



*Physics Teachers and Students Level of Awareness on ... Ogundeji, O. M. & Okoye, N. E. (2026)*

## **Physics Teachers and Students Level of Awareness on Energy and Society Concepts in Nigeria Secondary Schools: Implication for Energy Efficiency and Environmental Sustainability**

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### **Abstract**

*The role of education and information initiatives in schools is crucial in ensuring all citizens are energy aware. Thus, the study seeks to find out the level of students' awareness of energy and society concepts in Nigerian secondary schools and its implication to energy efficiency and a sustainable environment. Two research questions and one null hypothesis guided the study. The study adopted a descriptive survey research design. The sample size of 240 senior secondary three (SS3) physics students and teachers are drawn from the population were used for the study. Proportionate stratified random and Purposive sampling techniques were used to obtain the sample size. A questionnaire on Energy and Society Concepts (QESC) developed by the researcher to measure students' level of awareness of energy and society concepts was used for the study. Frequencies and percentages were used to answer all the research questions and chi-square for testing the null hypothesis of the study. Findings of the study revealed that the majority of Nigeria physics teachers and students are at Low and Very Low Levels of awareness of Energy and Society Concepts; and no statistically significant difference in the level of awareness of energy and society concepts among secondary school teachers and students of physics. It implies therefore that, improvement in the level of awareness of energy and society concepts in schools might promote: students' achievement in Energy and Society Concepts; best practices of energy use at home; and diversification into clean energy which is environmentally friendly.*

**Key Words:** Awareness, Energy and Society Concepts, Secondary School

### **Introduction**

The challenges facing the energy sector of Nigeria are enormous. Research has identified four (4) major barriers that border on the improvement of energy efficiency for users (Arup, 2016). One of the barriers is lack of an awareness and information on the benefit of Energy Efficiency measures to users. Benefits of Energy Efficiency were grouped into three (3) namely: social, economic, and environmental benefits (Arup, 2016). The benefits are consistent with the principles of sustainability development (Brundtland Report published by the World Commission on Environment and Development in 1987 as cited in United Nation Headquarters, 2012). This implies that, there exist a bond between energy efficiency and a sustainable energy environment. Although, the study of Din, Haron, & Ahmad, (2013) found that citizen engagement in the sustainability of their environment will still take some time. Since, global demand for energy consumption especially in the form of fossil fuels or grid, having its consequential effect, is increasing. In Nigeria, for example, households account for the large majority of electricity consumption (about 50%). Household energy sources come from: Hydro (0.4%), Oil/gas (17%) and Biofuel & waste (mainly firewood) (82%) (Energy Commission of Nigeria, 2014). This is obvious that Nigeria society over rely on fossil fuels and her citizen may lack engagement in the sustainability of her environment.



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To this effect, the consciousness of raising a society that is very aware of the changing environment, as well as continuously engaging in practices to sustain the environment is critical, even in this era of rapid industrial growth. Every sector must come up with policies and initiatives that will not jeopardise the safety of the world for mankind (Din, Haron, Ahmad, 2013). Since, experts have revealed that Nigeria can save up to half of the energy currently consumed in the country if energy is efficiently utilized (Uyigüe, Agho, Edevbaro, Godfrey, Uyigüe, and Okungbowa, 2009). Energy efficiency implies the use of energy in a manner that will minimize the amount of energy needed to provide services. There are two approaches to achieving energy efficiency (Uyigüe, et. al., 2009). The first one is the technological approach while, the second is the behavioural approach. For the technological approach, it stressed the need to change the type of technology used to a more efficient (i.e. Energy saving) one. For example: replacing incandescent bulbs usage with compact fluorescent light bulbs. While, the behavioural approach entails changing the way things are done. e.g. switching off appliances when not in use. The implication is that, energy consumption is critical to environmental sustainability, but waiting for energy efficiency education for its solution. Education is paramount in a bit to ensure that all citizens are energy aware. Europeans are extending energy education and information initiatives to school students of all ages (Anonymous, 2006), Nigerians should not do less. Primary and secondary school students should be exposed to energy education. Education has a strategic role in improving energy efficiency. So, teachers of Physics should be able to lead the discussion on the energy efficiency in our various secondary schools and by extension, the general public.

