



IMPLEMENTATION OF CURRICULUM AND ITS CONTRIBUTION TO AWARENESS OF CLIMATE CHANGE AMONG TEACHERS AND LEARNERS IN SECONDARY SCHOOLS IN GITHUNGURI SUB-COUNTY, KIAMBU COUNTY, KENYA

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ABSTRACT

This study sought to the extent to which implementation of the curriculum contributed to awareness of climate change among teachers and students in secondary schools in Githunguri Sub-county of Kiambu County in Kenya. To achieve the set objectives, the study adopted a descriptive survey research design. The study adopted purposive, stratified and simple random sampling techniques to compose a representative sample. Using stratified sampling technique, schools were divided into either boys, girls or mixed before selecting a sample of 10 schools. From the sampled schools, stratified sampling was used to divide teachers into departments before employing simple random sampling technique to select a sample of 8 teachers from each of the sampled schools making a total sample of 80 teachers. Purposive sampling technique was used to select four students before employing simple random sampling to select a sample of 10 students from each of the schools making a total of 100 students as part of the sample. Purposive sampling was also used to select a sample of 8 subjects for content analysis. Purposive sampling technique was also employed to select 8 respondents from the curriculum developer in Kenya. The study used a thematic area content analysis template to undertake content analysis on sampled subjects. Data from teachers and students was obtained using different questionnaires for each of the categories. An interview guide was used to collect data from sampled Kenya Institute of Curriculum Development officers. Quantitative data collected was analysed using inferential statistics while qualitative data was analysed through descriptions and narratives. Statistical Package for Social Science and Minitab programs were utilised to enhance quality analysis. On the relationship between implementation of curriculum and awareness among teachers, the chi-square value was greater than the significant value, $0.794 > 0.659$, and therefore the relationship was not significant. Results of this study were likely to be beneficial in policy, practical and theoretical dimensions.

Key Words: *Climate Change, Curriculum implementation*

CITATION: Implementation of curriculum and its contribution to awareness of climate change among teachers and learners in secondary schools in Githunguri Sub-County, Kiambu County, Kenya. *The Strategic Journal of Business & Change Management*, 6 (3), 703 – 715.

INTRODUCTION

The East African Community Climate Change Master Plan (EACCCMP) (2011), acknowledged that climate change and global warming are the biggest environmental issues of our time. Jekayinfa and Yusuf (2012) submit that climate change threatens the existence of mankind as well as his environment and is therefore a contemporary issue worldwide. Notably, the consequences of climate change will be, by far, more felt in less developed and developing countries although its causes are global (Small and Nicholis, [2003]; Jekayinfa and Yusuf, [2012]). Climate change impacts are already visible in the changing weather patterns. These have had serious impacts on human beings, destroying ecosystems and water supply, causing sea-levels to rise, distressing agriculture and food production. Climate change therefore has a swelling effect on both natural resources and the balance of nature (Jekayinfa and Yusuf, 2012).

In Kenya since independence, commissions have been established to look into the education system. It is however important to note that none of all the commissions touched on climate change and possible infusion into the education curriculum. It is therefore apparent that climate change, in Kenya's education policies, is casually treated and learning is hardly there at primary, secondary and tertiary levels. The National Climate Change Response Strategy (NCCRS) attributes 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 adaptation, impacts and mitigation measures (RoK, 2012).

It is therefore evident that curriculum is likely to play a crucial role in creating awareness about causes, impacts, mitigation and adaptation to the changing climate. The study therefore set out to establish which aspects of climate change were addressed in the current curriculum and in which subjects that was done. The study also sought to find out the level of

awareness of climate change among teachers and students. It also sought to find out how effective curriculum developers had been in infusing climate change content into the curriculum. By undertaking this study, it was sought to establish the extent to which use is made of the curriculum in contributing to creation of awareness among learners in schools about climate changes and their adverse effects on environment. However, as noted earlier, the contribution of curriculum in creating awareness about climate change has not been given much emphasis in Kenya's education curriculum. The dangers posed by a changing climate and the little emphasis given to curriculum in Kenya as far as its contribution to creating awareness on climate change is concerned formed the basis for this study.

