THE NEXUS OF STUDY DISCIPLINE AND CLIMATE CHANGE AWARENESS LEVEL AMONG UNDERGRADUATES OF KENYATTA UNIVERSITY, KENYA

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ABSTRACT

Aims: Climate change is an intergenerational challenge likely to impede the realization of Sustainable Development Goals. To combat the effects of climate change requires public understanding of the science behind climate change. Studies however show that the levels of awareness are still low across the world especially in Africa where vulnerability to the effects of climate change is on the rise. There is a need therefore for public education to enhance the relationship between awareness of climate change and study discipline, since awareness is important for effective climate action. This study sought to research on awareness levels of climate variability and change across undergraduate's study disciplines in Kenyatta University, in Kenya.

Place and duration: The study was conducted in Kenyatta University between the months of November and December 2021

Study Design: A quasi- experimental research design was adopted in which units on environmental education and climate change were considered the treatment variable.

Methodology: Purposive sampling and stratified random sampling technique were used to select the schools and respondents in various levels of study, respectively. The samplesize was 375 students(n=375) which included 177 female and 198 male students drawnfrom three schools. School of Environmental Studies formed the experimental group, while School of Business and School of Humanities and Social Sciences formed the control group. A questionnaire was administered to participants drawn from each year level within the three schools. Analysis was done using Kruskal Wallis one-way ANOVA.

Results: The results revealed a statistically significant difference in the medians of climate change knowledge level across the categories of schools, χ^2= 41.138, df =2, *P*=0.00. Also the distribution of climate change knowledge across the schools varies significantly χ^2= 17.968,df=3, *P*=0.00. School of Environmental Studies exhibited a significantly high level of knowledge and awareness. The three schools were statistically different from each other. Consequently, the null hypothesis of no significant difference in students' awareness of climate change across disciplines 'was rejected.

Conclusion: Given that study discipline influences awareness levels of climate change, the university curriculum should be reviewed to incorporate adequate content on climate change across study disciplines in order to enhance capacity for climate action.

Keywords: [Climate variability, Climate Change, Awareness level,Climate action, Study discipline, Level of study

ABBREVIATIONS AND ACRONYMS

KU	**KENYATTA UNIVERSITY**
SES	**SCHOOL OF ENVIRONMENTAL STUDIES**
SHSS	**SCHOOL OF HUMANITIES AND SOCIAL SCIENCES**
SB	**SCHOOL OF BUSINESS**

NOTE: School of Environmental Studies (SES) later changed its name to School of Agriculture and Environmental Sciences (SAES) but during data collection, it was known as the School of Environmental Studies (SES).

1. INTRODUCTION

Climate change is one of the greatest ecological and social challenge of the twenty first century [1] There is a general agreement among the scientific fraternity that there exists a correlation between global warming and anthropogenic activities [2], [3]. There is sufficient evidence that climate change is a natural occurrence, exacerbated by human influence [3], [4] Human activities have led to environmental degradation and a rise in atmospheric concentration of greenhouse gases from emissions, thus causing global warming and subsequently climate change [5]. Such human influences will cause far-reaching impacts that will threaten many aspects of life on earth [6], [7]. Responses to climate change will fundamentally reshape various phenomena, interactions and relationships [8]

The adverse effects of climate change which cannot be overlooked include; rising temperatures, rising sea levels resulting from melting glaciers, increase in disease outbreaks, increase in frequency of floods and heat waves in different parts of the world [9], [10]. Consequently, global health will be threatened by the changing climate, which is one of the causes of high morbidity and mortality rate from extreme weather events [9]. Rising temperatures and increasing harmful radiations for instance, are the major cause of heat related diseases such as heat stroke, skin cancer and diarrhea [10]. Some impacts of climate change directly affect the mental health and well-being of an individual. For instance, climate events such as wildfires, hurricanes, and droughts can cause trauma [11].

