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DETERMINING ECOLOGICAL KNOWLEDGE AND ATTITUDES OF STUDENTS: THE ROLE OF PERSONAL FACTORS AND SCHOOL EXPOSURE

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Abstract

This study assessed the roles of personal factors and school exposure in determining ecological knowledge and attitudes of secondary school students in Akure South Local Government Area of Ondo State, Nigeria. Data were obtained through structured questionnaires administered on 135 students in 10 randomly selected schools. Data were analyzed using descriptive statistics, Chi-Square, Pearson's correlation and multiple linear regressions. The result showed that 63.7% of the respondents were male; the mean and median age was 15.3 years and 15 years respectively. The components of the environment were effectively covered by the science based classes than the non-science based classes. The students showed positive knowledge about all the items listed on water, pollution, energy, recycling, animals and other general issues. The predictors of students' ecological knowledge were sex ($\beta = 0.18$, $p < 0.05$) and nature of class ($\beta = 0.34$, $p < 0.01$). The study further revealed that there was a strong and significant relationship between the status of the school ($\beta = 0.26$, $p < 0.01$) and the ecological attitude of the students. Also, the study showed that there was a significant relationship between school exposure through teachings ($r = 0.18$, $p < 0.05$) and their ecological knowledge and attitudes. It is therefore recommended enrichment of school environmental curriculum to ensure a sustainable ecological knowledge.

Keywords: *Ecological knowledge; attitude; personal factors; roles; exposure*.

Introduction

Human actions are fundamentally and to a significant level, irreversibly changing the biodiversity of life on earth and most of these changes represent a loss of biodiversity [1]. The distribution of species on earth is becoming more homogenous, that is, the difference between the set of species found at one location and the set of species found at another location are on averagely diminishing due to high invasion of new species in a new range as a result of reduction in the capacity of the ecosystem function for adjustment to changing environment in terms of stability, resilience, resistance and biological insurance, which is calling for urgency in decisions making and actions taking at all levels of knowledge to the public, in order to prevent future challenges *J.E.M. Watson et al.* [2]. Humans continue to engage in environmental unfriendly behaviors at the individual, corporate, governmental, and societal levels *I. Ugulu* and *S. Erkol* [3]. The Millennium Ecosystem Assessment carried out between 2001 to 2005 to assess the consequence of ecosystem changes for human wellbeing and analyze options available to enhance the conservation and sustainable use of ecosystem and

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their contribution to human wellbeing through education opined that knowledge comes with greater sense of responsibility and appreciation of value [1].

According to UNESCO-UNEP (1977), "environmental education is a process aimed at developing a world population that is aware of and concerned about the total environment and its associated problems, and which has the knowledge, attitudes, motivations, commitments and skills to work individually and collectively toward solutions of current problems and the prevention of new ones." The importance of education for sustainable development cannot be overstated, because education fuels the engines of environment awareness that energize the will for right attitude and cautions [1]. Education is generally agreed to be the most effective way to impart knowledge and skills that can be applied outside the classroom in everyday life. Students can be empowered by exposure to environmental curriculum, which itself, is an educational tool [4]. Environmental education empowers people and improves their environmental awareness through knowledge *M.P. Maloney et al*. [5]. Its ultimate aim is to motivate citizens to act individually and collectively in an environmentally conscious manner that balances the social, economic, and ecological needs of today without compromising those of the future *H. Hungerford et al.* [6]; *N. Yorek et al.* [7]. *M. Grodzinska-Jurczak et al.* [8] suggested that environmental education syllabuses at all educational levels (both formal and informal) should be prepared so as to help achieve these aims.