Statement of the Problem

According to McCarthy et al., (2001), there is now scientific opinion consensus that human activities are affecting the earth's climate. They affirm that such activities are modifying the concentration of atmospheric constituents that absorb or scatter radiant energy. The result of this is explained by Sarmiento et al., (2004), who warn that the warming could cross certain thresholds for unforeseen climate change. This will likely trigger shutdown of the ocean currents that supply nutrients to important fisheries and moderate the climate in most regions of the world. Again IPCC (2007), synthesis predicts that sea levels could rise by between 20 cm and 88 cm following global rise in temperatures by between 1.4° C and 5.8° C by the year 2100. In addition, weather patterns will become less predictable and the occurrence of extreme climate events, such as floods, storms and droughts will increase.

On the basis of the dangers posed by the changing climate, O'Neill and Oppenheimer (2002), proposed that we may have only a constricted time frame to act before the levels of emission reductions needed to prevent catastrophic and irreversible climatic

changes become extremely expensive. Bangay and Blum (2010) propose that the solution lies in formal education. They argue that “formal education is as important as health” and that an educated population is better equipped to recognize in advance the threats posed by a changing climate and act accordingly.

Recognizing the crucial role played by formal education in creating awareness about climate change, this study asked the question: Is the content in the current secondary school curriculum adequate and explicitly presented to create awareness of climate change among the learners? This study examined the scope of the work done by the scientific community in the area of climate change. A wide range of studies reviewed delved on issues of students’ awareness of climate change (Henry et al., 2012); teachers’ awareness (Eunice and Joy, 2014; Ekpoh and Ekpoh, 2011; Nkechi, 2014); climate change impacts (Aja, 2015); infusion of climate change into secondary school agricultural science (Michael, 2014) and the role of media in creating climate change awareness (Onkargouda et al., 2013). Studies reviewed from Kenya mainly touched on indigenous coping and adaptation strategies (Edward et al., 2014) and perceptions of teachers towards the integration of adaptation strategy topics on climate change into secondary school agriculture syllabus (Stephen et al., 2014). Notably, few studies had been conducted in Kenya in regard to climate change.

Recognizing the dangers posed by the changing climate and acknowledging the limited research especially in Kenya to link contribution of curriculum in creating awareness about climate change, it was pertinent for this study to establish the extent to which implementation of the curriculum contributes to awareness of climate change among teachers and students in secondary schools in Githunguri Sub-county of Kiambu County, Kenya.

The objective of this research was to establish the extent to which implementation of the curriculum contributes to awareness of climate change among teachers and students.

The research Hypothesis was;

H₀ There is no significant relationship between implementation of secondary school curriculum and climate change awareness among teachers and students.

LITERATURE REVIEW

People’s awareness of climate change depends on some factors. Ochieng (2014) argues that people’s level of awareness of climate change is influenced by among other factors, level of education. His arguments are in tandem with Acquah (2011) who asserts that individuals with high levels of education are more likely to be aware of climate change. Other factors, according to Ochieng, include: demographic factors including age, gender, and personal experience including experience of extreme weather events; and access to information including media coverage of the issue and advocacy.

In general, Pugliese and Ray (2009) affirm that numerous studies conducted reveal that the vast majority of people across the world, especially in developing countries, are still unaware of climate change despite their high vulnerability to the impacts of climate change. Taderera, (2010) also asserts that despite their experience of changing weather patterns, people in Africa, are poorly informed about global climate change. UNFCCC (2007) argues that the low level of awareness on climate change across sub-Saharan African countries is attributed to limited awareness campaigns on one hand and the fact that African countries have got too many problems ranging from poverty to political conflicts on the other hand hence climate change is never a priority issue.

Locally, Otieno, Pauker and Maina (2009) affirm that the majority of Kenya’s population is unaware of

climate change, notwithstanding climate variability being experienced in the country. However, they remain very much aware and concerned about frequent droughts and food scarcity in the country. The government of Kenya acknowledges this fact and as a result has developed the National Climate Change Response Strategy (2010) and its implementation plan, the National Climate Change Action Plan (2013-2017), outlining actions to be taken to mitigate and build resilience to the impacts of climate change. Following this, Ochieng (2014) argues that even as resources are put together to mitigate climate change, there is need to educate people on what climate change really is. Increasing people's awareness on climate change through education is an important measure to persuade people at all levels in the community to play an active role in mitigating and adapting to climate change.

