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Awareness and Responsiveness to Environmental Issues by Youths: A Logistic Regression Approach

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Abstract: This research was carried out among student in Nigerian schools. The logistic regression model and ordinal logistic model were fitted with Awareness to environmental issues (AEI) with two levels and Responsiveness to environmental issues (REI) with five levels as the response variable. The predictor variables are age, geographical zones, type of school and location of school. The fitted logistic regression was shown to be a good fit and the result revealed that the older the students the more responsive they are to environmental issues. The overall effect of zone and type of school were statistically significant though the type of school had a negative effect. The ordinal logistic regression was equally fitted and the results also show that the older the student the more aware they are of environmental issues. The result also shows that the zones, urban schools and students in senior secondary and university are associated with higher likelihood of being aware of environmental issues and these effects are significant. The summary of the results reveals that though there is awareness of environmental issues in Nigeria but responsiveness towards is very low among students. Hence, we recommend that courses on environmental issues and responsiveness towards them should be incorporated in the academic curriculum of students especially in the universities since age has a positive effect on both RIE and AEI.

Keywords: Awareness to Environmental Issues, Responsiveness to Environmental Issues, Logistic Regression, Ordinal Logistic Regression

1. Introduction

The health of our planet earth and the well-being of individuals on in it are essentially dependent on the diversity of life on earth. The demand for energy, food, water, land, and other needs is putting serious pressure on the environment by polluting our air, land and water, destroying habitats, and causing some species of animals and plants to become extinct. The rate at which biodiversity is being lost in recent years is almost 10,000 times faster in comparison to 100 years ago. Literature has it that the loss of biodiversity is indirectly linked to population growth. The ecosystems can help in the mitigation and adaptation to climate change, this natural means of help, should be explored and accessed Malhi et al (2020) [10]. Nigerian as a country is one of the most populous countries in the world and has the largest population in Africa. Nigeria is not exempted from the negative impact of large population on

the environment. Significant loss of biodiversity and pollution have been reported in Nigeria. Thousands of people buy food, clothes, furniture, etc. every single day, with no proper way of disposing the waste-used. These waste either end up in places like rivers or other places or they are burnt by individuals. This improper disposal can lead to adverse health issues, especially water, soil, and air pollution. The alarming issue is that you will hardly find individuals that border about where the things we buy and consume come from and what kind of natural resources are always used to produce the things we consume or use. These environmental issues awareness and the response gap are more among the youths because they make up a greater percentage of the population, hence an urgent need to increase the number. It has become a quest to have informed youths on the environmental issues facing the world, so that they can be well equipped to respond to them and find ways to reduce or eliminate them where possible. This quest led to this research work. This research was carried out in Nigeria and it focused on the six geopolitical zones in the country with focus on students in tertiary and secondary schools. The six geopolitical zones in Nigeria are North Central, North West, North East, South East, South West, and South-South. In February 2021, the six geopolitical zones in Nigeria populations are 29,252,408 for North Central, 26,263,866 for North West, 48,942,307 for North East, 21,955,414 for South East, 38,257,260 for South West and 28,829,288 for South-South Ennis *et al* 2022) [4]. The Percentage of students population by geopolitical zones are as follows: - 14.5% from North Central, 14.1% from North East, 27.7% from North West, 10.8% from South East, 19.0% from South West and 13.8% from South-South this was reported by Central Bank of Nigeria (2021) [3]. The research is aimed at finding out the awareness of youths about the environmental issues facing the country and how or if they are responding to them. In achieving our aim, logistic regression and ordinal logistic regression were applied.

1.1. Logistic Regression

Logistic Regression is a generalized linear model with categorical outcome. Logistic Regression is a statistical technique that is related to linear regression in the sense that both find an equation that predicts an outcome variable, say *Y,* from one or more predictor variables, say *X*. The result of logistic regression shows the impact of each variable on the odds ratio of the observed event of interest, as stated by Sperandei S. (2014) [16]. The difference between them is that, in linear regression, the response variables must be continuous; but for logistic regression the model does not strictly require the response variable to be a continuous data. Also, the linear regression often times uses the least squares method to obtain estimation of the model parameters but Logistic Regression uses the log odds ratio rather than probabilities and an iterative maximum likelihood method obtain estimation of the model parameters. In other words, logistic regression affords the researcher more freedom during analysis because it is very appropriate for non-normal data and when there is an unequal covariance matrix but the method is usually limited by its assumption of independence among variables. Logistic regression can be classified into three, namely; binomial logistic, this is when there are only two possible outcomes, multinomial logistic, this is when there can be 3 or more possible unordered responses and ordinal logistic, this is when there can be 3 or more possible ordered responses. Logistic regression has been applied in many areas for over 2 decades.

