



## Towards Sustainable Development: Exploring the Knowledge of Environmental Impact Assessment among Undergraduates in a Nigerian University

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### Authors' contributions

This work was carried out in collaboration among all authors. Author QNSN conceptualised and designed the study, managed the literature and wrote the first draft of the manuscript. Authors AOG, GEF, FCE and ANE performed the acquisition and statistical analysis of data. Author CCN wrote the protocol, interpreted the data and revised the draft critically for important intellectual content. All authors read and approved the final version of the manuscript to be published.

### Article Information

DOI: 10.9734/AJARR/2020/v14i230324

#### Editor(s):

(1) Dr. Fagbadebo Omololu Michael, Durban University of Technology (DUT), South Africa.

#### Reviewers:

(1) Ana Margareth Siqueira Bassols, Federal University of Rio Grande do Sul (UFRGS), Brazil.

(2) P. S. Venkateswaran, PSNA College of Engineering and Technology, India.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/61350>

Original Research Article

Received 15 July 2020  
Accepted 21 September 2020  
Published 12 October 2020

### ABSTRACT

**Background:** Efficient project management suffices that decision makers are adequately informed on the impacts of their actions and inactions on the environment.

**Objective:** To explore the knowledge of environmental impact assessment (EIA) among undergraduates of the faculty of environmental sciences in a university in Nigeria.

**Materials and Methods:** This was a cross sectional survey of 350 undergraduates selected via multistage sampling technique. Data were obtained using self-administered semi-structured questionnaires, and analysed using statistical package for social sciences software version 22. Statistical significance were done using Chi-square test at p value < 0.05.

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**Results:** Two hundred and eighteen (62.3%) respondents reported awareness of EIA and cited their sources of information on EIA as 111(50.6%) schools, 109 (50%) textbooks, etc. Only (12.6%) out of 350 respondents had good level of knowledge on EIA. Fifty one (14.6%) out of 350 respondents reported ever participated in EIA process, while 34 (9.7%) were participating in EIA process currently. The level of knowledge of EIA process among respondents significantly vary with [gender,  $p=0.002$ ) and marital status,  $p= 0.032$ ] respectively.

**Conclusions:** This study found apparently poor awareness of EIA, poor knowledge of EIA and poor participation in the EIA process. The level of knowledge on EIA vary significantly with gender and marital status. We recommend comprehensive but targeted, need- based environmental education to help create awareness, impart knowledge and equip these students with EIA strategies and skills to handle environmental challenges.

*Keywords: Environmental impact assessment; Nigeria; undergraduates; knowledge.*

## 1. INTRODUCTION

Concepts such as environmental- sustainability, sensitivity, protection, exploitation, consciousness eco-friendly technologies for environmental conservation and environmental management, currently constitute key outcomes in public health research [1, 2]. Man's health and his environment are intricately intertwined. As such, several issues with morbidity, mortality, poverty and poor development are documented in the literature as resulting from impacts of man's decisions towards actions or inactions on the environment [3]. Also, about 13 million deaths can be prevented annually by making our environment healthier [4].

Generally, impacts (positive or negative), comprise three types viz:- direct - impacts that immediately result from a project; indirect - consequences of direct impacts and cumulative-impacts of multiple projects [5]. For instance, burning of fossil fuels, coal, oil, and gas for electricity, heat, and transportation are key sources of carbon dioxide (CO<sub>2</sub>), greenhouse gases and other air pollutants, leading to a direct impact (Air pollution). Other human activities that generate air pollutants include: deforestation, fires, other forms of forest degradation, agriculture (livestock production, fertilizer use) and road construction. Normally, these pollutants would escape into space—but can last for centuries in the atmosphere, trap the heat and cause an indirect impact - recent rise in the global average temperature near the earth's surface (Global warming) [6]. Then, as temperatures and carbon levels rise, the impact of the new developments synergize with existing environmental impacts via a myriad of factors (natural and human) to exert a larger (that is, Cumulative) impact on the earth's climate system, and (climate change) has become a challenge [5,6,7]. Concerns about climate

change and the potential of its integration in EIA, in terms of achieving mitigation of its impact have driven a transition in energy regime to renewable (or CO<sub>2</sub> –neutral) alternatives such as solar, offshore wind, wave and tidal sites [6,8,9].