Intentions of reviewing school curricula to include climate change knowledge at all levels is demonstrated in the NCCAP 2013-2017. However, Ochieng (2014) affirms that before that is done it is important to assess the teachers' level of awareness on climate change since their level of awareness is likely to influence how they transfer climate change knowledge to the learners. Anderson (2010) reaffirms that teachers are an untapped resource that the world can use to combat climate change. They can use their expertise to disseminate information on climate change in the classroom and beyond the school compounds to help individuals and communities make informed decisions and take sustainable actions to build a climate resilient society. However, Otieno, Pauker and Maina (2009) confirm that very little research has been done to investigate the level of climate change awareness among teachers.

Some of such studies have been conducted in Nigeria and include one Akinnubi et al. (2012) that reviewed secondary school teachers' level of awareness in Ondo West Government Local Area and another by

Ekpoh and Ekpoh (2011) in Ondo State and Calabar Municipality. Both studies revealed a general low level of awareness of climate change issues among secondary school teachers.

In Kenya, RoK (2012) affirms that only 1.11% of issues related to climate change are either addressed directly or indirectly by the Primary Teacher Education Curriculum in Kenya and hence, the majority of primary school teachers in Kenya may have limited understanding of climate change and this may affect their delivery on this subject. Another study by Ochieng' (2014), among primary school teachers in Kisumu County, Kenya revealed that primary school teachers recorded a medium level of awareness on climate change, which shows that they have some good understanding of climate change, but gaps exist in their knowledge.

Ochieng' argued that although teachers appeared to be aware of the causes, effects and mitigations of climate change, they expressed limited understanding of the role of fossil fuel and poor management of waste in climate change. Teachers also exhibited little knowledge surrounding the existence of the UNFCCC, Kyoto Protocol and IPCC. They also portrayed limited understanding of the effect of climate change on sea level as well having poor understanding of the scientific consensus on anthropogenic climate change. Ochieng's analysis also revealed that teachers' personal reading of books and related materials, research in the internet, and informal trainings by Non-Governmental Organisation (NGOs) has played a significant role as sources of their climate change knowledge.

Literature and arguments in this section reveal that there is limited research as far as awareness of climate change among teachers is concerned. The study reviewed in Kenya was among primary school teachers in Kisumu County. No such study was found to have been done in Githunguri Sub-county of Kiambu County. Also, studies reviewed here did not

link the level of awareness among teachers to the current curriculum in secondary schools. This study therefore felt that there exists a gap in knowledge as far as awareness of climate change among teachers in secondary schools in Kenya is concerned.

This study also sought to establish level of awareness of climate change among secondary school students. The study established that limited studies exist that delve into students awareness of climate change issue. One such study was conducted by Oruonye (2011) who examined the level of awareness on the impacts of climate change effects among tertiary institution students in Jalingo Metropolis, Nigeria. The study established that low level of awareness existed among the students. Of the 225 students Oruonye interviewed, 18.8% had never heard of climate change before while 89% of those who claimed to be aware of climate change were unaware of its causes, effects, and possible adaptations or mitigations measures. A study was also conducted among junior high school students in Ghana by Owolabi, Gyimah and Amponsah (2012). Their study sought to compare students of different ages as far as awareness of climate change was concerned. The study revealed that awareness of climate change and sustainable development was more significant among younger students (below 15 years) are than in older students.

In conclusion to this section, it is important to note that very limited research was found in the area of climate change awareness among learners in secondary schools. The study from Nigeria was on tertiary institution students and mainly assessed level of awareness of climate change impacts only. The second study mainly emphasised age of students as far as awareness of climate change is concerned. None of the two studies reviewed linked the awareness of students to the learning process (curriculum). This study saw this as a gap in knowledge and delved into it in a bid to establish to what extent curriculum is creating awareness about

climate change among Kenyan secondary school students.

METHODOLOGY

The study adopted a descriptive survey design. The study also used both qualitative and quantitative approaches. However it was more inclined to the qualitative approach. Since this study was highly qualitative and aimed at seeking clarification as pertains the issue of climate change and Kenya's curriculum by collecting data from individuals by administering questionnaires and interviewing, the design was deemed the best and was therefore adopted for the study. The study was conducted in Githunguri Sub-county located in Kiambu County. There were 303 secondary schools consisting of 227 public and 76 private schools. The total enrolment rate was 89,065 out of which 44,777 were males and 44,288 were females. The gross enrolment rate was 69.3 percent and the net enrolment rate was 61.8 percent. According to Kiambu County Government website, the number of teachers in the county stood at 3,479 and the teacher/pupil ratio was 1:25. The target population for this study was 31 public secondary schools, 570 secondary school teachers and 3038 form four students (as per 2013) from Githunguri Sub-county. The study also targeted 25 examinable subjects in Kenya's secondary school education curriculum (Appendix 5), as well 25 KICD officers representing each of the examinable subjects.

