



# An Assessment of the Extent of Inclusion of Climate Change in Secondary School Curricular in Africa: A Content Analysis

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**Abstract:** *Despite the great role played by education in creating knowledge, developing skills and attitudes among people, little climate change and mitigation content exists in taught curricula in most developing countries. There has been a lot of discussion surrounding education and climate change in schools. This comprehensive corpus study used Content Analysis technique to assess the extent to which Africa has taken up the inclusion and or integration of climate change in its curricular. The researchers used this corpus study as a comparative assessment of how countries in East Africa, West Africa, Central Africa and Southern Africa have included climate change in their curricular and the efforts these regions have done to adopt strategies and policies in their education systems. The study found out that climate change is an emerging challenge for most African countries, education is a key player in awareness and mitigation of climate change in developing countries of Arica, secondary schools in developing African countries have climate change integration in their curricular at very minimum levels and that the greatest challenges the countries face are those of funding and teacher empowerment and efficacy in the area of climate change. It is recommended that African countries integrate climate change across their curricular as a way of bringing awareness and mitigating its impact on the planet.*

**Keywords:** Taught Curricular, Climate Change, Mitigation, Inclusion, Integration

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## 1. Introduction

Climate change has been considered as the defining challenge of our time (UNESCO, 2010) which is coming faster and rougher than scientists had expected (Romm, 2007). Education is considered as a weapon towards

addressing this challenge. It is proposed that education can play a crucial role in building social and individual capacities and attitudes for climate change mitigation so as to pre-empt worst case climate change scenarios in the future (UNESCO, 2009). Education has the task of developing the skills, capacities and attitudes for adaptation in the face of already evident and looming

climate impacts. In addition, education has a continuous role to play in stimulating and reinforcing understanding of and attentiveness to the realities of climate change. Despite the danger that climate change poses to humanity and the crucial role that education has to play in mitigating and adapting to its consequences, Bloom et al. (2005) claim that Africa still has the least intellectual institutional and technological capability to address the climate challenge. This study reviewed a wide variety of literature and established that most of the studies conducted in Africa delved on issues of students' awareness of climate change, (Henry et. al., 2012), teachers' awareness as well as infusion of climate change in schools (Joy and Eunice, 2014; Ekpoh and Ekpoh, 2011; Nkechi, 2014); climate change impacts (Aja, 2015); and the role of media in creating climate change awareness (Onkargouda et al., 2013).

Very few of the reviewed studies were conducted on issues of climate change and the few mainly touched on indigenous coping and adaptation strategies (Edward, et al., 2014), status of climate change content in secondary school subjects, (Kariuki et al., 2019), impact of climate change adaptation strategies on small holder farmers' livelihood (Mushy, 2016) and perceptions of teachers towards the integration of adaptation strategy topics on climate change into secondary school agriculture syllabus (Stephen, et al., 2014). However, this study established that limited studies have been conducted to establish efforts being made by curriculum developers, successes and challenges, in a bid to infuse climate change content into the curriculum. Therefore, a corpus study on four African regions of Eastern, Western, Central and Southern was conducted bringing awareness and mitigation of climate change through their curricular in secondary schools. The study was a bid to help curriculum developers from the African continent to establish the successes they have made as well as challenges they face in their bid to infuse climate change content into secondary school curricular.

## 1.1 Statement of the Problem

Since its inception, modern education has been trusted as one of the potential human assets and mechanisms to tackle many of the social, economic and political problems that humans have so far seen. Based on their transformative nature, both formal and informal education can play a central role as a vehicle for understanding, mitigating and adapting to climate change. Given the amount of information on climate change currently available as solutions globally, not all of it is applicable uniformly across all countries in the world. Educationists have to decide in their regions and locations what works for them and what should be included in the curricular of their children to ensure that

education becomes a vehicle for mitigating effects of climate change in a given locale. The impact of climate change is more significant in the least developed countries than in developed countries, particularly in Sub-Saharan Africa where rain-fed agriculture is the mainstay of the greater part of its population. Education in this instance can be employed in Sub - Saharan Africa to improve lives and enhance development in the face of climate change. This corpus study therefore is an assessment of the extent of inclusion of climate change in the secondary school curricular of African countries for this very purpose.

## 1.2 Research Questions

This study was guided by the following research questions:

1. What are the effects of climate change on the developing countries of Africa?
2. Why is education viewed as a key player in the awareness and mitigation of climate change in the developing countries of Africa?
3. To what extent do secondary schools in developing African countries integrate climate change in their curricular?
4. What challenges are in integration and implementation of climate change and mitigation in secondary schools in developing countries in Africa?