The present Nigeria secondary school physics curriculum (as revised by Nigerian Educational Research and Development Council, NERDC, 2008) which has been in use since 2011, buttressed this viewpoint of the present study. It gives Physics teachers the responsibility to train students in energy education at the secondary school level. Physics curriculum considered Energy and Society concepts relevant under the Conservation Principles themes. As enshrined in the curriculum, sources of energy; renewable and non-renewable energy; uses of energy; energy and development; energy diversification and conservation; environmental impact of energy use: global warming, climate change, green-house effect, oil spillage, and energy crisis, were sub-topics of Energy and Society. Apart from the fact that the concept of “energy efficiency” is not well captured in the present curriculum, it seems some physics teachers are not even aware of the additional topics and thematic arrangement of the present Nigerian secondary school physics curriculum. The study by Guven and Sulun (2017) revealed that there is a lack of awareness and knowledge of renewable energy among pre-service teachers in Turkey. In Nigeria, Ogundeji et. al., (2020) found that physics and technical teachers lack adequate knowledge of solar energy concepts in Oyo State. On this same issue, Daramola and Omosewo (2012) had earlier lamented that Nigeria Physics educators are not competent to teach some topics in the new curriculum especially topics under Physics in technology. Of course, secondary school students might lack the understanding of energy and society concepts if studies, like: Guven, et. al., (2017); Ogundeji, et. al., (2020); Daramola, et. al., (2012) has reported that physics teachers do not have adequate knowledge about renewable energy, which is part of Energy and Society Concepts. The study by Oruonye (2011) on the level of awareness of climate change among students of tertiary institutions in Jalingo Metropolis of Taraba, Nigeria, revealed that out of the 81.8% that have heard about climate change, 89% do not know what climate change is all about; its causes, effects, and possible adaptive or mitigative measures. Though the study was conducted in tertiary institution over a decade now, while the present study in secondary school, the feelings is that students of this educational level are not still aware of energy and society concepts especially in Zamfara State, Nigeria. It is based on this background, that the researcher wishes to



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find out: the level of awareness of energy and society concepts among teachers and students in Nigerian secondary schools, and its implication on energy efficiency and a sustainable environment.

**Purpose of the Study**

The main objective of this study is to find out the level of awareness of energy and society concepts in Nigerian secondary schools and its implication on energy efficiency and a sustainable environment. Specifically, the study seeks to find out:

1. If the Nigerian secondary school teachers and students of physics are aware of “Energy and Society concepts” as situated in Nigerian Secondary School Physics Curriculum
2. the level of awareness of energy and society concepts among Nigeria secondary school teachers and students of physics.

**Research Questions**

The following research questions were posed to guide the study:

1. Are you aware of any sub-theme in the Nigeria Secondary School Physics Curriculum called Energy and Society?
2. What is the level of awareness of energy and society concepts among Nigeria secondary school teachers and students of physics?

**Hypotheses**

1. There is no statistically significant in the level of awareness of energy and society concepts among Nigerian secondary school teachers and students of physics.

**Methodology**

This study adopted a descriptive survey research design that aimed at collecting data on, and describing in a systematic manner the characteristics, features or facts about a given population. The population for this study was 2,148 senior secondary students’ class III and 21 physics teachers in all the 7 out of 8 science and technical schools in Zamfara State, Nigeria. Because, one school was closed down because of insecurity. A sample of 240 (228 physics students and 12 physics teachers) was used for the study. The proportionate stratified random sampling technique and purposive sampling technique procedure were adopted in composing the sample. The proportion of 0.106 (i.e. 10.6%) was used to select 32, 22, 76, 24, 21, 13, and 40 physics students from science and technical schools located at Bakura, Bukkuyum, Gusau, Kauran Namoda, Maru, Shinkafi and Talata Mafara Local Government Areas of Zamfara State. Meanwhile, the entire physics teachers that have taught SSIII physics in recent times was selected purposively in all the schools. A questionnaire on Energy and Society Concepts (QESC) was developed by the researcher to measure both teachers’ and students’ level of awareness of energy and society concepts. QESC has two sections A and B. Section A has two items having “yes” and “no” responses and was only meant for teachers, while, Section B (meant for teachers and students) has 13 items having the following response patterns: High Level (HL), Average Level (AL), Low Level (LL), Very Low Level (VLL). The method of delivery employed was the direct delivery method, whereby the researcher administers and retrieve the filled instruments on the spot. Thereafter, frequency was used to answer all the research questions and chi-square was used in testing the null hypothesis under study.

**Presentation of Results**

**Research Question One:** Are you aware of the concept “Energy and Society” as positioned in the Nigerian Secondary School Curriculum?

