

Effects of Ethno-Science Instructional Strategy on Junior Secondary School Students' Achievement in Basic Science

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Abstract

The study investigated the effect of ethno-science instructional strategy on junior secondary school students' achievement in basic science. Two research questions and six hypotheses guided the study. The hypotheses were tested at 0.05 level of significance. The design of the study was quasi-experimental. The population of the study was 5,017 Junior Secondary School year two (JSS 2) Basic science students in Aguata Education Zone of Anambra state, Nigeria. A sample of 74 students were drawn and used for the study. The instrument for data collection was Basic Science Achievement Test (BSAT) validated by experts in Nnamdi Azikiwe University, Awka. The reliability of BSAT was established using Kuder-Richardson formula 20 and found to be 0.69. Data were collected by administering the instrument as pretest and posttest after treatment of the groups. The data obtained were analyzed using mean, standard deviation and Analysis of Covariance (ANCOVA). The results showed that there is a significant difference in the mean achievement scores of students in the experimental and control groups in favour of the experimental group taught using ethno-science instructional strategy. The influence of gender on the achievement of the students was also significant. It was recommended that basic science teachers should relate learning and instruction to the students' cultural practices and other indigenous knowledge by adopting ethno-science instructional strategy.

Keywords: basic science, ethno, ethno-science, instruction, strategy

Introduction

The role of science and technology in the development of a nation is glaringly clear to everyone. In most countries of the world including Nigeria, admission quota for science students is often higher than that of those for other disciplines (Chikendu, 2018). Efforts are also put in place to ensure that the quality of science education meets that standard for which solutions to the needs of the society is met. The foundation for science learning is laid in the junior secondary through the teaching of such subjects as basic science and technology. Basic science forms the most basic level of science while expressing the unity of science (Oyewole, 1971). It integrates the different aspects of science into a unified whole, thus, making it a pre-requisite for later studies in any of the science disciplines. However, the unifying nature of basic science makes it difficult for teachers to choose the teaching methods that can enhance students' achievement. The nature of the subject creates a problem that is based on the question of which teaching method could better be used to attain its objectives.

The problem of teaching basic science is further compounded by the fact that most innovative teaching methods such as the integration of computer technologies into the learning process can hardly be employed in the Nigerian classroom at the junior secondary level. Most schools lack the facilities and finances to use such teaching methods. Hence, there is the need to seek other methods of instruction that could bring science to the students' world of reality at the introductory level of science learning. This research was designed to investigate whether relating basic science learning to the cultural practices, indigenous knowledge and sayings through ethno-science instruction could improve or enhance students' achievement in basic science.

The term ethno-science according to Okwara & Upu, 2017 refers to the materials, ideas, beliefs and technology in a given society or environment, that derive from the past and present cultural practices and traditions. It is knowledge that is indigenous to a particular people. Ethno-science instructional strategy involves the organization of instruction based on diverse cultural context. The strategy requires the teacher to draw analogy and explanations from traditional culture while focusing on the basic science needed by students in the society. Ethno-science instructional strategy according to Abonyi (2014) involves the teacher designing practical models of integration of indigenous and cosmopolitan knowledge systems with a view to achieving a balanced process of development and change.

In the ethno-science classroom, the teacher introduces the lesson by presenting students with cultural practices and knowledge related to the concept. The teacher gives a brief explanation of the concept and calls on the students to present other cultural knowledge related to the concept as the instruction proceeds step by step. The benefit of the instructional strategy is such that the gap in knowledge of the students and their culture and the new field of knowledge is bridged (Abonyi, Achimugu & Njoku, 2014). According to Nwegu, Eze and Asogwa (2011), teachers need to draw upon cultural anthropology which regards learning of science as the acquisition of the culture of science. In this regard, ethno-science may help sequence the learning process through previous knowledge of the culture, offering learners' opportunity to know more about reality, culture and themselves. The approach may encourage students to see science within them and arrive at meaningful learning and understanding towards proper application for improved achievement irrespective of gender.

