climate change yet since they started the PLC, it was revealed that no one has ever brought such issue on board. However, they were optimistic that, discussions on climate change may come on board for discussion as they continue to meet weekly.

However, the responses given by the teachers with regards to their understanding on the focus and principles for delivering the curriculum can be put into five sub-themes which include: holistic child development; learner-centred classroom; teachers as facilitators; inclusivity and collaborative learning and terminology change.

5.1.1 Holistic child development

In their narratives, almost all the participants explained how the curriculum focuses on developing the child holistically by developing in the core competencies and values. They expounded how the focus of the curriculum is to train the children not only to pass exams but to develop their competencies in critical thinking and problem-solving skills, effective communication skills, creative thinking skills whilst also nurturing them to become honest, creative, responsible citizens as well as a global citizen. A class three teacher in one of the circuits, as expressed in nearly all the teachers, outlined that:

It also involves the child’s environment in the home and out of the school’s environment. The curriculum concerns with developing the child to be becoming honest, creative, and responsible citizen. (Pebiwa)
When probed for further explanation, it was expounded that the new curriculum recommends engaging the students in activities to develop their critical thinking skills and building on values than the mere passing of examinations.

With the new curricula, most of the work depends on the child. The child is supposed to do so many research works, and present in class to develop their critical thinking skills, communication skills, and engage them in activities that will develop them to become honest, and good citizens. The old curriculum concentrated on the child passing exams, this new curriculum is not like that but looks at developing values in the child (Pebiwa)

To add to what has explained another teacher from different circuit added that:

... Ghanaian child holistically so that at the end the child will become a global citizen. A child who will fit into any activity in any part of the world. (Asare)

As depicted in the extracts from the interviews, every teacher from all the grade level seems to agree that the curriculum focuses on development of core competencies and values.

5.1.2 Learner-centred classroom

In all the interviews, the participants mentioned a learner-centred approach in lesson delivery as a difference between the old and the new when probed on the delivery approach of the new curriculum.

At first, it was more teacher-centred but now it is more child-centred which is very good to my opinion. (Adadzewa)

However, one teacher, acknowledged that the old curriculum was also supposed to be learner-centred but was not implemented as such.

... they are almost the same but what they are much emphasizing is everything should be done by the pupils even though the old one also states that initially they were supposed to be done by the students but was being done by the teachers. But for this one, the more emphasis is placed on the child coming out with those ideologies that we want them to come out with. (Darkwah)

The teachers acknowledged that though the mode of delivery of the previous curriculum also involved learner-centred activities however, the current curriculum emphasized on learner-centred approach in its delivery.
5.1.3 Terminologies

Another thing that kept resurfacing from the narratives of the participants was the introduction of new terminologies in the curriculum. These terms: strands, sub-strands, content standard, indicators and exemplars which are closely associated with the teachers work in the new curriculum kept being mentioned as being different from the old curriculum.

When the participants were probed further on the features of the new curriculum compare to the old one, it was revealed that:

Looking at this new curriculum I will say that, it is the old that has been rebranded. And then just a few things added onto it. So, we have terms like strands, sub-strands, indicators, and content standards. The indicator is, what you want the kids to achieve at the end of that particular lesson. So when you go through your curriculum you realize that each, it is organized into strands, sub-strand, content standards and then indicators, of which if it were to be the old curriculum we would have said, Specific objectives so the indicator is more like specific objective. The strand is the broad area that, that subject is supposed to cover, and then, the sub-strand is more like the subsets or sub-topic within the broad area. (Baasiwa)

Even though these terminologies were new things in the new curriculum, they however, pointed out that, those terminologies are just a rebrand of the terminologies in the old curriculum.

5.1.4 Teachers’ as facilitators

In an attempt to get more insight into how the teachers understand the curriculum, they were probed on whether the curriculum requires them to make changes in how they work or teach. The role of the teacher in working with the curriculum was revealed in almost all the participant's narratives. The teachers understand their role in the use of the curriculum as facilitators. They noted themselves as facilitators who are to create the platform and guide the students in the teaching and learning process. This is shown in the following extract from some of the interviews as displayed below.

... the teacher creates the atmosphere or the environment in such a way that it will suit the child to think critically and responds to words or issues or see the environment in different perspectives. Right now, we need to spoon-feed the children again. We are rather to facilitate their learning. (Kyerewaa)
The teachers see themselves as facilitators and therefore need to move away from teacher-centred approach in teaching as has been the case in the previous curriculum.

### 5.1.5 Inclusivity and collaborative learning

The participants through their narratives in distinguishing the differences between the new and the old curriculum also exhibited that they understand the curriculum to have an element of inclusivity and collaborative learning.

When probed whether the new curriculum requires them to make changes in how they work or teach, their responses also exhibited understanding of the curriculum having element of inclusivity and collaborative learning in its delivery.

Yes, there are changes, more especially this new curriculum, involved every child in the class. So, you need to know the individual differences of children and then tailor your lesson towards them. Yeah, and you need to group them and give them more project work, more group work so that all of them will be able to participate. (Asare)

... there is the collaborative learning technique, so now the children are to learn in groups, they are to do exercises in groups, discuss in groups, pairs also but all of the collaborative learning done before where you deal with the child individually. Here the children are allowed to even peer teach themselves. (Baasiwa)

Every teacher agreed that the curriculum now requires them to involve every child in the class through group work and individual exercise.

### 5.2 Teachers’ perception about the of climate change and CCE

In this part of the study, the intention was to elicit responses from the participants concerning their understanding of the concept of climate change and climate change education. The areas of which teachers were asked questions to establish their understanding includes what CCE is, it’s content and the teaching strategies appropriate for CCE. Responding to how they understand what climate change education is, the teachers gave various responses which can be grouped into three themes: Seasonal changes, curriculum change and UNESCO (2015) related.

In educating the learners on climate change, the teachers see themselves as having the role of helping the learners to recognize the causes, effect and avoiding activities they contribute to climate change. However, teachers’ idea on the content of climate change education is geared towards sanitation and environmental degradation whilst the use of videos, pictures,
field trips, observation and discussion and debates as the appropriate teaching strategies for CCE.

5.2.1 Periodic changes in climate (Seasonal changes)

In an attempt to explain the concept of CCE, their explanations suggest their understanding of the concept of climate change in terms of the two main periodic seasonal changes in weather (Dry season – Harmattan and Wet season – rainy) in Ghana. Hence, their understanding of the concept of CCE is to educate the learners on these two seasons and their effects on humanity.

