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

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Abstract

This study investigated Effect of Ethnoscience Blended Instructional Strategy (EBIS) on Urban and Rural 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. The study adopts quasi-experimental pretest posttest non-randomized research design. 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 0.89 and 0.76 using Cronbach-Alpha Method and Kuder-Richardson 20 formula respectively. The sample size of 341 upper basic II students

was drawn from the population of 6,285 using multi-stage sampling technique. Mean and standard deviation were used to answer the research questions while null hypotheses were tested at 0.05 level of significance using Analysis of Covariance (ANCOVA). The results showed no significant difference in mean interest ratings with a small effect size of $\eta^2_p = 0.42$, mean achievement scores with effect size of $\eta^2_p = 0.44$, as well as mean retention scores with a small effect size of $\eta^2_p = 0.43$. Based on these findings, it was concluded that EBIS is an effective strategy for teaching BST, capable of bridging the gap between urban and rural students' interest, achievement and retention. It was recommended that EBIS should be used for the teaching and learning of BST where applicable; that government at all levels and school administrators should organize seminars and conferences as an in-service training for serving BST teachers to update their knowledge on how to use EBIS.

Keywords: Ethnoscience Blended Instructional Strategy, Urban Students, Rural Students, Interest, Achievement, Retention, Basic Science and Technology

Introduction

Basic Science and Technology is a viable tool for providing students with strong solid foundation in science and technology to pursue science and technology-related courses in tertiary institutions that are essential ingredients for national development. Basic Science and Technology is the bedrock for the systematic way of acquiring scientific and technological knowledge and skills as well as putting the acquired scientific and technological knowledge and skills into practical use for solving our immediate societal problems (Etonihu & Agu, 2018). This subject is taught at this level to present rudiments of science content, concepts and principles as the fundamental unified body of knowledge to avoid premature stress on the distinctions between the various scientific fields (Okwara & Upu, 2018). It is therefore important for students to be well grounded in Basic Science and Technology to acquire useful knowledge and skills for Nigerian nation to attain the state of national development it desires and to be ranked favourably among the communities of the developed nations.

Despite the importance of Basic Science and Technology, there has been consistent poor achievement of students in the subject over the years. The poor achievement of students has been attributed to many factors ranging from students' poor interest, background, inadequate instructional resources, poor implementation procedures and the use of archaic instructional approaches that do not take care of students' cultural environment among others (Nnorom 2015; Okwara & Upu, 2018). Instructional approach is a systematic way of organizing and presenting learning experiences to the learners by showing the activities by which learners and teachers should carry out to achieve the objectives. Obiekwe (2008) blames the poor achievement of students in science on teachers for neglecting the culturally blended instructional approaches for science instruction.

This implies that negligent attitude of science teachers in shying away from culturally related instructional approaches led to poor students' interest, achievement and retention of scientific concepts. The implication is that teaching and learning of Basic Science and Technology will be more effective if it is blended with the cultural background of the students. Fassasi (2017) suggests that the use of ethnoscience blended instructional strategy for the implementation of science curriculum would help students link up what they learned

in their homes or culture to science classes which will improve their interest, achievement and retention of the scientific concepts.

Ethnoscience blended instructional strategy is the technique implore to harnesses indigenous scientific knowledge driven from past and present socio-cultural practices of the students to enhance their interest, achievement and retention in Basic Science and Technology concepts. Anderson (2009) and Brown (2015) reported that ethnoscience blended instructional strategy is an environmentally friendly which can help to improve students' interest, achievement and retention irrespective of gender and location of learners. This necessitates the researchers to carry out this study to investigate effects of ethnoscience blended instructional strategy on urban and rural students' interest, achievement and retention in Basic Science and Technology in Benue State, Nigeria.