## 1.3 Theoretical Framework

This study is supported by Wilber's Integral Theory propounded in 1977 by Ken Wilber (Karen, 2010). The theory is a framework that views various human knowledge strands as one comprehensive view of consciousness evolution in the world (Claus, 2012). It suggests a combination of all human knowledge and experience in a four-quadrant grid of subjective, intersubjective, objective and interobjective, along the lines of interior-exterior and individual-collective to understand reality in the world (Wilber, 2006). According to Ballard, Reason & Coleman (2010), the scientific community frameworks and models used to respond to climate change do not incorporate the subjective and interior human dimensions of climate change by not recognizing the depth of human experiences and developments. The Wilber's Integral theory provides a bigger framework of climate change occurrence and offers an insight on the kind of responses and strategies of mitigation (Karen, 2010). This view informs the need for prerequisite need for increased

scientific knowledge by researchers and community policies to mitigate the impact of climate change.

The other tenet of the theory is recognizing the interior and exterior dimensions of climate change by emphasizing the closely relationship of four quadrants (I, we, it and its) and recognizing the vital role of values in understanding the impacts and consequences of climate change as well as influence in prioritized responses to climate issues (Karen, 2010). In this case, UNESCO (2013) suggests provision of information and explanation of climate change science to different groups, implying that climate education is a crucial tool to promote the awareness of the causes and effects of climate change and provide responses across curricular and multidisciplinary perspectives in preparing learners to face uncertain hazards with informed decision in building society resilient to environmental and climate challenges. In the context of the study, the theory is viewed to enrich the development of potential all inclusive secondary school curriculum which holistically embraces the psychological transformation and growth in preparing learners to contribute and tackle the looming issues of climate change in African developing countries.

## 2. Literature Review

Sustainable Development Goal 13 compels all countries globally to integrate mitigation and adaptation, impact reduction and early warning into school curricula (Maupin, 2017). Enhancing students' knowledge on climate change can improve the awareness of the phenomenon in society thus, increasing the awareness of climate should focus on the educational system of the society with an aim to identify the students' conceptions and misunderstandings of climate change as paramount (Krofi et al., 2019). Selby and Kagwa (2013) assert that in a good modern curriculum, numerous aspects of climate change are embedded into existing subjects and integrated within cross-curricular spaces hence, the integration of curriculum, school environment, community and culture, offers students hands-on opportunities for practical and safe apprenticeship in transformative action.

### 2.1 The effects of climate change on the developing countries of Africa

Central Africa is among the most vulnerable areas to climate change effects in Africa having a humid tropical climate in the south and very dry in the north (Teke & Atanga, 2011). The Congo Basin Forests represent a vast natural resource pool rich for national development plans of the countries in the region. Therefore, the tropical forest ecosystems' vulnerability to climate change poses

a high risk to the livelihoods of communities which depend on these forests for the development of national economies (Brown et al., 2010). Similarly, Cameroon is observed to be highly vulnerable socially to the direct effects of climate change due to high poverty levels and corruption. Lack of technology, information, skills and infrastructure as key determinants of adaptive capacity, has increased the vulnerability of Cameroon to address climate change issues (Brown et al., 2010).

In Southern Africa, research has shown that variability and climate change are the crucial challenges of the 21<sup>st</sup> century predominantly in South Africa (Vogan, 2015). South Africa acknowledges that there is need for transformative and reflective approaches to teaching of climate change in secondary schools which should see a deliberate shift in teacher training with a slant towards skills impartation on how to teach this area (Musoni, 2019).

In the case of Zambia, research shows that the country acknowledges that it is one of the hardest hit countries by climate change as it falls under Southern Africa and classed as underdeveloped (Kamukwamba and Nachiyunde, 2018). According to Kamukwamba and Nachiyunde (2018), most countries in Southern Africa are underdeveloped, have weak governments and poor education systems which is fertile ground for adverse effects of climate change. Zimbabwe acknowledges that climate change is the principal challenge and adaptation of innovation in the area is hindered by the uncertainty related to climatic variability. The consequences of the current local practices, infrastructures, processes and systems are becoming more and more unsuitable because of climate change (Brown et al., 2013). Climate change is invariably driving poverty in the country among other factors as farmers both peasant and commercial rely heavily on climate driven rains and seasons. Literature contends that the country needs to aggressively apply mitigation programs and activities in a more sustainable way than those used before (UNICEF, 2018).