The stability of natural environment and biodiversity are being threatened by climate change, yet there exist great disparities in public awareness on the issue [12] In Africa, climate change effects are progressively disrupting the social and economic structures that the greater population relies on for good health and economic stability [13]

The effects will be detrimental to many sectors in the country's economy such as the agricultural sector, health sector, tourism sector, education sector and even to the greater global economy. [14]

Episodes of climate change manifested by extreme weather events are already being experienced in Kenya, affecting food production and consequently threatening food security especially to the vulnerable communities living in the arid and semi-arid areas. Thus, the effects will alter crop patterns and yields in several regions. [14]

Climate change has generated controversial beliefs among different people to the extent that perception, awareness and knowledge on the causal factors vary widely [15,16]. Studies point towards an increasing skepticism in the first world countries, supported by socio-political and economic factors while in other regions of the world, there is a developing interest in climate change [15,16]

Awareness levels are still low worldwide; more so in developing countries despite the fact that they are more susceptible to climate change effects, given their economic and political challenges [17]. It is anticipated that the changing climate could negatively affect the realization of sustainable development of many developing countries. Studies show that people in Africa are more knowledgeable about the varying weather patterns but they are less informed about climate change and the impacts. [17]

2. METHODOLOGY

2.1 Study Area

This study was carried out in Kenyatta university main campus located approximately 18km by road North East of Nairobi Central Business District (CBD) off Nairobi-Thika Road. Kenyatta University was selected as a preferable study area because of accessibility. Kenyatta University is the second oldest university in Kenya with approximately nine-teen schools offering diverse programmes at certificate & diploma, undergraduate, masters and Ph.D. Level. Kenyatta university has over 70,000 students enrolled in undergraduate and postgraduate courses and approximately 23,800 undergraduate students on different programs. The university actively participates in environmental management and conservation activities within the University and even outside.