This is what a section of the teachers said when probed to tell how they understand what climate change education is:

Climate change is the change in weather as in rainfall, raining season, dry season and the stuff. I think it is about educating the kids on the changes in the weather which constitutes the rainy season, dry season, cloudy, foggy and sunny weather. (Adadzewa)

Yeah, it’s about the weather changes. Right now, we are in the harmattan season, that is dry. And it affects the kids as well, nasal, eye problem, that is Apollo that we all talk about, sometimes headache comes because of the weather. The air itself is very dry, all these things amount to the climate change that we talk about in the classroom and it’s a huge problem to the kids. (Kuntu)

These explanations a section of the teachers suggest how they perceive climate change in terms of the normal alternating seasonal changes between the dry season and rainy seasons we experience in Ghana.

5.2.2 Curriculum change

In explaining the concept of CCE, a section of the participants also expressed their understanding of the concept of CCE in the current changes in the educational system in Ghana. They regarded the change from the old curriculum to the new curriculum as the CCE.

Climate change education if I should say is, I think it’s all, it talks about the changes in our education system. If I should say that is how I understand it. The changes in our education system as compared to the, to that of the old system that we were running. Yeah. So it has a link with the curriculum change, whatever, because everything about the child's teaching and learning experience has been changed. Yeah. About the child's education. (Pebiwa)
This section of the participants believed CCE is concerned with the change of the old curriculum to the new curriculum.

5.2.3 UNESCO (2015) related explanations

Other participants gave varied explanations which do not fall within the other two themes identified but relate to the explanations given by UNESCO (2015) and the ozone layer. Though their explanations were not accurate comparing to that of UNESCO (2015), they contain some elements which relate to the explanations to CCE given by UNESCO (2015).

The climate change education just like as I said we were having a normal routine in which the weather is but now there are some changes and there is a cause for the change the climate change education is going to teach the child the causes that make the climate change comes and what we can do, remedies what we can do to make it sustain. (Kyerewaa)

On the other hand, another participant explains the concept of climate change this way:

It is the depreciation of the ozone layer. Gradually wearing away of the Ozone layer. (Amponsah)

When probed for further explanation, it was explained that:

Due to human activities like industrial activities, cutting down of trees, destroying the water bodies through all leads to the, the chemicals that goes direct, because the trees are protecting the chemicals and then, but it goes straight and then it destroys the ozone layer, and then we are also having the adverse sunshine on the earth. So, we have to educate the student on these activities which bring about the wearing away of the ozone layer. (Amponsah)

They believe that climate change is concerned with educating the learners about the causes of climate change and its mitigation measures. However, one out of the 18 teachers believed that it is about educating the learners about the causes of ozone layer depletion.

5.2.4 Content of climate change education

To get a deeper understanding of how the participants understand the climate change concept, the participants were probed further on what the content of climate change education
is. Though some of them honestly declared of not know the content of climate change education, most of the participants saw human activities such as improper disposal of waste, deforestation, sand winning and illegal mining and the need to stop those activities as the content of climate change education.

The issues we talk about just like I said are the “galamsey” activities (illegal mining), cutting down of trees, defecating at the beach, dumping of waste at places where they are not supposed to and the need to stop those activities. These are the issues common with our society which the curriculum wants to address. So, we are to give the children this knowledge so that they refrain from these activities as they grow. (Baasiwa)

As shown in the above excerpts the participants concurred that the content of climate change education is concerned with sanitation and environmental degradation.

5.2.5 Teachers’ role in CCE
When teachers were asked of their role in CCE, nearly all the teacher saw their role as helping students to know the causes and effects climate change to take inform decisions in their daily activities. This is depicted in the interview extracts below.

I think as the definition says I am supposed to let them know the causes and effects, and prevention. (Mensima)

... the role of the teacher is to let the children or the pupil know the causes and effect of the climate change in order to desist from activities that have negative effect on the climate. (Oduro)

Teachers only see their role as helping the learners to gain knowledge on the causes and effect of climate change and to avoid activities that have negative effect to on the climate.

5.2.6 Teaching methods
When teachers were asked of the teaching methods important for CCE, almost all the teachers mentioned the use of videos, pictures and field trips coupled with discussion as the best way when working with CCE.

MH a female teacher said that:
... you can use videos and pictures. If you are lucky to have access to projectors or even laptop, you can show to the children pictures, videos and discuss with them of human activities that can cause climate change. (Mensima)

It can’t be field trips so that the kids will go and see hands-on problems in their environment so that they can solve it for themselves. (Asare)

All the teachers agreed to the use of pictures, videos, field trips and discussion as the appropriate teaching strategies for delivering climate change lessons.

5.3 Teachers’ perception of their capacity in working with CCE

At this point, responses on how the teachers perceive their capacity to implement climate change education as required by the curriculum were elicited. When teachers were asked of how they perceive their capability in implementing CCE, some teachers expressed explicitly having the requisite knowledge and experience to work with climate change education. They pointed out on the other hand that, their effort could be hindered by teaching and learning resources, others expressed otherwise. However, their narratives also depicted their positive attitude towards the implementation of the curriculum. When asked of their strengths and weaknesses in working with the curriculum, almost all the teachers indicated that the curriculum, internet and their knowledge on how to read and write are their strengths. They however, saw the students background and inadequate teaching resources as their weakness in working with the curriculum; as the excerpt depicts.

I will say the curriculum is one of my strength because it gives the guidelines to implement the curriculum. I can also talk on the internet. Because with my phone I get information on what to teach. Now the weakness has to do with the students. You give them work to research because most of them don’t have access to the internet for them to search for information and it does not help us at all. Because their textbooks are also not ready it makes it difficult for the students to get information. When you give them a research assignment because they don’t have textbooks, they are not able to bring any information to support the class activity. Only a few are able sometimes able to bring information, that is those whose parents have smartphones and willing to give it their wards for the work. Moreover, teaching aids to help deliver lessons easily are lacking. We don’t have ICT facilities which help lesson delivery. So, for the capacity to implement the climate change education effectively as required is low. (Oduro)
Analyzing their responses to their capacities, three themes suggesting their low capacity to implement CCE emerged. That is teachers’ teaching resources; knowledge; and students’ background. Most of the teachers expressed their low capacity to implement CCE as required by the curriculum in terms of inadequate teaching resources and students’ inability to respond to research activities. Responses from a section of the participants also suggest their low capacity to work with CCE with regards to their limited knowledge on the CCE concept. A critical look at their responses reveals that, at least each participant’s response expresses their low capacity to work CCE either in one or two of the identified themes.