Ghana in West Africa has a fair share of climate change catastrophes such as change in rainfall patterns, a rise in the incidence of pests and diseases of crops and livestock, that lead to reduction in crop yield, and lives and property destruction caused by floods and droughts (Cecilia, 2015; All-Africa, 2013; Ofei-Nkansah, 2013). The causes of the above catastrophes is as a result of human activities like deforestation caused by bush burning and the use of wood as fuel and charcoal making (Ghana Centric, 2010). In order to curtail this, a National Climate Change Policy (NCCP) has been made, and it has been approved by parliament to help combat the effects of climate change in Ghana (Omg Ghana, 2013). Nigerians too lament that they are hard hit by climate change, with farmers and fishermen – representing two

major employment sectors. Thus, educating students on issues of climate change is one of the best ways of strengthening communities on the problems of adaptation to climate change (Amanchukwu et al., 2015).

The East African devastating impacts of climate change, will intensity and the predictability of precipitation will ultimately affect water availability and may lead to decreased agricultural production and potentially widespread food shortages (IPCC, 2001). The Uganda's five-year National Development Plan II (NDP) 20116–2021 appreciates that climate change will affect agriculture, forestry and energy, the main key economic sectors of Uganda resulting into negative effects on the national economy (USAID, 2018). Similarly, Tanzania and Kenya has experienced climate change effects manifested in increased heat, drought and insect outbreaks, increased wildfires, water shortages, low productivity in agriculture and health impacts are additional concerns (Zhou et al., 2004). However, many education systems in East Africa have been found lacking content necessary to produce learners that will lead efforts in mitigating climate change.

## **2.2 Education as a key player in the awareness and mitigation of climate change**

Education has a central role to play in understanding, mitigating and adapting to the changing climate (UNESCO, 2009). Similarly EAC (2011) posed similar sentiments that learning plays an important role in developing climate change knowledge, preparation and presentation of climate change information in a way that benefits local communities, partner states and the region and that access to climate change information and technology is one of the key elements necessary to effectively respond to climate change regionally. Since its inception, modern education has been trusted as one of the potential human assets and mechanisms to tackle many of the social, economic and political problems we have seen so far. Education for Sustainable Development (ESD) is one instance of such belief that education can play indispensable roles in changing the minds of children - the very first and key step to move towards sustainable development (Damte, 2008). Likewise, Environmental Education (EE) has been given an increasing attention at equipping learners with relevant knowledge and skills necessary for protecting and conserving the environment.

UNESCO (2010) recently introduced the concept of Climate Change Education for Sustainable Development (CCESD) with an argument that knowledge, skills and competences relevant to mitigation and adaptation are the core elements that the school curricula should include. Climate Change Education should introduce basic

scientific concepts, theories and projections of climate change. Themes such as sustainable consumption, disaster preparedness, environmental protection, recycling, water, desertification and renewable energies should be discussed, taking into account their relevance in the specific national and local context. Despite the perceived crucial role of EE as well as CCESD, numerous challenges still exist in their development. For instance, EE in many cases is seen as an alternative education which has little value to mainstream educational development goals, and is therefore widely addressed through environmental topics in curricula and training programs (Bangay & Blum, 2010). Such inclusion of some environment related themes or topics in the form of classroom lessons across various school subjects may not be sufficient to bring about meaningful pro-environmental behavior among learners which is the ultimate goal of EE (UNICEF, 2017).

On the other hand, UNESCO observed that the compartmentalization of the curriculum development process weakened ESD in the curriculum materials leading to inappropriate teaching and learning resources on climate change hence, revealing no existing coordination and partnership among stakeholders, including non-government organizations, in promoting Climate Change Education for Sustainable Development (CCESD) at school especially at secondary level (UNESCO, 2015).

In East Africa, the pertinent donor-funded activities for climate change adaptation have largely focused on assessments and supporting mainstreaming of adaptation into development strategies, plans, and policies, and strengthening understanding of vulnerabilities and adaptation options in health or food security sectors. This has led to important sectors remain under-examined, such as water resources and energy in terms of understanding vulnerability and piloting adaptation measures (USAID, 2011). The current regional awareness initiatives include the assessments of impacts and adaptations to Climate Change (United Nations Environment Programme, System for Analysis Research and Training, and the Third World Academy of Sciences) and capacity strengthening of least developed countries for adaptation to Climate Change (International Institute for Environment and Development UASID, (2018).

