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**Knowledge and the Extent of Integration of Climate Change and Adaptation at
Universities in Kenya**

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Abstract

Purpose: This study investigated levels of awareness on climate change in five public universities in Kenya. The study aimed at assessing levels of knowledge on climate change issues among lecturers and students and documenting levels of access to information on climate change among lecturers and students.

Methodology: The study adopted a survey design. The population for the study consisted of 200 hundred undergraduates and lecturers. Data was analysed using both descriptive (frequency counts, percentages, means and standard deviations) and inferential statistics (Chi-square test) and presented in forms of charts and graphs.

Findings: The results showed that teaching staff and students possessed high level of awareness on the concept of climate change, have access to the sources of information and factors of personal experience, public sources and education greatly influence their awareness. There was a statistically significant association between years teaching at the University ($Chi-Sq. = 72.844, DF = 3, P-Value = 0.000$) and integration of climate change in the courses taught. However, we found no association between gender ($Chi-Sq. = 2.534, DF = 1, P-Value = 0.111$) and University ($Chi-Sq. = 1.279, DF = 4, P-Value = 0.865$) where a lecturer was teaching in terms of integration of climate change in the courses taught.

Unique Contributions to Theory, Practice and Policy: These findings indicate the teaching staff and students in Kenya have a widespread awareness of climate change and its immediate threat to human society, while knowledge of how to deal with the challenge due to climate change is still limited. Almost half the respondents believed climate change would result in impacts on human life. Nevertheless, the teaching staff and students need regular capacity development on climate change effects and in turn upscale the knowledge to the wider society.

Keywords: *Climate Change, Kenya, Teaching Staff, Students, Universities*

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INTRODUCTION

Society is today presented with climate change challenges and this is evident in everyday media reporting (Mwangi et al 2022; Sharon & Baram-Tsabari 2020). Climate change is the alteration of global atmospheric composition and is primarily caused by human activities mainly fossil fuel burning and deforestation (IPCC, 2007). Climate change adaptation (CCA) has been proposed as one of the approaches that can be adopted by societies to address challenges related to climate change. CCA reduces the impacts of climate change on human livelihoods and builds resilience while exploiting beneficial opportunities. One way it does this is by promoting knowledge required for locally dealing with global climate issues through education (Williams et al. 2021; Kibue et al 2016; Kibue et al 2015). This is so because education plays an important role in creating awareness among the young people (Apollo et al 2021). Thus in many countries climate change issues have been mainstreamed into education curricula at various levels of education. Kenya is no exception and its National Climate Change Response Strategy (Government of Kenya, 2023) recommends among other measures “the need to include curricular review to integrate climate change into the Kenya education system”.

Climate change education is defined as an intentional inquiry-based and interactive teaching and learning process which improves students’ scientific literacy regarding climate change (Stevenson et al 2017). The misconceptions on climate change amongst student products from institutions of higher learning has wider societal implications, for instance, the University products pursue careers at various sectors of the society where they are expected to propagate the climate change issues amongst their subjects. If the wider societal is to understand climate change concerns and thus be better prepared to cope with challenges associated with climate, then there is need to ensure that the change agents that the institutions of higher learning produced are properly equipped with the right skills (Ampaire et al 2017).

Previous studies among teachers on understanding of climate change in the US (Lee et al., 2020), Australia (Jones & Davidson, 2021), the UK (Petersen et al 2020) and The Czech Republic (Mile et al 2012), revealed that misconceptions and knowledge gaps are common amongst teachers. Similarly, studies focusing on student understanding of climate change from across the globe reveal that students of all ages hold misconceptions about climate change and have extensive knowledge gaps. Few studies have been reported from Africa (e.g. Boakye, 2015, Reimers, 2021) and many of these have focused on high school teachers and students. Although a number of studies exist in Kenya, most of them focused only on pre-service teachers (Ochieng, 2014, Huho, 2015) making it difficult to determine how practicing teachers think about or address climate change in the classroom.

