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EFFECT OF THE USE OF SCIENCE PROCESS SKILLS APPROACH IN TEACHING ENVIRONMENTAL EDUCATION CONCEPT ON SENIOR SECONDARY SCHOOL BIOLOGY STUDENT'S ACADEMIC PERFORMANCE IN SABON-GARI LOCAL GOVERNMENT AREA OF KADUNA STATE

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Abstract

The research titled "Effect of the Use of Science Process Skills Approach in Teaching Environmental Education Concept on Senior Secondary School Biology Student's Academic Performance in Sabon-Gari Local Government Area of Kaduna State. The study was based on two (2) research objectives and in order to achieve these objective; two (2) research questions and two (2) hypotheses were formulated.The experimental research design was employed in the conduct of this study.The study total population comprised of one thousand eight hundred and eighty seven (1887) SS II Biology students from ten (10) senior secondary schools in the study area, five (5) schools were purposively selected and used for the study with total population of four hundred and twenty (420) SS11 biology students with sample size of two hundred (200).The research instrument that was used in the study consist of performance multiple-choice objective test developed by the researcher which will be main primary source of collecting data. A pre-test was given and data collected. After three weeks treatment, post-test was given. Data collected for pre and post-test were subjected to analysis of variance (ANOVA).Findings from the study indicated that there is no significant difference on effect of learning environmental education using science process skills on secondary school students' academic performance in Biology; there is significant difference in the academic performance of students in biology when taught with science process skills and when taught with lecture method. Recommendations were made as follows environmental education should be taught using science process skills as it encouraged maximum student participation in the learning activities and the acquisition of knowledge in the field of science, in senior secondary schools in Sabon-gari local government area of Kaduna State; Teachers should also impore appropriate approaches in teaching and learning environmental education in senior secondary schools in Sabon-Gari local government area of Kaduna State

Keywords: Environmental Education, Science Process Skills, academic performance, Test,

Introduction

Environment denotes a broad and comprehensive term referring to all that surrounds human: air, water, soil and light. It is a condition or circumstance that affects living beings. Environment could be said to consist of all external factors and forces with which one interacts from conception until demise. It includes the physical, chemical, biological, psychological andsocio-cultural dimensions and in fact everything that makes up the context in which the individual lives (Mbalisi and Ugwu, 2012). Learning about them and theirinterrelationship could be termed Environmental Education (EE).But in reality in the field the learning process that trains students' science process skills is not optimal. Based on the results of several studies on science process skills, the results obtained in the aspect of predicting. This is because students only memorize concepts without ever seeing them

directly or practicing them, Ilma, *et al* (2020). In developing a process of sense of responsibility and increasing the importance of research methods in the learning process students need science process skills that are formed through an independent learning process (Harahap, 2019) Therefore, it is important to be understood by teachers because of the importance of these skills in science learning (Harahap, 2019). Teachers are often more concerned with learning outcomes obtained by students, especially in the cognitive domain, rather than the processes experienced by students.Environmental Education (E.E) desires much attention, due to the environmental challenges that are facing the society, most especially the developing nations. Education seems to be the major tool to combat environmental degradation, climatic challenges, flooding, and indiscriminate dumping of refuse, poor knowledge of refuse disposal, unhygienic living, and unkempt or untidy environment (Mbalisi and Ugwu, 2012).

Environmental Education is the acquisition of knowledge of how man can manage environment to bring about comfortable, healthy and worthwhile living. It is also about the study ofenvironmental challenges. It is aimed at preventing human factors that constitute environmental challenges, and to have awareness of the challenges to be surmounted and to make environmenthabitable for people' survival, and comfort. Environmental Education is a process in which individuals gain awareness of their environment, acquire knowledge, skills, values, experiences, and also the determination and enablement to act individually and collectively, to solve present and future environmental problems. Environmental education is aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems,awareness of how to help solve these problems. Environmental Education stimulates motivation towards finding solutions as potential dangerous trajectory of the globe based on humans' activities become more evident(Mbalisi and Ugwu, 2012).