Therefore, EIA health impact assessment (HIA) and benefits analysis remain key pre-, intra, peri- and post- development of projects with potentials of significant effects on the environment [10,11]. Environmental impact assessment is the process of identifying, predicting, evaluating and mitigating the biophysical, social and other relevant effects of development proposals prior to major decisions being taken and commitments made or declined [12]. The EIA procedure aims to provide information for decision-making promote transparency and participation of the public in decision-making; incorporate a balanced approach to environmental alternatives in project planning and design, eco- friendly cum efficient technologies for sustainable development, protection and conservation of the environment [1,5,10].

In Nigeria, three independent EIA systems are in operation; EIA Decree 86 (1992), town and county planning decree 88 (1992) and petroleum act (1969). [13] The EIA act made it mandatory for EIA to be conducted for projects that pose potential significant threats to the environment. "The projects include: agriculture/agro-allied industry/manufacturing food and beverages, tobacco processing and brewery; infrastructure; ports, housing, airport, drainage and irrigation, railway; transportation; resort and recreational development, power generation;-petroleum, mining and quarries, waste treatment and disposal, water supply and land reclamation" [13].

From the foregoing, this is a topic of great relevance in the current situation, drawing

attention to environmental issues which are disregarded by a large part of the population, non-governmental and government officials. The Nigeria government mapped out strategies to control these impacts but not much has been achieved due to poorly regulated human anti-environmental practices in the country [14]. Also, EIA is a knowledge intensive activity that benefits from a highly structured approach to knowledge management [15]. Consequently, there is need for increase in knowledge, to help the people imbibe positive behavior towards the environment. In the same vein, environmental science is an approach to education which provides students with the requisite scientific principles, concepts, and methodologies to understand the inter relationships of nature to identify and analyse environmental problems (natural and man-made), to evaluate the relative risk associated with these problems, and to examine alternative solutions for resolving and/or averting them [16]. The findings of this study will contribute to future scientific studies, bridge the knowledge gap on EIA among the study group as well as equip them for future public and professional challenges. It is imperative to explore the knowledge of EIA among undergraduates of the faculty of environmental sciences in a university in Nigeria.

## **2. MATERIALS AND METHODS**

### **2.1 Study Design**

This was a cross-sectional descriptive study conducted in April 2016 to June, 2016.

### **2.2 Description of Study Area**

The study setting was Imo State University Owerri located in Owerri Municipal, one of the three local government areas (LGA) that constitute Owerri the Capital of Imo State in South East Nigeria. The LGA had an area of 8km<sup>2</sup> and a population of 127,213 (23). The University was established in 1981 and had its re-establishment at the current Lake Nwaebere Campus formally approved by the National Universities Commission in 1992. It has a population of about 15,000 undergraduates and offers series of post-graduate and undergraduate courses in 11 faculties and 63 departments [16]. The faculty of environmental sciences comprises eight departments namely: Architecture, Building, Estate management, Quantity surveying, Fine and applied arts, Geography, Environmental

management, and Urban and regional planning (16).

### **2.3 Study Participants**

This comprises undergraduate students in the faculty of environmental sciences of the Imo State University, Owerri.

#### **2.3.1 Inclusion criteria**

Students enrolled in an undergraduate regular program at the faculty of environmental sciences at the Imo State University, Owerri for at least one year.

#### **2.3.2 Exclusion criteria**

Such students of the faculty, who were absent from school during the study period.

### **2.4 Variables**

These comprise:

- a) sociodemographic variables of respondents such as age, gender, religion, etc.,
- b) awareness of EIA,
- c) level of knowledge of EIA and
- d) participations in the EIA process.

### **2.5 Data Sources and Measurement**

Frequencies of the variables were determined by univariate analysis, while bivariate analysis, using chi-square test was employed in testing associations between variables.

### **2.6 Bias**

This study is based on self-reporting practices and thus the data are subject to errors such as over reporting.