The study adopted several sampling techniques in constituting a representative sample. Using purposive sampling technique, 8 out of 25 examinable subjects were selected to form part of the sample. The subjects were selected based on prior knowledge that they possessed content relating to the topic of study. The subjects were also selected based on the number of students who sat for them at the national examination in Githunguri Sub-county. A subject ought to have been done by at least 20% of the candidates at the national exam.

Data was collected using four data collection tools namely a thematic area content analysis template, questionnaire for teachers, a questionnaire for students and an interview guide for KICD officers. Using the content analysis thematic area template, the researcher personally reviewed syllabi of the sampled subjects as well as text books and checked the content against the template. The researcher would tick on the template according to information that was found in the syllabi and the text books.

The researcher also personally visited the sampled schools and administered questionnaires to both teachers and students. Completely filled questionnaires were closely examined to ensure no errors were present. Qualitative data obtained was analysed using narratives in form of discussions and explanations. Programs used to conduct the analysis were; Statistical Package for Social Sciences (SPSS) and Minitab.

FINDINGS

The objective of the study was to establish the extent to which implementation of the curriculum contributes to awareness of climate change among students and teachers. The research question to which response was made was: How does implementation of curriculum contribute to awareness of climate change among students and teachers? The research instruments used to elicit responses to this question were a questionnaire for teachers and a questionnaire for students. Findings were shown and discussed.

On awareness among Sampled Teachers, data was collected from sampled teachers to establish their understanding on issues of climate change. Teachers were asked to express their understanding of major climate change concepts and the results were as displayed in table 1.

Table 1: Teachers' Awareness of Key Concepts

Concepts	1*	2*	3*	4*	5*
Climate change	29.2	33.8	10.8	15.4	10.8
Climate variability	3.1	1.5	38.5	26.2	30.8
Global warming	64.6	26.2	0.0	6.2	3.1
Greenhouse gases	35.4	32.3	1.5	16.9	13.8
Greenhouse effect	26.2	20.0	15.4	20.0	18.5

NOTE: 1= strongly agree, 2= strongly disagree, 3= undecided, 4= Disagree and 5= strongly disagree. All the scores between 1 and 5 are in percentages. N=65.

Table 1 outlined the perception of teachers towards their understanding of the key concepts that were related to climate change. Notably from the table, most teachers expressed their understanding of the concepts of climate change, global warming, greenhouse gases and greenhouse effect. For instance, 64.6% of the respondents said that they understood the concept of global warming while 35.4% understood the concept of greenhouse gases. Notably also majority of the teachers did not have an

idea of the concept of climate variability as indicated in table 1 where 38.5% were undecided while 26.2% and 30.8% disagreed and strongly disagreed to understanding the concept respectively. This showed correspondence to the concepts being addressed in the sampled subjects.

Teachers were asked whether their subjects of specialization addressed the main identified concepts. The results obtained were as shown in the table 2.

Table 2: Subjects Address of Key Concepts

Key concepts	Yes	%	No	%
Climate change	34	52.3	31	47.7
Climate variability	0	0	65	100
Global warming	41	63.1	24	26.9
Greenhouse effect	38	58.5	27	41.5
Greenhouse gases	43	66.2	22	33.8

Table 2 explained that the understanding of teachers hardly unaddressed in their teaching subjects (0%) while concepts such as climate change (52.3%), global warming (63.1%), greenhouse effect (58.5%) and greenhouse gases (66.2%) were well addressed. This probably expressed why most sampled teachers had and understanding of the concepts.

The study went on to establish teachers understanding of the causes of climate change. Teachers were asked to identify their understanding on the causes, mitigation and adaptation measures as well as consequences of climate change. Results obtained from sampled teachers were analysed and presented in table 3.