## **2.3 The extent secondary schools integrate climate change in their curricular**

Climate change (CC) inclusion in secondary schools in West African region is at infancy stage as majority countries have just woken up to include CC education in their national curricular and this ranks the region 50%

inclusion rather than the international accepted standard of 80% climate change inclusion. This is evident in the survey done by Afro barometer (2019) that revealed that most West African countries have limited inclusion of climate change in their education system with exception to Cote d'Ivoire with 31%, Morocco 29%, Senegal 26%, Mali 21%, Ghana 21%, Nigeria 20% and Liberia was the least with 14% yet all these nations are among those most vulnerable to climate change (Edem & Selormey, 2019; Adger et al., 2007; Afro-Barometer, 2019; Boko et al., 2007; IPCC, 2007; Lema & Majule, 2009; Mertz et al., 2009; Yanda & Mubaya, 2011). Therefore, the integration of an innovative educational approach called Climate Change and Environmental Education (CCEE) into the curricular offerings of primary and secondary schools is believed to bring up a new generation of citizens that are environmentally conscious, who will understand, address, mitigate and adapt to the impact of climate change (Adakole and Edwin, 2018) thus, there is a need for curricula reforms to address and incorporate CC as a coherent body of knowledge (Efrat et al., 2016).

In West African, Ghana's National Climate Change and Green Economy Learning Strategy 2016, was launched at the beginning of the year 2020 to integrate climate change into the general education system. Together with the Ghana Environmental Protection Agency (EPA) and the Ministry of Environment, Science, Technology and Innovation, Ghana Education Service (GES), have integrated climate change into all subjects of the new primary school curricula, particularly Science (EPA, 2016). EPA and GES also trained teachers from various regions of Ghana on climate change and green economy issues. What is surprising is that, climate change education in secondary school curriculum is not given adequate attention it deserves as there is no official document showing inclusion of CC beyond primary schools. However, Nigeria is yet to recognize secondary education as the most effective counter-strategy for climate change. Henceforth, currently there is a deficit of climate change education in the school curriculum

Most secondary schools in Central Africa treat climate issues with few elementary topics in the social science and Integrated Science subjects focusing on climate and its elements like rainfall, temperature and wind integrated in secondary school curriculum but have limited information on topics such as extensive impact of climate change on food security (Ikehi et al., 2014). There are fewer topics on awareness of the effects of climate change, elements of climate, adaptation strategies, mitigation strategies and global policy issues and sustainable development among other areas (Owolabi et al., 2012). While in Cameroon the schools have joined the various government institutions and NGOs in the green campaign to raise climate change awareness; there is no official integration of climate change in the

secondary school curriculum which makes it a challenge to community awareness in the fight against climate change (Sara de Wit, 2011).

In Democratic Republic of Congo (DRC), some climate change content appears in some text books but inadequate (Taba et al., 2015). Therefore, there have been serious debates on the necessity to preserve nature through environmental education. Thus, the meeting between the two DRC ministers of Environment and Sustainable Development and Secondary Education on July 13, 2020 noted that the integration of environmental education in school curricula had a great impact on the children's complexity of environmental issues and their role in mitigating climate issues. Hence, the two ministers recommended for inclusion of Environmental Education in secondary school programs by the end of 2020 (Ngounou, 2020).

The compartmentalization of the curriculum development process in Equatorial Guinea weakened Environmental Sustainable Development in the curriculum materials leading to inappropriate teaching and learning resources on climate change hence, revealing no existing coordination and partnership among stakeholders, including non-government organizations, in promoting Climate Change Education for Sustainable Development (CCESD) at school especially at secondary level (Teke & Atanga, 2011). Owolabi et al. (2012) further contend that in Equatorial Guinea, there is an urgency to add to the learning experiences and identifying new teaching methods and pedagogies structures suitable for building the capacities for climate change and sustainable development for all inclusive students in secondary schools to develop positive attitude towards their environment as the world strives to attain the Millennium Development Goals (MDGs).

However, in South Africa, it is sad to note that while stakeholders have the will to integrate climate change in the curriculum, the actual implementation at classroom level is still lacking in the majority of schools across the country (Mutizwa & Pesanayi, 2014). Zambia acknowledges that education offers a better prospect in mitigating and combating climate change towards the erection of resilient societies even in Southern Africa (Anderson, 2010). Therefore, Zambia is observed as showing a will to integrate climate change to its secondary school curriculum. However, little is observable on the ground to support this observation (REDD, 2016).

In Tanzania, the secondary school curriculum does not include climate change as a specific topic rather it is considered to be a cross-cutting theme in subjects such as Geography, Biology, Civics and History (Kiwonde, 2019; Kimaryo, 2011). Similarly in Kenya, the NCCRS

acknowledged that little has been done in the infusion of climate change into the curriculum and there is lack of adequate climate change information and knowledge (Ndiritu et al, 2016). In addition, the content about climate change in Uganda curriculum is not explicit (Mwangu, 2017) hence, little about climate change content is associated with Geography subject and the teaching depends on interest, expertise and capacity of individual teachers.