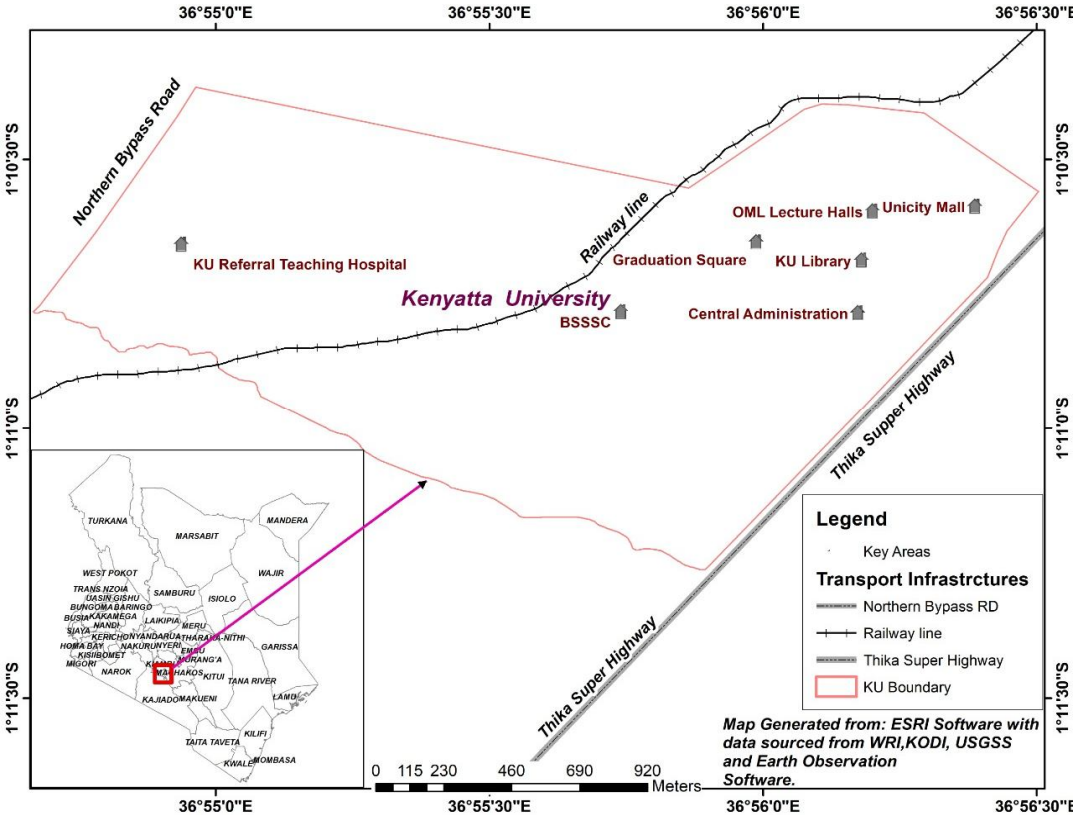

Figure 1. Study Area Map (Source; Author, 2023)

2.2 Research Design

The study adopted a quasi-experimental design usually applied in situations where a true experiment cannot be conducted for ethical or practical reasons. [18],[19]. In a quasi-experimental design, manipulation of the independent variable is not possible as it occurs naturally, and participants cannot be randomly assigned to groups. Any significant difference amongst the groups being studied arise from the treatment administered and not confounding variables [19],[20]This study used a quasi-experimental design with non-equivalent groups, where three schools, were purposively sampled for the study. Respondents from Kenyatta University School of Environmental Studies (KU-SES) formed the experimental group while the control group constituted respondents from Kenyatta University School of Humanities and Social Sciences (KU-SHSS) and Kenyatta University School of Business (KU-SB) with the assumption that, the experimental group (KU-SES) has already been subjected to a treatment variable, in this case, course content in Environmental Education and Climate Change while the control group (KU-SB and KU-SHSS) have not received the same treatment.

2.3 TARGET POPULATION

Kenyatta University has an approximated population of 23,800 undergraduate students on different programs. According to the information providedthrough oral interview by the administration of the three selected schools, the total number of students enrolled in the three sampled schools was estimated to be 4820 students, distributed as follows: 2822 students

enrolled in KU-SHSS, 1200 in KU-SB and 800 are in the KU-SES. The target population for the study therefore is 4820 students from the three selected schools in Kenyatta university.

Table 1. Target Population

YR LEVEL / SCHOOL	Y1	Y2	Y3	Y4	TOTAL
SES	120	220	200	260	**800**
SHSS	510	800	604	906	**2822**
SB	220	250	350	380	**1200**
TOTAL	850	1270	1154	1546	**4820**

2.4 Sampling and the sample size

Three schools, KU-SES, KU-SHSS and KU-SB were purposively sampled. A stratified random sampling technique was then used to select respondents from each year level. Using (Yamane, 1967) formula, the representative sample(n) from the total number of students in KU-SAES, KU-SHSS and KU-SB was obtained and denoted n1, n2 and n3 respectively as shown in the table below. From the list of units offered to each level (referred to as treatment t level) in the semester in each school, one core unit was randomly selected from each level (t1=100 level, t2=200 level, t3=300, t4=400). School and University Common Units, (UCU) were purposively sampled as they provided a suitable forum for the administration of the questionnaires. All students in level 100 in the three schools responded to the questionnaire during UCU 100 lecture. UCU 100 is a common unit in the university for all students in first year in all schools. For the rest of the levels, questionnaires were administered to them when they had a core unit within their respective schools. From level 200, the number of units drawn for the study were one per level in each school by (t2-t4) units to make nine units. In total, ten units were sampled in the three schools. The sample size in each school was then divided proportionally according to the number of students in each year level**. The** formula below was used to determine the sample size;

$$n = \frac{N}{1 + N(e)^2}$$

Where n is the sample size, N is the population size, e is the level of precision (Yamane, 1967). Thus, the sample size for this study was determined as follows

$$n = \frac{4820}{1+4820(0.05)^2}$$

n=369

During data collection, 375 respondents were included in the study.

2.5 Data Collection Instrument

Data was collected using a semi-structured questionnaire, constructed from the objectives of Environmental Education, to test students' knowledge and awareness level of climate change, attitude towards the subject matter.

