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EFFECTS OF ETHNO-SCIENCE-ENRICHED-INSTRUCTION ON PERFORMANCE IN ENERGY CONCEPT AMONG UPPER BASIC II STUDENTS IN SABON GARI LOCAL GOVERNMENT AREA, KADUNA STATE, NIGERIA

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Abstract
The study ascertained the Effects of Ethno-Science-Enriched Instruction on Performance in Energy Concept among Upper Basic II students in Sabon Gari LGA, Kaduna State, Nigeria. The study employed a pretest posttest quasi-experimental design. The population comprised 8,919 Upper Basic II students from the 14 co-educational public schools in Sabon Gari LGA. A randomly selected sample of 143 students from 2 co-educational schools was used for the study. The schools were randomly assigned into experimental and control groups, respectively. The experimental group was taught energy concepts using ethno-Science-Enriched-Instruction while the control group was taught the same concepts using the conventional method. The groups were post tested to determine their performance on energy concepts. The Energy Concept Performance Test (ECPT), with a reliability coefficient of 0.81 using Cronbach's alpha statistical tool, was used for data collection. The research question was answered using descriptive statistics. The hypothesis was tested using a t-test statistic at $\alpha \leq 0.05$ levels of significance. The findings revealed that students in the experimental group performed better than those taught using the conventional method. Based on the findings from this study, it was concluded that Ethno-Science-Enriched Instruction has positively improved students' academic performance taught Energy concepts compared to their counterparts taught using conventional methods. It was recommended, among others, that textbook authors should include examples and illustrations that utilize locally available instructional materials that are easily accessible to the learner in their immediate environment.

Keyword: Ethno-Science-Enriched Instruction, Conventional Method, Performance, Energy Concepts, Basic Science

Introduction
Today, science is the tool for advancement and development of any nation. In realization of this, the National Policy on Education (FRN, 2013) emphasized the introduction of Basic Science and Technology at the Lower Basic Level and Basic Science at the Upper Basic Level of the school system. Shaibu (2014) defined science as human activity that leads to the production of a body of universal statements called laws, theories, or hypotheses that serve to explain the observable behavior of the universe or some aspects of the universe. According to Peni (2016), a child studying science at the upper basic level is exposed to basic science, formerly known as integrated science. Basic prepares students for the study of core science subjects such as biology, chemistry, and physics, among others, at the senior secondary school level. Based on the National Policy on Education (FRN, 2013), basic science was introduced as nature study and hygiene, which later metamorphosed into various subject disciplines as biology, chemistry, and physics at the senior secondary (SS) level of education in Nigeria. Lattuca, Voight, and Fath (2017) posited that integrating concepts from multiple

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disciplines can provide students with a more holistic understanding of scientific phenomena. This step was geared towards presenting science to students in their culture and traditions in their societies. According to Dike and Rowland (2020), this implies that teaching and learning of basic science are expected to be culturally and environmentally oriented to provide students with adequate foundations capable of solving societal problems, among which is ethno-science-Enriched instruction.

Abonyi, Achimugu, and Njoku (2014) defined ethno-science as indigenous knowledge from a culture that is connected with scientific knowledge, or is called knowledge owned by a nation. Rahayu and Sudarmin (2015) posited that science will be easier to understand if the teacher pays attention to the students' culture. Sudarmin, Febu, Nuswowati, and Sumarni (2017) argued that teachers' comprehension of activity-based teaching methods, such as ethno-science-Enriched instruction, can enhance the significance of science education. Therefore, it is important for teachers to be knowledgeable about the integration of cultural understanding with scientific knowledge in the classroom. Research had been carried out to find the effectiveness of ethno-science-Enriched instruction. Nisa, Sudarmin, and Samini (2015); Khoerunnisa and Sudarmin (2016) stressed that one of the ways that could be done to improve students' academic performance was making correlation between learning topics and daily activities around their environment as learning sources so that it would be more beneficial for the students' by using learning tools integrated with local wisdom. Other than that, Adhi, Sudarmin, and Linuwih (2018) viewed that the use of ethno-science-based video also improved the students' learning achievement during learning of science. Peni (2016) asserted that ethnoscience has the capacity to blend with knowledge-based science and technology, thereby complementing scientific and technological efforts to solve problems associated with understanding science concepts. Dike and Rowland (2020) stressed that, since Basic Science is the first science subject a child encounters before its indigenous science, if taught using an ethnoscience-based approach, it will improve students' creativity, critical thinking, and performance for sustainable national development. All these related findings have no link to the energy concept using Ethno-Science; hence, this study examined the effects of Ethno-Science Enriched Instruction on Performance in Energy Concept among Upper Basic II Students in Sabon Gari, Kaduna State, Nigeria.