### **2.7 Study Size**

#### **2.7.1 Sample size determination**

The sample size was determined using the sample size formula for cross sectional studies in populations greater than 10,000 (Cochran) stated thus: [17]  $n = Z^2 pq/d^2$ , where n= minimum sample size; Z=standard normal deviate at 95% confidence interval set at 1.96; p=prevalence in a previous study; q=1 -p; d=degree of precision (0.05); Thus prevalence of knowledge of EIA among undergraduate students of the Faculty of

Environmental Sciences, Imo State University which is 0.5, as no such studies has been conducted in the study area,  $m=384$  [18]. Since the formula above implies when population is more than 10,000, for population less than 10,000, we applied the formula below [18]:  $n_f = \frac{n}{1 + \frac{n}{N}}$ , where,  $n_f$  = The desired sample size when the population is less than 10,000,  $n$  =

The desired sample size when the population is more than 10,000, The target study population,  $N$  is 1,230, [16]:  $n_f = 293$ . Assuming 20% of the sample size was added to cover for attrition, the estimated sample size was approximately 352 students.

### 2.7.2 Sampling technique

The study participants were selected using multistage sampling technique. In the first stage, stratified sampling technique was used to group the faculty into eight departments. Proportionate allocation of the sample size of 352 into 44 students per department was done. In the second stage, stratified sampling technique was used to further split each department into four [4] levels. Proportionate allocation of the 44 students into 11 per level was done. In the third stage, the class register was used as the sampling frame and 11 participants were selected from each level, by simple random sampling technique using a table of random numbers (i.e. eleven students per level, 44 per department and 352 in total (the faculty)). Designated places for collection per department were provided at ease and convenience of participants.

### 2.8 Data Collection Technique

Data collection in this study was done using pre-tested, semi-structured questionnaires developed from review of relevant literatures [5,6,7,8,9]. All questions were written in English language and pre-tested on similar set of respondents in Madonna University Elele, Nigeria. This was done, to check for the reliability, validity, appropriateness of format, wording and time needed to fill the questionnaire. Thereafter the instruments were reviewed by colleagues, necessary adjustments and corrections were effected before administering the questionnaire to the study participants. To ensure data quality, training of data collection team and field monitoring of data collection were done. Post data collection team meeting was

held daily to share experiences, submit completed forms, and solve field problems.

### 2.9 Quantitative Variables

Continuous variables were displayed as means  $\pm$  standard deviation (SD).

### 2.10 Statistical Methods

The data were edited and entered into the computer, cleaned, with range and consistency checks. Descriptive and analytical statistics of the data were carried out using International Business Machine/statistical package for social sciences (IBM/ SPSS) Windows version 22.0 [19]. Descriptive data were presented as simple frequencies and percentages. Tests of statistical significance were carried out using Chi square tests and  $p$  values  $\leq 0.05$  were considered significant. Twenty five (25) knowledge items {Aims of EIA [5]; Types of environmental impacts [3]; Environmental impact cum consequences [9]; Timing of EIA [5]; Factors involved in EIA [3], were used with a total scale score of 100 at four [4] points each, where (0-50= poor; 51-75= fair; 76 - 100 =good).

## 3. RESULTS

Table 1 shows the socio- demographic characteristics of respondents. Three hundred and fifty questionnaires were distributed, returned and were analysed giving a response rate of 100%. The modal age group 240 (68.6%) was 21-25 years, while only one (0.3%) was in the age group 31-35 years. Majority, 195 (55.7%) were males, 331 (94.6%) were never married, 302 (86.3%) were Christians and 230 (65.7%) were of the Ibo ethnic extraction.

