

Effects of Ethnoscience Blended Instructional Strategy on Students' Interest, Achievement and Retention in Basic Science and Technology in Cooperative Setting in Benue State, Nigeria

¹UPU, Francis Terseer,

²Prof. ERIBA, Joel Oche,

³Prof. IJI, Clement O.,

⁴Dr. OKWARA, Kalu Okwara,

^{1,4}Department of Science Education Joseph Sarwuan Tarka University Makurdi

²Department of Curriculum and Teaching Benue State University Makurdi

³Department of Mathematics Education Joseph Tarka University Makurdi

Abstract

This study investigated effect of ethnoscience blended instructional strategy (EBIS) on students' interest, achievement and retention in Basic Science and Technology (BST) in Benue State, Nigeria. The study answered three research questions, and tested three null hypotheses. Quasi-experimental of non-randomized, pretest posttest control group design was adopted. Three instruments; Basic Science and Technology Interest Scale ((BSTIS), Basic Science and Technology Achievement Test (BSTAT) and Basic Science and Technology Retention Test (BSTRT) were validated and used for data collection. Reliability coefficients of BSTIS and BSTAT were established at .94 and .79 using Cronbach-Alpha Method and Kuder-Richardson-20 formula respectively. The sample size of 643 upper basic II students was drawn from the population of 16,285 using multi-stage sampling technique. Mean and standard deviation were used for answering of research questions while null hypotheses were tested at 0.05 significance level using analysis of covariance, (ANCOVA). The result revealed a significant difference between the mean interest, achievement and retention scores of student taught BST using EBIS and those taught using conventional method with large effect sizes of $\eta^2_p = 0.86$, $\eta^2_p = 0.83$ and $\eta^2_p = 0.91$ respectively. Based on these findings, it was concluded that EBIS is effective in teaching Basic Science and Technology, because the technique enhanced student's interest, achievement and retention of BST concepts. It was recommended among others that, EBIS should be used for the teaching of BST in particular and other science subjects in general where necessary; that stakeholders in education should organize seminars and conferences to train serving BST teachers on how to use ethnoscience blended instructional strategy to enhance students' interest, achievement and retention of scientific concepts.

Keywords: Ethnoscience Blended Instructional Strategy, Interest, Achievement, Retention, Basic Science and Technology, Cooperative Setting

Introduction

Education in science and technology provide standards to good citizenry in search for solutions to problems and emerging issues of our time such as corruption, drugs abuse, global

warming, religious radicalization, and terrorism. This is because education in science and technology is a viable tool for transforming and empowering individuals to have rational thinking on how to become self-reliant for the benefit of the society and for the sustainable national development (Adejoh & Ekele, 2014). Development is a comprehensive growth; mentally, emotionally, economically and socio-culturally of the citizen which is aimed at improving the total well-being of individuals and the nation at large.

To achieve creativity for overall national development, proper teaching and learning of Basic Science and Technology (BST) at basic education level will provide students with adequate foundation to acquire appropriate attitudes, knowledge and skills to live and contribute effectively for the development of our society. This is why Basic Science and Technology has been made a compulsory subject for the 9-year Basic Education programme in Nigeria so as to provide all school going children with a solid base to develop interest, scientific attitudes and technological knowledge and skills in science and technology (Okwara & Upu, 2018).

Basic Science and Technology can simply be seen as the bedrock for man's systematic way of acquiring desirable attitudes, knowledge and skills as well as putting the acquired attitudes, knowledge and skills into practical use for solving man's problems in the contemporary societies (Etonihu & Agu, 2018). According to Nigerian Educational Research and Development Council (NERDC, 2012) effective teaching and learning of Basic Science and Technology place emphasis on guided inquiry, field studies and cultural related instructional approaches by using locally made sourced materials. This means that teaching and learning of Basic Science and Technology is expected to be culturally and environmentally oriented to link up what students learned at home to classroom in order to provide them with adequate foundations to sustain their interest and increase achievement and retention in science and technology for the survival of contemporary society.

Despite Nigerian government effort through NERDC to improve students' interest, achievement and retention in Basic Science and Technology for sustainable national development, they have hardly been improved as evident in the poor achievement of students' year in year out (Etonihu & Agu, 2018). This had been attributed to many factors ranging from students' poor background/foundation in Science, Technology and Mathematics to instructional methods that do not take care of students' cultural environment that would link up what they learned at home to science classroom among others (Iji 2013; Okwara & Upu, 2018).