5.3.1 Teachers knowledge

From the interviews, the responses from some teachers suggest that they lack the requisite knowledge and therefore need to work extra for effective result in working with CCE. When asked how they perceive their capacity to work with CCE, some of the teachers said that:

I think I have to be abreast myself with it before. I have to prepare well before to give my best. (Anaa)

I think much is needed to be done to effectively work on climate change education. On my part, I think I need to do more readings as well. (Nuamah)

To get deeper knowledge on the teachers’ capability in working with CCE, the researcher decided to probe further on the kind of knowledge the participants have about climate change and CCE. Almost all the teachers admitted not having enough knowledge and information on climate change and CCE.

Well I have, I don’t have the comprehensive knowledge about climate change but I have the basic knowledge in climate change. I know that at least some of our activities contribute to the changing of the climate. And I know that when we say climate change it is not one person’s job. It is a group of people or it concerns everybody because one way or the other what I do, what you do contribute either negatively or positive to the climate. I don’t have a comprehensive understanding of the topic but at least I have the fair and basic understanding of the topic. (Kyerewaa)

When asked to give an example of the knowledge she has about CC and CCE she clarified that:

Oh, for example burning of bushes, car fumes, deforestation, dumping of waste in the environment all contribute to climate change. (Kyerewaa)
As shown in the extracts from the interviews, almost every teacher agreed that they have limited knowledge on the concept of climate change and CCE.

5.3.2 Teaching resources

When asked of how they perceive their capacity in working with climate CCE, most of the teachers saw themselves as having a low capacity in working with CCE in terms of unavailability of teaching resources.

As a teacher, I think I am capable to teaching or implementing CCE but maybe the resources that we will need to make the lessons more child-centred or more activity base is what sometimes makes it a problem. Like I was saying on the pollution topic if we had projectors that could have helped. Maybe you show pictures, they look live pictures or videos of activities that contribute to air pollution but we are not having these resources, so some of them you just have to tell them and also you just have to show it from the textbooks that they have. (Mensima)

From their narratives, they saw themselves having the basic required knowledge needed in implementing CCE at the level at which they teach, and they would want to do it right. However, what hinders their effort is teaching and learning materials that would aid in their work with climate change.

The researcher at this point decided to find out the resources they have access to in working with CCE. Nearly all the teachers stated having access to the curriculum itself, access to the internet through their phone, you-tube videos through their phones and science textbooks with pictures on climate change issues. Though two schools did the state of having access to computers in their school, only one has access to internet.

What we have now is only the Curriculum, and some of the old books which have some little little information on climate change issues, the internet through our phones (Oduro)

From the interviews, it can be noted that the resources the teachers have access to in working with CCE are limited to the natural environment, curriculum, internet and videos through their phones and other pieces of information in other old science textbooks available in their schools.
5.3.3 Students’ background

In addition to teachers’ insufficient knowledge and inadequate teaching and learning resources as factors hindering their ability to work with CCE, students’ inability to cooperate in teaching and learning stemming out from their parental background (poverty, illiteracy) was also seen as a hindrance to implementing the CCE. From the interviews, it was revealed that learners have not been able to contribute to teaching and learning through the research assignment given them due to lack of access to computers and internet and smartphones in their homes.

... when you give the students' research assignments as the curriculum requires, they are not able to do it because they don’t have the resources at home. The parents who are to help these kids, some are not even using phones and then to talk about computers and internet at home. It is only a few who may have access to these gadgets, and this makes it difficult to work as the curriculum requires you to. Some parents also refuse their children access to their phones even if they have the fear that their children might spoil the phone. (Pebiwa)

Most of the teachers stated that the students’ inability to do research assignments is a problem to them when working with the curriculum.

In summary, teachers’ perception of their low capacity to work with CCE is much focused on issues that are external to themselves, such as a lack of teaching resources and lack of parental support. None of the teachers mentioned any need for strengthening their own pedagogical capacity as an important aspect of their capacity to be developed.

5.4 Teacher support needed

The interest of this section of the study was to investigate the kind of support teachers need as individual and the school in general to enhance their work with CCE. To fulfill the aims of the study the researcher decided to find out from the participants the support they would require personally to strengthen their capacity and the support their schools need in general to strengthened its capacity to work with climate change education. From their narratives, workshops on climate change, provision of textbooks, internet access, ICT centre, projectors and access to electricity were the support the participants made mention of. Interrogating the participants on their support needs to strengthen their capacity to work with CCE, the responses given were apparently the same as when they were asked of the support their schools need to work with CCE. Their responses on support needs is much concentrate on the need of
teaching resources than support needs in expanding their knowledge in content and pedagogy.

When asked of the support they would personally like to have to work with CCE, nearly all the teachers said that:

I think they have to provide us with textbooks on climate change education, teaching aids, I mean pictures, videos, computers and internet access. ... some our classrooms to do not have electricity so if the authority can extend electricity to all the classroom, it will be helpful. (Amoah)

Organizing workshops, I think when they do that, we are going to have new things to improve upon our knowledge to help the kids. And the provision of materials that we can use in delivering our lessons. (Adadzewa)

Teachers believed what they need to support their work with CCE is teaching and learning resources as well as a workshop on CCE for them to gain more knowledge on working with CCE.

To get more information on the support needed to work with climate change, the participants were probed further on support they think their school will required to support their work with CCE.

I think the school will need the same things I mentioned. So as a school we need textbooks, the school can be equipped with computers with internet access, projectors and provision of more documentaries or videos on climate change issues, courses on climate change education too can be organized for teachers. And not all of the blocks in the school has access to electricity, so if electricity is extended to all the blocks it will help. (Mensima)

The support teachers think their schools need is the same as they themselves. The support teachers mention require by their schools to work with CCE include textbooks, computer labs, internet access, workshops on CCE and electricity supply in their schools.

Overall, the teachers emphasised the change that is needed is solely based on external support, i.e. something that they should be provided with, such as material resources. None of them explained that the teachers themselves, need to change, e.g. in how they work or how to strengthening their own capacity in pedagogy to be able to implement the new curriculum.

