

Status Of Climate Change Content In Kenya's Selected Secondary School Subjects

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Abstract: *There is now scientific consensus that climate change is a real phenomenon and that it is coming faster than expected. It is also evident that despite the fact that it is likely to impact negatively on most countries of the world, developing countries are more likely to bear more consequences owing to their location and inability to adapt caused by their low levels of technology. For developing countries to adapt to the changing climate, they must first be aware that climate change is happening and also learn ways of adapting to the changes. One major tool of passing the required knowledge, skills and changing people's attitude towards the phenomena is education. Despite its importance in performing the said role, most education curricula especially in developing countries have little such content. This paper therefore shall conduct a survey on selected secondary school subjects in Kenya to ascertain the level to which they carry climate change content. The paper shall further give recommendations on required interventions to ensure climate change is addressed by Kenya's secondary school education curriculum.*

Keywords: *Climate Change, Curriculum, Environmental Education, adaptation, impact, mitigation*

I. Introduction

According to The United Nations Educational, Scientific and Cultural Organization (UNESCO, 2009), education has a central role to play in understanding, mitigating and adapting to the changing climate. They argue that education at all levels and in both formal and informal settings is needed but instilling climate change awareness and understanding at a young age is ultimately the best way to change behaviours and attitudes. Similarly Bangay and Blum (2010), argue that education is as important as health. They assert that a well educated population is better equipped to recognize in advance the threats posed by a changing climate. These arguments are in line with one of the United Nations' millennium development goals that state that environmental sustainability must be ensured which is only possible through ongoing education around environmental issues. Despite these revelations, the government of Kenya, GoK (2010) acknowledges that since independence, commissions have been established to look into the education system. However none of all the commissions touched on climate change and possible inclusion in the education curriculum. It is therefore evident that climate change is not formally acknowledged in Kenya's education policies at primary, secondary and tertiary levels. The National Climate Change Response Strategy (NCCRS) acknowledges this reality and notes that the major concern in Kenya is the lack of adequate climate change information, knowledge and long-period data to researchers, planners, policy makers and the general public on climate change impacts, adaptation and mitigation measures. This study therefore aimed to conduct a survey on selected subjects to establish the status of climate change content in such subjects and offer recommendations on how to improve the situation.

1.1 Statement of the Problem

McCarthy *et al.*, (2001), citing IPCC, states that there is now scientific opinion consensus that the earth's climate is being affected by human activities: such activities are modifying the concentration of atmospheric constituents that absorb or scatter radiant energy. IPCC (2007), synthesis further predicts that global temperatures could rise by between 1.4° C and 5.8° C and sea level could rise by between 20 cm and 88 cm by the year 2100. In addition, they warned that weather patterns will become less predictable and the occurrence of extreme climate events, such as storms, floods, and droughts, will increase. Sarmiento *et al.*, (2004), further warn that such warming could cross certain thresholds for abrupt climate change, triggering such dangerous events as a shutdown of the ocean currents that supply nutrients to important fisheries and moderate the climate in Europe and other regions. To be safe, O'Neill and Oppenheimer (2002), categorically warn that we may have only a narrow window of time to act before the levels of emissions reductions needed to prevent dangerous and irreversible climatic changes become prohibitively expensive. Bangay and Blum (2010) propose

a solution to this. They argue that education is as important as health and claim that an educated population is better equipped to recognize in advance the threats posed by a changing climate and act accordingly. It is therefore evident that climate change is a real problem that needs to be addressed urgently and that education shall play a major role in controlling the situation. This study therefore aimed to undertake a survey in sampled secondary school subjects to establish the status of climate change in the subjects and offer recommendations on how to improve the situation if need be.

1.2 Research questions

This study was guided by the following objectives:

- i. To establish the status of climate change content in selected Kenya secondary school subjects.
- ii. To offer recommendations based on the findings of the study

II. Literature Review

2.1 The Concept Of Climate Change

Different authors have advanced different definitions for the concept of climate change. For instance, The Intergovernmental Panel on Climate Change (IPCC), defined climate change as a phenomenon created by human beings and nature, which devastates the earth and causes hardship of unpredicted magnitude to the living. In a more explicit manner United Nations Environmental Programme, (UNEP, 2008), defines climate change as extreme reactions of the weather phenomenon which creates negative impacts on agricultural resources, water resources, human health, depletion of ozone layer, vegetation, soil and doubling of carbon (IV) oxide (CO₂) in the ecosystem.