### 3. Methodology

This is a Content Analysis type of study, a *modus operandi* employed to make valid inferences by construing and coding related data. It is a Corpus based descriptive study where a five step qualitative data management process was employed starting with (i) collecting allied data (ii) organizing and arranging data for analysis (iii) data coding (iv) classifying patterns and themes (v) interpreting the data. Content Analysis gave the researchers the room to work on large amounts of literal information and systematically identify, extract, and categorize evidence needed to answer the research questions of the study.

#### 3.1 Data Collection

The researchers divided Africa into four distinct regions: East Africa, Central Africa, West Africa and Southern Africa. The desk research comprised a thorough review of existing literature dating back from 2001 to 2020 from twelve focus countries selected from the four regions for the research study, covering; Uganda, Kenya, Tanzania, South Africa, Zambia, Zimbabwe, Malawi, Ghana, Nigeria, Equatorial Guinea, Cameroon and Democratic Republic of Congo. The review aimed at drawing data on integration of climate change in secondary school curricular. Attention was on abstracts, introductions, findings, conclusions and recommendations. The technique was deemed suitable for this study because of the nature of the study.

#### 3.2 Data analysis

**Data thinning:** The first step was data thinning. Data that could be used to answer the research questions was classified as relevant. The Data was then organized ready for analysis.

**Data Coding:** The Researchers identified patterns and common sequences that appeared in the data and organized it into smaller units in relation to the research questions for coding. Codes were given to units of analysis: research questions, that is, what are the effects of climate change in developing African countries, why

education is viewed as a key player in the awareness and mitigation of climate change, to what extent secondary schools in African countries integrated climate change in their curricular and are there any challenges faced by developing African countries in integration and implementation of climate change in secondary schools.

**Identifying patterns and themes:** After the coding was done, the researchers went on to examine the data and embarked on identifying patterns and themes in the created research question units.

#### 3.3 Reliability and Validity

Reliability and validity in qualitative research, especially for content analysis should be emphasized (Writing@CSU, 2017). Reliability defines stability in a content analysis study where recoding of similar data by coders is consistently done in a comparable way over a period of time. In this study, the researchers systematically coded observing discreetly the units, into which countries were sampled, focusing on exact reference to each of the research questions. The findings from this meticulous data analysis meant that if the same data was again collected the same information will be obtained. Validity became the by-product of the procedure chosen for analysis which in turn enabled researchers to come up with valid responses in relation to the research questions. The diversity of the countries sampled increased objectivity and by so doing overcame content analysis' shortcomings through data collection from such a wide range of 12 countries, following research rules on data analysis and systematic coding of the said data. As a result, it was possible to generalize findings from this research.

### 4. Results and Discussion

#### 4.1 Emerging Themes

The following themes came out of the review of the 12 countries selected namely; Uganda, Kenya, Tanzania, South Africa, Zambia, Zimbabwe, Malawi, Ghana, Nigeria, Equatorial Guinea, Cameroon and Democratic republic of Congo, to further give highlights the research questions this study aimed to achieve:

1. The role of education in climate change awareness and mitigation in African developing countries
2. Climate change effects as an emerging challenge facing the African developing countries

3. Climate change and transformative educational approaches integration in secondary schools' curricular
4. Factors affecting teacher awareness in integration and implementation of climate change in secondary schools curricular.

#### **4.1.1 The role of education in climate change awareness and mitigation in African developing countries**

Education at all levels and in both formal and informal settings is needed to instill climate change awareness and understanding to change behaviors and attitudes of people. In reaction to this, several countries took an important step in planning the education sector to respond to climate change (UNESCO, 2009). Education is proposed to play a central role in understanding, mitigating and adapting to the changing climate. In Tanzania, for instance, climate change is considered to be more of a cross-cutting theme in subjects such as Geography, Biology, Civics and History (Kiwonde, 2019). In Kenya, that little has been done in the infusion of climate change into the secondary curriculum because of lack of adequate climate change information, knowledge and long-period data to researchers, planners, policy makers (Government of Kenya, 2009). On the other hand, the content about climate change in Uganda curriculum is not explicit (Mwangu, 2017).

Findings in research in South Africa has shown that there is need to develop knowledge based teaching materials and provide content for the teaching and learning of climate change in a more robust and interesting way (Wals, 2011; O'Brien, 2015). The approach is based on the premise that climate change is a complex challenge that requires more than awareness campaigns and attitude changing, it needs an interdisciplinary and trans-disciplinary curricular to equip the young generation with both knowledge and skill to reverse the impact and effects of climate change in the Southern African Region (Vogan, 2015). Teacher training and development of materials for teaching has been the approach that South Africa has adopted to equip implementers of the curriculum with requisite content for the classroom.