In the ethnoscience blended instructional strategy classroom setting, the teacher presents the lesson by linking concepts to the cultural and traditional practices in the environment of the students. The teacher after giving a brief explanation allow students to present other cultural and traditional practices in their environment that are related to the concept, step by step as the instruction proceeds. In this way, ethnoscience blended instructional strategy can help sequence the learning process through previous knowledge of the culture, offering students' opportunity to know more about reality, culture and their natural environment. The strategy can encourage students to see science within them and arrive at meaningful learning and understanding leads to proper application to improve students' interest, achievement and retention irrespective of gender and location of school.

Interest deals with the persistent tendency of students to pay attention and enjoy some activities or contents (Nnorom, 2015). Interest in Basic Science and Technology referred to students' reactions, feeling and impression about Basic Science and Technology contents and concepts as well as related tasks. Ugwuanyi (2015) observed that the type of interest students brings into the classroom is the reflection of their achievement and retention. This means that without students' positive interest in a subject meaningful learning cannot take place.

Achievement is an exhibition of knowledge attained or skills developed by students in a subject as determined by test scores assigned by teachers (Ogundukun & Adeyemo, 2010). Achievement of students is their abilities to demonstrate the extent to which classroom instructions and experiences have been attained. Achievement of students in Basic Science and Technology is an essential function for sustainable students' interest, achievement and retention of scientific and technological skills in Biology, Chemistry and Physics for national development. Various studies showed that achievement of students is dependent on good instructional approach that can facilitate retention of knowledge and skills.

Retention can be seen as the capability of the students to keep students and reproduce knowledge, information or ideas and skills acquired, for future use. Upu, Ezeudu and Okwara (2016) describe retention as the ability of an individual to keep certain information in their memory and remember them for a given period after a course has been completed. This is because the rate of retention varies from individual to individual due to the differences in their gender, interest, age, cognitive capacities and location of the school. This

means that students' retention in Basic Science and Technology required students' ability to store and reproduce the knowledge and skills acquired for sustainable achievement in the pure science subjects and to solve societal problems.

The reports on students' abilities, interest, achievement, storing capacities and retention based on school location difference have been debated over the years. Location can be referred to as the demographic area or place where schools are situated. Generally, the schools which learners attended are classified into either rural or urban school based on where the school is situated (Peni, 2015). Different studies have shown positive correlation of school location and students' academic achievement (Duadu & Udofia, 2010). Fassasi (2017) found out that urban students perform better than rural students in concept attainment in science. In a study carried out by Peni (2015) showed a significant main effect of school location on interest and cognitive attainment of students in Basic Science and Technology with learners in rural schools performing better than those in urban schools. The author also maintains that good instructional methods break the boundary of gender in students' interest, achievement and retention in science. This call for more research which necessitates the present study to find out if the use of ethnoscience blended instructional strategy will help provide both urban and rural students gain requisite knowledge and skills that would sustain their interest and improve achievement and retention in Basic Science and Technology.

Statement of the Problem

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

Various studies reveal that effective utilization of ethnoscience blended instructional strategy increase both urban and rural students' interest, achievement and retention in science. Most of these research works focus in other areas like Biology, Chemistry and Physics but much is yet to be done in Basic Science and Technology particularly in Benue State, Nigeria.

Objectives of the Study

The general objective of this study is to determine the efficacy of ethnoscience blended instructional strategy on urban and rural students' interest, achievement and retention in Basic Science and Technology in education zone B, Benue State, Nigeria. The specific objectives of this study are to:

- i. Investigate the difference between mean interest ratings of urban and rural students taught Basic Science and Technology using ethnosience blended instructional strategy.
- ii. Find the difference between mean achievement scores of urban and rural students taught Basic Science and Technology using ethnosience blended instructional strategy.
- iii. Obtain the difference between mean retention scores of urban and rural students taught Basic Science and Technology using ethnosience blended instructional strategy.

Research Questions

The following research questions were raised to guide the study:

- i. What is the difference between mean interest ratings of urban and rural students taught Basic Science and Technology using ethnosience blended instructional strategy?
- ii. What is the difference between mean achievement scores of urban and rural students taught Basic Science and Technology using ethnosience blended instructional strategy?
- iii. What is the difference between mean retention scores of urban and rural students taught Basic Science and Technology using ethnosience blended instructional strategy?