Table 3: Understanding of Causes, Impacts, Adaptation and Mitigation of CC

STATEMENT	1*	2*	3*	4*	5*	Total
Climate change is natural	4.6	24.6	33.8	32.3	4.7	100
Climate change is human caused	32.3	29.2	13.9	13.8	10.8	100
I have knowledge of natural causes of CC	7.7	3.1	9.2	43.1	36.9	100
I have knowledge of human causes of CC	26.2	40.0	1.5	16.9	15.4	100
I have knowledge of impacts of CC	20.0	32.3	18.5	15.4	13.8	100
I have knowledge of mitigation measures	13.8	20.1	10.6	26.3	29.2	100
I have knowledge of adaption of CC	6.2	13.8	18.5	29.2	32.3	100

NOTE: 1= strongly agree, 2= strongly disagree, 3= undecided, 4= Disagree and 5= strongly disagree. All the scores between 1 and 5 are in percentages (n=65). CC- Climate Change

Table 3 expressed teachers' understanding of causes, impacts, mitigation and adaptation to climate change. From the table, majority of teachers strongly agreed (32.3%) and agreed (29.2%) that climate change was human caused and on the same note strongly agreed (26.2%) and agreed (40.0%) to understanding human causes of climate change. Notably though, 33.8% were undecided on whether climate change was natural while another 13.9% remained undecided on whether it was human caused. This trend raised doubts on whether teachers really understood what actually caused climate change. Sampled teachers also exhibited low understanding of the natural causes of climate change with only 7.7% and 3.1% strongly agreeing or agreeing to have knowledge of the same. Those who had knowledge of the natural causes of climate change were mainly skewed

towards those that had Geography as a subject of specialization. From the results, geography was noted as having expounded on natural as well as anthropogenic causes of climate change but was skewed on the natural. This is likely to have influenced the results in this section.

From the table also, teachers expressed having knowledge on impacts of climate change. Majority of the respondent teachers 32.3% agreed to have knowledge while 20.0% strongly agreed to the same. Only 13.8% strongly disagreed to have knowledge on climate change impacts. However the high percentage of those that remained undecided (18.5%) leaves a lot to be desired.

As for mitigation measures, a gleam picture emerged from this study. Majority of the respondents strongly

disagreed to have knowledge of mitigation measures of climate change constituting 29.2% and 26.3% who disagreed to have knowledge of the same. On the other hand 13.8% and 20.1% of the respondents strongly agreed and agreed to have knowledge of mitigation measures while 10.6% remained undecided. A similar trend was reported when it came to adaptation measures. Only 6.2% and 13.8% of the respondents strongly agreed and agreed respectively to have knowledge on adaptation measures while majority (32.3%) strongly disagreed to have any knowledge of adaptation to the changing climate. This was the same trend respondents to the discussion on climate change content in the current curriculum. Whereas causes and impacts of climate change were discussed in some of the sampled subjects, adaptation, and mitigation remained barely unaddressed except in the carrier subject, Geography, which also did not address adaptation measures.

This study sought to establish from sampled teachers whether their subjects of specialisation addressed causes, impacts, adaptation and mitigation measures.

The results showed that causes and impacts were mainly addressed as per the opinion of the

respondent teachers. For instance, 100% of the sampled teachers (n=7) in geography were for the opinion that causes as well as impacts of climate change were addressed in the subject. Results also showed that mitigation was addressed fairly in some of the subjects, for instance, 33% of the sampled teachers in chemistry and agriculture felt that mitigation was addressed in the subjects while 29% of geography teachers felt the same. However, adaptation fared decimally as per teachers opinions. Only 25% of respondent physics teachers felt that adaption was well addressed in the subject while in the carrier subject, geography, a mere 14% were for the opinion that adaptation measures were addressed in the subject. The results of this study were in agreement with an earlier study by Ochieng' (2010) on Kenya's primary school syllabus. Ochieng' established that adaptation to climate change, though a very important concept for Kenya, is seemingly lacking in the current primary school syllabus.

The study went on to establish teachers' understanding of the certainties, uncertainties and future projection of climate change. The teachers were asked to express their opinion in table 4.