This implies that poor students' interest, achievement and retention of scientific concepts is as the result of negligent attitude or inability of science teachers to blend science concepts to students' cultural practices that are of scientific important. The indication is that teaching and learning of Basic Science and Technology will be more meaningful if it blends with the ethnoscientific activities of the students. Risdianto *et al.* (2020) suggests that the use of ethnoscience blended instructional strategy for the implementation of science curriculum

would help students to link up what they learned in their homes to science classrooms which will improve their interest, achievement and retention of the scientific concepts.

Ethnoscience blended instructional strategy is the teaching approach that combines cultural and traditional practices in the environment of the learners and explain them scientifically in the classroom with the use of locally made instructional materials. It provides greater opportunity for learners' interaction with their cultural practices and natural environment for better understanding of scientific concepts. Ethnoscience blended instructional strategy implores cultural knowledge, prior experiences, frames of reference, and performance styles of cultural and linguistically diverse of the students to make learning encounters more relevant and effective (Fassasi,2017). Rationale for adopting ethnoscience blended instructional strategy for teaching and learning of science subjects is because, it improves learning effectiveness, increased access to instructional materials, it is convenience and cost effective. Therefore, ethnoscience blended instructional strategy would make it easy for students to understand and linked up the concepts of Basic Science and Technology as they lean in class to modern scientific concepts.

Ethnoscience blended instructional strategy can be referred to as the technique that harnesses indigenous scientific knowledge driven from past and present socio-cultural practices that are scientific explainable to enhance students' interest, achievement and retention of Basic Science and Technology concepts. Anderson (2009) reiterates that ethnoscience blended instructional strategy is very inclusive because all categories of learners are supported in the learning process. It takes care of heterogeneous groups of learners in the classroom despite their different backgrounds, gender, experiences or disabilities. This necessitates the researchers to carry out this study to investigate effects of ethnoscience blended instructional strategy on students' interest, achievement and retention in Basic Science and Technology in cooperative setting in Benue State.

Cooperative setting is a situation whereby students of different ability, ethnic background, and gender are blended in a group to achieve a common learning goal of Basic Science and Technology. Novia *et al* (2019) reported that ethnoscience blended instructional strategy in a cooperative setting is an environmentally friendly, if well implemented will help improve students' interest, achievement and retention irrespective of their cultural background. Implication of this is that students' interest in any subject dependent on the good instructional method.

The issue of the influence of instructional method on students' interest in science is debatable over the years. Researchers like Novia, *et al.* (2019) found out that instructional strategies have significant effect on students' interest in science while Nnorom (2015); Etonihu and Agu, (2018) in various studies showed that instructional method do not significantly influence student interest. Interest in Basic Science and Technology is referred to students' reactions, feeling and impression about Basic Science and Technology contents and concepts as well as related tasks. Ugwuanyi (2015) observes that the type of interest students brings into the classroom is the reflection of their achievement and retention.

Achievement is an exhibition of knowledge attained or skills developed by students in a subject as determined by test scores assigned by teachers. Ogundukun and Adeyemo, (2010), describe achievement of students as the demonstration of their abilities to attain certain levels of classroom instructions and experiences. The achievement of students in Basic Science and Technology is an essential function of the production of scientific and technological man power that would retain the knowledge and skills acquired for sustainable national development.

Retention can be seen as the capability of the students to acquired and store information or ideas and skills and reproduce same in future when needed. Upu, *et al* (2016) describe retention as the ability of an individual to acquire and keep certain information in their memory and remember them for a given period of time after a course is completed. They maintain that the rate of retention varies from individual to individual due to the differences in their storing capacities as well as how the learned materials align or relate to their external environment.

Statement of the Problem

The aim of teaching and learning of Basic Science and Technology is for students to develop interest in science and technology and to acquire basic scientific and technological knowledge and skills in science and technology, to retain the scientific and technological knowledge and skills acquired to solve contemporary societal problems. Failure of this aim has been attributed to methods of instruction used by the teachers which do not take care of the cultural background and the needs of the students. Also, students have been viewing Basic Science and Technology concepts taught to them in schools as foreign, abstract, unreal and meaningless and so students merely memorize the concepts taught, to pass their examinations with little or no retention for future use. This necessitated the researchers to find out if the use of ethnoscience blended instructional strategy in a cooperative setting will help to achieve objectives of BST.