Statement of Hypotheses

The following null hypotheses are formulated and will be tested at 0.05 alpha level of significance:

- i. There is no significant the mean difference between interest ratings of urban and rural students taught Basic Science and Technology using ethnosience blended instructional strategy.
- ii. There is no significant mean difference between achievement scores of urban and rural students taught Basic Science and Technology using ethnosience blended instructional strategy.
- iii. There is no significant mean difference between retention scores of urban and rural students taught Basic Science and Technology using ethnosience blended instructional strategy.

Methodology

A quasi-experimental non-randomized, pre-test, post-test control group design was adopted in this study. The population of the study was 34,125 Upper Basic II students of Benue State, Nigeria. A sample of 345 drawn from four Basic schools in education zone A of Benue State was used for the study. Education zone A was randomly chosen out of three education zones of Benue State by simple random sampling technique of balloting. The simple random sampling technique was used in selecting sampled schools. Only four basic schools were randomly chosen because of the experimental nature of the study. Two schools each were selected in urban and rural areas.

The instruments for data collection were and Basic Science and Technology Interest Scale (BSTIS) and Basic Science and Technology Achievement Test (BSTAT) as well as Basic Science and Technology Retention Test (BSTRT) they were developed by the researchers. BSTIS consists of 30 items, and it scored on a four-point scale of strongly agree (SA) = 4 points, agree (A) =3 points, disagree (D) =2 points and strongly disagree (SD) =1 point. The BSTAT consists of 50 multiple choice items, drawn from Basic Science and Technology of Upper Basic II curriculum based on the following topics: diseases, pollution, drug abuse and habitats. The validation of BSTAT and BSTIS were done by three experts in the Department of Science Education, Joseph Sarwuan Tarka University, Makurdi, Nigeria. The reliability of the BSAT and BSTIS were determined using Kuder-Richardson 20 formula ($K-R_{20}$) and Cronbach Alpha Coefficient which gave the values of 0.76 and 0.78 respectively. These values showed positive relationship within the test items which means that the instruments are both internally consistent and reliable.

The regular Basic Science and Technology teachers were used as research assistants for the study. Three days training programme was organized for the research assistant by the researchers. They were properly trained on how to teach using ethnoscience blended instructional strategy and administration of BSTIS, BSTAT and BSTRT. The trained teachers practiced by demonstrating on how to teach, using the researchers' prepared lesson plans that contained the necessary steps of ethnoscience blended instructional strategy in form of micro teaching.

BSTIS and BSTAT were administered to students as pre-test to establish their initial level of interest and achievement in Basic Science and Technology before the commencement of the experiment. Immediately after the pre-test the teachers taught the content, adhering to ethnoscience blended instructional strategy lesson plans and procedures prepared by the researchers. The treatment lasted for six weeks. Teachers in urban and rural area completed the content as stipulated in the researchers' guideline. Immediately after the conclusion of the teaching, the BSTIS and BSTAT were given as post-test and two weeks later BSTRT was given to determine retention of students in Basic Science and Technology and scores were recorded. The mean and standard deviation were used for answering of research questions while Analysis of Covariance (ANCOVA) was used to test null hypotheses at 0.05 level of significance. The choice of ANCOVA is to check the group initial difference that might exist due to the random assigning of schools.

Results

The results of this study are presented according to corresponding research questions and hypotheses.

Research Question One

What is the difference in mean interest ratings of urban and rural students taught Basic Science and Technology using ethnoscience blended instructional strategy?

To answer research question one, the analyzed Basic Science and Technology mean interest ratings of male and female students is presented in Table 1.