C. Moseley [9] defines environmental knowledge as a life-long interdisciplinary approach with the aim of developing a world population which is conscious of the environment and related issues which contribute to the solution of existing environmental problems and prevent the formation of new knowledge, skills, attitudes, motivation, personal and social duties and responsibilities. The work of *J. Frick et al.* [10] introduces three forms of environmental knowledge, that are, systematic knowledge, action-related knowledge and environmental knowledge opened new doors in the study of the impact of environmental knowledge on effective environmental behavior. Some researchers, such as *J.C. Bradley et al.*[11] and *F. Aydin* [12] think that the participation of students in environmental courses will make an increase in their responsibility of environmental problems. One purpose in developing environmental literacy is to empower people with a belief in their ability to contribute to environmental solutions through personal behavior either as an individual or part of a group *S. Peer et al.* [13] and *J. Mondéjar-Jiménez* [14]. On the other hand, *A. Ewert* and *G. Galloway* [15] believe that one of the more noteworthy areas of interaction between human and the natural environment is environmental attitudes. According to *T.L. Milfont* [16], one of the ways to contribute to the amelioration of environmental problems is through the study of environmental attitudes since they may underlie people's behavior in preserving or damaging natural resources.

As opined by *T.L. Milfont* [16], environmental attitudes are a psychological tendency that is expressed by evaluating perceptions of or beliefs regarding the natural environment, including factors affecting its quality, with some degree of favor or disfavor. Many studies are particularly concerned about young peoples' environmentally sensitive attitudes, because young people will be affected by and need to provide solutions to environmental problems as a result of present-day actions *J.C. Bradley et al.* [11]. Consequently, promoting environmental attitudes has been considered as an important part of environmental education as suggested in the respective international conventions and charters *M. Sarkar* and *Q.A.J. Ara* [17]. Research shows that environmental attitudes continue to develop up to adolescence and by adolescence, according to *J.C. Bradley et al.* [11] many require some level of environmental understanding which is important for environmental attitudes so, adolescents may have a level of understanding to express their attitudes towards the environment.

To face the challenges of pollution, deforestation, salinity, urbanization, global warming, climate change and so on, it is important to acquaint younger generation with appropriate knowledge, skills and attitudes relating to environment *M. Sarkar* and *Q.A.J. Ara* [17]. There is paucity of information on students' ecological knowledge and attitudes in Nigeria. Thus, limited studies have been conducted on ecological knowledge and attitudes of students. This study therefore seeks to examine the roles of personal factors and school

exposure in determining ecological knowledge and attitudes of students. Specifically, it was to determine the roles of gender, age, level of education, school status and nature of class and school exposure on the ecological knowledge and attitudes of students. It was hypothesized that significant relationships exist between personal factors of the students, school exposure and their ecological knowledge and attitudes.

Materials and Methods

The study area

The study area was Akure South Local Government Area, one of the eighteen (18) local government areas in Ondo State of Nigeria, having its headquarters in Akure town, the state capital. Ondo State is located in the South Western part of Nigeria with a land mass covering an area of 331km^2 with a population of 360, 268 people as at the 2006 population census (Nigeria Population Commission, 2006). There are 180 primary schools, 190 secondary schools (162 private and 28 public), and five tertiary institutions in Akure South Local Government.

Sample, Survey, Measurement and Data Analyses

The study population was the senior secondary school students (Senior Secondary School (SSS) 1 and 2). The list of the registered schools was obtained from the Ondo State Ministry of Education, Akure. There were 190 secondary schools in the local government as at the time of this study, comprising 28 public and 162 private secondary schools. For this study, a random sample of 5% of the schools was made. From the selected schools, 10% of the students in each arm of SSS1 and SSS2 classes were selected for this study. In all, 135 students were sampled. One instrument (questionnaire) was designed for this study. The questionnaire was made up of five parts. Part one consisted of the personal factors of the respondents such as name of school, school status (private or public), gender, age and level of education. Part two consisted of the subjects and components of the environment covered by the school curriculum, part three consisted of the level of exposure of the students to environmental knowledge, part four consisted of the ecological knowledge of the students and part five consisted of the ecological attitudes of the students. For the ecological knowledge and attitude, the Children Environmental Attitudes and Knowledge Scale (CHEAKS) by *F. Leeming et al.* [18] was utilized. Age was measured in years, status of the school was measured as public=1, private = 0, gender was measured as male = 1, female = 0, level of education was measured as SSS1=1, SSS2=0, nature of class was also measured as science = 1, commercial/art= 0, level of exposure to ecological knowledge was measured in a Likert-Scale type ranging from no exposure=1, occasional exposure = 2, frequent exposure = 3. Ecological knowledge and attitudes were also measured in a Likert-scale type ranging from very false = 1, mostly false = 2, not sure = 3, mostly true = 4, to very true = 5. Descriptive statistical tools such as frequencies, medians, means and standard deviations were used to describe data and the inferential statistical tools used were Chi-square, Pearson's Correlations and multiple linear regression analysis.