However, studies indicate that the dynamism that was expected for the classroom has not yet been achieved (O'Brien, 2015). For Malawi, climate change in school is approached more as awareness and not as an explicit part of the school curriculum (UNDP, 2013). Posters were designed with the intention of raising awareness on climate change in primary schools across the whole country (Wiseman, 2014). This approach does not equip the teachers enough with the content needed for the thorough implementation of the study area and to have it

treated with the seriousness it deserves. Stakeholders in Malawi agree that the complexity of the issues of climate change and mitigation requires that teachers be trained and at the same time teaching and learning material with enough content to increase the knowledge of the teacher on climate change is requisite for integration into the school curricular (UNDP, 2015).

Research findings in Zambia indicate that while there are some activities taking place in schools like green campaigns, quizzes on environmental issues and participation by some learners in a project on integrated Approach in Mitigating Climate Change, the vast majority of learners remain unreached with the information (UNICEF, 2017). The education ministry in Zambia is said to have done what stakeholders call very little in the area of awareness among learners on mitigation on climate change (Kamukwamba & Nachiyunde, 2018).

Zambia acknowledges that it is one of the hardest hit countries by climate change as it falls under Southern Africa and classified as underdeveloped (Kamukwamba & Nachiyunde, 2018). According to Kamukwamba & Nachiyunde (2018), most countries in Southern Africa are underdeveloped, have weak governments and poor education systems which is fertile ground for adverse effects of climate change. Zambia acknowledges that education offers a better prospect in mitigating and combating climate change towards the erection of resilient societies even in Southern Africa (Anderson, 2010). Zambia is observed as showing a will to integrate climate change to its secondary school curriculum, however, little is observable on the ground to support this observation (REDD, 2016).

Zimbabwe is in Southern Africa, a region said to be one of the hardest hit by climate change. Climate change in schools under the old curriculum was taught under environmental education from primary schools to secondary schools and research showed that minimum attention is given to the environmental education as demanded by the curriculum (Makoni, 2013). Findings showed that teachers are taking more of a factual approach as opposed to the intended practical slant. Researchers contend that this type of education on climate change is evidenced by the inability by schools to solve practical problems related to the environment in their areas (Makoni, 2013; Mhaka, 2019). The spirit and intention of the curriculum in integrating climate change was to help teachers become models of climate change issues in their constituencies. This is not evident and schools are not leading in the transformation of communities as intended by the syllabi (Chaguta, 2010).

Schools are better placed to help local farmers in mitigating the effects of climate change as local farmers view the future with uncertainty due to the constantly

changing climate which is affecting food security in the country (Brown Chanakira et al., 2013). Integration of climate change in the curriculum has been received with a positive attitude by stakeholders hoping that mitigation information and activities can reach the rest of the country in a fast and efficient way through learners who have been conscientized and equipped for mitigation (Parnel & Walawege, 2011). Zimbabwe needs to adopt a more aggressive stance in terms of mitigation through schools as education has been seen as the best tool any country can employ. However, teachers are seen to lack both the will and content to equip learners through the updated curriculum that has integrated climate change (Brazier, 2015).

The Sahelian zone and coastal areas of Cameroon have also been hit hard by climate change impacts of desertification and rising of sea levels respectively. A joint green campaign initiative by International organizations like WWF, UNDP, FAO and the World Bank with NGOs, civil society groups throughout the country has been mounted in support of the efforts of government, the media, the schools, churches and traditional rulers, to sensitize the population in the fight against climate change (Sara de Wit, 2011). However, while there is a raised climate change awareness in the various government institutions and NGOs and despite the schools joining the campaign, there is no explicit integration of climate change in the secondary school curriculum in Cameroon which makes it a challenge to community awareness despite the green campaign initiative.

The study by Ikehi, et al. (2014) observed that few elementary topics with elements of climate change such as rainfall, temperature and wind, were being integrated in secondary school curriculum leaving out topics with extensive climate change impact on food security. Hence, the authors recommended for full integration of allied topics in agricultural science such as global warming, agro-biodiversity, bio-fuels, adaptation strategies, mitigation strategies and global policy issues among other areas integrated in secondary schools curriculum.