The Basic Science Process Skills (BSPS) include the following:

i. **Observing**: Noting the properties of objects and situations using the five senses. It is description of what was actually perceived.
ii. **Measuring**: Expressing the amount of an object or substance in quantitative terms.
iii. **Inferring**: Giving an explanation for a particular object or substance in quantitative terms.
iv. **Classifying**: Relating objects and events according to their properties or attributes.
v. **Predicting**: Forecasting a future occurrence based on past observation or the extension of data.
vi. **Communicating**: Using words, symbols, or graphics to describe an object, action or event.
vii. **Controlling variables**: Manipulating and controlling properties that relate to situations and events or the purpose of determining causation.
viii. **Hypothesizing**: Stating tentative generalization of observations or inferences that may be used to explain a relatively larger number of events but that is subject to immediate or eventual testing by one or more experiments.
ix. **Experimentation**: Testing a hypothesis through the manipulation and control of independent variables and noting the effects on a dependent variable: interpreting and presenting results in the form of a report that others can follow to replicate the experiment.

x. **Data Interpreting**: Arriving at explanations, inference, or hypotheses from data that have been graphed or replace with table (Afif and Majdi, 2015).

Science is a great enterprise which nations depend on, inorder to advance technologically.Science education occupies important position in the growth and development of a nation (Odunnusi, 2011). Muhammad (2014) observed that the economic and political strength of a nation is always assessed in terms of its achievement in science and technology. The awareness of the importance of science and technology as the basic tools for industrialization and national development has made science educators to continually seek for avenues in making teaching and learning of science very effective (Muhammad, 2014).

In essence, studying biology is the process of finding facts, concepts, and principles that are not just mastery of science. But it is necessary to learn about how to obtain information through scientific skills. Biology as an integral part of scienceprovides various ways to acquire knowledge through a number of science process skills activities by means of inquiry, observation and experiment. Biology learning must emphasize the process by which students build the knowledge obtained from the learning activities they experience. Biology learning should be designed to provide students with opportunities to discover facts, construct concepts, and discover new value through the process as scientists discover knowledge (Muhammad, 2014).

Science educators and Specialists believe that teaching science must be divided into two parts (materials and methods). he first one includes the facts, concepts, laws and theories, while the second part includes scientific thinking, critical thinking and scientific processes. In general, teachers evaluate the first part and ignore the second because they feel that teaching thinking skills and science processes is a waste of time and effort. According to Blooms taxonomy, educational objectives are divided into three "domains": cognitive, affective and psychomotor. In the Nigerian schools, science teacher's focus on the cognitive outputs rather than the other outputs such as those related to the effective domain which includes students' attitudes toward science. The aim of this study is to evaluate the effect of the Use of Science Process Skills Approach in Teaching Environmental Education Concept on Senior Secondary School Biology Student's Academic Performance in Sabon-Gari Local Government Area of Kaduna.

Objectives of the Study

The study is guided by the following objectives:

1. Examine the effect of learning environmental education using science process skills can impact secondary school students' academic performance in Biology.
2. Examine the difference on the academic performance among Biology students in environmental education using the science process skills approach and those taught using the Lecture method of instruction.

Research Questions

The following research questions were formulated for this study;

1. How does the learning of environmental education using science process skills impact secondary school students' academic performance in biology?
2. What is the difference in the academic achievement among biology students in environmental education using the science process skills approach and those taught using the Lecture method of instruction?

Research Hypotheses

The following hypotheses were tested for this study:

i. There is no significant difference on the effect of learning environmental education using science process skills can impact secondary school students' academic performance in Biology
ii. There is no significant difference in the academic performance among biology students in environmental education using science process skills approach and those taught using lecture method of instruction

Methodology

The study adopted a Pre-Test & Post-Test intact class quasi-experimental design. The study was conducted in Sabon-Gari Local Government Area Kaduna State, Nigeria.