Results and Discussions

Table 1 presents the personal characteristics of the students. Of the total sampled, 63.7% were male while 36.3% were female. This might be due to the higher number of male enrolment in the schools sampled. In addition, majority of the respondents were within the age range of 12-15 years, with the mean age of 15.3 years and the median age of 15 years, which is lower than the country's estimated median age of 18.2, *CIA* [19]. This is an indication that majority of the respondents were teenagers. Considering school status, 60.7% of the respondents were from public schools. This might be as a result of the large number of students attending public schools in the state due to low tuition. Furthermore, 76.4% of the respondents were in Senior Secondary School 2 while 57% were science students.

Table 1. Personal characteristics of the students (N=135)

Personal factors	Frequency	Percentage (%)
Gender		
Male	86	63.7
Female	49	36.3
Age		
12-15	72	53.0
16-19	63	47.0
Mean	15.3	
Median	15.0	
School status		
Public	82	60.7
Private	53	39.3
Education level		
SSS1	32	23.7
SSS2	103	76.3
Nature of class		
Science	77	57.0
Commercial/Art	58	43.0

Table 2 showed that three subjects have higher level of coverage of environmental issues in the sampled curriculum. They include biology (75.6%), agriculture (71.1%) and geography (64.2%). This is an indication that science students were more exposed to ecological components through subjects taught than other non-science class. The environmental components with the highest level of coverage were soil (80.0%), water (75.6%), vegetation (76.3%), wild animals (75.6%), and forestry (62.2%). However, climate change (41.5%) and climate related hazards (21.5%) were the least covered among the components of environment.

Table 2. Sources of ecological knowledge through school curriculum

Subjects	*Frequency	*Percentage (%)
Biology	102	75.6
Agriculture	96	71.1
Geography	87	64.2
Economics	45	33.3
Physics	34	25.2
Chemistry	28	20.7
Commerce	10	7.4
History	12	8.9
Literature	16	11.9
English	28	20.7
Home Economics	22	16.3
Yoruba	7	5.2
Computer	3	2.2
Government	1	0.7
Technical drawing	3	2.2
Basic electronics	5	3.7
Accounting	3	2.2
Insurance	4	3.0
Mathematics	1	0.7
Environmental components		
Soil	108	80.0
Water	102	75.6
Vegetation	103	76.3
Wild animals	72	75.6
Forestry	102	62.2
Climate change	84	41.5
Climate related hazards	56	21.5
Sustainability	29	53.3
Conservation	72	57.0

*Multiple responses recorded

The results from Table 3 showed that 70.4% of the respondents reported that they were frequently exposed to ecological knowledge through teachings, followed by lectures (55.6%), instructional aids (46.7%) and outdoor activities (44.4%). However, special conservation programs (53.3%), lectures and debates (52.6%) and field practical (48.1%) were methods through which ecological knowledge were occasionally passed to them. The results showed a high level of ecological knowledge among the students whereas their level of exposure to ecological knowledge by the school seemed to be low. It is possible the students gained their ecological knowledge from other sources including mass media at home. This is indicated by the findings of *K.W. Hausbeck et al.* [20] showing that the students in New York State overwhelmingly selected electronic media as their primary answer to a question asked about where the students learned about environmental issues.