Despite increasing attention to climate change in the curriculum, students and products from education institutions continue to hold misconceptions about climate change issues and their factual knowledge and conceptual understandings on the issue remain incomplete and often

misleading (Ratinen, 2016). Previous studies have shown that lecturers know the basic facts about climate change, such as increasing earth temperature, but that their knowledge is basic (Ekborg & Areskoug 2006; Huho, 2015) and as such also have misconceptions and misunderstandings about climate change (Mile et al., 2012) and thus probably pass his own ideas on to their students. This is further compounded by the fact that lecturers have limited exposure to professional training opportunities on climate change dynamics attributed to amongst others, financial challenges faced by institutions of higher learning in Kenya.

The University is a high level centre for learning. It is expedient that University students are not ignorant of climate change issues as they relate to sustainable development. The awareness and possession of knowledge and understanding of climate change concepts and phenomena although scientific, are expedient for all humans, suffice to state that undergraduates assume the responsibility of transferring the knowledge when they graduate and practice their professions (Nath & Behera, 2011). The University teachers have a special responsibility for instilling environmental awareness in all their students, graduate and undergraduate in all disciplines either by formal curricula or structured discussion (Agboola & Emmanuel, 2016). Climate change has a cumulative effect on natural resources and the balance of nature and its effects are already visible in the country. As critical as the effect of climate change is, it is not clear whether undergraduates are aware of what climate change is or its effect, hence this study.

Few studies have explored the knowledge perceptions among women as it relates to climate change issues. This is a critical gap within the climate change perceptions literature for several reasons. First, although women appear to be more ideologically receptive to climate change education than men (McCright & Dunlap, 2011 and Selm et al 2019), they may possess self-perceived limitations, intensified by educational attainment (McCright & Dunlap, 2011), that could influence the way they engage with climate issues in public. This report provides insights on the status/ levels of understanding of climate change at select institutions of higher learning in Kenya. It is pegged on the premise that Universities are citadels of knowledge and as such should take lead in providing factual information on contemporary issues as this will be cascaded to the wider society and ultimately the general society will be well informed on issues of climate change

This study aimed to contribute to improved conceptualization of climate change issues amongst students graduating from institutions of higher learning through provision of insights on the extent of adoption of climate change issues in curriculums and examining how lecturers perceive their role in climate change knowledge transmission

METHODOLOGY

Sampling Frame

The study was conducted in five public universities in Kenya. The five institutions of higher education were chosen because they have a long history of offering courses on Environmental

conservation. They are; University of Nairobi, Kenyatta University (KU), Egerton University, Laikipia University and South Eastern Kenya University (SEKU).

Validation and Reliability Testing

The the questionnaire was subjected to tests of validity and reliability during the piloting phase that was conducted at Pwani University which was not among the participating universities. Reliability of outcome of questionnaires was tested using Chronbach's coefficient alpha and a threshold of over 0.7 considered reliable. The questionnaire was validated by a social science expert lecturer at Egerton University.

Questionnaire Administering

The questionnaires were administered by physically delivering the hardcopies to the participants. The participants were requested to avail feedback after two weeks' period. Periodic reminders were send every end of week for two weeks to the participants who had not have returned/ responded after which the data collection period was deemed closed. Twenty close ended questionnaires were administered in each institution where 10 targeted male lecturers teaching environment related courses and another set of 10 targeted female lecturers teaching courses not related to environment. The same approach was repeated among students in the five institutions. In total 200 questionnaires were administered for a period of one month.