**Table 1: Frequency and Percentage Analysis of the awareness of Energy and Society as positioned in the Nigeria Secondary School Curriculum**

S/N Item Statement	Yes	No
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	f (%)	f (%)
1 Is there any sub-theme in the Nigeria secondary school physics curriculum called Energy and Society	7(58.3)	5(41.7)
2 Energy and Society Concepts are situated under thematic area called Conservation Principles	4(33.3)	8(66.7)

Table 1 revealed that 58.3 per cent of the physics teachers are aware of “Energy and Society” as one of the sub-themes in the Nigeria secondary school curriculum, but only 33.3 per cent knows how it was correctly positioned in the Nigerian secondary school curriculum.

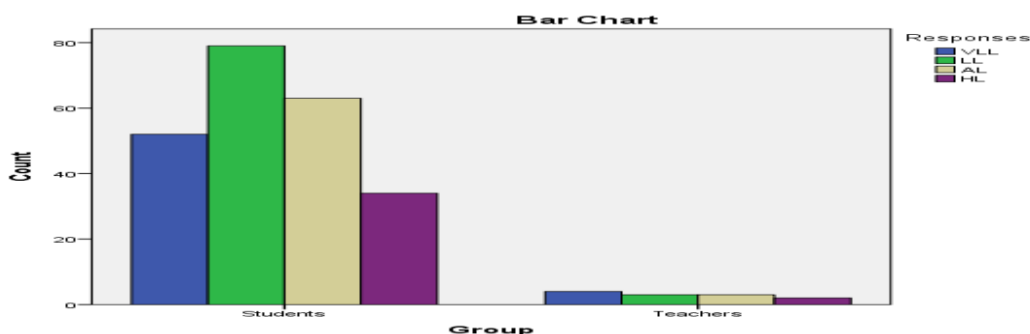
**Research Question Two:** What is the level of awareness of energy and society concepts among Nigeria secondary school teachers and students of physics?

**Table 2: Frequency and Percentage Analysis of the level of awareness of energy and society concepts among Nigeria secondary school teachers and students of physics**

S/N	Energy and Society Concepts	Teachers (12)				Students (228)			
		HL f (%)	AL f (%)	LL f (%)	VLL f (%)	HL f (%)	AL f (%)	LL f (%)	VLL f (%)
1	Renewable Energy	9(75.0)	1(8.3)	2(16.7)	0(0.0)	138(60.5)	56(24.6)	29(12.7)	5(2.2)
2	Non-renewable Energy	9(75.0)	1(8.3)	2(16.7)	0(0.0)	127(55.7)	66(28.9)	29(12.7)	6(2.6)
3	Energy and development	0(0.0)	3(25.0)	6(50.0)	3(25.0)	8(3.5)	62(27.2)	117(51.3)	41(18.0)
4	Energy diversification	0(0.0)	4(33.3)	5(41.7)	3(25.0)	14(6.1)	61(26.8)	112(49.1)	41(18.0)
5	Energy Conservation	6(50.0)	4(33.3)	2(16.7)	0(0.0)	115(50.4)	79(34.6)	28(12.3)	6(2.6)
6	Energy Efficiency	0(0.0)	2(16.7)	4(33.3)	6(50.0)	0(0.0)	59(25.9)	77(33.8)	92(40.4)
7	Green House Effect	0(0.0)	3(25.0)	2(16.7)	7(58.3)	0(0.0)	59(25.9)	75(32.9)	94(41.2)
8	Global warming	0(0.0)	4(33.3)	5(41.7)	3(25.0)	15(6.6)	62(27.2)	110(48.2)	41(18.0)
9	Climate change	0(0.0)	3(25.0)	2(16.7)	7(58.3)	1(0.4)	62(27.2)	75(32.9)	90(39.5)
10	Energy tax	0(0.0)	2(16.7)	4(33.3)	6(50.0)	0(0.0)	59(25.9)	77(33.8)	92(40.4)
11	Oil Spillage	0(0.0)	5(41.7)	4(33.3)	3(25.0)	5(2.2)	73(32.0)	106(46.5)	44(19.3)
12	Energy Crisis	0(0.0)	4(33.3)	5(41.7)	3(25.0)	14(6.1)	63(27.6)	110(48.2)	41(18.0)
13	Energy Efficiency Building	0(0.0)	1(8.3)	3(25.0)	8(66.7)	4(1.8)	56(24.6)	81(35.5)	87(38.2)
<b>ONR</b>		<b>2(15.3)</b>	<b>3(23.7)</b>	<b>3(29.5)</b>	<b>4(31.5)</b>	<b>34(14.9)</b>	<b>63(27.6)</b>	<b>79(34.6)</b>	<b>52(22.9)</b>

ONR: Overall number of Respondent. n = Number of Respondents; VLL= Very Low Level; LL = Low Level; AL = Average Level; HL = High Level; F = frequency; % = Percentage.