Table 3. Methods of school exposure of respondents to ecological knowledge (N=135)

Variables	*Frequently (%)	*Occasionally (%)
Teaching	70.4	24.4
Field practical	16.3	48.1
Instructional aids	46.7	32.6
Maps	28.9	27.0
Charts	21.5	37.8
TV documentary	29.6	27.4
Video documentary	28.1	28.9
Case study	28.9	42.2
Special conservation program	22.2	53.3
Lectures	55.6	52.6
Debate	35.6	52.6
Outdoor	15.4	40.7

*Multiple responses recorded

As highlighted earlier, students responded to an ecological knowledge scale consisting of 30 items, which were divided into six categories: animal knowledge, pollution knowledge, knowledge on general issues, water knowledge, energy knowledge and recycling knowledge. Table 4 presents the results obtained from the students' responses to the each item in the scale. The ecological knowledge scale of the students was measured ranging from 0-2.49 as low knowledge to 2.50-5.00 as high knowledge. From the result, the students showed high knowledge about all the items listed on water, pollution, energy, general issues, recycling and animals. This is an indication that the students were well informed about the components of their environment. *M.M. Abd El-Salam et al.* [21] on the other hand, found environmental knowledge among preparatory students in Alexandria to be low.

Table 4. Mean and Standard Deviation of the ecological knowledge of respondents (N=135)

	Knowledge statement	Mean	Standard Deviation
	Item 1: Animal knowledge		
1	Most elephant are killed every year to provide people with ivory	3.44	1.37
2	Catching tuna in the ocean also kills many dolphin	3.55	1.05
3	Animals alive today are most likely to become extinct in the nearest future	3.71	1.19
4	Killing animals like wolves that eat others may increase the number of other animals	3.26	1.57
5	A species that no longer exist is extinct	3.29	1.57
	Item 2: Pollution knowledge		
1	The most pollution of water source is caused by chemical run off from farms	3.88	1.17
2	Nitrates and phosphates are the most common poison found in water	3.81	1.05
3	High octane gas does not do much to reduce the pollution by automobiles	3.21	1.15
4	Most air pollution in our big cities comes from cars	3.89	1.31
5	Most lead in our air is caused by cars	3.59	1.36

	Knowledge statement	Mean	Standard Deviation
	Item 3: Knowledge on general issues		
1	Ecology is the study of the relationship between organisms and their environment	4.75	0.69
2	Overpopulation is dangerous to earth's environment	4.14	1.06
3	I do not worry about environmental problem	2.04*	1.35
4	Environmental problems are threats to all living things in the world	4.15	1.12
5	Ecology assumed that man is related to other parts of nature	4.02	1.21
	Item 4: Water knowledge		
1	Phosphates are harmful in the sea water because they suffocate fish by increasing algae	4.07	0.09
2	Building dam on a river damages the river's natural ecosystem	3.52	1.27
3	Sulphur dioxide is most responsible for creating acid rain	3.77	1.14
4	Underground waters are found in aquifers	3.39	1.13
5	The main problem with the use of aquifers for water supply is becoming used up	3.36	1.12
	Item 5: Energy knowledge		
1	Burning coal for energy releases carbon dioxide and other pollutants into the air	4.44	0.94
2	Solar is an example of perpetual energy source	4.41	0.89
3	Coal and petroleum are examples of fossil fuels	4.10	1.22
4	An example of non-renewable resources is petroleum	3.44	1.65
5	Hot water heater uses the most energy in an average house in Nigeria	3.60	1.29
	Item 6: Recycling knowledge		
1	Compared to other papers, recycled paper takes less energy to make	3.79	1.18
2	Garbage is dumped from the garbage trucks to a landfill where it is buried	3.69	1.11
3	Pre-cycling means that people buy things that can be used again	3.91	1.21
4	The main problem with landfills is that it takes up too much space	3.62	1.25
5	An item which cannot be recycled and used again is known as disposable diapers	3.91	1.24