Data on level of awareness on climate change issues between environment oriented and non-environment oriented lecturers and students was collected using two sets of questionnaires: The student's questionnaire contained four sections. The first section was a description of the participant(s) profile including age, gender, their University, year of study, the degree programme being they pursued. The second section contained questions seeking participants ranking of the potential threats to the society, based on their severity. It further investigated the perception of changes in the environment in the past 10 years and participants' familiarity with the climate change related activities. The third section looked at behavioural aspects, in particular looking into whether participants consider the environment and climate change while making daily decisions, reasons behind those considerations, as well as barriers to environmental and climate friendly behavior. The fourth looked at the participant sources of climate change information. It targeted answers regarding the participants' sources of climate change information, observations related to a possible increase of the climate change related topics in the media. The section also assessed the participants' familiarity with public awareness campaigns and the institutions they relate to climate change projects. The questionnaire administered to the lecturers mirrored the student's questionnaires in all the sections except in the first section

Data were entered into Excel spreadsheet and imported into Minitab version 14.0 for statistical analysis. Descriptive statistics were used to illustrate respondents' demographic characteristics and percentages of categorical variables. Chi-square or Fisher's exact test (for expected cell

frequencies less than or equal to five) were used to test for the relationships between demographic variables and Knowledge, perception and attitudes variables and presented in forms of charts and graphs

RESULTS

Respondent Demographic Characteristics

A total of 60 completed lecturer questionnaires were returned from five universities where questionnaires were administered which constituted about 60% response rate. The distribution of respondents per University is indicated in Figure 1a. More than half of the respondents (57 %) were males. In terms of the number of years the lecturers had experience teaching at the University, majority (34 %) indicated that they had less than five years' experience (Figure 1b). It is imperative to note that majority of these respondents (86%) were teaching course that were science based.

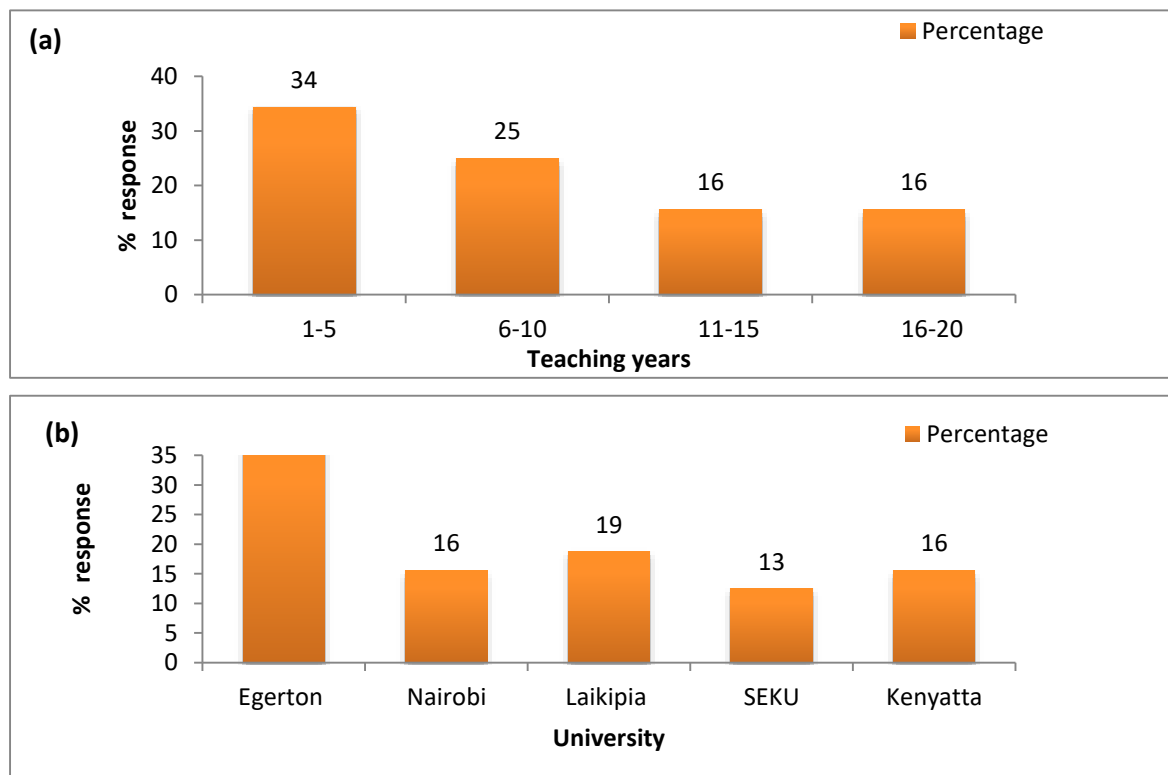


Figure 1: A Graph Showing: (A) Number of Years Teaching at the University and (B) Distribution of Respondents Across the Universities Sampled.