The role of gender in science learning has continued to be in the center of research (Ward, Roden, Hewlett & Foreman, 2008). Results of studies on gender and its influence on science learning have remained inconclusive. Since both male and female students are open to the cultural practices and possess the indigenous knowledge of their immediate community, it is expected that the gap in science learning due to gender can be bridged. There is the need however, to further examine the role of gender in the achievement of students when ethno-science instruction is adopted.

Purpose of the Study

The study investigated the effects of ethno-science instructional strategy on junior secondary school students' achievement in basic science. Specifically, the study determined:

1. Effects of ethno-science instructional strategy on junior secondary school students' achievement in basic science.
2. Influence of gender on students' achievement.
3. Interaction effects of instructional strategy and gender on junior secondary school students' achievement in basic science.

Research Questions

1. What is the difference between the mean achievement scores of students taught basic science using ethno-science instructional strategy and those taught using conventional method?
2. What is the difference between the mean achievement scores of male and female students?

Hypotheses

The following hypotheses were tested at 0.05 level of significance.

1. There is no significant difference between the mean achievement scores of students taught basic science using ethno-science instructional strategy and those taught using conventional method.
2. There is no significant difference between the achievement scores of male and female students.
3. There is no interaction effects of instructional strategies and gender on students' achievement in basic science.

Method

The design adopted for the study was quasi-experimental design, specifically the pretest-posttest non-equivalent control group 2x2 factorial study. The area of study was Aguata Education Zone of Anambra State. The population of the study was 5, 017 junior secondary school year two (JSS II) students in 20 secondary schools in Aguata Education Zone (Source: Department of Planning, Research and Statistics, Post Primary School Service Commission, Awka, 2019). The sample size for the study was 74 (42 males and 32 females) junior secondary school year two (JSS 2) students obtained using multi-stage procedure. First, two junior secondary schools under Aguata education zone were selected. The rationale for their selection was because they are co-educational and situated far apart from each other, thus, the gender variable and extraneous variable of class interaction was taken controlled. The two schools were randomly assigned to experimental and control group. The experimental group had 36 students (19 females and 17 males) while the control group had 38 students (22 females and 16 males).

The instrument used for data collection was Basic Science Achievement Test (BSAT). BSAT was constructed by based on the concepts taught while using a test blue print to ensure that adequate number of questions is covered for each content taught. The 50 objective questions were designed on a four-response option lettered A-D. The purpose of the study, research questions, hypotheses, BSAT and instructional plans were validated by experts from Nnamdi Azikiwe Univeristy, Awka. The recommendations and corrections from the validators were effected in the final copy of the instrument. The reliability of the instrument was established using Kuder-Richardson-20 Formula 20. The instrument was administered once to 20 basic science students in a school in Aguata which was not used in the study. The generated scores were used to compute the reliability co-efficient. The reliability coefficient obtained was 0.69. The experiment was carried out in two phases. The first was the briefing of the research assistants who are the regular basis science teachers in the schools used for the study and was done in two contacts within one week. The second was treatment using ethno-science instructional strategy for the experimental group and conventional method for the control group. In the first week of the treatment, the pretest was administered to the two groups, and no feedback was given to them. In the same week, the treatment commenced. In each lesson, the teacher used an ethno-science inventory containing sayings, cultural practices and indigenous knowledge of the school community that are related to the concepts for instruction.

The teacher first introduced the topic of the day by giving an exposition on a particular belief, knowledge or practice that is related to concept. Thereafter, the teacher gave a brief scientific explanation on the topic of growth and development and called on the students to present other cultural practices and knowledge, belief or sayings that are related to the concept for discussion. Some of the cultural practices on child growth and development presented by the students are: suckling toddlers are bathed with the water which the mothers used to bath, to make them stronger and not sick when their mother conceives another baby; children are given biscuit bone to enable them grow stronger teeth.

During the discussion, the teacher using probing questions determined students' understanding of the concept being taught in related to the indigenous knowledge the possess and classify their presentation into: compactible with science and not compatible with science. The teacher followed the same procedure in each step of instruction and evaluated the instruction at each step of the instructional delivery. At the close of instruction, a summary of the important points of the lessons was given by the teacher with an assignment on the next topic of instruction. The assignment was mainly to write up sayings, cultural practices and indigenous knowledge that are related to the concepts studied. Mean and standard deviation were used to analyze answer the research questions. The hypotheses were tested at 0.05 level of significance using Analysis of Covariance (ANCOVA). The decision rules are that when P-value is less than or equals 0.05, the null hypotheses will be rejected; otherwise we do not reject the null hypotheses.