Objective of the Study

The general objective of this study is to determine the effects of ethnoscience blended instructional strategy on students' interest, achievement and retention in Basic Science and Technology in a cooperative setting in Benue State, Nigeria. The specific objectives of this study are to:

1. determine the difference between the mean interest ratings of students taught Basic Science and Technology using ethnoscience blended instructional strategy and those taught, using conventional method.
2. assess the difference between mean achievement scores of students taught Basic Science and Technology using ethnoscience blended instructional strategy and those taught, using conventional method.

3. investigate the difference between mean retention scores of students taught Basic Science and technology using ethnosience blended instructional strategy and those taught using conventional method.

Research Questions

The following research questions were raised to guide the study:

1. What is the difference between mean interest ratings of students taught Basic Science and Technology using ethnosience blended instructional strategy and those taught using conventional method?
2. What is the difference between mean achievement scores of students taught Basic Science and Technology using ethnosience blended instructional strategy and those taught using conventional method?
3. What is the difference between mean retention scores of students taught Basic Science and technology using ethnosience blended instructional strategy and those taught using conventional method?

Research Hypotheses

The following null hypotheses were formulated and tested at $p > .05$ alpha level of significance:

1. There is no significant difference between mean interest ratings of students taught Basic Science and Technology using ethnosience blended instructional strategy and those taught using conventional method.
2. There is no significant difference between mean achievement scores of students taught Basic Science and Technology using ethnosience blended instructional strategy and those taught, using conventional method.
3. There is no significant difference between mean retention scores of students taught Basic Science and Technology using ethnosience blended instructional strategy and those taught using conventional method.

Methodology

The study adopted a quasi-experimental, non-randomized, pre-test, post-test control group design. The population of the study was 16,285 Upper Basic two (UBII) students in Education Zone B of Benue State. A sample of 643 UBII students drawn from eight intact classes of the public secondary schools was used for the study. Multi-stage sampling technique was used for the selection of the sampled schools. Only eight schools were randomly chosen because of the experimental nature of the study. Four schools each were assigned to experimental and control group. The instruments used for data collection were Basic Science and Technology Interest Scale (BSTIS), Basic Science and Technology Achievement Test (BSTAT) and Basic Science and Technology Retention Test (BSTRT) which were developed by the researchers. The validation of the instruments was done by three experts. The reliability of BSTIS and BSTAT were calculated using Cronbach Coefficient Alpha test method and Kuder-Richardson 20 formula which gave the value of 0.94 and 0.86 respectively. These values indicate that there is

a positive relationship within the test items which show that items of the instruments are both internally consistent and reliable.

Basic Science and Technology teachers currently teaching in the sampled schools were used for the study in both experimental and control group as research assistants. BSTIS and BSTAT were administered to students as pre-test to ascertain their initial level of knowledge on the concept of BST before treatment (teaching) commence. The control group was also taught the same contents using conventional method. The teaching lasted for six weeks with 18 periods both in experimental and control group. Immediately after conclusion of the teaching, the BSTIS and BSTAT were given as post-test and scores were recorded. The research assistants also administered BSTRT to the students after two weeks of the post test. Research questions were answered using mean and standard deviation. Null hypotheses were tested at .05 alpha level of significance using Analysis of Covariance (ANCOVA). ANCOVA was used to check the initial difference that might exist between the groups due to the random assigning of the schools.

Results

Research Questions 1: What is the difference between mean interest ratings of students taught Basic Science and Technology using ethnoscience blended instructional strategy and those taught, using conventional method?

Table 1: Mean and Standard Deviation on Students' Mean Interest Ratings in BST

Teaching Method	N	Pre-interest		Post-interest		Mean Gain
		Mean	SD	Mean	SD	
EBIS	341	2.43	1.09	3.87	0.05	1.44
CM	302	2.48	1.08	2.96	0.25	0.48
Total	643					
Mean difference		-0.05		0.91		0.96

Result in Table 1 showed that the mean interest ratings of students taught Basic Science and Technology using EBIS was higher than those taught using CM. The difference between mean interest ratings of students taught Basic Science and Technology using EBIS and CM is 0.96. Hypothesis one was tested for level of significance to confirm this result in Table 2.

Null Hypothesis 1: There is no significant difference between mean interest ratings of students taught Basic Science and Technology using ethnoscience blended instructional strategy (EBIS) and those taught using conventional method (CM).