As almost all the teachers recommended for a workshop on CCE, in view of this, the researcher decided to find out from the participants the time they think will be convenient if workshop should be organized for them. Most of the teachers said they preferred it to be
organized during the school term with the reason that, if it should be organized during vacation it is going to prevent them from embarking on their holidays. On the other hand, few of the teachers also suggested that it will be better during the vacation, because it should be organized during the school term, it is going to disrupt learning.

I think workshop on climate change education can be organized on Fridays getting to school closing time or a day every week where the teachers come early in the morning to have it before school starts. Vacation too is not bad but sometimes you vacate, and the teachers would want to travel so it becomes a problem for those teachers. So, I think within the school term is okay. (Amoah)

On the contrary, other teachers suggested that:

It entails a lot so it should be during the vacation so that the teacher will have time to study. During school hours it will disrupt the teaching. (Amponsah)

Majority of the teachers wanted the workshop on CCE education to be organized within the school term whilst few anted it to be organized during vacation.

5.5 Summary
The results from the interview indicate that the teachers gained understanding of the new curriculum in general with regards to its focus, their role as facilitators and the role of the students in delivering the curriculum during the introductory workshop hence enhancing the curriculum implementation. This understanding of curriculum culminated as a result of the introduction to the curriculum workshop hence indicating how important it is to provide clearly to teachers, adequate information on the curriculum during the initiation stage of curriculum change.

However, the result also clearly suggests that the participants’ misconception and misunderstanding of the concept of CCE, inadequate teaching and learning resources and the students background (poverty and illiteracy level) are the factors likely to hinder the CCE implementation. Another major factor which is likely to hinder the implementation is the difficulties in changing from the teacher-oriented classroom to the student or learner centred classroom. However, he initial stages of PLC in each school and teachers’ positive attitudes towards the curriculum are the factors enhancing the implementation of the curriculum.

All the teachers seemed to agree for their schools to be provided with the teaching and learning materials and workshops on CCE to support their work. They recommended for workshops to be held within the school term. However, based on the teachers responses in the
interviews, the teachers did not prioritise the strengthening of their own pedagogical capacity but focused mostly on the lack of resources and lack of partental support. In sum, none of the teachers explained neither any need for more pedagogical knowledge nor need for change in the pedagogical approach they use, i.e. a need for support in changing how they work when implementing the new curriculum.
6 Discussions and conclusions

The main purpose of this study has been to investigate the constraints and contributing factors primary school teachers in Cape Coast Metropolis encounter in classroom when implementing the curriculum in a bid to identify how they can be supported.

In this chapter, the findings in relation to the research questions posed are discussed. The implications of the study are presented and then recommendations for education policymakers are given, as both indicators of what needs improvement and what kind of support is needed to offer the teachers who are the ones who implement the curriculum.

6.1 Teachers’ experiences of training and support

Understanding the principles and focus of the general curriculum was deemed important as it will shape the belief and the attitude of the teachers concerning the new curriculum and therefore enhance its implementation (Fullan, 2007; Roy, 2013). As pointed out by Fullan (2007) curriculum initiation and implementation require adequate preparation which includes awareness creation, provision of resources and teacher orientation towards the curriculum. It is also indicated in the literature that a school with a culture of learning community engenders the improvement in teachers’ knowledge and students’ achievement (Dogan & Adams, 2018; Huffman et al., 2016; Schaap & Bruijn, 2018; Teague & Anfara Jr., 2012). Examining the teachers’ knowledge and perception with the new curriculum revealed their general understanding of the new curriculum.

The teachers’ participation in the introductory workshop as part of the initiation stage and establishment of professional learning community (PLC) in the various schools seems to have given the teachers some knowledge on the principles and the focus of the curriculum. Teachers categorically stated that the workshop introduced them to the components of the curriculum, the focus, classroom management and the approaches to implementing the curriculum in general. This could be the reason behind their knowledge on the principles behind the implementation of the curriculum, the roles students, as well as they themselves, are supposed to play and bring forward the meanings of the terminologies used in the curriculum. Teachers narrated how the curriculum requires of them to facilitate students’ learning, involve all learners in lessons and encourage students in collaborative learning. It was further explained that, the curriculum has the focus of developing the child holistically where they are supposed to develop the learners’ competency skills, nurture them to become good citizens and the inclusivity nature in its approach of delivery. The teachers’ knowledge on the principles and focus of the curriculum confirms what the principles, the focus and curriculum delivery as outlined by NaCCA (2019a, p. 14) and therefore could serve as a driver enhancing the implementation.
They also confirm Fullan (2006, 2007), Nevenglosky (2018) and Zaifuddin (2015) emphasis on the importance of giving adequate information and educating the various stakeholders on objective of the curriculum. This seems to have been true with Fullan (2007) which states that giving adequate information on instructional practices needed to work out the curriculum at the initiation stage serves as a vehicle for the implementation of the curriculum. However, it is important to note that, the teachers knew these and could express them, their thorough understanding of how to perform or to coordinate these principles and their roles as they narrate them is difficult to point out. Thus, how this knowledge as they put out here and how it is translated into classroom practice needs further research with particular focus on factors such as teachers’ understanding of the curriculum and their classroom work together with infrastructure and teaching resources (Alderson & Wall, 1993; Everard et al., 2004; Pálsdóttir, 2014). The literature indicates that, for a successful transition from one curriculum to the other, there is a need to involve the stakeholders. This accounts especially for teachers in all stages in the change process (Fullan, 2007). This helps the teachers to get understanding of the innovation right from the inception. The understanding of the philosophy, principles required to approach is enhanced when teachers are involved in curriculum development. It also engenders sense of ownership and hence serves as driving force for the curriculum implementation at the classroom level.

Summing up, the findings of this part of the study indicate teachers knowledge about the curriculum and the approaches they are to use are in line with the proposed curriculum framework (NaCCA, 2019a). However, as to how this knowledge could effectively reflect in their classroom activities is difficult to say.

6.2 Teacher’s perception of the concept of climate change and CCE

With regards to the new curriculum, teachers are to educate learners on climate change hence teachers’ understanding of the concept of climate change and climate change education was of great concern in this study.