3.0 RESULTS AND DISCUSSION

3.1 Demographic information

Demographics included gender, age, school and level of study of the respondents, as well as their main and popular source of climate change information. The response rate was at 95.4%

3.2 Gender of the respondents

The study involved a total of 375 respondents (n=375) 198 males and 177 females. The response rate was at 52.8% for males and 47.2% for females. Generally, more males showed interest to participate in the study than females.

3.3 Schools

The study involved respondents from three sampled schools across the year levels. The response rate was 54.7% for SHSS (n= 205), 26.4% for SB (n=99) and 18.9% for SAES (n=71) as shown in the table below

Table 2. Participation by School

	n	%
SES	71	18.9
SB	99	26.4
SHSS	205	54.7
Total	375	100

3.4 Level of Study

Generally, there was a higher response rate among the fourth year students and second year students across the three schools (n=134), 35.7% and (n=98), 26.1% respectively, compared to the 1st and 3rd years who were a bit more reluctant.

Table 3. Participation by level of study

	n	%
Level 1	67	17.9
Level 2	98	26.1
Level 3	76	20.3
Level 4	134	35.7
Total	**375**	**100**

3.5 Age of the Respondents

All respondents were between the age of 18 and 26 years with majority falling between the age of 22-23 years (n=138). This is the age group for majority of students who enroll for undergraduate programs in Public Universities in Kenya.

Table 4. Age of Respondents

Age Category	**n**	**%**
18 - 19 years	42	11.2
20 - 21 years	134	35.7
22 - 23 year	138	36.8
24 years and above	61	16.3
Total	**375**	**100.0**

3.6 Knowledge of Environmental Bodies

Students' knowledge of selected environmental bodies was measured using a 5- item Likert Scale where (1- No knowledge, 5- Excellent knowledge). A significant number of students indicated that they had little or average knowledge in environmental bodies such as IPCC (n=109, 29.1%), REDD+(n=123, 32.8%), Kyoto Protocol (n=116, 30.9%) and UNFCCC, (n=131, 34.9%). On the other hand, 22.7% (n=85) indicated that they had no knowledge of CDM, while 26.7% had average knowledge of CDM. These numbers are significant as they depict existing gaps in students' knowledge of climate change, and environmental bodies responsible for addressing issues concerning climate change. A minority (less than 10%) of the respondents indicated that they had excellent knowledge of the environmental bodies. From the statistics displayed below, it is evident that students have limited knowledge about IPCC, REDD+ and CDM.

Table 5. Knowledge on Environmental Bodies

	None		Little		Average		Good		Excellent		Total	
Body	n	%	n	%	n	%	n	%	n	%	n	%
IPCC	66	17.60	108	28.8	109	29.1	75	20.0	17	4.5	375	100.0
REDD+	63	16.80	102	27.20	123	32.80	74	19.70	13	3.50	375	100.0
Kyoto Protocol	72	19.20	86	22.90	116	30.90	73	19.50	28	7.50	375	100.0
UNFCCC	49	13.10	86	22.90	131	34.90	73	19.50	36	9.60	375	100.0
CDM	85	22.70	93	24.80	100	26.70	68	18.10	29	7.70	375	100.0

3.6 Sources of climate change information

A significant number of the respondents across the three schools and the four year levels indicated that the internet (n=186), 49.6% and the television (n=75), 20% are their main source of climate change information. This implies that the internet plays a key role in disseminating knowledge about climate as well as creating awareness among students since a significant number of them (49.6%) always have access to it through their personal gadgets or the computer laboratories provided by the institution.Other sources of climate change information were rated as shown in the table below.

Table 6. Sources of climate change information

Source	**n**	**%**
Television	75	20
Radio	12	3.2
Newspaper	11	2.9
Internet	186	49.6
Environmental groups	22	5.9
Friends and family	32	8.5
Books and journals	34	9.1
Other	3	0.8
Total	**375**	**100**

3.7 Popularity of sources of climate change

Various sources of climate change information were ranked as either most popular or least popular On a 5-item Likert scale (1-Most popular and 5- least popular). Media (broadcasting, print and social media) was ranked as the most popular source of climate change information (n=240), 64% while Climate Change Seminars/ Conferences, Lectures and educational programs were ranked as the least popular. Family and friends, as well as books and journals were ranked as average. The outcome is as summarized in the table below.