Results

Research Question 1: What is the difference between the mean achievement scores of students taught basic science using ethno-science instructional strategy and those taught using conventional method?

Table 1: Mean Achievement Scores of Students taught Basic Science using Ethno-science Instructional Strategy and those taught using Conventional Method

Groups	N	Pretest Mean	Posttest Mean	Gain Mean	Pretest SD	Posttest SD
Experimental	36	26.61	54.36	27.75	6.13	11.05
Control	38	29.68	42.87	13.19	5.97	6.17

Data in Table 1 show that the group taught using ethno-science instructional strategy has mean gain achievement score of 27.75 while the control group taught using conventional method has mean gain achievement score of 13.19.

Research Question 2: What is the difference between the mean achievement scores of male and female students?

Table 2: Mean Achievement Scores of Male and Female Students taught in Basic Science

Group	Gender	N	Pretest Mean	posttest Mean	Gain Mean	Pretest SD	Posttest SD
Experimental	Male	17	29.76	55.18	25.42	6.56	8.23
	Female	19	23.79	53.63	29.84	4.12	13.27
Control	Male	16	31.44	46.81	15.37	5.53	4.90
	Female	22	28.41	40.00	11.59	6.08	5.43

Table 2 show that the male students taught using ethno-science instructional strategy has mean gain achievement score of 25.42 while for the females, it is 29.84. The male students taught using conventional method has mean gain achievement score of 15.37 and the females, 11.59.

Hypothesis 1: There is no significant difference between the mean achievement scores of students taught basic science using ethno-science instructional strategy and those taught using conventional method.

Table 3: ANCOVA on Significance of Main Effects of the Treatment on Students' Achievement

Source of variation	SS	Df	MS	F	Sig.	Decision
Corrected Model	3183.580 ^a	4	795.895	11.110	.000	
Intercept	9339.428	1	9339.428	130.376	.000	
Pretest	290.530	1	290.530	4.056	.048	

Gender	1640.061	1	1640.061	22.895	.000	S
Method	526.852	1	526.852	7.355	.008	S
Method*Gender	79.120	1	79.120	1.104	.297	NS
Error	4942.799	69	71.635			
Total	181902.000	74				
Corrected Total	8126.378	73				

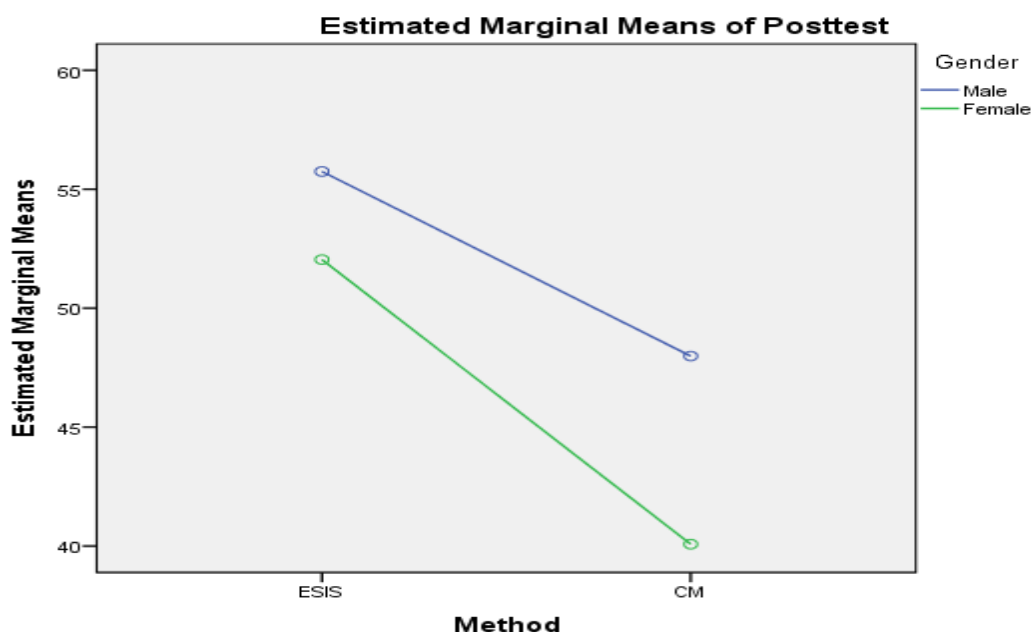
Table 3 show that there is a significant main effect of the treatment on the achievement scores basic science students, $F(1, 73) = 22.895$, $P(0.000) < 0.05$. Thus, the null hypothesis was rejected. Therefore, there is a significant difference between the mean achievement scores of students taught basic science using ethno-science instructional strategy and those taught using conventional method.