When teachers were asked of how they understand climate change education, nearly all them explained it referring to weather and transitions between the two seasons experienced in Ghana (Wet [rainy] season and Dry [Harmattan] season). Their definition seems to be more associated with day to day weather condition in the two seasons than the climatic changes as indicated in the literature, i.e. involving long-term changes in climate variability (IPCC, 2012, p. 557; Shanahan et al., 2013, p. 14) whereas weather deals with the day-to-day atmospheric conditions (Bathke et al., 2014, p. 3; Shepardson & Hirsch, 2019).
Analyzing the teachers’ responses suggests their awareness of the climate change happening but, they tend to rely on their day-to-day experiences of the weather conditions in discussing it. Most of the teachers explained how the weather has been changing as we have in Ghana fewer rains in rainy season as compared to previous rainy seasons. Yet their explanation lacks the decade-long term frame which describes the concept of climate change. This finding is in congruence with Weber (2010) Papadimitriou (2004) and Lambert (2012) which indicated that people confuse the concepts of weather and climate and also tend to rely on their personal experiences in discussing climate change though it is statistical phenomenon. The misconception and misunderstanding on the meaning of climate change is also demonstrated in earlier study by Pruneau (2001) which indicated people confuse between climate change and normal transition from one season to another.

However, examining responses given on the climate change education, explanations were given that had little element of definition of climate change education presented by UNESCO (2015). This indicates that some teachers are lacking substantial information to be regarded as a correct explanation for climate change education. One clear example was given by a teacher who explained climate change as the depletion of the ozone layer. This misconception and misunderstanding between climate change and ozone layer is in line with Papamiditrou (2004) research where teachers incorrectly related ozone layer depletion to climate change.

Another misunderstanding was related to the curriculum itself. Some teachers mistook climate change education to be changes in the educational system being implemented in Ghana. These teachers explained climate change education being the change from old curriculum to the new one. This explanation is in no way related to the concept of climate change or climate change education. Clues from their gesture during the interviews suggest, that these teachers are not abreast with the content of curriculum, thus not being aware that climate change education is even part of the curriculum. These teachers seem not to understand the concept and, based on their explanations, they have never heard of it. This further, explains the revelation from their narratives that, the initial workshop was only an overview of the curriculum. However, upon more explanations and analysis of their responses it seems that they were more geared towards the transition between the two seasons than the actual meaning of climate change. Their initial response might have been informed by the previous question posed to elicit their understanding on the new curriculum in general. That is not clear from the data.

Thus it seems to be a limitation of the research design and gives ground for further research on the topic. However, this came not as a surprise keeping in mind research on initial and implementation stage of educational change. Research has indicated that implementers need to be given adequate preparation and either coached or given professional opportunity to develop their knowledge with regard to content and pedagogical skill (Carless, 1998; Fullan,
2007; Razzaq, 2012; Roy, 2013; Tarosa, 2013). Thus, analysing the teachers’ responses suggest that, though they had introductory workshop, the development might not have been enough. Also, the professional learning community meetings seems not have had its effect, since the teachers are not yet ready to be engaged with climate change education (CCE).

With regard to content of CCE there were few teachers who mentioned causes and effect of climate change as the content of CCE including examples such as burning of bushes, illegal mining, littering and defecating at the beach, improper waste management, beach sand excavating, indiscriminate logging. This indicates that few teachers are prepared for this topic in their teaching though these topics are supposed to be part of the new curriculum and evaluated as important. According to UNESCO (2015) CCE is the type of education that helps learners to recognize the causes and effect of climate change, prepare them to adapt to its impact and empowers them to take appropriate action to live in a sustainable lifestyle. Now juxtaposing teachers’ perception on the content of CCE to that of the definition of UNESCO (2015) leaves out some essential aspect of the content of CCE. A critical look at teachers responses reveals that they seem to ignore mitigation and adaptation strategies to climate change as aspect under CCE and it seems that the teachers do not have the knowledge of these being important part of the content of CCE. This implies that the teachers do not have comprehensive understanding of what constitute the content of climate change education.

CEE has a direct link with sustainability education (UNESCO, 2013) as its aim gears towards promoting sustainable world. As discussed earlier, Education for sustainable development (ESD) or Sustainability Education (SE) do not have a common universal model or understanding of what is to be worked with and how. This has to be related to local sites and situations (Pálsdóttir, 2014). Therefore, UNESCO (2005) has emphasised that every country or community needs to define its sustainability pathway to reflect their conditions and culture. In this research it was noticed that though some of the participants held varied misconceptions about the concept of CCE, their knowledge and perception on the content of CCE is hinged on sanitation and environmental degradation. Analyzing the curriculum OWOP, in relation to the ESD phenomenon, reveals that the curriculum is oriented towards problems of Ghanaian society where the prevalence of “galamsey” (illegal mining), degrading water bodies and the forest, bush burning, fishing with chemicals, inappropriate waste management has crept into the society, i.e. indicating the right path of sustainable development and including the essence of ESD. This implies that teachers’ perception of the content of CCE might have been influenced by the content of the curriculum, particularly in the teachers’ narratives stating the curriculum itself as one of their strengths in working with the curriculum. This idea of the curriculum being the strength for implementing the CCE was also demonstrated in Pálsdóttir (2014) where
teachers indicated that the inclusion of sustainability in the national curriculum as one of the factors contributing to the success of implementing sustainability in the schools.

The teachers perceived their role as climate change educators is to help learners understand the causes and effect of climate change for them to desist from those activities. However, the role of climate change educator goes beyond helping children to know what the causes and effect are when the concept of CCE is analysed, i.e. CCE requires change of mind or change in attitude (Anderson, 2012; Bryan 2011; Sterling 2001; UNESCO 2013; Wals, 2014). This has been explained by UNESCO (2013) and Anderson (2012) that, the role of teachers is not only of helping the students to identify the causes and effect of climate change but also to help develop the learners’ dispositions and skills essential for rectifying the causes to live a sustainable lifestyle. As Bryan (2011) has pointed out the teachers role it to touch both the mind and the heart to transform the child. And this is not yet the understanding of the teachers in this research. The teachers’ role is not just this mitigation role, it is also to equip the learners with the adaptation skills to the impact of climate change. In some part this is explained in Sterling’s (2014) transformative learning model, which states that we need to have a different perspective of our worldview. For this transformation to occur, learners need to be engaged in activities which incorporate their “the heart”, “the hand” and “the head”. The model explains that, the way we see the world and make sense of it, how we understand the world and represent it to others and ourselves and the way we engage in activities in relation to our planning, decision making, designs etc. relate to our worldview and hence need to be considered for transformation. Sterling (2014) then asserts that all the three elements of the transformative learning model must be applied holistically for transformation to occur. However, the teachers seemed not to be aware of or do not have the requisite competence about how these elements could be applied holistically for transformation to occur.