Table 7. Popularity of sources of climate change information

	1		2		3		4		5		Total	
	n	%	n	%	n	%	n	%	n	%	n	%
Lectures/education programs	27	7.2	60	16.0	58	15.5	102	27.2	128	34.1	375	100
Family, friends & public	53	14.1	92	24.5	125	33.3	62	16.5	43	11.5	375	100
Media (TV, internet)	240	64.0	69	18.4	37	9.9	18	4.8	11	2.9	375	100
CC seminars/conferences	9	2.4	27	7.2	41	10.9	151	40.3	147	39.2	375	100
Books&Jo	47	12.5	125	33.3	113	30.1	50	13.3	40	10.7	375	100

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3.8 Inferential Statistics

The variables of interest in this research were climate change knowledge and awareness. Since these variables do not have a scale of measure, the Likert scale was used. Likert scale items were constructed for each variable and the respondents indicated their level of agreement with the different items. The collected data was averaged for each variable resulting into new variables that were continuous. The new variables were then subjected to normality and homoscedasticity test and none was found to be normally distributed or having homogenous variance. Therefore, non-parametric tests were used to run the required statistical tests

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3.8.1 Climate Change Knowledge by School

Kruskal Wallis one-way ANOVA test was performed to establish if the knowledge and levels of climate change awareness significantly varied. Kruskal Wallis test was used to test for the difference in medians of the three independent groups and their distributions.

Table 8. Climate change knowledge by school

	School		
Climate Change Knowledge	SES	SB	SHSS
Median	4.071	3.683	3.661
Interquartile Range	0.500	0.570	0.570

The median of climate change knowledge level among the students from the School of Environmental Studies is higher (Med = 4.071, IQR = 0.500) compared to that of School of Business (Med = 3.683, IQR = 0.570) and the School of Humanities and Social Sciences (Med = 3.661, IQR = 0.570). This summary gives an indication of a difference being present between the schools in as far as the level of climate change knowledge in concerned. SES exhibited a higher level of awareness compared to the SHSS and SB. Kruskal Wallis one-way ANOVA was used to establish if there's a significant difference between the knowledge levels of the students from the three schools. The results showed a statistically significant difference in the median climate change knowledge level across the categories of the schools, χ^2= 41.138,df=3*P*=0.00. Additionally, the test results showed that there is a significant difference in the distribution of the climate change knowledge level across the three schools χ^2= 17.968, df=3, *P*=0.00. The results were visually displayed in the boxplots output below.