1.2. Ordinal Logistic Regression

In any analysis, the use of binary logistic regression (logistic regression with two outcomes) for a naturally ordered variable usually leads to invalid inferences [17]. In the event of polychotomous outcomes, there are two possible categories which are multinomial and ordinal regression [5]. The multinomial logistic regression model as stated earlier can only be applied when there are three or more possible unordered responses. In the event where the dependent variable (outcome variable) is categorized according to its order of magnitude the ordinal logistic regression is must suited. Many ordinal logistic regression models have been proposed these include the proportional odds model (POM), two versions of the partial proportional odds model-without restrictions (PPOM-UR) and partial proportional odds model-with restrictions (PPOM-R), continuous ratio model (CRM), and stereotype model (SM) [7]. The most frequently used ordinal logistic regression is the cumulative logit model also known as the proportional odds model. Some researchers that have applied ordinal logistic regression in recent years include; the study of the mental health of students based on some stress factors using the ordered logistic regression. The relationship was modeled using the proportional odds model. Based on the odds ratio and the regression coefficients estimated it was concluded that the most influential factors of the mental health of students are the current well-being, followed by coping strategies and lastly the mental health assessment [12]. The ordinal logistic regression model was utilized to determine the factors associated with Socio-economic status for households in Tepi town, Southwest Ethiopia. The findings revealed and acknowledged the fact that ordinal regression is a better option when the outcome variable is ordered in nature [8]. The ordinal logistic regression was applied in obtaining a reliable and accurate means of preoperative evaluation of the extent of nodal involvement in oral cancer in India. The results show that pain at the time of presentation, sub mucous fibrosis, palpable neck node, oral site and degree of differentiation were significantly associated with the nodal involvement. Also, it was observed that under partial-proportional odds model the tumor size was significant [15].

2. Literature Review

Logistic regression was first proposed in the 1940s as an alternative technique to overcome the limitations of ordinary least squares (OLS) regression in handling dichotomous outcomes [13]. Since then there have been various applications and modifications of logistic regression in various disciplines. Some applications of logistic regression include; Alzen et al (2018) [2], that applied logistic regression in investigating the relationship between the Learning Assistant model and failure rates in introductory STEM courses. Their results revealed that using the Learning Assistant support in any STEM gateway course is related to a 55% reduction in odds of failure for females and a 63% reduction in odds of failure for males in subsequent STEM gateway courses. A research was carried out to review work on logistic regression to explain internet use among older adults. They did a systematic search in Scopus and PubMed for English-language peer-reviewed articles that reported the application of logistic regression, for published articles between 2010 and 2020 [9]. Their review supplied a thorough insight on the use of logistic regression analysis and they suggested that improvements should be done on the reporting of the studies. The issue of multicollinearity in logistic regression was addressed by using a modified estimator for estimating the parameter of the logit model in the presence of multicollinearity, this was achieved by modifying an existing Liu logistic estimator and the method was shown to do better than the existing ones in terms of variance, bias and the mean square error [6]. It was stated that odds ratio is one of numerous statistics that is very important and have been fully established in clinical research and decision-making. Its usefulness is mainly because of the effect-size statistic, it presents understandable and straight information to clinicians about which treatment approach has the best odds of benefiting the patient [11].

3. Methodology

The research work made use of survey design by constructing and distributing questionnaires in other to collect opinions of students on their awareness of environmental issues and their responsiveness towards them. The study implemented ordered logistic regression, logistic regression and correlation analysis. The survey covers University students and Secondary students in the Six Geopolitical Zones of Nigeria. We made use of two models, the first model will have the environmental awareness as the response (y_1) where age, geographical zone and place of residency are the predictor variables(x) and the second model will have Responsiveness to environmental issues as the response variable (y_2) with the afore mentioned predictor variables. The response variable, environmental awareness (y_1) has 5 categories (strongly agree, Agree, Do not know, disagree and strongly disagree). Since the response is ordered, the ordered logistic regression will be implemented. The response variable Responsiveness to environmental issues (y_2) has two categories; hence logistic regression is suitable to be used. Finally a correlation analysis will be carried out between environmental issues awareness and responsiveness to environmental issues. Data analysis and results were obtained using R software. The sample size for this research is 2000 students.