One of surprising results of this research was that throughout the teachers narratives none of them talked about the importance of attitudinal change. Moreover, they did not see it in their roles as climate change educators to equip the learners with adaptation skills needed for making the learners resilient to climate change impact. The teachers seemed to be more concerned with giving the learners knowledge about the causes and effect of climate change than seeing to the transformation or change in attitudes of the child. Teachers have the role of influencing the learners’ attitudes through the use of appropriate teaching and learning process that encourages the learners to take action in living a sustainable lifestyle. It can therefore be deducted that teachers have limited understanding of the concept of CCE for sustainable development and therefore may constraints their delivery as required. This can be seen in their responses as they openly declared having basic knowledge on the concept when probed of the kind of knowledge they have with regards to the concept of CCE. This is in line with
Razzaq (2012), Tarosa (2013) and Fullan (2007) explanations of teacher being the fulcrum to educational change and the importance of using their expertise, strategies and skills to convey information encapsulated in the curriculum to the learners. This implies that teachers’ understanding of their roles in CCE may seriously influence the implementation of the curriculum. The teachers understanding of their role is crucial as Snyder et al. (2001) and Pálsson (2014) identified in the process of curriculum implementation and thus, if the teachers have limited knowledge concerning their roles, it may serve as a constraint for proper implementation of the curriculum and enriching professional learning community to develop.

6.3 Teachers’ perception of their capacity to work with CCE

The teachers who participated in the research found themselves having low capacity to work with CCE due to inadequate teaching and learning resources. Bušjjeta (2013) and Bizimana and Orodho (2014) have explained this importance of resources to help teachers to put their ideas into practice with ease and efficiency. Though teachers understandings are important lack of resources hinder effectiveness and make the teaching and learning process difficult (Munchiri and Kiriungi, 2015; Bizimana and Orodho, 2014). Almost all the schools who participated in the research seem to lack teaching and learning resources such as pictures, textbooks, computers, internet accessibility and projectors. Some teachers even complained of not having electricity supply in some of their classrooms. This implies that the teachers sometimes forgo some of the activities which could aid the learners in class activities for better understanding of some concepts. Among the schools only two schools reported having computers for studies but only one school reported having access to internet in addition to the computers.

Analyzing the new national pre-tertiary curriculum framework, (NaCCA, 2019a) revealed that information communications technology (ICT) as a pedagogical tool for implementing the curriculum is important for working towards the United Nations sustainable development goals (SDGs) and policy framework of MoE. In relation to this Cherry (2011), Pruneau (2003) and Beach et al. (2019) also indicates the use of videos and other graphical representation in climate change education are particularly effective means because it helps learners to have the feel of the past and present at the same time which can help develop their dispositions for effective change. However, these resources are lacking in the various schools creating constraints, and implies that teachers’ effectiveness in working with the curriculum could be compromised. Kapur (2019) and Bušjjeta (2013) argue that teaching and learning materials secures the attention of the learners thereby helping the students to pay attention to what is being taught. This implies that learners minds could drift out of class if proper steps are not taking when teaching without teaching and learning materials and consequently affect the teachers effectiveness in the curriculum delivery.
The lack of basic instructional materials such as textbooks and pictures seems to be still a common constraint in the developing countries. Farrell and Oliveira (1993) explained decades ago how the importance of these resources for the schools’ achievement. As did Snyder et al. (2001) and Pálsdóttir (2014) in their identification of factors that influences curriculum implementation. In spite of these constraints, the teachers nonetheless showed positive attitudes and commitment to working with the curriculum. The teachers seem just to improvise, try to use their old textbooks, show the learners videos from their own personal mobile phones, and even sometimes even hire people to sketch on cardboard for them to use in their lesson. This indicates the teachers positive attitude to the curriculum and their work which is a good sign to enhance the implementation of the curriculum (Marsh and Willis, 2007; Tarosa, 2013). However, they are greatly hindered to do their best due to lack of proper teaching and learning materials.

In addition to teaching and learning materials, another area which may render the teachers low capacity in working with the curriculum, is their ability to change their teaching practices. This requires change of mind and attitudes. Teachers need to sincerely realise their own capacity, which when done will show their readiness for change. Analysis of their responses seems to suggest their perception of their knowledge of what is the right thing to do. However, they seem not to know how to do it. This could be as a result of their lack of pedagogical knowledge in working with CCE. As pointed out by Shulman (1987) and the European Commission (2012; 2013), the 21st century educators need to be adept in both subject matter knowledge and pedagogical knowledge to be effective in their professional endeavours. The teachers seems to have less understanding of how the learners could be influenced through appropriate pedagogical skills to effect changes in the learners attitudes as required by the “OWOP” curriculum.

The narratives of the teachers from the interviews suggest their priority in external factors that influence their effectiveness, i.e. teaching and learning materials and other issues associated with the students background. They seem to lack focus on changing teaching strategies which are important underlying issue for implementing the new curriculum as explicated by NaCCA (2019a). The teachers need to recognise the importance to participate in development of teaching approaches and the need to make changes in teaching methods. Therefore, one major obstacle to tackle to enhance effective implementation of the “Curriculum for change”, is most likely to support teachers in changing their teaching approaches. Thus, strengthening both the content knowledge and pedagogical knowledge on how to use effective teaching methods is vital for the success of the new curriculum in Ghana. This finding is in line with Fullan (2006) explanation of the failure of reform initiatives rolled out in Milwaukee, Chicago
and Seattle. According to Fullan, the implementors of the reform initiatives failed to recognize the very changes associated with the instructional strategies needed to induce the reforms.

One of the factors found influencing the curriculum implementation was teachers not being proactive to the students’ background. The responses from the teachers suggests that the learners are not familiar with research activities and working independently. Also, the parents who are supposed to provide the learners with textbooks on climate change, computers and internet or smartphones, through which the learners can access information at home, are either poor and do not have them or have to low literacy level to help. As a consequence most of the learners are not able to contribute to class activities through research assignments as required. It was revealed that in situations where parents even have smartphones of which the students can use it, the learners are denied access to the phones with the fear that the children might spoil the phone. Another view which might relate to this phenomenon is that, the parents might not be well informed on their roles with regard to the new curriculum. This finding is in congruence with Everard et al. (2004) assertion that, parents and community’s readiness for curriculum reform and their continuous support has a greater influences on the success of curriculum implementation. The idea of the students not being familiar with the teaching and learning with the new curriculum is also demonstrated in Pálsdóttir (2014) where students were found being unaccustomed to working autonomously as a constrain in implementing sustainability education. This is in line with what Fullan (2007) explains to be vital in curriculum implementation, i.e. the success of a new curriculum requires provision of adequate education to the central stakeholders and other stakeholders such as parents at the initiation stage of the change process.