The subjects listed in the secondary schools' curriculum with some relevant content to climate change are Social Studies and Integrated Science but with less topics on awareness of the effects of climate change, elements of climate and sustainable development (Owolabi et al., 2012). In Democratic Republic of Congo (DRC), some climate change content appears in some text books but inadequate (Taba et al., 2015). In another study, Owolabi et al., (2012) further contend that there is an urgency to add to the learning experiences and identifying new teaching methods and pedagogies structures suitable for building the capacities for climate change and sustainable development for all inclusive students to develop positive attitude towards their

environment as the world strives to attain the Millennium Development Goals (MDGs).

#### **4.1.2 Climate change effects as an emerging challenge facing the developing African countries**

UNESCO (2009) asserts that climate change consequences are likely to impact disproportionately on people in developing countries especially in Africa. Scholars report that climate change is one of the most significant global challenges in the twenty first century. The average global surface temperature has warmed up 0.8 degree Celsius (°C) in the past century and 0.6°C in the past three decades largely because of human activities (Adger et al., 2007; Boko et al., 2007; IPCC, 2007). The impacts of climate change are more significant in the least developed countries (LDCs) than in developed countries, particularly in Sub-Saharan Africa (SSA) where rain-fed agriculture is the mainstay of more than 80 percent of its population (Lema & Majule, 2009; Mertz et al., 2009; Yanda & Mubaya, 2011).

Observations from the meteorological neighbouring countries Kenya for instance, indicate a local warming rate of 0.275 °C per decade between 1976 and 2000, significantly higher than globally averaged warming (Agrawala et al., 2003). Incidences of floods and droughts have also been reported within the region. In Tanzania available records on climate reveal a declining trend in precipitation on slopes of Kilimanjaro Mountain at least since 1880 (Agrawala et al., 2003). The glacial retreat observed on Mount Kilimanjaro, is arguably, the most iconic indication of climate change where over the 20th century the spatial extent of ice cap has decreased by 80 percent (URT, 2007; Agrawala et al., 2003). With the current rate of warming, it is projected that the glacier may disappear entirely by 2020 (URT, 2007; Agrawala et al., 2003). This will have considerable implications for the local ecosystems on the mountain slopes, which provide critical water services and support livelihoods for over a million local inhabitants on the slopes of the mountain, and the whole of Pangani river basin (Agrawala et al., 2003). IPCC (2014) reported that due to increase in temperature, expansion of different diseases such as malaria into cold areas of the world has been on an increase.

#### **4.1.3 Climate change and transformative education approaches integration in secondary schools' curricular**

There is active content production for schools by international bodies in a bid to stream climate change and mitigation awareness among pupils in Zambian schools (UNESCO, 2015). This comes about as the United Nations research has found out that Southern Africa is

the worst affected region in Africa in terms of climate change as it largely relies on climatic conditions for food security and environmental sustainability (Bungay & Blum, 2010).

According to Wiseman (2014), Malawi has come up with a National Climate Change Strategy and went on to develop a climate change source book for primary school teachers. This aimed at changing attitudes of the young generation, their practices and behaviour towards being climate friendly (Wiseman, 2014). Malawi partnered with the United Nations Climate Change (UN CC: Learn), an organisation whose mandate is to fund countries and support them in the designing and implementation of sustainable teaching and learning towards climate change mitigation. However, production of this resource for teaching and learning materials and distribution of posters to all primary schools in the country has sadly not seen the climate change being taught explicitly as it should, it is more of an awareness campaign than what is intended by the curriculum (UNICEF, 2018).

Stakeholders in Zimbabwe recently tried to rope climate change in schools through the Ministry of Primary and Secondary education but this was implemented by schools thus, it was not a sustainable action (Kokolombeni, 2019). These 'Hit and Run' activities in Zimbabwean schools are a common phenomenon as long as the key issues of climate change are not examinable as a terminal requirement in both secondary and primary schools, teachers tend to pay more attention on examinations than on life skills (Tatenda, 2019). It is observable from findings that teachers lack organised and condensed content on climate change for the classroom in Zimbabwean secondary schools.

#### **4.1.4 Factors affecting teacher awareness in integration and implementation of climate change in secondary schools' curricular**

##### ***Training and teaching materials for teachers and educators to promote climate change educations:***

UNESCO (2009) also identified the professional development of teachers in education for sustainable development as the top priority, in recognition of the transformative role that teachers and teacher educators need to play in re-orienting education to help realize a sustainable future. Chakeredza et al. (2009) affirm that education has a vital role to play in strengthening knowledge systems. They noted that issues of climate change should be infused into educational curricular as a matter of urgency. However, UNESCO (2009) sadly noted that development of teacher education in CCESD is in its infancy. Climate change education is considered to have peripheral status in educational research and practice, and when it is addressed, it is only within

science education (Rolls et al., (2009). The response to climate change challenges should be through systematic education programs that are not restricted to a single subject.