*Low knowledge

In Table 5, the students also responded to an ecological attitude scale consisting of 36 items, which were divided into six categories namely: concern for animals, concern for energy, concern for water, concern for pollution, concern for general issues and concern for recycling. The ecological attitude scale of the students was divided into two, ranging from 0-2.49 as negative attitude, to 2.50-5.00 as positive attitude using the mean of the responses. The results presented in Table 5 showed that from the items relating to concerns for animals, energy, water, pollution, recycling and general issues, students only showed negative attitudes towards five statements in all, one in each item of the ecological attitude scale except their concern for recycling. They were negative towards statements towards their concern for animals (*I will ask my parents to stop buying products from animal furs*, Mean = 2.44, SD = 1.35), concern for energy (*I leave the refrigerator door open while I decide on what to get out,* Mean=2.15, SD = 1.40), concern for water (*I am not worried about running out of water,* Mean = 2.45, SD = 1.60), concern for pollution (*I am not frightened about the effect of pollution on my family,* Mean = 2.27, SD = 1.60), concern for general issues (*I do not worry about environmental problems,* Mean = 1.96,SD = 1.34). The students however showed positive attitude in all the items listed on their concern for recycling. This result contradicts the findings of *M.M. Abd El-Salam et al.* [21] which revealed that students expressed negative ecological attitude which showed that the attitude of 80% of preparatory students in Alexandria towards environmental issues was found to be negative, the rest (20%) were indifferent. Furthermore, attitudes of the students were negative towards reuse and recycling issues.

From this study, it is observed that gender ($\beta = 0.18$, $p < 0.05$) and nature of class ($\beta = 0.34$, $p < 0.01$) were the predictors of students' ecological knowledge, thus accounting for 18% of the variation in the relationship between personal factors of the respondents and their ecological knowledge (Table 6). This result is however in agreement with the study of *J.S. Gambro* and *H.N. Switzky* [22] suggesting that that gender is an influential factor in gaining environmental knowledge. The result on gender and nature of class was inconsistent with the observation of *C.O. Akomolafe* [23] that the gender of students was not important in their

environmental awareness knowledge. However, this study also showed that the school status of the students will not significantly influence their ecological awareness knowledge. In other words, the students' ecological knowledge was not dependent upon whether they attended public or private secondary schools.

Table 5. Mean and Standard Deviation of ecological attitude of respondents (N=135).

	Attitudinal statement	Mean	Standard Deviation
	Item 1: Concern for animals		
1	I will be willing to stop buying some products to save animals' lives	3.19	1.40
2	I will give ₦50 out of my pocket money per month to help protect wild animals	3.10	1.44
3	I get angry when I think about companies testing products on animals	2.69	1.50
4	I will put up a bird house near my house	3.24	1.53
5	I will ask my parents to stop buying products from animal furs	2.44*	1.35*
6	It makes me sad to see houses being built where animals used to live	2.87	1.60
	Item 2: Concern for energy		
1	To save energy, I will turn off lights at home when they are not in use	4.33	1.19
2	It frightens me to think about how much energy is being wasted	3.43	1.40
3	I leave the refrigerator open while I decide on what to get out	2.15*	1.40*
4	I will be willing to save energy using less air conditioning	3.41	1.43
5	It makes me feel happy to see people trying to save energy	4.22	1.39
6	To save energy, I will be willing to use dimmer light bulbs	2.91	1.51
	Item 3: Concern for water		
1	I do not let the water facet run when it is not necessary	4.13	1.34
2	To save water, I will be willing to use less water when I bathe	2.60	1.52
3	I will be willing to turn off water tap while I wash my hands in order to save water	3.30	1.69
4	I turn off the water in the sink while I brush my teeth	3.72	1.57
5	It upsets me when I see people use too much water	3.04	1.61
6	I am worried about running out of water	2.45*	1.60*
	Item 4: Concern for pollution		
1	I would be willing to ride the bus to more places in order to reduce air pollution	2.93	1.69
2	I would be willing to write letters asking people to help reduce pollution	3.90	1.37
3	I have not written someone about a pollution problem	3.21	1.59
4	I have asked others what I can do to help reduce pollution	3.59	1.49
5	I get angry about the damages pollution does to the environment	4.19	1.30
6	I am not frightened about the effect of pollution on my family	2.27*	1.60*
	Item 5: Concern for general issues		
1	I would be willing to give ₦50 out of my own pocket money to help the environment	3.81	1.32
2	I would go from house to house to pass out environmental information	3.47	1.38
3	I have talked to my parent about the environment	3.67	1.43
4	I often read stories that are mostly about the environment	3.62	1.51
5	I am frightened to think that people do not care about the environment	3.84	1.29
6	I do not worry about environmental problems	1.96*	1.34*
	Item 6: Concern for recycling		
1	I would not be willing to separate my family's trash for recycling	2.87	1.55
2	I would be willing to go from house to house asking people to recycle	3.16	1.37
3	I have asked my family to recycle some of the things that are at home for recycling	3.42	1.51
4	I do not separate things at home for recycling	3.11	1.53
5	It makes me happy when people recycle used bottles, cans and paper	3.82	1.43
6	I get upset when I think of the things people throw away that could be recycled	3.58	1.48