6.4 Teacher support
Teacher support has been a major concern of this study. As displayed in the review, teachers training in curriculum implementation should not be treated as a piecemeal but should be continuous and developmental to ensure successful curriculum implementation (Carless, 1998; Mandukwini, 2016; NaCCA, 2019a; Roy, 2013). In the study, it was found that there is a continuous internal in-service training, i.e. a kind of professional learning community (PLC) support, held every Wednesday in every school in the metropolis as well as a termly external in-service training for the teachers. This local and external in-service training are held to discuss any challenging topics or experiences the teachers encounter in their various individual classrooms. Sense of belongingness, cordial relationship among themselves where every teacher feels to be part of the whole fighting for a common goal was felt in teachers’ responses. Thus, teachers seems to have one “share vision” which characterizes effective PLC (Huffman et al., 2016; Schaap & Bruijn, 2018; Scribner, et al., 2007; Teague & Anfara Jr., 2012).
The narratives from the interviews suggest that this initiative lessens teachers’ burdens of working in isolation. It enhances their understanding on certain problems and how to tackle them in their individual classrooms. This boosts their confidence therefore, serving as the driving force accelerating implementation. This confirms Snyder et al. (2001), Roy (2013) and NaCCA (2019a) views, that training in various teaching strategies and in the use of resources and continual support help teachers to develop stronger commitment towards curriculum implementation.

When probed further into what has been discussed in these PLC-meetings, it was revealed that CCE has never been discussed in these meetings since no one has brought the issue of climate change up. Two deductions could be made here. It is either that the teachers have not yet started treating climate change issues with regards to the new curriculum or they do not feel comfortable with the concept of climate change and CCE. Whether this is due to their misconceptions or a gap in knowledge of what constitute CCE needs to be researched further. Whatever the reason the teachers responses indicated the teachers sincere will to do things the right way, including participating in the PLC-meetings and assenting to do CCE workshops. This is in line with Guskey (2002) assertion that teachers are interested in professional development which are likely to expand their knowledge and skills that will help them stay relevant in their work.

6.5 Conclusion

The idea behind this study has been the desire to help contribute to making the world a sustainable one for the present and generation yet to surface. As Ghana integrate climate change education into its education system it became imperative to investigate the understanding of the teachers on climate change education and the processes teachers go through as they educate the learners on climate change. The main aim of this analysis endeavour has been to research the constraints and contributing factors that the teachers may encounter in order to identify how to best supported them in their work in implementing the CCE as an emerging curriculum area. From the findings, the following conclusions have been made.

6.5.1 Factors likely to constraint implementing the curriculum

Teachers’ knowledge gap and misconception on climate change: It was delineated from the discussion, that there is a knowledge gap and misconceptions about the concept of climate change and what constitute CCE among the teachers. This limited knowledge in climate change and climate change education is likely to hinder effective implementation of the curriculum.
Teachers pedagogical knowledge: Teachers’ responses as discussed suggest a gap in knowledge appropos to appropriate teaching skills to effect attitudinal and behavioural change which underly CCE and the “OWOP” curriculum. The move from their accustomed teacher-centred to unaccustomed learner-centred approach could serve as impediments for effective implementation of the curriculum.

Students background: Due to poverty background and illiteracy parental background or misinformed parent, learners are not given the needed support to assist in their work at home. This affects the role of the students with regards to the new curriculum and therefore hinders teachers work.

Lack of teaching resources: The lack of teaching and learning material within the various schools serves as one of the major impediments to implementing the curriculum. Climate change education more often requires showing the students videos and pictures to enhance their understanding. However, these resources are not available in the schools and serve as hindrance to implementing the curriculum.

6.5.2 Factors contributing to implementing the curriculum

Teachers understanding of the curriculum: Teachers have general knowledge of the curriculum. They understand the focus, terms associated with it and how it should generally be approached in its delivery. This could serve as a basis and a driving force for implementing the curriculum.

Professional learning community (PLC): Through the establishment of PLC teachers feel free to bring to fore any problem they face in their various classrooms for discussion and possible solution. This eases the teachers’ ordeal to go through problems alone and therefore enhancing the implementation of the curriculum.

The curriculum and teachers commitment to work: The teachers have professional obligation to fulfil as teachers and therefore might not have a choice than to implement the curriculum. They might do it in their own way which may not be in favour of the curriculum. However, their commitment and positive attitudes towards the curriculum as revealed in their narratives serve as a driving for implementing the curriculum.

6.6 Recommendation

Based on the findings and the conclusions drawn from this research, the following recommendations are presented:

- The professional learning community (PLC) has a positive effect on implementing the curriculum and schools’ output and thus a PLC should be strengthened. Teachers should be motivated to fully engage in the PLC. Resource persons on CCE should be
invited to train the teachers during the PLC sessions. This will resource the teachers with climate change issues and clear of the misconception held among teachers and put their best out. Resource persons in didactics should also be invited to train teachers in delivery practices, i.e. various teaching methods.

- Essential teaching and learning materials should be provided to aid in CCE delivery. Photographs, textbooks on climate change, videotapes, computers, projectors and internet access should be made available to the schools. Electricity should be supplied to the schools and classrooms. TV sets can be provided for the meantime where computers and internet accessibility are not readily available.

- The parents of the students should be educated on the aims of the curriculum and the roles that they as parents are supposed to play in the curriculum delivery. Thus educational directorate, school administrators and teachers should be responsive to the students’ background to enhance the implementation of the curriculum. This education can be done through PTA meetings.

- There is a need to consider the inclusion of climate change education into the preservice teachers’ preparation. Efforts must be made to reform the teacher training courses to integrate CCESD. Climate change is designated as the problem of the 21st century and education is believed to be the way forward. Hence, the 21st teacher century teacher must be prepared in to be abreast with the climate change issues and the pedagogical skills needed to work with CCE.