The study population comprised of one thousand eight hundred and eighty seven (1887) SS II Biology students from ten (10) secondary schools in the study area, five (5) schools were purposively selected and used for the study with population of four hundred and twenty (420) SS11 biology students were used for the study.

According to Krejcie and Morgan, 1970 sample size determination table drawn out from four hundred and twenty (420) in five (5) schools were two hundred (200) SS11 biology students.

Table 1: Sample Population

S/N	Name of Ward Selected	No of People Sampled
1	Dogon Bauchi Secondary School S/Gari, LGA, Kaduna State	52
2	Aminu Government Secondary School S/Gari, LGA, Kaduna State	54
3	Muchia Secondary School S/Gari, LGA, Kaduna State	42
4	Government Secondary School Chindit BarrackS/Gari,LGA, Kaduna State	32
5	Government Secondary School KwangilaS/Gari, LGA, Kaduna State	20
		Total= 200

Source: Field Survey 2022

The research instrument that was used in the study consist of performance multiple-choice objective test developed by the researcher which was the main primary source of collecting data.A pre-test was given and data collected. After three weeks treatment, post-test was given.

Data collected for pre and post-test were subjected to analysis of variance (ANOVA).

Table 2: Analysis of Students performance test questions in biology

S/N	Questions	Objective Options	Answers	Percentage%	
			Right answer	Failed%	Passed%
1	Environment consists of factors and force which human interacts with includes the	a. Physical b. Chemical c. Biological d. Thermal	√	58%	42%
2	following except Environment is broad term which refers to all that	a. weather b. Air c. soil d. water	√	59%	41%
3	surround man EXCEPT: Human activities have effects on the environment	a. global warming b. ozone layer depletion c. green house effect d. drought		60%	40%
4	in the following ways except: _____ has		√		
5	caused serious environmental damage	a. mechanization b. industrialization c. overpopulation d. humanization	√	35%	65%
6	____ causes rise in atmospheric temperature.	a. gases b. bush burning c. noise d. weather	√	46%	54%
7	___ is not good for the environment:	a. over-population b. reproduction c. building of houses d. farming	√	59%	41%
8	Urban centers are becoming more noisy and filthy as a result of _____	a. overpopulation b. unemployment c. industrialization d. weather	√	50%	50%
	Increase in the number of vehicles and industries have resulted in high rate of ___	a. noise b. pollution c. gas emission d. mechanization	√	60%	40%

Source: Field Survey 2022

The table above shows that, item 1 58% of biology students who attempted the achievement failed while 42% passed, in item 2, 59% biology students failed 41% passed, in item 3, 60% biology students failed 40% passed, item 4, 35% biology students failed 65% passed, in item 5, 46% biology students failed 54% passed, in the item 6 also, 59% biology students failed 41% in item 7, 50% biology students failed 40% passed, passed, while in the item 8, 60% biology students failed 40% passed respectively, this indicated that, the percentages of the failure students of biology in environmental education has the highest percentages.

Table 3: Analysis of Students performance test questions in biology

S/N	Questions	Objective Options	Answer	Percentages	
			Answer	Failed%	Passed %
9	Throwing of waste indiscriminately causes one of the environmental problems:	a. noise pollution b. air pollution c. sand pollution d. house pollution	√	40%	60%
10	One of the impact of the monthly environmental sanitation is to:	bring people together monitor people's cleanliness c. bring about an healthy environment	√	71%	29%
11	The existence of the following in the same place has pose serious problems EXCEPT:	d. to know if people can work or not a. factories	√	64%	36%
12	Exploitation of the environment can cause ___ to the environment.	b. workshops c. residential houses d. vehicles	√	65%	35%
13	The study of __ using science process skills develops skills in the learner which he or she could use in solving everyday problem.	a. serious havoc b. renew c. replacement d. repair	√	30%	70%
14	Environmental education is:	a. Environmental education b. Environmental knowledge c. Environmental issues d. Environmental studies	√	25%	75%
15	Environmental education using science process skills encourages	Acquisition of education on man acquisition of education on how man can manage the environment acquisition of education on the environment acquisition of education on how the environment isinfluenced	√	35%	65%
16	Environmental education aims at:	a. maximum student participation in the learning activities b. the acquisition of knowledge in the field of science c. all of the above d. none of the above producing a citizenry that	√	49%	51%

		has knowledge on the environment, its problems and how to solve these problems motivating people to study the environmental education solving environmental problems providing knowledge on the environment			