Table 2 shows the awareness, and knowledge of EIA among respondents. Two hundred and eighteen (62.3%) respondents reported awareness of EIA. The sources of information on EIA reported by the 218 respondents that have heard of EIA were 111(50.6%) from schools, 109 (50%) from textbooks. Eighty eight (40.3%) of these 218 respondents reported that the aims of EIA include to ensure there is information for decision-making, while 87(40%) and 65 (29.7%) reported participation in decision-making and sound and sustainable development. The commonest type of environmental impacts as was reported by 110 (50.6%) of the 218 respondents, was direct impact, while the examples of environmental impact cum

consequences reported include: 187 (85.7%) global warming, and climate change, 185 (84.9%) greenhouse gases emission, 186 (82.6%), collapse of buildings, 180 (82.6%) air pollution and poor urban air quality, 109 (50%) oil spills. Intra- project and pre - project implementation, were cited as the most common timing for EIA by 181(83%) and 171 (78.4%) of the 218 respectively, while 131 (60.3%) reported impact identification as the commonest factors involved in EIA.

Table 3 highlights the level of knowledge on EIA among respondents. Only (12.6%) out of 350 respondents had good level of knowledge on EIA.

Table 4 shows the participation in EIA process among respondents. Fifty one (14.6%) out of 350 respondents reported ever participated in EIA process, while 34 (9.7%) were participating in EIA process as at the time of the study. The stages of EIA process participated in by the 51 that had ever done, include: 47(92.7%) appraisal (planning and design of the project), 46 (89.7%) screening (description of the project), 46 (89.7%)

decision-making and implementing the project, 46 (89.7%) preparing and presenting of an EIA report/ results (EIAR).

Table 5 shows the factors affecting the level of knowledge of EIA among respondents. There were statistically significant associations between level of knowledge of EIA and [gender ( $\chi^2=9.4528$ ,  $p=0.002$ ) and marital status ( $\chi^2=4.5972$ ,  $p=0.032$ )] among respondents respectively. There was no statistically significant association between level of knowledge of EIA and ever participated in EIA process ( $\chi^2=1.3975$ ,  $p=0.2375$ ).

#### 4. DISCUSSION

This cross-sectional descriptive study determines the knowledge of EIA among undergraduates of the faculty of environmental sciences in a university in Nigeria. This study gauges the environmental awareness and empowerment of this group (agents of change), as a prelude to their potentials towards long term protection and stewardship of the environment [14].

**Table 1. Socio- demographic characteristics of respondents**

Characteristics	Frequency N=350	Percentage (%)
<b>Age at last birthday (in years)</b>		
16-20	85	24.3
21-25	240	68.6
26-30	24	6.9
31-35	1	0.3
<b>Gender</b>		
Male	195	55.7
Female	155	44.3
<b>Marital status</b>		
Never married	331	94.6
Currently married	17	4.9
Separated	1	0.3
Divorced	1	0.3
<b>Religion</b>		
Christianity	302	86.3
Islam	46	13.1
African Traditional religion	2	0.6
<b>Ethnicity</b>		
Ibo	230	65.7
Hausa.	44	12.6
Yoruba.	31	8.9
Others*	45	12.9

\* Others- Edo, Efik, Esan, Urhobo, Igala, Ijaw, Ikwerre, Isoko, Ogoni. Tiv

**Table 2. Awareness and knowledge of EIA among respondents**

<b>Variables</b>	<b>Frequency (N=350)</b>	<b>Percentage (%)</b>
<b>Have heard of EIA</b>		
Yes	218	62.3
No	132	37.7
Total	350	100
<b>Sources of information on EIA (n=218)*</b>		
School	111	50.8
Textbooks	109	50
Seminars/workshops/ conferences	92	42
Radio	47	21.4
Print media	46	21.1
Billboards	29	13.1
Social media	23	10.6
<b>Aims of EIA- To ensure there is (218)*</b>		
Information for decision-making	88	40.3
Participation in decision-making	87	40
Sound and sustainable development	65	29.7
Transparency in decision-making	76	34.9
Proper project planning and design	18	8.4
<b>Types of environmental impacts (n=218)*</b>		
Direct	110	50.6
Indirect	82	37.4
Cumulative	24	10.9
<b>Environmental Impact cum consequences (n=218)*</b>		
Global warming, and climate change	187	85.7
Greenhouse gases emission	185	84.9
Collapse of buildings	180	82.6
Air pollution and poor urban air quality	121	55.4
Oil spills	109	50
Post construction flooding	77	35.1
Diseases, allergies or death of humans,	65	29.7
Species endangerment and loss of biodiversity	61	28
Contamination of soil and groundwater	54	24.9
<b>Timing for EIA (n=218)*</b>		
Pre-project implementation	171	78.4
Intra- project implementation	181	83
Post-project implementation	21	9.7
Peri- project implementation	89	40.6
Not necessary	59	26.9
<b>Factors involved in EIA (n=218)*</b>		
Impact identification	131	60.3
Environmental identification	122	55.7
Impact Prediction	112	51.1