Table 4: Understanding of Certainties, Uncertainties and Projections

STATEMENT	1*	2*	3*	4*	5*	Total
Climate change is real	40.0	35.4	0.0	15.4	9.2	100.0
Climate change is a myth	3.1	9.2	23.1	26.2	38.5	100.0
Climate change is a natural cycle	4.6	7.7	26.2	40.0	21.5	100.0
CC will continue despite stopping emissions	3.1	10.8	35.4	23.1	27.7	100.0
CC will affect countries disproportionately	9.2	4.6	29.2	33.8	23.1	100.0

NOTE: 1= strongly agree, 2= strongly disagree, 3= undecided, 4= Disagree and 5= strongly disagree. All the scores between 1 and 5 are in percentages (n=65). CC- Climate Change

From table 4, majority of the respondents felt that climate change was actually real with 40.0% of respondents strongly agreeing and 35.4% strongly agreeing. However the study's attention was drawn to the high number of respondents who remained undecided on most of the statements. For instance, 35.4% were undecided on whether climate change

would continue when emissions are stopped with another 29.2% remaining undecided on where climate change would affect countries disproportionately. The trend only meant that teachers had limited knowledge as pertained the certainties, uncertainties and future projections of climate change. When asked whether their subjects

of specialization touched on the same, sampled teachers unanimously felt that the area was not addressed at all. Controversies have existed over the years as pertains whether climate change is real and whether it is natural or human caused. Omotosho (2007) claims that arguments have been advanced that climate change is natural while others feel that it is human induced. However, IPCC (2007), stated unequivocally that climate change is predominantly human-induced. They stressed that people's actions are intensifying the climate's natural variability, and the Earth's temperature is rising.

The foregoing discussion established that teachers had some knowledge on climate change but which was skewed on some areas such as causes, impacts and mitigation measures while other areas such as climate variability and future projections remained poorly performed. The study therefore sought to establish the main source of climate change knowledge possessed by teachers. Sampled teachers were asked to identify their source of climate change. The study established that 57% of the teachers obtained their understanding on issues related to climate change from the media. The least number of them (5%) had obtained knowledge from

postgraduate education while 12% had obtained such knowledge from secondary school education. Information obtained from teachers, showed that education is contribution to creating awareness about climate change but its contribution is meagre as compared to the media. The results were in tandem with Ochieng' (2014) whose analysis also revealed that teachers' personal reading of books and related materials, research in the internet, and informal trainings by Non-Governmental Organisation (NGOs) had played a more significant role as sources of their climate change knowledge as compared to education.

On awareness among Sampled Students, the study subjected learners to questions to ascertain how well they possessed knowledge as pertains climate change. Information obtained from learners was presented and discussed.

First, the study sought to establish learners understanding of causes of climate change, consequences, mitigation and adaptation measures to the changing climate. The study collected data on the same using a questionnaire designed for the students. Information obtained was as shown in table 5.

Table 5: Students' Understanding of Climate Change

Students Understanding	Yes	%	No	%
Human causes of climate change	53	55.2	9	44.8
Natural causes of climate change	19	19.8	16	80.2
Consequences of climate change	58	60.4	8	39.6
Mitigation measures	24	25.0	15	75.0
Adaptation measures	14	14.6	17	85.4

From table 5, students expressed diverse understanding of climate change related areas. Majority of the students reported to understand the human causes of climate change constituting 55.2% however, only 19.8% reported to having knowledge on the natural causes of climate change. Emphasis is mainly placed on anthropogenic causes of climate change since nothing much can be done over the natural causes. This was likely the reason why very

few students reported to understanding natural causes. On the same note, the study had earlier noted that except for geography that had brought out the natural causes of climate change, other subjects remained silent on the issue. However, despite the fact that majority (55.2%) of the sampled students expressed having knowledge on the causes of climate change, when asked to identify some of them, some of the students' responses showed low

understanding. Such responses included: use of nuclear energy; quarrying, afforestation; planting of trees that attract rain among others. The study also noted that most students linked climate change to the destruction of the ozone layer. On further research, the study established that in chemistry, students were made to understand that the destruction of ozone has led to more solar energy reaching the earth and as a result climate was changing. This is a misleading interpretation. In spite of this majority of the students correctly identified human activities related to causing climate change such as: industrialization, deforestation, use of aerosol sprays, and release of exhaust gases from vehicles among others.

From table 5, majority of the students (60.4%) also reported an understanding of the consequences of climate change with only 39.6% reporting low understanding. Students were then asked to identify some of the impacts and some of the mentioned included: drying of water sources; shortage of food due to prolonged droughts; deaths as a result of flooding; discouragement of agricultural activities among others. However, some of the students elicited responses that showed some level of inadequate knowledge on climate change impacts. Some of such responses include: destruction of ozone layer; environmental pollution; global warming among others.