*Low concern

The study further showed that the status of school ($\beta = -10.08$, $p < 0.05$) was the only determinant of ecological attitude of the students (Table 6), indicating that other personal factors (such as age, gender, level of education and nature of class) had no relationship with students' ecological attitudes. The value of R^2 (0.10) implies that this model explained 10% of the total variance in ecological attitudes. Thus, nature of school accounted for 10% of the variations in the relationship between the personal factors of the students and their ecological

attitudes. This result is in agreement with the findings of *D.G. Henderson et al.* [24] that gender was not one of the top three factors related to environmental attitudinal outcomes.

Table 6. Relationship between the personal factors of the respondents and their ecological knowledge and attitude

	Ecological knowledge		Ecological attitude	
Variables	β	t values	β	t values
School status	-0.02	-0.25	-0.26	-2.60*
Gender	0.18	2.07*	0.02	0.27
Age	-0.07	-0.74	-0.05	-0.51
Education	-0.14	-1.56	-0.05	-0.50
Nature of class	0.34	4.22**	0.09	1.11
R	0.42		0.32	
R^2	0.18		0.10	
R^2 (adj.)	0.14		0.07	
ΔR^2	0.18		0.10	
Standard error	13.50		18.65	
Df	134		134	

**Significant at 0.01 probability level *Significant at 0.05 probability level

Table 7. Bivariate correlation between frequencies of school exposure of respondents to ecological knowledge and attitudes

Methods	Correlation value (r)	P	Decision
Teaching	0.02	0.78	NS
Field exposure	0.18*	0.04	S
Instructional aid	-0.03	0.75	NS
Maps	0.05	0.53	NS
Charts	0.10	0.23	NS
Television documentary	0.14	0.11	NS
Video documentary	0.05	0.57	NS
Case study	-0.03	0.76	NS
Conservation programme	0.11	0.20	NS
Lectures	0.20*	0.02	S
Debates	0.01	0.94	NS
Outdoor activities	0.08	0.36	NS

S = Significant NS = Not Significant

Table 7 presents the bivariate correlation between frequencies of school exposure of respondents to ecological knowledge and attitudes. The result indicated that field practical ($r = 0.18$, $p < 0.05$) and lectures ($r = 0.20$, $p < 0.05$) had significant relationship with ecological knowledge and attitude. This is in consistence with the findings of *E. Eilam* and *T. Trop* [25], *M. Sakar* [26] and *UNESCO Final Report* [27] indicating that schools are successful in influencing students' environmental attitudes.

Conclusion

In addition to global challenges of pollution, deforestation, salinity, urbanization, global warming, climate change, etc. coupled with the importance of school exposure and personal factors in determining students' ecological knowledge and attitudes are issues to be investigated. The results of this study revealed that all the ecological components were effectively covered by the science class curriculum, which means that the respondents in other classes (art and commercial) have less ecological components in their curriculum. Also, the students showed a high level of ecological knowledge whereas their level of exposure to ecological knowledge by the school seemed to be low, possibly suggesting that the students gained their ecological knowledge from other sources such as mass media at home or from friends. Moreover, the students showed high level of ecological knowledge and attitudes Age,

level of exposure and school status did not contribute to students' ecological knowledge. Furthermore, age, gender, level of education and nature of class were not determinants in students' ecological attitudes. School exposure contributed less to students' ecological knowledge and attitudes as only field exposure and lectures had significant relationships with school exposure. This study recommends that schools should adopt effective methods of imparting ecological knowledge into students which can aid in developing more positive ecological attitudes.

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