Fifty seven responses were received from students which constituted about 57 % response rate and of the respondents, 68 % were male. The respondents were distributed across the five

universities but the majority (35%) were from Egerton University (Figure 2a). In terms of courses taken, majority of the respondents were taking science based courses (Figure 2b).

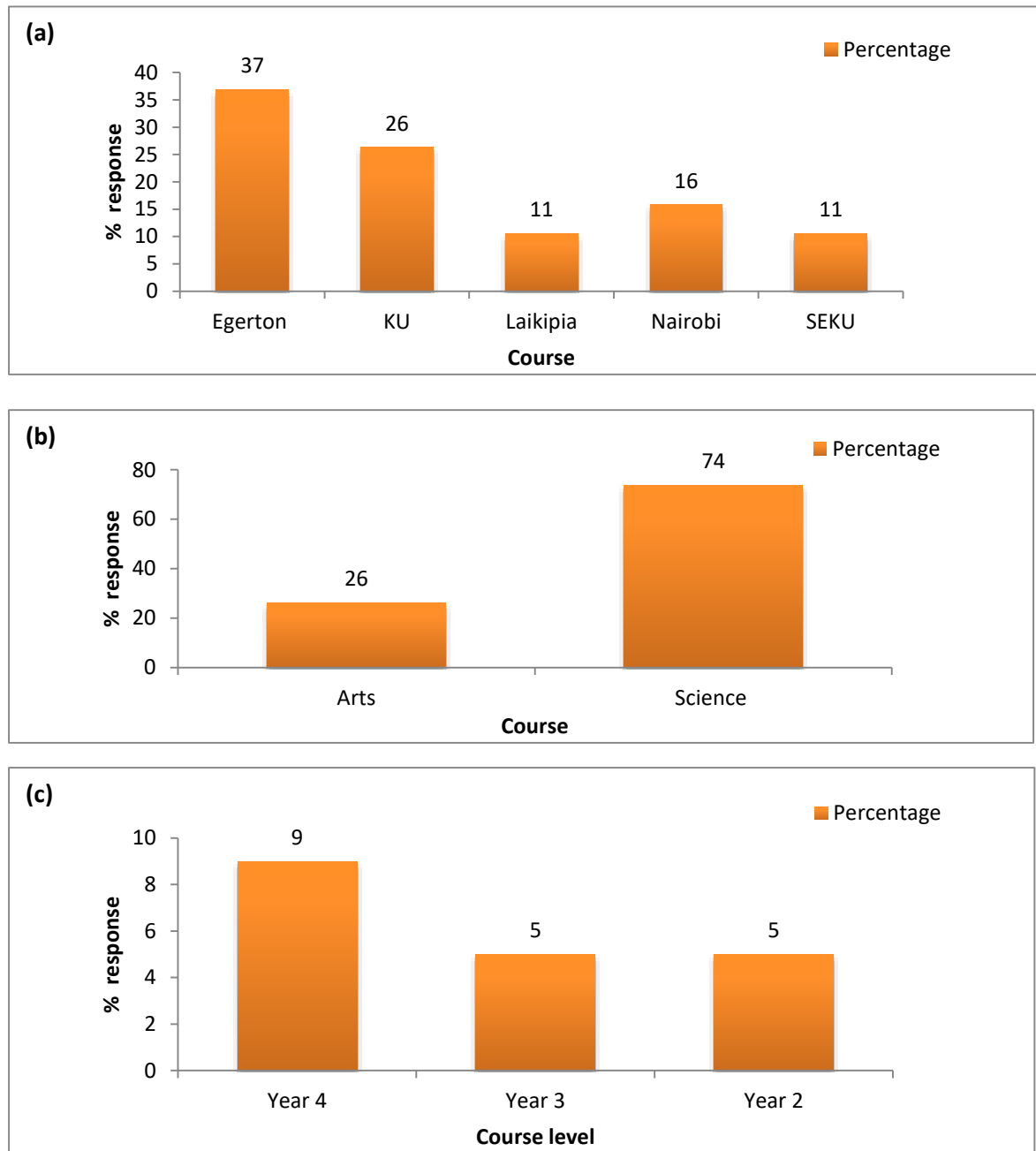


Figure 2: A Graph Showing (a) Distribution of Student Respondents per University (b) Course That the Respondents are undertaking and (c) Course Level of the Respondents.

Respondents Levels of Awareness/Knowledge on Climate Change

Table 1 shows the responses of the teaching staff on climate change. Majority indicated that they had fair knowledge on the issue such as the causes and effects of climate change. Many also mentioned that climate change was already happening at local and global scales and that there was need to address challenges related to climate change. Many also the respondents also agreed that introducing concepts on climate change in their unit was a priority. While results of this study may be taken to mean that majority of teaching staff are aware of climate change, such as conclusion might be misleading because awareness about climate change does not translate to understanding deep issues related to it. This can be attested by a study done by Oruonye (2011) in Nigeria which