All the previous definitions attribute climate change to human as well as natural causes, however Omotosho (2007), defines it as a change of climate that is attributable directly or indirectly to human activities and, which alters the composition of the global atmosphere, in addition to natural climate variability observed over comparable time periods. From the definition, the idea that climate change is human induced and the concept 'climate variability' emerges. United Nations Framework Convention on Climate Change (UNFCCC, 2004), uses "climate variability" for non-human caused variations and argues that climate change only refers to the changes in modern climate, including the rise in average surface temperature (global warming) caused by human beings. The idea of human induced climate change was later advanced by The Intergovernmental Panel on Climate Change (IPCC, 2007), who stated unequivocally that climate change is predominantly human-induced. They stress that people's actions are intensifying the climate's natural variability, and the Earth's temperature is rising.

Scholze and Prentice (2005), attribute climate change to intensified human induced actions such as: the widespread use of land, the broad scale deforestation, the major technological and socio-economic shifts with reduced reliance on organic fuel, and the accelerated uptake of fossil fuels. Human-induced (or anthropogenic) climate change is caused by increased production of greenhouse gases, including carbon (IV) dioxide (CO₂), methane and nitrous oxide. Carbon dioxide, the main contributor, is produced primarily by the burning of fossil fuels — oil, gas and coal. Although methane occurs in smaller quantities than CO₂, it has higher warming effects. Increased methane production is linked to increased levels of livestock farming for meat production. Warming of permafrost areas in Siberia and Canada may also contribute significantly to an increase of methane emissions, since permafrost lakes store methane gases. Increases in greenhouse gas production are directly linked to the post-1750 period of industrialization in Western countries. These gases now far exceed the natural rate of greenhouse gas production as measured in pre-industrial era ice cores spanning many thousands of years. They finally note that although climate change is global, its consequences are far more reaching in developing countries.

Climate change shall have far reaching consequences as highlighted by Ishaya and Abaje (2008), that include frequent drought, increased environmental damage, increased infestation of crop by pests and diseases, depletion of household assets, increased rural urban migration, increased biodiversity loss, depletion of wildlife and other natural resource base, changes in the vegetation type, decline in forest resources, decline in soil conditions (soil moisture and nutrients), increased health risks and the spread of infectious diseases, changing livelihood systems. United Nations Development program (UNDP, 2010), explain that they will impact on key sectors of the economy as well as important drivers of growth, including agriculture and natural resources, water, health and infrastructure. Coupled with the country's low adaptive capacity to climate change, the country experiences a high level of vulnerability and a complex development picture.

2.2 The Concept of Curriculum and its role in creating climate change awareness

Wheeler (1978), explains curriculum as a sequence of potential experiences set up in schools for the purpose of disciplining children and youths in ways of thinking and acting. The curriculum of any school

consists of all the experiences that a school may select and consistently organize for the purpose of bringing about changes in the behaviours of the learners and as a means of developing the personality of the individuals.

Doll (1996), affirms that curriculum is the formal and informal content and process by which learners gain knowledge and understanding, develop skills, and alter attitudes, appreciations, and values under the auspices of an academic institution. In other words, he argues that curriculum is the total experience that includes not only the content selected and delivered, but also the planned and unplanned activities in which individuals' participate as students. Ronald goes further to define a syllabus as the content or subject matter, instructional strategies and evaluation means of an individual course. The collective syllabus of a program of study represents a map of the curriculum for that program. He also outlines the process of curriculum development under Tyler's model. The model provides a framework of how to construct a planned curriculum. It involves a four-step approach which is logical, sequential and systematic: setting objectives; learning experiences and content; organizing learning experiences; and evaluation.

EAC (2011), argues that access to climate change information and technology is one of the key elements necessary to effectively respond to climate change regionally. They affirm that learning and research institution play 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. Similar claims are advanced by UNESCO (2009), who argue that education has a central role to play in understanding, mitigating and adapting to the changing climate. They argue that education at all levels and in both formal and informal settings is needed but instilling climate change awareness and understanding at a young age is ultimately the best way to change behaviours and attitudes.