Table 2: Analysis of Covariance on Students' Mean Interest Ratings in BST

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	5067.567 ^a	2	2533.784	210.307	.000	.397

Intercept	33979.036	1	33979.036	2820.305	.000	.615
Pre-test	209.274	1	209.274	17.370	.002	.026
Interest *	413.408	1	413.408	34.313	.000	.86
Error	7710.694	640	12.048			
Total	1081300.000	643				
Corrected Total	12778.261	642				

a. R Squared = .397 (Adjusted R Squared = .393)

Findings in Table 2 indicated that F-value for interest was 34.313 at the significance value of 0.000, which is less than the p-value of 0.05. Based on this findings hypothesis one which stated that there is no significant difference between mean interest ratings of students taught Basic Science and Technology using ethnosience blended instructional strategy (EBIS) and those taught using conventional method (CM) is rejected. This means that there is a significance difference between mean interest ratings of students taught Basic Science and Technology using ethnosience blended instructional strategy and those taught using conventional method. To assess effect size between the groups the computed value of partial eta squared gave the value of 0.86. This value indicates that there is high effect size between the groups that was taught BST using EBIS and those that were taught using conventional method.

Research Questions 2: What is the difference between mean achievement scores of students taught Basic Science and Technology using ethnosience blended instructional strategy and those taught, using conventional method?

Table 3: Mean and Standard Deviation on Students' Achievement Scores in BST

Group	N	Pre- BSTAT		Post- BSTAT		Mean Gain
		Mean	SD	Mean	SD	
EBIS	341	35.90	1.03	63.38	0.93	27.48
CM	302	35.86	1.04	55.70	1.06	19.84
Total	641					
Mean difference		0.04				7.64
				7.60		

The result in Table 3 showed that students taught Basic Science and Technology using EBIS have higher mean scores than students taught BST using conventional method. The mean difference between experimental and control group was 7.64. This shows that students taught Basic Science and Technology using EBIS have achieved higher than those taught using CM. This result was further investigated by testing of hypothesis four as shown in Table 4.

Null Hypothesis 2: There is no significant difference between mean achievement scores of students taught Basic Science and Technology using ethnoscience blended instructional strategy and those taught, using conventional method.

Table 4: Analysis of Covariance on Students' Achievement in BST

Table results revealed that the experimental group had F-value of 57.821 and

Source	Type III Sum of Squares	df	Mean square	F	Sig.	Partial Squared	Eta
corrected Model	9893.146 ^a	2	4946.673	416.053	.000		.320
Intercept	19239.312	1	19239.312	1618.109	.000		.010
Pretest	28.652	1	28.652	2.41	.242		.041
Group	687.486	1	687.486	57.821	.000		.83
Error	3597.763	639	11.890				
Total	405400.000	643					
Corrected Total	4490.909	642					

a. R Squared = .199 (Adjusted R Squared = .190)

Findings in Table 4 revealed that the experimental group had F-value of 57.821 at the significance value of 0.000, this significance value is less than p-value of 0.05 (i.e. $p = 0.05 > 0.00$). With this result, the null hypothesis two which stated that there is no significant difference between mean achievement scores of students taught Basic Science and Technology using ethnoscience blended instructional strategy and those taught, using conventional method is rejected. This implied that there is a significant difference between mean achievement scores of students taught Basic Science and Technology using ethnoscience blended instructional strategy and those taught using conventional method. The partial eta squared was investigated which gave a value of 0.083. This value indicates that there is a high effect size between the experimental and control group.

Research Question 3: What is the difference between mean retention scores of students taught Basic Science and Technology using ethnoscience blended instructional strategy and those taught using conventional method?

Table 5: Mean and Standard Deviation of Students' Mean Retention scores in BST

Teaching Method	N	Pre-BSTAT		BSTRT	
		Mean	SD	Mean	SD
EBIS	341	35.90	1.03	55.48	1.02
CM	302	35.86	1.05	41.88	1.04
Total	643				
Mean Retention difference				13.60	

The result from Table 5 showed that the mean retention scores of students taught BST using EBIS was higher than their counterpart in CM. Hypothesis 3 was tested for level of significance of this result in Table 6.

Null Hypothesis 3: There is no significant difference between mean retention scores of students taught Basic Science and technology using ethnosience blended instructional strategy and those taught using conventional method.

Table 6: Analysis of Covariance on Students' Mean Retention in BST

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	8697.286 ^a	2	4348.643	733.578	.000	.155
Intercept	3354.541	1	3354.541	565.881	.000	.469
Pretest	869.836	1	869.836	11.159	.336	.064
Retention*	28.994	1	28.994	21.761	.002	.91
Error	3793.624	640	5.928			
Total	405400.000	643				
Corrected Total	4490.909	642				

a. R Squared = .155 (Adjusted R Squared = .146)

Table 6 findings indicated that retention had F value of 21.761 at the significance value of 0.002, which is less than the p-value of 0.05. Based on this findings, hypothesis three which stated that there is no significant difference between mean retention scores of students taught Basic Science and technology using ethnosience blended instructional strategy and those taught using conventional method was rejected. This result indicates that there is a significant difference in the mean retention scores of students taught Basic Science and Technology using EBIS and those taught using CM. The computed value for partial eta squared was 0.91 which implies that there is large effect size between students that was taught BST using EBIS and those that were taught using CM.