\* Multiple responses

The findings of the index research revealed that about six in every ten respondents had awareness of EIA. Studies elsewhere report general lack of awareness on environmental issues among students surveyed [20,21] and average overall awareness among the study participants [20,22]. In the same light, the results

of a study on 224 undergraduate students in the Family and Consumer Sciences Program in the Hacettepe University, Ankara, Turkey reveal that these undergraduate students' level of environmental awareness is higher than average (3 points) with a value of 3.50 [23]. The slight variations in values, could be linked to

methodological and study area differences in the respective research works. From the findings of the index study, about half of this proportion that had awareness of EIA, reports the commonest sources of information on EIA as schools, and textbooks respectively.

In the present study, the degree of general knowledge of EIA- the aims of EIA, commonest type of environmental impacts, examples of environmental impact cum consequences, etc. were analysed. The analysis also extrapolates findings in tandem with those among undergraduate science students of the colleges of Gurdaspur district of Punjab, India, where, majority of students has an average knowledge of the issue under discuss [24]. This knowledge about EIA should be offered to students more effectively at the secondary school level. This would make it possible for them to be better prepared to deal with this issue on admission into the University.

The level of knowledge on EIA among participants was investigated in the present research work. Only 12.6% of the participants had good level of knowledge on EIA. While there is paucity of studies and data on this subject in our clime, a study in Québec, Canada reports high level of knowledge towards the environment among the students studied [25]. Explanations for these contrasting findings could be due to differences in study areas, methodologies such as study subjects, sampling techniques and data collection tools and procedures.

The findings of the current study reveals that only 14.6% of the study participants reported ever participated in EIA process, while 9.7% were participating in EIA process as at the time of the study. In a reference study, more than seventy percent of students have neither taken active role in EIA in principle [24]. The authors surmise in tandem with the position elsewhere, that active participation of students is an utmost requirement for the protection of environment [24].

**Table 3. The level of knowledge on EIA among respondents**

Overall Knowledge Grade	Frequency (N=350)	Percentage (%)
Poor		
Poor (Have heard of EIA)	122	34.9
Poor (Have not heard of EIA)	132	37.7
Poor (Subtotal)	254	72.6
Fair	52	14.8
Good	44	12.6
Total	350	100

**Table 4. Participation in EIA process among respondents**

Participation in EIA process	Frequency (N) N=350	Percentage (%)
<b>Ever Participated in EIA process</b>		
Yes	51	14.6
No	299	85.4
Total	350	100
<b>Currently Participating in EIA process</b>		
Yes	34	9.7
No	316	90.3
Total	350	100
<b>Stages of EIA process participated in (n=51)*</b>		
Screening (Description of the project)	46	89.7
Scoping (Examination of all environmental effects)	39	76.4
Appraisal (Planning and design of the project)	47	92.7
Decision-making and implementing the project	46	89.7
Mitigation measures, monitoring and evaluating	33	64.1
Preparing and presenting of an EIA report/ results	46	89.7