revealed that majority of College/University teaching staff and students were aware of climate change based on the survey question whether they heard of it before. A further probe of some respondents revealed that majority (89%) them did not understand deep issues of climate change thus arriving into a conclusion that majority of students in high levels of education had low awareness on climate change. In their opinion, all subjects should integrate the aspects of climate change as it cut across the entire facet of societal challenges. In terms of what would be done to improve teaching of climate change issues, majority of the respondents mentioned that information on impacts need to be strengthened by scientists.

Table 1: Lecturers' Self-Perceived Understanding of Climate Change

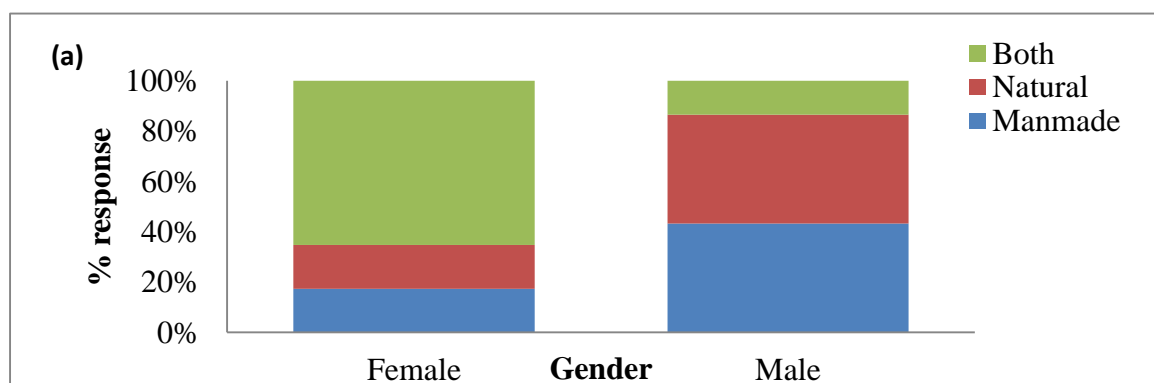
Response	Frequency	Percentage (%)
Yes, a lot	33	34
Yes, somewhat	27	28
Not sure	15	16
Only a little	9	9
No, not at all	12	13

There was a statistically significant association between years teaching at the University ($Chi-Sq. = 72.844, DF = 3, P-Value = 0.000$) and integration of climate change in the courses taught. However, we found no association between gender ($Chi-Sq. = 2.534, DF = 1, P-Value = 0.111$) and University ($Chi-Sq. = 1.279, DF = 4, P-Value = 0.865$) where a lecturer was teaching in terms of integration of climate change in the courses taught (Table 2).