From Table 2 showing the overall responses of the respondents, it was revealed that physics teachers are aware of Energy and Society Concepts at 2(15.3%) on HL; 3(23.7%) on AL; 3(29.5%) on LL and 4(31.5%) on VLL. Out of 12 physics teachers that participated in the research, only 5(39%) were above Average Level, while, more than half of the teachers were below average. Similarly, physics students showed that they are aware of Energy and Society concepts at 34(14.9%) on HL; 63(27.6%) on AL; 79(34.6%) on LL and 52(22.9%) on VLL. Out of 228 physics students that participated in the research, only 97(42.5%) physics students were above Average Level, while, more than half of the students were below average.



However, the chart above (Fig.1) revealed how awareness of Energy and Society concepts was distributed to levels among physics teachers and students’ in Nigeria secondary schools. The chart



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showed clearly that the larger percentage of respondents were at Very Low Level (VLL) and Low Level (LL) on the awareness of Energy and Society concepts in Nigeria secondary schools. While, fewer percentage of respondents were at Average Level (AL) and High Level (HL) on the awareness of Energy and Society concepts in Nigeria secondary schools. To this end, the chart revealed that the level of awareness of energy and society concepts among Nigeria secondary school teachers and students of physics is below Average Level.

**Hypothesis One:** There is no statistically significant difference in the level of awareness of energy and society concepts among Nigeria secondary school teachers and students of physics.

**Table 3: Chi-square Analysis of the Level of Awareness of Energy and Society Concepts among Nigeria Secondary school Teachers and Students of physics.**

Item no.	Teachers (n = 12)				Students (n = 228)				$\chi^2$	P-value	Dec
	HL f (%)	AL f (%)	LL f (%)	VLL f (%)	HL f (%)	AL f (%)	LL f (%)	VLL f (%)			
1	9(75.0)	1(8.3)	2(16.7)	0(0.0)	138(60.5)	56(24.6)	29(12.7)	5(2.2)	2.06	0.56	NS
2	9(75.0)	1(8.3)	2(16.7)	0(0.0)	127(55.7)	66(28.9)	29(12.7)	6(2.6)	2.94	0.40	NS
3	0(0.0)	3(25.0)	6(50.0)	3(25.0)	8(3.5)	62(27.2)	117(51.3)	41(18.0)	0.75	0.86	NS
4	0(0.0)	4(33.3)	5(41.7)	3(25.0)	14(6.1)	61(26.8)	112(49.1)	41(18.0)	1.36	0.72	NS
5	6(50.0)	4(33.3)	2(16.7)	0(0.0)	115(50.4)	79(34.6)	28(12.3)	6(2.6)	0.50	0.92	NS
6	0(0.0)	2(16.7)	4(33.3)	6(50.0)	0(0.0)	59(25.9)	77(33.8)	92(40.4)	0.64	0.73	NS
7	0(0.0)	3(25.0)	2(16.7)	7(58.3)	0(0.0)	59(25.9)	75(32.9)	94(41.2)	1.73	0.42	NS
8	0(0.0)	4(33.3)	5(41.7)	3(25.0)	15(6.6)	62(27.2)	110(48.2)	41(18.0)	1.36	0.72	NS
9	0(0.0)	3(25.0)	2(16.7)	7(58.3)	1(0.4)	62(27.2)	75(32.9)	90(39.5)	2.01	0.57	NS
10	0(0.0)	2(16.7)	4(33.3)	6(50.0)	0(0.0)	59(25.9)	77(33.8)	92(40.4)	0.64	0.73	NS
11	0(0.0)	5(41.7)	4(33.3)	3(25.0)	5(2.2)	73(32.0)	106(46.5)	44(19.3)	1.21	0.75	NS
12	0(0.0)	4(33.3)	5(41.7)	3(25.0)	14(6.1)	63(27.6)	110(48.2)	41(18.0)	1.28	0.73	NS
13	0(0.0)	1(8.3)	3(25.0)	8(66.7)	4(1.8)	56(24.6)	81(35.5)	87(38.2)	4.18	0.24	NS

n = No. of Respondents; VLL= Very Low Level; LL = Low Level; AL = Average Level; HL = High Level; F = frequency; % = Percentage;  $\chi^2$  = Chi-Square; p-value = Probability value; df = Degree of freedom; Dec = Decision

The result presented in Table 3 revealed that all the items showed not significant (NS), since their probability values ranging from 0.24 to 0.98 was greater than the level of significance set at 0.05 for testing hypothesis. The above result was further confirmed by the overall trace analysis below.