UNESCO (2005), 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. However, they recognize that development of teacher education in climate change education for sustainable development is in its infancy.

Bloom et al., (2005), affirms that Higher Education plays a critical role in preparing and providing leadership to meet these challenges and to stimulate sustainable development. He however exposes an even worse case claiming that Africa is among the continents with the least intellectual institutional and technological capability to address the climate challenge. Rolls *et al.*, (2009), confirms the same by claiming that climate change education has peripheral status in educational research and practice, and when it is addressed it is only within science education. There is therefore a clear and present need to respond to climate change challenges through systematic education programmes that are not restricted to a single subject area.

2.3 Education and Climate Change in Kenya's Situation

EAC (2011), affirms that the level of climate change awareness is generally low because climate change is a relatively new and developing concept in the general public domain. Similarly, they accept that there is a critical shortage of climate change content in the education curricula of most developing countries at nearly all levels of education, ranging from primary through to tertiary. They argue that the same is true for the EAC Partner States where climate change education and training is limited to a few courses at some colleges and universities. For instance, major public and private universities in Kenya, such as Nairobi University, Moi University, Egerton University, Kenyatta University United States International University (USIU), Jomo Kenyatta University of Agriculture and Technology (JKUAT) and Maseno University offer the traditional courses of geography, meteorology, geology, agriculture, environmental and natural resources management with some climate change related content.

At the postgraduate level, a number of these institutions have attempted to introduce climate change as a specific discipline (EAC, 2011). For instance the Tegemeo Institute of Egerton University has recently incorporated climate change research into its research agenda. At the University of Nairobi, The Department of Meteorology also offers an executive course on climate change adaptation and mitigation, specific courses called Climate Change and Renewable Energies, besides the traditional courses on climatology and climate dynamics. At the Institute for Climate Change and Adaptation (ICCA), a research institution has been established to focus on climate change adaptation research.

However, given that climate change stands out as one of the greatest challenge that mankind has ever faced, more is needed from educational institutions. GoK (2012), recognizes this fact and in its National Climate Change Action Plan acknowledges that students at secondary school will need to be equipped with skills to support a future climate resilient economy. As has been recommended for primary schools; integrating climate change in secondary education should happen through the introduction of content that makes learners aware of the need to develop climate adaptation and mitigation capacities for the country. Courses touching on specific areas such as clean energy alternatives and reduction of deforestation should then be introduced incrementally at secondary school level.

III. Methodology

The study adopted survey research design. Eight subjects were selected using purposive sampling technique to form the sample. A template was developed by the researcher containing eight (8) thematic areas. The template was used as a checklist to identify areas that were addressed in the sampled subjects. The thematic areas included:

- Scientific concepts and processes
- Certainties, uncertainties and projections
- Causes of climate change
- Mitigation and adaptation measures
- Consequences/impacts
- Time-space dynamics
- Interests that shape responses to climate change

Data was collected using an eight thematic areas template to ascertain the status of climate change content in the sampled eight subjects namely: Agriculture, Biology, Business Studies, Chemistry, Christian Religious Education, Geography, Physics and History.

IV. Findings

To ascertain the status of the identified concepts in the sampled subjects, the study sought to compute the variation ratio in each subject. The ratio is a measure of dispersion for nominal variables. It is defined as the proportion of cases which are not the mode (Linton 1965). It ranges from 0 to 1. A zero value implies absence of any variation while 1 implies maximum variation. To compute variation ratio, the following formula was used:

$$v := 1 - \frac{f_m}{N}$$

Where: f_m is the frequency of the mode
 N is the total number of cases

4.1 Summary of findings

Table 4.3: Summary Of Variation Ratio For Sampled Subjects

Subject	Variation Ratio
Geography	0.63
Agriculture	0.66
Christian Religious Education	0.72
Physics	0.81
Business Studies	0.84
Chemistry	0.84
Biology	0.91
History and Government	0.91