Source: Field Survey 2022

The table above shows that, item 9 40% of students who attempted the achievement failed while 60% passed, in item 10, 71% students failed and 29% passed, in item 11, 64% students failed 36% passed, item 12, 65% students failed while 35% passed, in item 13, 30% students failed 70% students passed, in the item 14 also, 25% students failed 75% passed, in item 15, 35% students failed 65% students passed, while in the last item on the table item 16, 49% students failed 51% passed respectively, this indicated that, the percentages of the failure students of in environmental education has the highest percentages.

Table 4: Analysis of Students performance test questions in biology

S/N	Questions	Objective Options	Answers	Percentages	
			Right answers	**Failed%**	**Passed%**
17	Problems associated to the environment includes the	a. pollution b. industrialization c. resource use d. energy utilization	√	48%	52%
18	following EXCEPT:	a. awareness b. knowledge c. attitude d. responsibility	√	55%	45%
19	The following are the objectives of environmental education EXCEPT	a.environmental knowledge b. environmental studies c. environmental education	√	32%	68%
20	__ is often used to imply education the school system from primary to post primary	d. science knowledge a. living and non-living b. natural and man-made c. living and natural d. man-made and non-living	√	47%	53%
21	In Nigeria, the environment is riddled with ____ problems:	a. AKADEM b. PESADN c. AKASEP d. MASEPK	√	74%	26%
22	Objectives of environmental education can be summarized :	a. skills that student use to become scientist b. skills that teachers use to become scientist c. inquiry skills used by scientists in their scientific investigation d. all of the above	√	43%	57%
23	Science process skills can be seen as:	a. basic process skills and		50%	50%

		enquiry process skills b. intergrated process skill and basic process skills c. basic process skills and inquiry process skills			
24	Science process skills can be categorize into__and__ Science process skills helps to EXCEPT:	d. inquiry process skills and inquiry process skills facilitate the learning of science ensures active students participation develop the sense of understanding and responsibility d. to be a scientist	√	49%	51%

Source: Field Survey 2022

The table above shows that, item 17 48% of the students who attempted the achievement failed while 52% passed, in item 18, 55% students failed and 45% passed, in item 19, 32% students failed 68% passed, item 20, 47% students failed while 53% passed, in item 21, 74% students failed 26% students passed, in the item 22 also, 43% students failed 57% passed, in item 23, 50% students failed 50% students passed, while in the last item on the table item 24, 49% students failed 51% passed respectively, this indicated that, the percentages of the passed students of biology in environmental education has the highest percentages.

Table 5: Analysis of Students Performance test questions in biology

S/N	Questions	Objective Options	Answers	Percentages	
			Answers	Failed %	Passed %
25	Science process skills requires the following except:	a. collecting data b. processing data c. interpretation of data d. reaching conclusion	√	79%	21%
26	Science process skills are classified into__	a. 3 b. 4 c. 2 d. 5	√	52%	48%
27	The five science process skills that can be achieved through the study of	a. observing b. inferring c. manipulating materials d. hypothesizing	√	46%	54%
28	environmental education are as follows EXCEPT:	a. critical thinking and critical solving b. inquiry and enquiry c. critical thinking and inquiry d. inquiry and solving	√	51%	49%
29	Science process skills are the building blocks of__ and ___	a. observing b. classifying c. inferring		60%	40%

		d. transforming data	√		
30	Basic process skills are the following EXCEPT:	a. predicting b. interpreting data c. manipulating materials d. identifying and defining variables	√	53%	47%
31	Integrated science process skills are the following EXPECT:	a. seeing b. hearing c. feeling d. thinking	√	69%	31%
32	Observation in the basic science process skill include the use of the following senses except:	a. develops skills in the learner b. motivates interest c. encourages student participation in learning activities d. none of the above	√	48%	52%
	The importance of science process skills in environmental education towards academic achievement of students are the following EXCEPT:				