**Table 4: Overall Trace Analysis of the Level of Awareness of Energy and Society Concepts among Nigeria Secondary school Teachers and Students of Physics.**

Group	Response					$\chi^2$	df	p-value	Dec.
	HL	AL	LL	VLL	Total				
Students	34	63	79	52	228	0.904	3	0.824	NS
Teachers	2	3	3	4	12				
	36	66	82	56	240				

VLL= Very Low Level; LL = Low Level; AL = Average Level; HL = High Level;  $\chi^2$  = Chi-Square; p-value = Probability value; df = Degree of freedom; Dec = Decision

The result presented in Table 4, revealed the probability value (0.824) which was greater than the level of significance (0.05). This further confirms the decision that the hypothesis is NS (Not Significant). Hence, the null hypothesis was not rejected by the researcher. Thus, no statistically significant difference in the level of awareness of energy and society concepts among Nigerian secondary school teachers and students of physics.

## Discussion

The present study showed that more than average physics teachers are aware of Energy and Society concepts as sub-themes in the Nigeria secondary school curriculum, but only 33.3% knows how it



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was correctly positioned in the Nigeria secondary school curriculum. By implication, this fewer percentages only understands its role to the society at large. However, it was further revealed that physics teachers and students were at 39% and 42.5% level of awareness of Energy and Society Concepts respectively. These percentages are below average, meaning that, majority of Nigeria physics teacher and students are at Low Level and Very Low Level on level of awareness of Energy and Society Concepts. Also, findings of the study revealed no statistically significant different in the level of awareness of energy and society concepts among Nigeria secondary school teachers and students of physics. These findings are in agreement with the findings of the recent studies (Anonymous, 2006; Oruonye, 2011; Daramola and Omosewo, 2012; Guven and Sulun, 2017; Yuksel (2020); Ogundeji et. al., 2020; Din, Haron, & Ahmad, 2013; Arup, 2016; Uyigue, et. al., 2009). Findings of Anonymous (2006) who affirm that Europeans are extending energy education and information initiatives to school students of all ages; Oruonye (2011) revealed that 89% of students of tertiary institutions in Jalingo Metropolis of Taraba do not know the causes, effects, and possible adaptive or mitigative measures of climate change; justified the fact that education on energy and society concepts are needed right from the primary and secondary school learners. To achieve this majority of physics teachers needed to be aware or improve in the level of their awareness of energy and society concepts. This is consistent with Daramola and Omosewo (2012) who had earlier professed and lamented that Nigeria Physics educators are not competent to teach some topics in the new curriculum i.e. Energy and Society concepts, Physics in technology topics among others; Ogundeji et. al., (2020) who found that physics and technical teachers lack adequate knowledge of solar energy concepts in Oyo State (since, solar energy is one of the areas under renewable energy which is also under Energy and Society); and Guven and Sulun (2017) who revealed that there is lack of awareness and knowledge of renewable energy among pre-service teachers in Turkey. However, Din, Haron, & Ahmad, (2013) confirmed that lack of education on energy and society concepts as implications citizen engagement in environmental sustainability vis-a-vis energy efficiency. However, the findings of Uyigue, et. al., (2009) further strengthen the findings of the study on the relevance on energy and society education to energy efficiency. These findings have some implication on education, energy efficiency, and environmental sustainability. For instance, improvement in the level of awareness of energy and society concepts in schools might: promote students' achievement in examinations; promote best practices on energy use at home, teach a technological and behavioural approaches to be adopted for managing energy effectively; and diversify into clean energy (rather than over- reliance on energy through fossil fuel i.e generator) which is environmentally friendly because it does not release harmful substances into the environment and does not make noise.

## Conclusion

The level of students' awareness of energy and society concepts in Nigerian secondary schools and will have implication on energy efficiency and a sustainable environment. It should therefore be of paramount importance to Nigeria Society. This is the thrust of this present study. Findings of the study buttressed this fact: that improvement in the level of awareness of energy and society concepts in schools is desired to promote: students' achievement in Energy and Society Concepts; best practices of energy use at home; and diversification into clean energy that is environmentally friendly.

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