The table above gives a summary of the variation ratio for each of the sampled subjects. Biology and History and Government exhibit the greatest variation ratio at 0.91 while business studies and chemistry recorded a variation ratio of 0.84. Physics had a ratio of 0.81 followed by Christian religious education at 0.72. The top two with the smallest variation ratio were agriculture at 0.66 and geography at 0.63. It is therefore evident that none of the sampled subjects produced half of the expected information as per the content analysis template's eight thematic areas. Henry *et al.*, (2012) in a study conducted in Nigeria noted that climate issues are treated in the social science subject in most secondary schools with few topics focusing on climate and its elements like rainfall, temperature and wind. Similarly in Ethiopia Abraham (2013), shows that in primary school there is a separate subject called *Environmental Science* which is being given from grade 1-4. However, beginning from second cycle primary school (grade 5-8) through secondary school (grade 9-12) and higher learning institution, environmental education is given in the form of infusion so that environment related issues are incorporated in various subjects (as unit and sub-units) such as, biology, geography, chemistry, social studies, civic and ethical education, and English.

Overall, sampled subjects had a variation ratio of 0.4375. This implies that approximately 44% of what the study deemed important content in creating climate change awareness was not featured in the sampled subjects. The study established that main concepts and processes related to climate change were addressed in the sampled subjects except for the concept of climate variability. Main causes of climate change were also found to have been addressed in one subject or the other either directly or indirectly. Mitigation and adaptation measures seemed also addressed though not exclusively and the same case applied to the consequences as well. However, none of the sampled subjects touched at all on certainties, uncertainties and future projections of climate change; time space dynamics and neither did any of the subjects address interests that shape responses to climate change.

Notably as well is the fact that despite Geography having the least variation ratio and being the carrier subject, the subject is optional according to ministry of education guidelines. According to statistics from Kenya National Examination Council, KNEC (2014), Geography was done by only 25% of candidates at the national exam in 2013.

The Government of Kenya (2009), in its National Climate Change Response Strategy (NCCRS) acknowledges that despite many commissions being established in Kenya to look into the education system none of all the commissions touched on climate change and possible inclusion in the education curriculum. They attributed this to lack of adequate climate change information, knowledge and long-period data to researchers, planners, policy makers and the general public on climate change impacts, adaptation and mitigation measures.

V. Conclusions

Climate change awareness involves creating knowledge, understanding and values, attitude, skills and abilities among individuals and social groups towards the issues of climate change for attaining a better quality environment. Climate change specialists have repeatedly pointed out that a solution to climate change problem will require climate change awareness and its proper understanding. The role of teachers will go a long way in achieving this purpose.

However, sampled secondary school subjects recorded an overall variation ration of 0.44. The ratio suggests that 44% of identified themes (ideal climate change curriculum) were absent in the sampled subjects. Geography being the carrier subject performed best with a variation ration of 0.63 while Biology and History and Government had the largest variation ratio at 0.91. Main concepts such as climate change, global warming, greenhouse gases and the greenhouse effect were found to be addressed in several of the sampled subjects but were most explicitly addressed in Geography. Causes and impacts of climate change were also addressed in Geography and indirectly addressed in other subjects through practices such as encouraging environmental conservation, discouraging deforestation, encouraging use of green energies, reducing emissions etc. However, the study established that mitigation and adaptation measures were poorly addressed at least not directly. Certainties, uncertainties, future projections, interests that shape climate change debates as well bodies charged with climate change were not addressed in the entire curriculum.

Considering the low level of content in current secondary school subjects, there is need for the curriculum developers to take action to utilize the curriculum considering the important role it plays in creating awareness.

VI. Recommendations

From the foregoing findings of this study the following recommendations are proposed for the ministry of education, curriculum developers (KICD), teacher training institutions, teachers, students and researchers. These recommendations are aimed at enhancing the effectiveness of secondary school curriculum in creating climate change awareness in Kenya.

- i. Teacher training institutions should ensure that deliberate effort is made to equip teacher trainees with knowledge, skills and attitudes on climate change. This will ensure that teachers are well versed and able to pass required knowledge to students.
- ii. Curriculum developers (KICD) should ensure that more content is availed in subjects especially on certainties, uncertainties, future projects as well as interests that shape climate change responses. Bodies that deal with climate change should also be entrenched into the taught curriculum. These will give learners a wider understanding on the whole issue of climate change.
- iii. The ministry of education should also ensure that they provide proper policy guidelines. This will ensure that climate change content is availed in a compulsory subject so as to reach a wider audience of students. The ministry should also ensure that teachers are given proper in-service training to equip them with necessary knowledge to handle emerging issues.