Table 2: Differences in Prioritization in Teaching Climate Change Knowledge among Different Respondent Groups. N=96

Respondent profiles	integration of climate change in the courses taught	
	Yes	No
Years taught at the University		
1-5	14	8
6-10	13	6
11-15	13	7
16-20	14	7
>20	7	7
<i>Chi square</i>	<i>Chi-Sq. = 72.844, DF = 3, P-Value = 0.000</i>	
Gender		
Male	43	26
Female	12	15
<i>Chi square</i>	<i>Chi-Sq. = 2.534, DF = 1, P-Value = 0.111</i>	
University		
Egerton	23	13
UOE	10	5
Pwani	11	7
SEKU	6	6
Laikipia	9	6
<i>Chi square</i>	<i>Chi-Sq. = 1.279, DF = 4, P-Value = 0.865</i>	

With regard to capacity development, majority of the respondents (63 %) indicated that they had attended training on climate change but few of them have been involved in a project on climate change (29%).



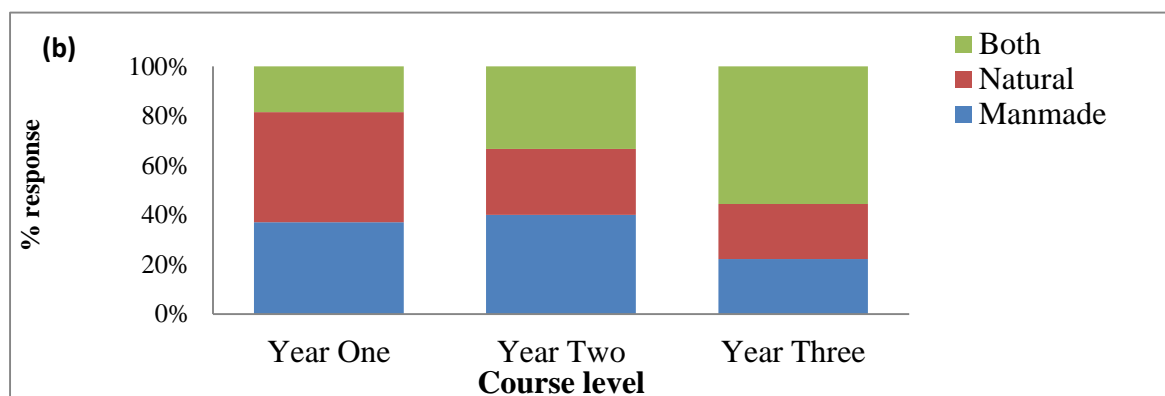


Figure 3: A Graph Showing Perceptions of (a) Gender and (b) Course Level of the Respondents to Causes of Climate Change

The most common climate change mitigation strategy noted by almost all students was afforestation and reforestation. About 89% of the students argued that planting trees would stop mitigating climate change. The knowledge about the role of trees in carbon sequestration was very scanty amongst students. Similarly, the link between greenhouse gases and global warming was not clear to about 64.5% of the students. Terms like 'carbon sequestration', 'carbon footprints' and 'carbon trading' were unknown to 70.3% of students. Other mitigation measures mentioned by less than 5% of the students were: control of greenhouse gas emission, use of energy efficient appliances and agro-forestry. The distinction between climate change adaptation and mitigation measures was not clear amongst students. As such, when asked to identify the mitigation measures against climate change, students stated irrigation, early planting and planting of drought resistant crops.