Mitigation and adaptation measures remained misunderstood among the students with 75.0% and 85.4% of the students reporting no understanding of mitigation and adaptation respectively. When students were asked to mention some of the mitigation and adaptation measures, the study established very poor understanding of the same. As earlier noted, mitigation and adaptation were hardly outlined even in the carrier subject, Geography, and therefore students were unlikely to explicitly mention them.

The study then sought to find out how students rated the curriculum they had gone through in terms of equipping them with awareness on climate change. Results showed that the rating of the curriculum in creating awareness on climate change as poor (55%). None of the students rated it as excellent but 15% felt that it was good (mainly Geography students) while 20% felt it was satisfactory. However, 10% rated it very poor. The results correspond with a study by Michael et al., (2014), in Nigeria who affirmed that curricula for secondary schools in most African countries do not have contextualized information on climate change.

The study also sought to find out the students own rating of themselves as far as understanding climate change. From that results, majority of the students (35%) rated themselves as poor when issues climate change were concerned while another 11% rated themselves very poor. However 29% of the students gave themselves a satisfactory rating with another 20% and 5% recording good and excellent respectively.

Having noted a satisfactory performance among learners' understanding of climate change, the study was then interested in identifying their source of climate change knowledge. The study established that majority of the students (41%) had obtained knowledge of climate change from the media while from 20% had obtained the same from internet sources. Education that had formed the basis for this study contributed 21%. Education which should play a key role had again performed poorly as far as creating awareness on climate change.

To ascertain whether there existed a no significant relationship between implementation of secondary school curriculum and climate change awareness among teachers and students. The study finally performed a chi-square test. Results of the test were presented in table 6.

Table 6: Chi-Square Test for Teachers' and Students' Awareness

Chi-Square Tests	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	0.794	2	0.659
Likelihood Ratio	0.196	2	0.658

According to table 6, the chi-square value was greater than the significant value. That was $0.794 > 0.659$ ($n=65$). The hypothesis was therefore accepted at 5% confidence level indicating that there is no significant relationship between implementation of secondary school curriculum and climate change awareness by teachers. The results were likely because the curriculum did not target the teacher rather the students and the fact that teachers only specialized in two teaching subjects and were therefore only well versed in their areas of specialization. The results were in tandem with findings of two studies in Nigeria. Akinnubi et al. (2012) reviewed secondary school teachers' level of awareness in Ondo West Government Local Area while by Ekpoh and Ekpoh (2011) in Ondo State and Calabar Municipality. Both studies revealed a general low level of awareness of climate change issues among secondary school teachers.

On the side of the students, the likelihood ratio presented was less than the significant value ($0.196 > 0.658$), thus implying that students were aware of the climate change, hence there was a significant relationship between implementation of secondary school curriculum and climate change awareness by students. Sampled students were from four students and having gone through the secondary school curriculum were likely to have gathered knowledge on climate change. Again, students specialized in at least seven subjects and therefore have a wider base of access to climate change knowledge from their different subjects. A study by Oruonye (2011) in Ghana also established that 18.8% of the 225 students interviewed, had never heard of climate change while 89% of those who claimed to be aware of climate change were unaware of its causes,

effects, and possible adaptations or mitigations measures.

CONCLUSION

The study also established that understanding of climate change among teachers and students was different. The hypothesis set in line with teachers' and students' awareness on climate change issues was divided into two parts. The first part showed that majority of students were informed about climate change, while majority of teachers were not. Therefore the set hypothesis in regard to relationship between curriculum implementation and climate change awareness among students was rejected at 5% significant level while for teachers it was accepted at 5% significant level. However the awareness was skewed at different levels. More awareness among learners was likely due to the fact that students did more subjects and therefore gathered information from a wider range while teachers majored in only two subjects. Most of the learners that had good knowledge on climate change were reported to take Geography as a subject and only understood as much as was in the curriculum. The same trend was established among teachers with those teaching Geography exhibiting better understanding. Other subjects had limited climate change content, thus majority of students and teachers had no adequate information. Again the interests that shape climate change response, certainties, uncertainties and future projections were mainly unfamiliar among sampled teachers and students.

RECOMMENDATIONS

Recommendations were proposed for the Ministry of Education, curriculum developers (KICD), teacher training institutions, teachers, students and researchers. These recommendations were aimed at

enhancing the effectiveness of secondary school curriculum in creating public climate change awareness in Kenya.