Source: Field Survey 2022

The table above shows that, item 25 79% of students who attempted the achievement failed while 21% passed, in item 52, 55% students failed and 48% passed, in item 27, 46% students failed 54% passed, item 28, 51% students failed while 49% passed, in item 29, 60% students failed 40% students passed, in the item 30 also, 53% students failed 47% passed, in item 31, 69% students failed 31% students passed, while in the last item on the table item 32, 48% students failed 52% passed respectively, this indicated that, the percentages of the failure students of biology in environmental education has the highest percentages.

Table 6: Analysis of Students performance test questions in biology

S/N	Questions	Objective Options	Answers	Percentages	
			Answers	Failed%	Passed %
33	____ is referred to as an intelligent guess.	a. observation b. manipulation c. hypothesis d. none of the above	√	32%	68%
34	Science process skills are use by scientists in their _____	a. observation b. investigation c. experimentation d. scientific investigation	√	50%	50%
35	Prediction can be seen as:	a. making an intelligent guess b. making educated guesses about outcome c. making inferences d. making hypothesis	√	55%	45%
36	The ability of learner to test the hypothesis formulated based on observation is _____	a. manipulation b. experimentation c. hypothesis d. classifying	√	44%	56%
37	The ability to read, make meaning and draw valued statements from obtained data is called_____	a. referemce b. interpretation c. manipulation d. observation	√	49%	51%
38	A __ is a physical representation of	a. chart b. drawing c. model d. map	√	75%	25%
39	explanation that sums up an observation made before	environmental education science process skills scientific skills environmental knowledge	√	37%	63%
40	__ is very critical for implementation of inquiry-based teaching ___ and _ are important in any scientific investigation such as conducting projects and carryout experiment	a. basic skill process and science process skill b. basic skill process and inquiry process skill c. integrated process skill and inquiry process skill d. integrated process skill and basic process skill	√	57%	43%

Source: Field Survey 2022

The table above shows that, item 33 32% of students who attempted the achievement failed while 68% passed, in item 34, 50% students failed and 50% passed, in item 35, 55% students failed 45% passed, item 36, 44% students failed while 56% passed, in item 37, 49% students failed 51% students passed, in the item 38 also, 75% students failed 25% passed, in item 39, 37% students failed 63% students passed, while in the last item 40, 57% students failed 43% passed respectively, this indicated that, the percentages of the failure students of biology in environmental education has the highest percentages.

Results of the finding

Answering research questions

Hypothesis one: There is no significant difference the effect of learning environmental education using science process skills can impact secondary school students' academic performance in Biology.

Summary of one way analysis of variance (ANOVA) on the the effect of learning environmental education using science process skills can impact secondary school students' academic performance in Biology.

Status	Sum of square	Df	Mean square	F Calculated	Prob.	F critical
Between Groups	.484	4	.128	.241	.860	3.84
Within groups	44.287	196	.407			
Total	**44.670**	**200**				

Source: Field survey, 2022

The test indicated that there was no significant difference in the respondents i.e F-ration value (.241) at 4df 196 and at the level 0.05. The critical value (3.84) is more than F ration value (.241). The probability level of significance P (.860) is more than 0.05. This means that there is no significance difference in the senior secondary school students towards environmental education. Therefore, the hypothesis is retained, meaning that there is no significance difference in the senior secondary school students towards environmental education.

Hypothesis Two

There is no significant difference in the academic performance of students in biology when taught with science process skills and when not taught with lecture method.

Summary of one way analysis of variance (ANOVA) on the cademic performance of students in biology when taught with science process skills and when taught with lecture method.