3.1. Determination of Sample Size

The determination of sample size based on sample population proportion and the total population is given by Scott (2016) [14] as;

$$n = \frac{n_0\ N}{n_0 + (N\quad 1)} \tag{1}$$

where N the population Size, n_0 is the sample proportion population. Scott also gave;

$$n_z = \frac{Z^2 P(1-P)}{e^2} \tag{2}$$

where Z is the Z-score is given as 1.96 (for 95% confidence), P is the probability (0.5), e is the margin of error (0.05), where $N = n_z * n_0$.

3.2. Model Presentation

3.2.1. Logistic Model

Given a binary outcome Y and a predictor variable X,

let $\pi(x) = P(Y = 1|X = x) = 1 - P(Y = 0|X = x)$; the logistic regression model is thus presented as;

$$\pi(x) = \frac{\exp(\alpha+\beta x)}{1+\exp(\alpha+\beta x)} \tag{3}$$

Likewise the log odds also known as logit is given by; (it equates the logic link function to the linear predictor).

$$logit[\pi(x)] = log\frac{\pi(x)}{1+\pi(x)} = \alpha + \beta x \tag{4}$$

Given multiple predictors, the logit is hence given by;

$$logit[\pi(x)] = \alpha + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_p x_p \tag{5}$$

3.2.2. Ordinal Logistic Model

Cumulative link models use logit link to link cumulative probabilities to the linear predictors. The most popular logit model for ordinal responses is the cumulative logits and it is given by Agresti (2002), [1], as;

$$P(Y \le j|x) = \pi_1(x) + \cdots + \pi_j(x), j = 1,..,J \tag{6}$$

The cumulative logits are thus defined as;

$$logiy[P(Y \le j|x)] = log\frac{P(Y\le j|x)}{1-P(Y\le j|x)} = log\frac{\pi_1(x)+\cdots+\pi_j(x)}{\pi_{j+1}(x)+\cdots+\pi_J(x)}, j = 1,\dots,J-1 \tag{7}$$

Each cumulative logits uses all J response categories.

Odds ratio: odds ratio is the ratio of two odds and odds can be defined as the probability of an event occurring divided by the probability of the event not occurring.

$$odds = \frac{Probability\ of\ success\ of\ an\ event\ (\pi)}{Probability\ of\ failure\ of\ an\ event\ (1-\pi)} \quad (8)$$

Odds ratio simply indicates how likely an event is to occur in one context relative to another.

The odds ratio formula below shows how to calculate it for conditions A and B.

$$odds\ ratio = \frac{odds\ of\ event\ A}{odds\ of\ event\ B} \quad (9)$$

3.3. Wald Test

Testing the statistical significance of regression coefficient β can be done by performing an approximate Wald test. The standard error of a single component in β, represented as β_i for i = 1, …, I, is given as the square root of the diagonal element of $cov(\hat{\beta})$ given by;

$$SE(\hat{\beta}_i) = \sqrt{V(\hat{\beta}_i)} \quad (10)$$

While the Wald statistic is given by;

$$Z = \frac{(\hat{\beta}_i)}{\sqrt{V(\hat{\beta}_i)}} asymptotically\ \sim N(0,1) \quad (11)$$

3.4. Correlation

Correlation is a term used to denote the association or relationship between two (or more) quantitative variables. This analysis is fundamentally based on the assumption of a straight –line [linear] relationship between the quantitative variables. Similar to the measures of association for binary variables, it measures the "strength" or the "extent" of an association between the variables and also its direction. The end result of a correlation analysis is a Correlation coefficient whose values range from -1 to +1. A correlation coefficient of +1 indicates that the two variables are perfectly related in a positive [linear] manner, a correlation coefficient of -1 indicates that two variables are perfectly related in a negative [linear] manner, while a correlation coefficient of zero indicates that there is no linear relationship between the two variables being studied.