\*Multiple responses

**Table 5. The factors affecting the level of knowledge of EIA among respondents**

Variables	Overall knowledge Grade				Test statistic( $\chi^2$ )	p value
	Frequency (n)/percentage (%)					
	Poor (%)	Fair (%)	Good (%)	Total (%)		
<b>Gender</b>						
Male	138 (39.4)	23(6.6)	34 (9.7)	195 (55.7)	9.4528	0.002
Female	116 (33.1)	29 (8.3)	10 (2.9)	155 (44.3)		
Total	254 (72.6)	52 (14.8)	44 (12.6)	350 (100)		
<b>Marital status</b>						
Never married	243 (69.4)	49 (14)	39 (11.1)	331 (94.6)	f=4.5972	0.032
Currently married	10 (2.9)	2 (0.6)	5 (1.4)	17 (4.9)		
Separated	0 (0)	1 (0.3)	0(0)	1 (0.3)		
Divorced	1(0.3)	0(0)	0(0)	1 (0.3)		
Total	254 (72.6)	52 (14.8)	44 (12.6)	350 (100)		
<b>Religion</b>						
Christianity	210 (60)	52 (14.8)	40 (11.4)	302 (86.3)	0.9065	0.3411
Islam	43 (12.9)	0(0)	3 (0.9)	46 (13.1)		
ATR **	1(0.3)	0(0)	1 (0.3)	2 (0.6)		
Total	254 (72.6)	52 (14.8)	44 (12.6)	350 (100)		
<b>Ever participated in EIA process</b>						
Yes	29 (8.3)	13 (3.7)	9 (2.6)	51 (14.6)	1.3975	0.2375
No	25 (64.3)	29 (8.1)	35 (10)	299 (85.4)		
Total	254 (72.6)	52 (14.8)	44 (12.6)	350 (100)		

\* Statistically significant association =  $p \leq 0.05$ ,  $\chi^2$ - Chi square test. f- fishers- exact test

\*\* ATR- African Traditional religion

Finally, this study determines that undergraduate students' level of knowledge of EIA vary significantly with gender and marital status among participants respectively. Reports elsewhere, supports that generally, male participants had more environmental knowledge than females [25]. Though we did not analyse gender variations as regards awareness of environmental issues, vis a vis EIA, reports are that overall awareness is higher in boys than in girls [20,21,22,26,27]. However, studies have observed no significant difference in the level of environmental awareness between boys and girls [20,28,29] These results could be due to inability of participants to translate their awareness to knowledge. Our study suggests that given the present dearth of knowledge of environmental issues in Nigeria, there is need for improved exposure to quality messages reiterating the relevance of such issues as EIA. Other studies concur and thus posit that students show more awareness and knowledge towards environmental issues after an introductory environmental course [14,30,31] while overall, we propose that focusing more resource and effort on awareness and active participation in EIA is likely an effective way to meeting the demands of poor knowledge of EIA among the select group [30].

More research needs to be conducted on the area of relationships between level of knowledge of EIA and gender, marital status cum ever participated in EIA process respectively. These studies are thus needed to make up for the unmet challenge of dearth of data and information, and transforming it into knowledge needed to provide support evidence for policy and decision -making., as well as help improve both effectiveness and efficiency of the EIA process.

## 5. LIMITATIONS AND STRENGTH OF THE STUDY

This study is a little old and conducted in the period of 2016, but will no doubt, provide contributions to scientific studies. Also, the study is based on self-reported practice which may not match actual situation, and the data is therefore subject to reporting errors. The biases would have been minimized by self-administration of survey tool, absence of lecturers in the class and anonymity entrenched in data collection. Another limitation is the use of cross-sectional design and researchers as an inclusion in further studies, may use some more statistical tools to explain different variables relationship through correlation/regression among environmental awareness and empowerment. A major strength

of this study is in the high response rate (100%) achieved.

## 6. CONCLUSIONS

This study examined the knowledge of EIA among undergraduates of the faculty of environmental sciences in a university in Nigeria. This study found apparently poor awareness of EIA among respondents, with source of information mostly via schools and textbooks. Level of knowledge of EIA was poor. Active participation in EIA process was also poor. The level of knowledge on EIA vary significantly with gender and marital status. We recommend comprehensive but targeted need-based environmental education to help create awareness, impart knowledge, device means to encourage efficient participation in EIA and equip these students with EIA strategies and skills to handle environmental challenges.

## CONSENT AND ETHICAL APPROVAL

Ethical approval was obtained from the appropriate authorities in the institution of study. Written consent of the respondents was also solicited and obtained for the conduct and publication of this research study. Study participants were free to refuse or withdraw from the study at any time without any penalty. All authors hereby declare that the study has been examined and approved by the Department of Community Medicine Madonna University ethics committee, Elele, Nigeria and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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