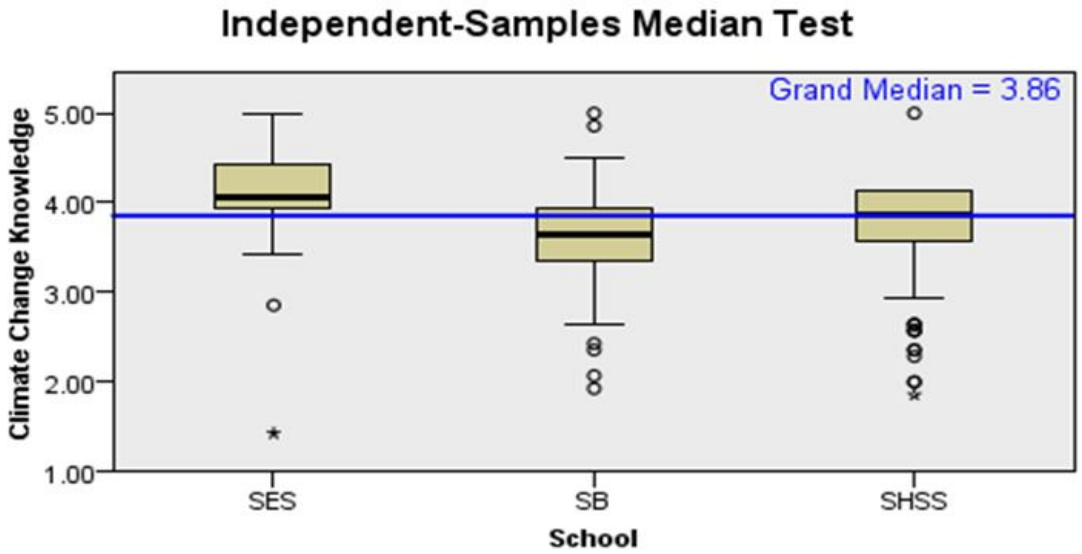

Figure 2. Climate change knowledge by school

The median climate change knowledge level of the School of Environmental Studies is above the grand median, the School of Humanities and Social Sciences is approximate to the grand median, and that of the School of Business is below the grand median line. This indicates that School of Environmental Sciences exhibits the highest level of climate

change knowledge, while the School of Business has the least. To establish the pair of schools that vary significantly from each other in climate change knowledge and awareness, a pairwise comparison-adjusted using the Bonferroni correction method was performed. The results revealed that the three schools are significantly different from each other. The median climate change knowledge level of the School of Business was significantly different from that of the SHSS and that of the SES P=0.00. The climate change knowledge level of students from the SES was significantly higher than that of SHSS and SB

3.8.2 Climate change knowledge by level of study

Students pursuing undergraduate degree courses, are grouped into four levels of study. A summary of descriptive statistics based on the year of study was done and the results were as shown below.

Table 9. Climate change knowledge by level of study

Climate Change Knowledge	Level of Study			
	1	2	3	4
Median	3.786	3.643	3.786	4.071
Interquartile Range	0.710	0.520	0.430	0.590

Students in fourth level of study exhibited the highest level of climate change knowledge (Med = 4.071, IQR = 0.590) while students in first and third levels were found to have the same median knowledge level of 3.786 and interquartile ranges of 0.710 and 0.430 respectively. The students in the second level recorded the least level of climate change knowledge (Med = 3.643, IQR = 0.520). A visual representation of these results is displayed using the boxplots output below.