- There is a need to involve all teachers in all steps of the initiation and implementation stages in the educational change. That will both empower the teachers and call for further committment on their behalf.
References


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Appendix A: Letter of introduction

Reykjavík, Iceland, January 6th 2020

To whom it may concern,

This is to confirm that Mr. Michael Odoom is a final year master student at University of Iceland, in the Environment and Natural Resources programme. Mr. Odoom is working on his thesis entitled “Constraints and Contributors to Implementing Climate Change Education as an emerging curriculum area in basic education in Ghana”. The aim is to identify what support primary school teachers in Cape Coast Municipality in Ghana need in their work of implementing Climate Change Education according to the country’s newly issued curriculum.

It would be highly appreciated if Mr. Odoom would be granted permission to approach primary school teachers in Cape Coast Municipality for interviews for the purpose of his research.

Best regards,

[Signature]

Dr. Ævar Pálsdóttir
Supervisor of Mr. Odoom
Appendix B: Letter of introduction from CCMED

GHANA EDUCATION SERVICE

HEADTEACHERS CONCERNED
PUBLIC BASIC SCHOOLS
CAPE COAST

INTRODUCTORY LETTER TO CONDUCT SURVEY IN BASIC SCHOOLS

This is to inform you that, Management of the Metropolitan Education Directorate has granted permission to Mr. Michael Odoom, a final year student at the University of Iceland, in the Environmental and Natural Resources Programme, to undertake a research project titled “Constraints and Contributors to implementing Climate Change Education as an emerging curriculum area in Basic Education in Ghana”.

The purpose of the study is to identify what support primary school teachers in Cape Coast Metropolitan need in implementing Climate Change Education according to the new curriculum.

By a copy of this letter, Headteachers and Teachers concerned are to cooperate well with him for a successful exercise.

However, his presence in the school should not interfere with schools’ academic work.

Thank you.

PHILIP KWEI INCHEEM
METRO DIRECTOR OF EDUCATION
CAPE COAST

cc
1. Mr. Michael Odoom, University of Iceland
2. Dr. Audur Palsdottir, University of Iceland
Appendix C: Request for interview

Michael Odoom
(270979-4839)
University of Iceland
16/01/2020

To whom it may concern

Request for interview

I am a student of University of Iceland, Iceland and I am working on my thesis entitled: “Implementing climate change education in Cape Coast Metropolis as an emerging curriculum area in basic education in Ghana”. The study seeks to investigate into the constraints and contributing factors teachers encounter in implementing the new curriculum with a prime aim to identify the support teachers need to work with climate change education as required by the new curriculum. I am requesting your assistance in this study. As a teacher in this municipality (CCMA), your participation is very important in this study and I will be grateful if you could grant me an interview on this topic. The interview will last between 30 to 35 minutes. The topics to be discussed in this study includes:

a. Your understanding of the new curriculum
b. Your understanding of Climate Change Education (CCE)
c. Your role in CCE as a teacher and your capacity to implement CCE
d. The form of support you as an individual and the school collectively need to work with CCE

The study is purely academic endeavour and I, therefore, assure you that your responses to the questions will be confidentially and anonymously used such that the responses cannot be traced back to you. Names of participated schools and personnel will be avoided in the data analysis.

I will be glad if you can cooperate and grant me this interview. Please the attached is a copy of consent form.

Thanks for your assistance.

Michael Odoom
0242070201 / (mio3@hi.is)
Appendix D: Informed consent form

Informed consent form

I have read and understood the invitation letter and the researcher has answered any questions I wanted to ask about the project.

a. I have read and understood the project aims and objectives
b. I appreciate that my participation in the study is based on my own decision and I have the liberty to withdraw at any point in time without giving any reason

c. I understand that within the confines of the law, the researcher will not give out any personal information about me to anyone else
d. I understand that the researcher will ensure that my personality and answers will be treated confidentially and anonymously.
e. I consent for my understandings and perceptions to be captured and be used for no other purpose than publications of the study.

I have read all the above statements; I understand them and would like to participate in the study.

Name: ........................................................................................................................................

Signed: .................................................................................................

Date: ...........................................................................................................
## Appendix E: Interview schedule

<table>
<thead>
<tr>
<th>Four research sub-questions</th>
<th>For the interview schedule (what you will ask them)</th>
<th>Follow-up questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>How do teachers understand the new curriculum?</td>
<td>Let’s first talk about the new curriculum. Can you tell me in what way you perceive the new curriculum being different from the old one? Can you give me an example?</td>
<td>Does the new curriculum require you to make changes in how you work? Can you give me examples?</td>
</tr>
<tr>
<td>How do teachers understand the concept of CCE?</td>
<td>Then, let’s move the focus to CCE. Can you tell me how you understand what is climate change education? What is its content? What teaching methods are important?</td>
<td>Can you explain that?</td>
</tr>
</tbody>
</table>
| | From where does your information about CC and CCE come from? | Can you give me an example? Where do you get the information from?  
  - Internet  
  - Books  
  - Classes/courses  
  - Curriculum |
| | Present a sheet with the definition of CC and CCE. For the rest of this interview, I will refer to these definitions when I talk about CC and CCE. Is that OK? | Have you worked with climate change in your teaching (based on this definition)?  
  Yes ->  
  No (ask about some indicators of CCE) | Can you give me an example?  
  What did you do?  
  How did you do it? |
| How do teachers perceive their role and capacity to curriculum changes for CCE? | What is your role as a teacher in CCE? | What is most important that you do?  
  What type of work should you prepare for your students? |
| | What decisions do you make?  
  What decisions have been made for you? | What is the role of the learner?  
  What decisions can the learner participate in? |
<p>| | How do you perceive your capacity to implement CCE? | What are your strengths (or weaknesses)? |</p>
<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>What kind of knowledge do you have about the topic of CC and CCE?</td>
<td>Can you give me an example?</td>
</tr>
<tr>
<td>What resources do you have access to in working with CCE?</td>
<td></td>
</tr>
<tr>
<td>So, if we move to teacher support in CCE. How did the workshop you did in August help you in CCE?</td>
<td>Can you explain or give an example?</td>
</tr>
<tr>
<td>What support is already (today) available for you and the school to work with CCE?</td>
<td>Can you explain or give an example?</td>
</tr>
<tr>
<td>If we look ahead, what support would you personally like to have to strengthen your capacity in working with CCE?</td>
<td>What should the support be about (content)? In what format should it be?</td>
</tr>
<tr>
<td>What kind of support do you think your school needs to work with CCE?</td>
<td>How should it be organised in terms of time?</td>
</tr>
<tr>
<td></td>
<td>• Courses • Lectures • Collaboration groups • Teaching material</td>
</tr>
</tbody>
</table>