Summary of Findings

1. There is a significant different between mean interest ratings of students taught BST using EBIS and those taught using CM.
2. There is a significant different between mean achievement scores of students taught BST using EBIS and those taught using CM.
3. There is a significant different between mean retention scores of students taught BST using EBIS and those taught using CM.

Discussion of Findings

The purpose of this study was to investigate whether the use of ethnosience blended instructional strategy is effective in improving the interest, achievement and retention of

students in Basic Science and Technology. Before the commencement of the treatment, it was established through the pre-test that the subjects had equivalent interest and knowledge in Basic Science and Technology. Therefore, the observed differences in the results are due to the treatment. The results of the analysis of data on research questions and null hypotheses are hereby discussed.

Interest ratings of students taught Basic Science and Technology using ethnosience blended instructional strategy and those taught using conventional method

The result of the analysis showed that post mean interest ratings of students that were taught BST using EBIS was 3.87, while those students taught using CM was 2.96. Therefore, the students that were taught BST using EBIS had higher interest to Basic Science and Technology than their counterparts that was taught using CM. This result was further supported by the testing of hypothesis one which showed a significant difference between mean interest ratings of students in the experimental and control groups. This finding agrees with those of Ugwuanyi (2015) and Novia, Hafnati and Abdul (2019) whose results indicated that the students taught using ethnosience based instructional strategies have higher mean interest to science than students taught using conventional teaching method. This means that the ethnosience blended instructional strategy has the potential of instilling positive interests to science learning among students.

Achievement scores of students taught Basic Science and Technology using ethnosience blended instructional strategy and those taught using conventional method

The result of the analysis showed that students taught Basic Science and technology using ESBIS achieved higher than those taught using CM. This result was further tested for the level of significance by testing hypothesis two which shows a significance difference between the mean achievement scores of students in the experimental and control group. The findings of this study is in agreement with those of Sudarmin (2015) who revealed that students taught with ethnosience based instructional strategies had higher mean scores in academic achievement than those taught using the conventional approach. The author argued that the higher achievement of students taught with ethnosience related instructional strategies was because the group was able to integrate or link their background/indigenous knowledge to the new concepts they were taught.

Retention scores of students taught Basic Science and Technology using ethnosience blended instructional strategy and those taught using conventional method

The findings of this study also reveal that the mean retention scores of students taught Basic Science and Technology using ESBIS was higher than their counterparts taught using CM. This was further investigated for the level of significance in hypothesis three, which

showed a significant difference in the mean retention scores of students taught Basic Science and Technology using ESBIS and those taught using CM. The finding of this study is in line with the finding of Risdianto *et al.* (2020) who established that ethnosience blended instructional strategy provides a linkage or connection between science concepts and the context of human experience which facilitate leaning storing of Basic Science and Technology concepts. This means that the essence of learning is to bring about a long-lasting change in the learner behaviour. This implies that if a student learns and forgets easily, such learning may not be worthwhile.

Conclusion

Based on the findings, the researchers concluded that ethnosience blended instructional strategy is an effective technique for improving students' interest, achievement and retention in Basic Science and Technology.

Recommendations

Based on the findings of this study, the following recommendations are made:

- a. That ethnosience blended instructional strategy is effective in teaching and learning, therefore it should be used by Basic Science and Technology teachers for the teaching of relevant concepts in order to improve students' achievement and retention.
- b. Science educators should endeavour to teach the prospective Basic Science and Technology teachers' proper way of blending scientific concepts with learners' environment and traditional practices that are of scientific interest through effective utilization of ethnosience blended instructional strategy during their training.
- c. Federal and State Ministries of Education should organize in-service training programme in form of conferences, seminars and workshops for serving Basic Science and Technology teachers to acquaint them with appropriate knowledge and skills on how to use ethnosience blended instructional strategy for effective teaching of science and technology particularly at basic levels of education.
- d. The government at all levels and schools' administrators should endeavour to provide adequate facilities and environment to enhance the use of ethnosience blended instructional strategy for teaching Basic Science and Technology.

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