$$r = \frac{\sum(x_i-\bar{x})(y_i-\bar{y})}{\sqrt{\sum(x_i-\bar{x})^2\sum(y_i-\bar{y})^2}} \quad (12)$$

where:

r = correlation coefficient

x_i= values of the x-variable in a sample

$\bar{x}$ = Mean of the values of the x-variable

y_i = Values of the y-variable in a sample

y_i = Mean of the values of the y-variable

4. Results and Discussion

4.1. Sample Size Justification

The estimated students' population was calculated using the percentage of students' population by geopolitical zones. Below presents the data;

Table 1. *Sampling Proportion of Students in the Six Geopolitical Zones.*

Zones	Population	Students' Population	Population of Others	Students Sample
NC	29,252,408	4,241,599	25,010,809	241
NE	26,263,866	3,703,205	22,560,661	211
NW	48,942,307	13,557,019	35,385,288	772
SE	21,955,414	2,371,185	19,584,229	135
SW	38,257,260	7,268,879	30,988,381	414
SS	28,829,288	3,978,442	24,850,846	227
TOTAL	193,500,543	35,120,329	158,380,214	2,000

The table 1 above shows that the sample population proportion of students is 2000. To determine n_z using equation (2) we have; $n_z = \frac{(1.96)^2 0.5(0.5)}{(0.05)^2} = 384.16$, hence the population becomes 384.16 × 2,000 = 768,320; therefore, using equation (1) the sample $n = \frac{2000*768320}{2000+(76320-1)} = 1999.998 \cong 2000$, hence justified. The sample size of 2000 was applied and drawn from each geopolitical zone using the proportion sampling technique. Using a well-structured questionnaire data was collected.

4.2. Descriptive Statistics Summary for Students Respondents

Table 2. *Descriptive Statistics for Students in terms of Sex and Age Range.*

Variable	Sub-variable	Frequency	Percentage (%)
Age Range	10-15	69	3.5
	16-20	740	37.0
	21 & above	1191	59.6

From Table 2, it shows that 48.4% of the students that respondent in the research were females while 51.6% of the respondents were males. This indicates that male students were slightly higher than female's respondents on the awareness and responsiveness of their environmental issues. The table 2 also shows that age range of 21 and above years old were more than other age range that responded to the administered questionnaires with 59.6% of the total respondents. This age range is an advantage to the results obtained in this research because it indicated older/experience individuals who have better understanding of their environmental issues, these older students are more who answered the research questions in this study.

Table 3. *Descriptive Statistics for Students in terms of School type, School location, Religion and School geopolitical zone.*

Variable	Sub-variable	Frequency	Percentage (%)
School Location	Rural	31	3.4
	Urban	868	96.6
School Geopolitical zone	South West	243	12.2
	South- South	211	10.5
	South East	771	38.6
	North Central	135	6.8
	North West	221	11.1
	North East	419	21.0

Table 3 of the summary statistics shows that the majority of those that responded to the administered questionnaires were university students with a percentage of 67.1, followed by senior secondary school students and lastly junior secondary. The table also showed that the questionnaires were administered more in the urbanized areas of geopolitical zone with a total figure of 1820 as against the rural respondents of 180. From the table 3 also the respondents with Christian faith were the highest with 66.9% followed by Others beliefs 66.0%, Muslim 30.9% and Traditional beliefs with 2.7%. For geopolitical zones, South-East had the highest number of respondents with a figure of 77.1 (38.6%), this may be as a result of proximity. South-West had a proportion of 12.2%, North West 11.1%, South-South 10.5% and north central 6.8%. This shows that majority of respondents are responsible individuals in the society and who have be taught/lecture on environmental issues and its implication health/society problems.

Table 4. *Logistic regression results.*

Parameters	Estimates	Exp (estimates)	Std error	z-value	p-value
Intercept	15.062	3.479	371.64	0.041	0.967
Age	2.110	8.249	0.262	8.062	7.50e-16*
North East	3.200	2.455	0.343	9.337	<2e-16*
North West	-0.858	4.237	0.232	-3.699	0.000*
South East	0.694	2.001	0.373	1.861	0.062
South South	2.017	7.521	0.322	6.273	3.55e-10*
South West	1.613	5.017	0.284	5.677	1.37e-08*
Urban	-1.567	2.087	0.195	-8.036	9.28e-16*
Senior Secondary	-17.992	1.535	371.624	-0.048	0.961
University	-23.072	9.551	371.624	-0.062	0.950