Hypothesis 2: There is no significant difference between the achievement scores of male and female students.

Table 3 also shows that there was a significant main influence of gender on students' achievement in basic science, $F(1, 73) = 7.355$, $P(0.008) < 0.05$. Thus, the null hypothesis was rejected. Therefore, there is no significant difference between the achievement scores of male and female students.

Hypothesis 3: There is no interaction effect of instructional strategies and gender on students' achievement in basic science.

Table 3 further shows that there is no significant interaction effects of instructional strategies and gender on students' achievement in basic science, $F(1, 73) = 1.104$, $P(0.297) > 0.05$. Therefore, the null hypothesis was not rejected. Thus, there is no interaction effect of instructional strategies and gender on students' achievement in basic science.



Covariates appearing in the model are evaluated at the following values: Pretest = 28.19

Figure 1: Plot of the interaction effects between instructional strategy and gender on students' achievement

The plot of the interaction effect of teaching methods and gender was not significant. .

Discussion

The result showed that the difference between the mean achievement scores of students taught basic science using ethno-science instructional strategy and those taught using conventional method was significant. The observed result of the study could be attributed to the in-depth understanding resulting from the use of ethno-science instructional strategy. The strategy exposes students to better learning experience by drawing and relating learning to what they practice, know or say in their culture. The approach also facilitated proper conceptualization of the concept taught as the teacher modified their misconceptions to be compatible with science or completely discarded as misconception.

The approach of ethno-science instruction strategy enabled students to easily retain the learning materials. The students had to process learning material through an experiential cognitive activity relating to what they already know and practiced culturally. Students became more interested in the lesson as learning was brought close to the real world and learnt concepts and their applications in life was clear. The finding of the study is in line with the findings of Peni (2011) that ethno-science instruction significantly enhanced students' achievement in basic science. The finding of the study also supports the findings of Kurume, Onah and Mohammed (2012) that ethno-science instruction was more effective in facilitating and improving students' retention in statistics than the conventional approach. The findings of the study further lend credence to the findings of Oluwatosin, Emmanuel and Peter (2017) that students taught using ethno-chemistry instruction had significantly higher achievement scores than those students not taught with ethno-chemistry.

The study further showed that gender significantly influenced the students' achievement in basic science. The interaction plot showed that the influence of gender on achievement was ordinal. The sensitivity to gender can be explained from the angle of the fact that in most cultural settings, women are often involved in most domestic and cultural activities, exposing them to more science related practices. On the other hand, males are involved in cultural works which most times have scientific relevance. The finding of the study is in contrast with the findings of Kurumeh, Onah and Mohammed (2012) that ethno-mathematics teaching approach did not significantly differentiate between sexes. The finding of the study also contradicted the finding of Ugwu and Diovu (2016) that gender had no significant influence on the achievement.

Conclusion

It can be concluded from the findings of the study that ethno-science instructional strategy is effective for enhancing students' achievement in basic science. The instructional strategy gives students an in-depth understanding into science concepts by relating learning to their background and cultural knowledge.

Recommendations

The following recommendations are made in the light of the findings of the study:

1. Basic science teachers should relate learning and instruction to cultural practices and other indigenous knowledge by adopting ethno-science instructional strategy. This is important as basic science is the foundation for science learning.
2. Basic science teachers should determine students' knowledge before instructional and remedy misconception which may affect achievement. They should explain clearly cultural practice, saying, experiences and knowledge that are scientific and those that are not.

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