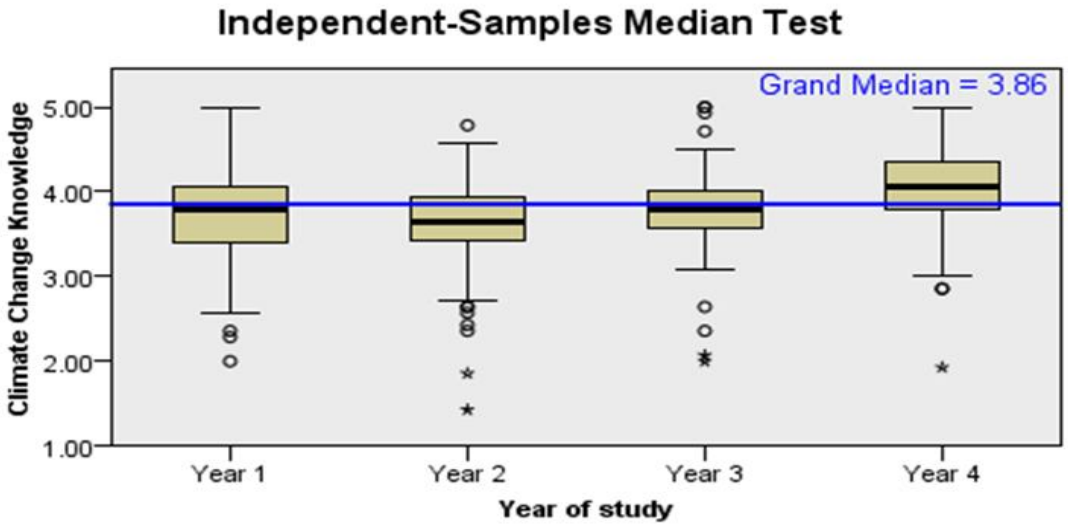

Figure 3. Climate change knowledge by year of study

The median climate change knowledge level of the fourth-year students is the only median above the grand median line. The other levelsof study are below the median line, with the second years being the lowest. Thus fourth year students are more informed about climate change compared to students in otherlevels implying that awareness levels increases with the level of study. A Kruskal Wallis test for similarity of median and distribution was conducted to establish if the difference in climate change knowledge level is significant among the students in the different levels of study. Results showed that there is a significant difference in the medians of the four groups, χ^2= 30.409,df=3 *P*=0.00. Furthermore, the distribution of the four groups was found to significantly vary, χ^2= 39.237, df= 3, *P*=0.00. To establish the groups that significantly vary from each other, a post hoc comparisons test was conducted and the results were adjusted using the Bonferroni correction. The results revealed that climate change knowledge level of students in fourth year of study significantly varies from that of students in their first, second, and the third years of study *P*=0.00. Likewise, there is no significant difference between the climate change knowledge level for students in their first year and second year, second year and third year,

first-year and third year. Based on these results, the fourth year students are the most knowledgeable on climate change matters. Students in the lower levels of study have a lower level of climate change knowledge and this was statistically similar between the groups.

However, there exists knowledge gaps in terms of causes and impacts of climate change as well as the environmental bodies charged with the mandate of addressing climate change matters.

Hypothesis Testing

3.8.3 Hypotheses Testing

The following was the hypotheses for the study

H_0: There is no significant difference in students' awareness of climate change across disciplines.

Based on the research results, there's a significant difference in knowledge and awareness levels of climate change across disciplines, as exhibited by the three selected schools Therefore the research fails to accept this null hypothesis.

CONCLUSION

Study discipline influences climate change awareness level. Respondents in SES exhibited a high level of awareness and knowledge of climate change compared to those from SB and SHSS whose knowledge level and awareness was significantly low. The three schools were statistically different from each other. These findings corroborate with those of Fitzgerald and Roberts, and (Freije in which study discipline enhances awareness levels and climate action. Thus, educational background has a significant influence on climate change awareness. [22], [23]

Student's level of study is also a factor that significantly affects the level of awareness of climate change as there are significant differences in the medians of the four groups representing the four study levels. Climate change knowledge level of the students in fourth level significantly varies from that of students in other three year levels implying that fourth year students are more knowledgeable on matters of climate change than First, Second and Third year students.

The main source of climate change information among the undergraduate students is the internet (n= 186, 49.6%) and television (n= 75, 20%) The internet plays a key role in disseminating knowledge about climate change and creating awareness among the students. Consequently, media is considered the most popular source of climate change information among the undergraduates as it was ranked the most popular source of climate change information while climate change seminars, conferences, lectures and other educational programs were ranked as the least popular sources of climate change information. Thus, students rarely attend climate change seminars and conferences, while lectures do not contain sufficient content on climate change hence ranked as the least popular sources of climate change.

RECOMMENDATIONS

1. The university curriculum should be reviewed to incorporate adequate content on climate change across disciplines and levels of study in order to increase awareness levels and knowledge about climate change. This will be essential in equipping graduates with necessary knowledge and skills needed for transformative changes and make informed decisions about our environment in their various professions
2. Since media was highly ranked as the most popular and reliable source of climate change information, and most youths are vibrant in the use of technology, there's need to embrace and maximize on the use of modern technology and media platforms which have a bigger audience, to cascade climate change information to the general public by inventing Mobile Applications that are efficient and effective in dissemination such crucial information.
3. Membership to environmental groups should be encouraged regardless of study level and study discipline. This will enhance access to climate change information and provide opportunities to take part in climate action. Other avenues of communicating such information should also be encouraged.

COMPETING INTERESTS

Authors have declared that no competing interests exists

AUTHORS' CONTRIBUTIONS

All authors read and approved the final manuscript.

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