- 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.
- 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 including climate change.

Areas for Further Research

Further research should be conducted on curriculum and climate change to ensure that curriculum is exploited to create climate change awareness among learners in the early stages. Researchers should also consider doing extra research in teacher training curricula to ascertain whether teachers are getting relevant information during their pre-service training to channel to students. Other research concerning climate change should be done in the areas of role of local media in creating climate change awareness.

REFERENCES

- Acquah, H. (2011). Public awareness and quality of knowledge regarding climate change in Ghana: A logistic regression approach. *Journal of Sustainable Development in Africa*, Vol. 13, pp. 146-157.
- Aja, S. (2015). Addressing the Challenges of Climatic Change through Environmental Education for Sustainable Universal Basic Education Programme in Nigeria. *IOSR Journal of Humanities and Social Science (IOSR-JHSS)*. Volume 20 (11), PP 10-13.
- EACCCMP, (2011). *East African Community Climate Change Master Plan*. East African Community Secretariat: Arusha, Tanzania.
- Ekpoh, U. and Ekpoh, I. (2011). Assessing the Level of Climate Change Awareness among Secondary School Teachers in Calabar Municipality, Nigeria: Implication for Management Effectiveness. *International Journal of Humanities and Social Science*. Vol. 1 (3) PP 106-110.
- IPCC, (2007). *Summary for Policymakers of the Synthesis report of the IPCC Fourth Assessment Report*. IPCC Secretariat: Geneva, Switzerland.
- Jekayinfa, A. and Yusuf, A. (2012). *Creating climate change awareness on the Nigerian citizens: challenges for social studies curriculum planners and implementors*. Edited proceeding of the University of Ilorin and University of Cape Coast joint international conference on climate change and sustainable development.
- Nkechi, J. (2014). Teacher preparation and climate change curriculum at university level in Nigeria. *International Journal of Multidisciplinary Academic Research*. Vol. 2, No. 3, 1-8.
- O'Neill, B. and Oppenheimer, M. (2002). Dangerous climate impacts and the Kyoto Protocol. *Science*, 296, PP 1971–1972.

- Ochieng, M. (2014). *Climate Change Awareness and Policy Implications among Primary School Teachers in Kisumu City, Kenya*. Masters of Environmental Studies Thesis (Unpublished), Kenyatta University: Nairobi.
- 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.
- Onkargouda, K., Shilpa, H. and Namrata, R. (2013). Role of Media in Creating Awareness about Climate Change. A Case Study of Bijapur City. *IOSR Journal of Humanities and Social Science*. Volume 10 (1), PP 37-43.
- Oruonye, E.D. (2011). An assessment of the level of awareness of the effects of climate change among students of tertiary institutions in Jalingo Metropolis, Taraba State Nigeria. *Journal of Geography and Regional Planning*, vol. 4, pp. 513-517.
- Otieno, S., Pauker, E. & Maina, P. (2009). Kenya talks climate. The public understanding of climate change. *Research Report*. BBB World Service Trust: London, U.K.
- Owolabi, H., Gyimah, E. & Amponsah, M. (2012). Assessment of junior high school students' awareness of climate change and sustainable development in central region, Ghana. *Educational Research Journal*, vol. 2(9), pp. 308-317.
- RoK (2012). Integrating climate change in education system. In *Knowledge management and capacity development* (chapter 5). Research findings report on the National Climate Change Action Plan prepared by Alin for the Ministry of Environment and Mineral Resources, Kenya. Government Printers: Nairobi, Kenya.
- RoK, (1999b). *Economic Survey*. CBS. Ministry of Planning and National Development. Government Printer: Nairobi, Kenya
- Sarmiento, J., Gruber, N. Brzezinski, M. and Dunne, J. (2004). High-latitude controls of thermocline nutrients and low latitude biological productivity. *Nature*, 427, 56–60.
- Taderera, D. (2010). South African's Awareness of Climate Change. *Briefing Paper No. 235*. Cape Town, S.A: The Catholic Parliamentary Liason Office.
- UNFCCC (2007). *Climate change: Impacts, vulnerabilities and adaptations in developing countries*. The UNFCCC Secretariat: Bonn, Germany.
- UNFCCC, (2004). *The First Ten Years*. Produced by the Information Services of the UNFCCC Secretariat. Technographic Design and Print Ltd.: Halesworth.