*Significant at 5% level

Table 5. *Results of Deviance and AIC.*

Null deviance	2397.8 on 1999 df
Residual deviance	1290.3 on 1990 df
AIC	1310.3

df- degrees of freedom and AIC- Akiake Information criteria

Table 4 results reveal that all the predictors are significant except students from south east zone, senior secondary and university students. The result reveal that for each unit increase in age of students increases the odds of responding to environmental issue increases by 8.2 and p-value indicates that age is somewhat significant in determining the response to environmental issues, also the older the students the more responsive they are to environmental issues. Likewise the zones all have positive significant effect on response to environmental issues except south east but the type of school and the location of the school have a negative effect on the response, such that a unit increase in school enrollment reduces the log odds of responding to environmental issue by -17.99 for senior secondary, -23.07 for Universities and -1.56 for urban schools. The model proves to be a good fit because the difference between the null deviance and the residual deviance is very large at 1107.5.

Table 5 shows that the model is a good fit because the difference between the null and the residual deviance is very large with a value of 1107.5.

The fitted logistic model is given by;

$$logit[\pi(REI)] = 15.06 + 2.11age + 3.2NE - 0.85NW + 0.69SE + 2.01SS + 1.61SW - 1.56Urban - 17.99Secondary - 23.07University$$

Based on the model, in other to predict responsiveness to environmental issues given that the student's age falls between 16-20, schools in the urban region, is from north central zone and is in senior secondary is obtained as 0.43; which means that the probability of responsiveness to environment issue increasing given the stated values is 0.43 or responsiveness to environment issue increases by 43% given the stated values.

Overall Effects:

Using the wald test, the overall effect of zone.

Chi-squared test: χ^2 = 172.5, df = 5, $P(> \chi^2)$ = 0.0, the result shows that zone has a significant overall effect on responsiveness to environmental issues.

The overall effect of type of school:

Chi-squared test: $\chi^2 = 239.4$, df = 2, $P(> \chi^2) = 0.0$

This result indicates that the overall effect of type of school is statistically significant.

Table 6. *Ordinal logistic regression Results.*

Parameters	Estimates	Std error	t-value	p-value
Agree|Disagree	1.899	0.340	5.580	0.000*
Disagree|Do not know	2.118	0.340	6.227	0.000*
Do not know|Do not know	2.121	0.340	6.235	0.000*
Do Not Know|Strongly Agree	2.343	0.340	6.885	0.000*
Strongly Agree|Strongly Disagree	5.674	0.369	15.352	0.000*
Age	0.803	0.1221	6.575	0.000*
North East	3.655	0.229	15.906	0.000*
North West	0.698	0.170	4.106	0.000*
South East	2.149	0.242	8.879	0.000*
South South	2.308	0.227	10.152	0.000*
South West	0.548	0.182	3.012	0.000*
Urban	0.755	0.159	4.744	0.000*
Senior Secondary	0.347	0.238	1.459	0.145
University	-1.954	0.268	-7.273	0.000*

*Significant at 5% level

Table 7. *Residual deviance and AIC.*

Residual deviance	4182.363
AIC	4210.363

The fitted cumulative logits are given below;

$$\text{Agree|Disagree - logit}[P(Y \leq 1)] = 5.580 + 0.803age + 3.65NE - 0.69NW + 2.15SE + 2.31SS + 0.55SW + 0.75Urban + 0.35Secondary - 1.95University$$

$$\text{Disagree|Do not know - logit}[P(Y \leq 2)] = 6.22 + 0.803age + 3.65NE - 0.69NW + 2.15SE + 2.31SS + 0.55SW + 0.75Urban + 0.35Secondary - 1.95University$$

$$\text{Do not know|Do Not Know - logit}[P(Y \leq 3)] = 6.23 + 0.803age + 3.65NE - 0.69NW + 2.15SE + 2.31SS + 0.55SW + 0.75Urban + 0.35Secondary - 1.95University$$

$$\text{Do Not Know|Strongly Agree - logit}[P(Y \leq 4)] = 6.88 + 0.803age + 3.65NE - 0.69NW + 2.15SE + 2.31SS + 0.55SW + 0.75Urban + 0.35Secondary - 1.95University$$

$$\text{Strongly Agree|Strongly Disagree- logit}[P(Y \leq 4)] = 15.34 + 0.803age + 3.65NE - 0.69NW + 2.15SE + 2.31SS + 0.55SW + 0.75Urban + 0.35Secondary - 1.95University$$