Status	Sum of square	Df	Mean square	F Calculated	Prob.	F critical
Between Groups	.680	4	.227	.191	.002	3.84
Within groups	124.642	196	1.187			
Total	124.421	200				

Source: Field of study 2022

The test indicated that there was no significant difference in the respondents ie F-ration value (.191) at 4df 196 and at the level 0.05. The critical value (3.84) is more than F ration value (.191). The probability level of significance P (.002) is less than 0.05. This means that there is significance difference in the academic performance of students in biology when taught with science process skills and when not taught with it. Therefore, the hypothesis is rejected, meaning that there is significance difference in the academic performance of students in biology when taught with science process skills and when taught with on lecture methods.

Discussion of findings

Hypothesis 0ne which states that there is no significant difference in the attitude of senior secondary school students towards environmental education was retained.The hypothesis was tested using analysis of variance and the result of the analysis revealed F (3.84= .241, P=.860). Findings from the study indicated that there is no significant difference in the senior secondary school students towards environmental education.

After five weeks of science process skills based instruction, the researchers found that the students in between group attained significantly higher scores in biology than the students in within group .It may be argued that students exposed to the Basic Science Process Skills (BSPS) had the opportunity to observe, measure, record and interpret data as they were involved in the investigative activities. It can further be suggested that the science process skills emphasized in this study might have assisted the experimental group to perform better in biology than the control group. Studies carried out by Khan *et al*. (2011) showed that inquiry-based teaching approaches enhanced students' achievement in science subjects, which are in agreement with the findings of this study. Raminarian and Hlatswayo, (2018) research findings were also in agreement with the findings of this study by indicating that active participation of the students in science lessons contributed to effective learning. Therefore, sciences process skills may be the desired instructional approach to teaching biology. This study gives support to the fact that achievement of students in biology could be greatly improved if they are exposed to science process skills teaching approach. However, it is important to note that the success of the approach may depend on the competence, enthusiasm and confidence of the biology teacher and the ability of the students in making use of the opportunity provided.

Hypothesis two which states that there is no significant difference in the academic performance of students in biology when taught with science process skills and when not taught with on lecture method is rejected. The hypothesis was tested using analysis of variance and the result of the analysis revealed F (3.84= .191, P=.002). Findings from the study indicated that there is significant difference in the academic performance of students in biology when taught with science process skills and when not taught with on lecture method

Also, the study by Olutola *et al*., (2016) corroborates with the present study since their findings on comparative effect of science process skills on students' academic performance reported a significant effect. Their findings on a comparative effect of science process skills on students' academic performance in Biology in Ilorin, Nigeria reported a significant effect. This means that acquisition of large number of skills influence students' academic performance. Eric (2013) also reported a significant effect of SPS on students' academic performance. The implication therefore is that, acquisition of SPS in large numbers has significant effect on students' learning outcome in practical components of science subjects. The findings of this study however contradict Raj and Devi (2014) who reported a non-significant effect on academic performance but rather sees science process skills acquisition as tools for facilitating the process of learning. Nonetheless, the significant interaction effect as revealed in this study could be attributed to the facts that students may have reasonably acquired science process skills which must have impacted positively on their academic performance in practical biology.

Conclusion

From the findings of the study, it is concluded that acquired skills of classifying, measuring and problem-solving significantly interact with students' academic performance in practical biology. Furthermore, the study has projected biology to both teachers and students as an action as oppose to one of mere talking and listening. On the basis of the findings, it was concluded that; Acquired classification, measurement and problem-solving skills only showed significant interaction effect on students' academic performance in practical Biology.

Recommendations

Based on the findings of this research, the following recommendations were made:

1. Environmental education should be taught using science process skills as it encouraged maximum student participation in the learning activities and the acquisition of knowledge in the field of science, in senior secondary schools in Sabon Gari local government area of Kaduna State
2. Teachers should also impore appropriate approaches in teaching and learning environmental education in senior secondary schools in Sabon-Gari local government area of Kaduna State

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