Access to Information on Climate Change

In terms of source of knowledge on climate change, Majority of the teaching staff reported that they relied most heavily on traditional media (books, newspaper, TV news, etc.) for information on climate change. Fewer staff indicated that they gained information from government sources, NGOs, professional development, or university classes (all less than 25%). Online sources also showed differing levels of uptake. Websites, such as Wikipedia, were mentioned as sources of information for nearly 50% of staff, but only 9% of staff learned from internet. There was a statistically significant association between years spent teaching at the University ($\chi^2 = 7.886$, $p = 0.005$), gender ($\chi^2 = 4.979$, $p = 0.026$) and the source of information being the internet. Respondents with fewer years teaching experience at the University (89.0%) were more likely to acquire climate change information through the internet. This could be due to the fact that teaching staff with less number of years are staff who have recently completed their studies and were mostly young people well adept with

technology and internet access and hence more likely to consult the internet for teaching materials.

Respondents' Attitude towards Impacts from Climate Change

Respondents were asked how concerned they were about the impacts of climate change. More than half of the respondents (52.9%) strongly agreed climate change would increase extreme weather (e.g., droughts, storms, floods, hurricanes); 50.0% felt agricultural production would be affected; 45.5% thought there would be impacts on human health and 42.0% thought climate change would initiate a natural ecological crisis. In addition, 77.7% of respondents were aware of possible emerging and re-emerging of infectious diseases due to climate change. In addition, respondents were asked how they perceived their health and wellbeing as a result of climate change. Personal discomfort was the most common concern (73.0%), followed by limited outdoor activities (65.5%), rising energy fees (52.0%), lethargy (48.5%), and work fatigue and low efficiency (47.0%).

Discussion

This study, to our best knowledge, is the first attempt to assess among teaching staff and students at institutions of higher learning in Kenya, perceptions of climate change. Studies have reported at other levels of education including primary schools (Gowda et al 1997, Ochieng, 2014), Secondary schools (Boyes et al., 2009, Gichuki, 2015, Ndiritu, 2017, Mageswary et al., 2017) and other tertiary institutions in Kenya. This study showed respondents were well aware of the effects of climate change on the population in general. Although respondents believed strategies and measures were extremely important to address climate change, they were also concerned about economic development, energy security, and local environmental protection. The results may provide useful information for policy makers at institutions of higher learning on climate change content that need to be integrated into the courses taught at University level. This will improve the general public perception on causes, effects of climate change and hence assist in mitigating their impact and improve public preparedness in Kenya.

The majority of the respondents believed that climate change is happening at both global and local levels, and would lead to adverse impacts. They strongly agreed that agricultural production, population health and natural ecology had already been affected by climate change in Kenya, with more extreme weather events. The findings are consistent with other studies (Taber and Taylor, 2009). Although climate change may lead to recurrence of drought episodes (Kebede et al., 2012), less than half (35.0%) of the respondents indicated it was an adverse impact of climate change.

The cross-sectional study design only provides a snapshot of perceptions, and the results may not be representative of all students and staff of Universities in Kenya. Despite these shortcomings, these findings are useful as they provide information on the perceptions of

climate change, and individual behavior change to address climate change at the higher educational level.

CONCLUSIONS and RECOMMENDATIONS

Conclusions

These findings indicate the teaching staff and students in Kenya have a widespread awareness of climate change and its immediate threat to human society, while knowledge of how to deal with the challenge due to climate change is still limited. Almost half the respondents believed climate change would result in impacts on human life. Nevertheless, the teaching staff and students need updated training on climate change and its effects. Efforts are needed to mitigate and adapt to climate change in the context of the proposed policies, which need to combine environmental educations and local sustainable development. Our findings will be useful in current policy making to better address the role of education in climate change adaptation and mitigation in Kenya.

Recommendations

Universities should incorporate climate change topics into the curriculum not only in the science and agriculture modules but also in all faculties. This will enable students from across the University spectrum to grasp the basic knowledge of climate change issues so as to educate their communities on a wide range of these issues. There should be programmes to prioritize climate change knowledge, awareness and mitigation where students are encouraged to take an active role. These programmes should include awareness workshops where experts in the field are regularly invited to address students.

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