Given the model and result from table 6 it shows that given one unit increase in age, the log odds of being aware of environmental issues increases by 0.08, in other words the older the student the more aware he/she is of environmental issues. Given the categorical variables zone, the result shows that all the zones as opposed to north central is associated with higher likelihood of being aware of environmental and these effects are statistically significant at 5% level. Also the students in the urban schools are aware of environmental issue contrary to the students at the rural schools. In the same vein students in senior secondary are aware of environmental issues unlike the junior students.

Prediction using the cumulative model:

Let the new data be defined thus; the student's school is the urban area of south west zone and his/her age is between the ages of 16-20 and he/she is in the university.

Table 8 result predicts that students agree that they are aware of environmental issues in Nigeria.

Table 8. *Prediction result.*

Agree	Disagree	Do not know	Strongly Agree	Strongly Disagree
0.7201	0.0420	0.0005	0.1907	0.0084

4.3. Correlation Test Result

Table 9 shows the students respondents' level of environmental issues awareness and respondents' level of environmental issues responsiveness. The result shows that there is a 33.6% correlation between students' responses on the level of environmental issues awareness and their level of environmental issues responsiveness. This indicates positive but low relationship. In other words, the level of responsiveness by students is not increasing commensurate to their awareness of these environmental issues.

Table 9. *The relationship between respondents' level of environmental issues awareness and respondents' level of environmental issues responsiveness.*

Correlation Coefficients	Students respondents level of environmental issues awareness	Students respondents level of environmental issues responsiveness
Students respondents level of environmental issues awareness	1	
Students respondents level of environmental issues responsiveness	0.3366	1

5. Conclusion

This research made use of sample size of 2000 students and the sample was drawn from each of the six geopolitical zones of Nigeria using the proportion sampling technique. The questionnaire was administered mainly to students above the age of 21, who are in the University and senior secondary schools in the urban areas. The logistic regression model and ordinal logistic model were fitted with Awareness to environmental issues (AEI) and Responsiveness to environmental issues (REI) as the response variable respectively. AEI has binary response while RIE has five responses. The predictor variables are age, geographical zones, type of school and location of school. The fitted logistic regression proves to be a good fit because the difference between the null deviance and the residual deviance is very large at 1107.5. The results from the model show that all the predictors were significant except students from south east zone, senior secondary and university students. The result reveal that each unit increase in age of students increases the odds of responding to environmental issue increases by 8.2, which indicates that the older the students the more responsive they are to environmental issues. The overall effect of zone and type of school were statistically significant, though the type of school had a negative effect. The model was also used to predict responsiveness to environmental issues given that the student is between 16 to 20 years, schools in the urban region in the north central zone and is in senior secondary and 0.43 was obtained showing that the probability of responsiveness to environment issue increases by 43%.

The ordinal logistic regression model was fitted for predicting awareness to environment issues. Five cumulative logit models were fitted and the results show that all the predictors were significant except senior secondary. The results show that given one unit increase in age, the log odds of being aware of environmental issues increases by 0.08, in other words the older the student the more aware they are of environmental issues. The result also shows that all the zones as opposed to north central is associated with higher likelihood of being aware of environmental issues and these effects are statistically significant. Likewise the students in the urban schools were also aware of environmental issue contrary to the students at the rural schools. In the same vein the result also showed that students in senior secondary are aware of environmental issues unlike the junior students. Prediction was obtained based on the data that the student's school is the urban area of south west zone and their r age is between the ages of 16-20 and they are in the university. The prediction results reveal that students agree that they are aware of the environmental issues in Nigeria. The result of the correlation test shows that there is a 33.6% correlation between students' responses on the level of environmental issues awareness and their level of environmental issues responsiveness. This shows that the level of responsiveness by students is not increasing commensurate to their awareness of these environmental issues. The summary of the results reveal that though there is awareness of environment issues in Nigeria but responsiveness towards is very low among students. Conclusively, it is recommended that courses on environmental issues and responsiveness be incorporated in the academic program of students at both the university and secondary schools.

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