Statement of the Problem

Shaibu (2014) posited that this persistent failure is associated with a lack of adequate laboratory equipment for practical-based activities. Samuel (2018) attributed the persistent failures in the subject to poor instructional strategy. Dike and Rowland (2020) opined that most of the instructional materials used by teachers to teach the students were alien, thereby reducing learning to rote memorization. It becomes obvious that concrete and locally sourced materials that are well known to students in their environment may improve their performance in Basic Science. Hence, the effects of ethno-science-Enriched-Instruction on academic performance in teaching energy concepts were determined.

Objective of the Study

The objective of the study is to ascertain the effects of Ethno-Science-Enriched Instruction on academic performance in Energy concepts among Upper Basic II Students in SabonGari LGA, Kaduna State, Nigeria.

Research Question

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What is the difference between the mean academic performance scores of Upper Basic II students taught energy concepts using ethno-science-Enriched instruction and those taught using conventional methods?

Null Hypothesis

The following null hypothesis was formulated for testing at $\alpha<0.05$ level of significance.
There is no significant difference between the mean academic performance scores of Upper Basic Science II students taught energy concepts using ethno-science-Enriched instruction and those taught using conventional methods.

Methodology

Research Design

A quasi-experimental and control group design of pretest and posttest was employed for this study. Intact classes were used for the study. In this study, two groups were used, which are the experimental and control groups. Students in the experimental group were taught energy concepts using ethno-science-enriched instruction, while those in the control group were taught the same concept using the conventional method for a period of six weeks. After treatment, an Energy Concept Performance Test was administered to both the control and experimental groups as a posttest. The population for this study covers all Upper Basic (II) public secondary school students in Sabon Gari Local Government Area, Kaduna State, Nigeria. There are 14 Upper Basic (II) public secondary schools offering Basic Science as a core subject with a population of 8,919 students, 4,203 males and 4,716 females in Sabon Gari LGA, Kaduna State, Nigeria, at the time of the study.

To select the sample of students, four schools were selected using simple random sampling technique involving the balloting method from the 10 co-educational public upper basic secondary schools in Sabon Gari LGA, Kaduna State, Nigeria. To select a representative class, the balloting method was applied, in which A, B, and C, according to the number of arms in each school, were written on paper, squeezed, put inside the container, and shaken very well before being picked randomly. The classes picked in each school represent that school. The four classes representing each school were given a pretest using the Energy Concept Performance Test (ECPT), and the results obtained were subjected to analysis variance (ANOVA) at $\alpha<0.05$ to determine the academic equivalence level of each school selected. Results obtained from ANOVA showed that there is a significant difference in the performance score of the 4 schools, which makes the result subjected to Scheffe's test to pick two schools with no significant difference. A total of 143 Upper Basic II students were used for the study.

The Energy Concept Performance Test (ECPT) consisted of 30 objective (multiple choice) test items that were drawn from the concept of energy. Each of the 30 multiple-choice items has four options, one correct answer, and three plausible distractors. One mark was awarded to each correct answer that was shaded, giving a total of 30 marks. The ECPT was validated by experts with a minimum qualification of Ph.D. from the Department of Science Education, Faculty of Education, Ahmadu Bello University, Zaria, and was found to have a reliability coefficient of 0.80 using cronbach alpha.