References

- [1] Abraham, D. (2013). *Environmental Education about, in and for the Environment: The case of two secondary schools in Ethiopia*. Available at <http://www.duo.uio.no/>
- [2] Bangay C. And Blum N. (2010). Education Responses to Climate Change and Quality: Twoparts of the same agenda? *International Journal of Educational Development*.30(4): 335-450
- [3] Bloom, D. Canning, D. and Chan, K. (2005). *Higher Education and Economic Development in Africa*. Harvard University Press: Harvard.
- [4] Doll, R. (1996). *Curriculum Improvement: Decision Making and Process* (9th ed.). Boston: Allyn and Bacon.
- [5] EAC (2011). *East African Community Climate Change Master Plan*. East African Community Secretariat: Arusha, Tanzania.
- [6] Government of Kenya (2010): *National Climate Change Response Strategy*. Ministry of Environment and Mineral Resources. Nairobi Kenya.
- [7] Henry, O., Emmanuel, G.K. and Amponsah, M.(2012) Assessment of Junior High School Students' Awareness of Climate Change and Sustainable Development in Central Region, Ghana. *Educational Research Journal*, 2, 308-317.

- [8] Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report: Climate Change 2007: Working Group II: Impacts, Adaptation and Vulnerability. Available at http://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch9s9-5-1.html
- [9] IPCC, (1990b), *Emissions scenarios. Response Strategies Working Group* (Ed.). IPCC Secretariat: Geneva
- [10] IPCC, (2007), *Summary for Policymakers of the Synthesis report of the IPCC Fourth Assessment Report*. IPCC Secretariat: Geneva
- [11] Ishaya, S. and Abaje, I.(2008). Indigenous people's perception on climate change and adaptation strategies in Jema'a local government area of Kaduna State, Nigeria. *Journal of Geography and Regional Planning* Vol. 1(8), November, 2008
- [12] KNEC, (2014). *The Year 2010 KCSE Examination Report*. KNEC: Nairobi.
- [13] Linton, C. (1965), *Elementary Applied Statistics*. John Wiley and Sons: New York
- [14] McCarthy J. et al., (2001). Eds., *Climate Change 2001: Impacts, Adaptation, and Vulnerability*. Cambridge Univ. Press: Cambridge.
- [15] O'Neill, B.C. and M. Oppenheimer. (2002). Dangerous climate impacts and the Kyoto Protocol. *Science*, 296, 1971–1972.
- [16] Omotosho, J.B. (2007). Pre-rainy season moisture build-up and storm precipitation delivery in the West Africa Sahel. *International Journal of Climatology*. 28:937-946. DOI. 10.1002/joc.1548.
- [17] Rolls, E., Grabenhorst, F., and Franco, L. (2009), Prediction of subjective affective state from brain activations. *Journal of Neurophysiology*, 101, 1294 – 1308.
- [18] Sarmiento, J.L., N. Gruber, M.A. Brzezinski and J. P. Dunne. (2004), High-latitude controls of thermocline nutrients and low latitude biological productivity. *Nature*, 427, 56–60.
- [19] Scholze M, Knorr W, Arnel N. W, Prentice IC (2006). A climate-change risk analysis for world ecosystems. *Proceedings of the National Academy of Sciences* 103(35): 116-120.
- [20] UNEP (2008) Scoping Paper for Expert Group Meeting on Climate Change Adaptation, African Minister Conference on the Environment 12th Meeting of the Expert Group TBC. Available at http://www.unep.org/roa/About_AMCEN/default.asp
- [21] UNESCO (2005). *UN Decade of Education for sustainable development: The DESD at a Glance*. UNESCO, Paris, France.
- [22] UNESCO. (2009). *World Conference on Education for Sustainable Development*. UNESCO: Bonn, Germany
- [23] Wheeler, D. (1978). *Curriculum process*. Hodder and Stoughton: London