On the other hand Okey & Ndum (2013) pointed out that the curricula should be handled as a separate subject or infused and integrated into the existing courses. Mwangu (2017) made a study in Uganda and found that the content about climate change in Uganda curriculum is not explicit. Teaching about climate change depends on interest, expertise and capacity of individual teachers. In Kenya climate change does not appear in the curricula as well as in the formal education (Ndiritu et al, 2016). In Tanzania, climate change content to some extent has appeared in the school curriculum at primary and secondary school level although it is not explicitly stated as it is being taught in few subjects in a curriculum and in specific topics (Kiwonde, 2019; Kimaryo, 2011).

***Financial incapacity for schools:*** The Ministry responsible for Education in Zambia sights its inability to raise funds to help come up with mitigation programs for learners across the education spectrum from primary to teacher training as a serious challenge that has seen them failing to report successful integration programs on climate change and mitigation (Kamukwamba & Nachiyunde, 2018). In most developing countries especially in Africa, literature has it that lack of books in the form of hard copies on climate change is making it difficult for learners to access more information on the subject and also to spice up the curricular which research calls 'uninspiring' (UNESCO 2018). Previously in Zimbabwe, reading texts was the in thing for students and that culture has died down. Modern influential and interactive platforms such as digital publishing, social media and video recordings are not easily accessible by most learners to allow them to use in schools to enhance their understanding of climate change (UNICEF, 2017; Makwanya, 2019). The absence of reading material for the present young learners makes them ill-equipped to be climate change heroes and game-changers as there is a dearth for the ecological concept of reading about climate change in their foundational years in schools today (Makwanya, 2019).

## **5. Conclusion and recommendations**

The study established the following conclusions and recommendations

### **5.1 Conclusion**

1. Climate change has negatively impacted developing countries of Africa. Research variability and climate change are the crucial

challenges of the 21<sup>st</sup> century predominantly in Sub-Saharan Africa. There is an unprecedented increase in incidences of floods and droughts across the region with high altitude areas like Mount Kilimanjaro summit glaciers reported as melting due to global warming.

2. Education is a key player in the awareness and mitigation of climate change in the developing countries of Africa due to its inherent ability to in developing climate change knowledge, preparation and presentation of climate change information in a way that benefits local communities as learners are in a position to help their farming parents and communities on how to mitigate climate change at grassroots levels. Education offers a better prospect in mitigating and combating climate change towards the erection of resilient societies even in Southern Africa by imparting knowledge at the base in society.
3. Secondary schools in developing African countries has climate change integration at a very minimum level in their curricular. Findings show that it is considered to have peripheral status in educational research and practice, and when it is addressed, it is only within science education. The response to climate change

challenges should be through systematic education programs that are not restricted to a single subject yet this is the approach that African education curricular across Sub-Saharan Africa have adopted.

4. The major challenges faced by developing countries in Africa are those related to funding. Most African governments have weak economies, which become a challenge in teacher training and provision of learning materials at such large scales. Curriculum development becomes an expensive endeavour for such countries such that at the end literature shows that climate change is not wholly integrated but becomes an event at given times during the school calendar year. Modern influential and interactive platforms such as digital publishing, social media and video recordings are not easily accessible by most learners to allow them to use in schools to enhance their understanding of climate change. Absence of reading material for young learners make them ill- equipped to be climate change heroes and game-changers as there is a dearth for the ecological concept of reading about climate change in their foundational years in schools today.

## 5.2 Recommendations

All African countries should urgently fully integrate allied climate change topics such as climate effects on agricultural science, global warming, agro-biodiversity, bio-fuels, adaptation strategies, mitigation strategies and global policy issues among other areas integrated in their secondary school curricular to spice up the curricular in order to equip the young learners with more information on the subject and make them climate change heroes and game-changers. Climate change education should be handled through systematic education as a separate subject or infused and integrated into the existing systematic education programs and not restricted to a single subject as witnessed within science education in many African education curricular across Sub-Saharan Africa that have attempted to integrate climate change.

Teachers should be trained and exposed to effective teaching and learning material with enough climate change content to increase their knowledge on complexity issues of climate change and its mitigation requirements

There should be more sourcing from international bodies and partners in education and development to support active content production, climate change strategy of developing climate change resource books for teachers and students to effectively change the attitudes of the young generation, their practices and behaviour towards being climate friendly in a bid to stream climate change and mitigation awareness among younger learners in African countries schools.

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