The research question was answered using data collected and analyzed using descriptive statistics in the form of mean and standard deviation, while the null hypothesis was tested using an independent sample t-test using data of posttest performance scores of students in the experimental and control groups.

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Results

Research Question:

What is the difference in the mean academic performance score between Upper Basic Science II students taught energy concepts using ethno-science-enriched instruction and those taught using conventional methods?

The mean and standard deviation of post-test scores for experimental and control groups are calculated and presented in Table 1.

Table 1. Means and Standard Deviations of Post Test Scores of ECPT for Experimental and Control Groups

Group	N	Mean	Standard Deviation	Mean Difference
Experimental	66	14.15	3.87	
				3.45
Control	77	10.70	2.95	

Table 1 shows that the experimental group has a mean performance score of 14.15 and a standard deviation of 3.87, while the control group has a mean performance score of 10.70 and a standard deviation of 2.95 and a mean difference of 3.45.

Testing Null Hypothesis

Ho: There is no significant difference between the mean academic performance scores of Upper Basic Science II students taught energy concepts using ethno-science enriched instruction and those taught using Conventional method.

Independent sample t-test was used to test hypothesis (H_0). The result of the analysis is presented in Table 2

Table 2: Summary of t-test Analysis of Post ECPT Scores of Students in Experimental and Control Groups.

Group	N	Mean	S.D	Df	t-cal	P-value	Decision
Experimental	66	26.77	3.29				
				141	31.08	0.03	*Sig
Control	77	10.81	2.82				

*Significant at P≤0.05 level of significance

From Table 2 it is clear that, the t-calculated is 31.08 and a P-value of 0.03 at the degree of freedom of 141 is obtained. The P-value of 0.03 is less than the alpha value of 0.05. Hence, the null hypothesis is rejected. This means that, there is a significant difference in the academic performance of Basic science students taught energy concept using ethno-science-enriched instruction. This difference is in favour of the experimental group. This also implies that, ethno-science-enriched instruction is effective for improving the performance of the students in the experimental group.

Discussion of Findings

This study investigates the Effects of Ethno-Science-Enriched Instruction on Interest and Performance on Energy Concept among Upper Basic II Students in Sabon Gari Local Government Area, Kaduna State, Nigeria. One null hypothesis was stated. Analyses of the data obtained were present in Table 1 in accordance with the stated hypothesis. The findings from the analysis were discussed.

The results in Table 2 show that there is a significant difference in the mean academic performance scores of students taught energy concepts in Basic Science with Ethno-Science-

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Enriched Instruction and those taught with conventional methods. This shows that ethno-science-Enriched instruction is effective in improving the performance of students in the experimental group. However, those taught energy concepts using ethno-science-Enriched instruction acquired significantly higher performance mean scores than those taught energy concepts using conventional methods. This finding agrees with those of Ebere and Appolonia (2017), Eko, Meli, and Nirwana (2020), Dike and Rowland (2020), and Nwankwo (2021), who found a significant difference in the mean performance scores of students in the experimental and control groups in favor of the experimental group. They believed that students who were taught using ethno-science-Enriched-Instruction gained more performance as a result of their engagement with the available cultural resources as compared to those taught using conventional methods.

Conclusion

Based on the findings from this study, it is concluded that ethno-science-enriched Instruction has positively improved students' academic performance taught Energy concepts compared to their counterparts taught using conventional methods.

Recommendations

Based on the findings of the study, it is therefore recommended that:

i. Basic Science teachers should adopt the use of ethno-science-enriched-instruction as it enhances students' performance in teaching and learning basic science.
ii. Instructional materials for teaching Basic science should be geared towards cultural relevance.
iii. Textbook authors should include examples and illustrations that utilize locally available instructional materials that are easily accessible to the learner in their immediate area. This will improve the academic performance of students.

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