Table 1: Mean and Standard Deviation of Urban and Rural Students' Mean Interest Ratings in BST

| Location | N | Pre-interest | | Post-interest | | Mean Gain |
|------------------------|-----|--------------|------|---------------|------|--------------|
| | | Mean | SD | Mean | SD | |
| Urban | 163 | 2.16 | 1.04 | 3.59 | 0.05 | 1.43 |
| Rural | 178 | 2.09 | 1.03 | 3.68 | 0.25 | 1.59 |
| Total | 341 | | | | | |
| Mean difference | | 0.07 | | -0.09 | | -0.16 |

Result in Table 1 showed that mean interest rating of rural students taught Basic Science and Technology using EBIS is slightly higher than that of urban students taught Basic Science and Technology using EBIS. This result indicates that the difference between mean interest ratings of rural and urban students taught Basic Science and Technology using EBIS is 0.16. This result was further investigated by testing hypothesis one as shown in the Table 2.

Research Hypothesis One

There is no significant mean difference between interest ratings of rural and urban students taught Basic Science and Technology using ethnosience blended instructional strategy.

Table 2: ANCOVA on Rural and Urban Students' Mean Interest Ratings in BST

| Source | Sum of Squares | df | Mean Square | F | Sig. | Partial Eta Squared |
|------------------|-----------------------|----------|----------------|---------------|-------------|---------------------|
| Corrected Model | 1357.198 ^a | 2 | 678.599 | 18.152 | .000 | .097 |
| Intercept | 39262.340 | 1 | 39262.340 | 1050.244 | .000 | .757 |
| Pre-test | 275.224 | 1 | 275.224 | 7.362 | .007 | .021 |
| Location* | 686.591 | 1 | 686.591 | 18.365 | .202 | .042 |
| Error | 12635.990 | 388 | 37.384 | | | |
| Total | 1042275.000 | 341 | | | | |
| Corrected Total | 13993.188 | 340 | | | | |

a. R Squared =.98 (Adjusted R Squared = .987)

From Table 2 the result showed that the F-value of location is 18.365 at significant p-value of 0.222 which is greater than alpha-value of 0.05. Based on this result hypothesis two is not rejected. This means that there is no significant difference in the mean interest ratings of rural and urban students taught Basic Science and Technology using ethnosience blended instructional strategy. To investigate effect size of ESBIS on rural and urban a computed value of partial eta squared gave a value of 0.042, this shows a low effect between interest of urban and rural students in experimental group.

Research Question Two

What is the difference in mean achievement scores of urban and rural students taught Basic Science and Technology using ethnosience blended instructional strategy?

To answer research question two, the analyzed Basic Science and Technology achievement scores of students is presented in Table 3.

Table 3: Mean and Standard Deviation on Urban and Rural Students' achievement in Basic Science and Technology

| Location | N | Pre-BSTAT | | Post-BSTAT | | Mean Gain |
|------------------------|-----|-------------|------|-------------|------|--------------|
| | | Mean | SD | Mean | SD | |
| Urban | 178 | 32.55 | 3.16 | 64.98 | 2.04 | 32.43 |
| Rural | 163 | 31.43 | 3.28 | 64.97 | 3.19 | 33.54 |
| Total | 341 | | | | | |
| Mean difference | | 1.12 | | 0.01 | | -1.11 |

Findings in Table 3 showed that the mean achievement score of rural students was slightly higher than urban students taught Basic Science and Technology using ethnoscience blended instructional strategy. The difference between mean achievement scores of urban and rural students taught Basic Science and Technology using ethnoscience blended instructional strategy was 1.11. This result is further investigated by testing hypothesis two in the Table 4.

Research Hypothesis Two

There is no significant mean difference between achievement scores of urban and rural students taught Basic Science and Technology using ethnoscience blended instructional strategy.

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

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. | Partial Eta Squared |
|-------------------|-------------------------|----------|---------------|--------------|-------------|---------------------|
| Corrected Model | 238.504 ^a | 2 | 119.252 | 9.507 | .009 | .053 |
| Intercept | 18095.518 | 1 | 18095.518 | 1442.564 | .000 | .810 |
| Pretest | 221.280 | 1 | 221.280 | 17.640 | .013 | .049 |
| Location** | 32.845 | 1 | 32.845 | 2.618 | .132 | .044 |
| Error | 4252.405 | 388 | 12.544 | | | |
| Total | 405400.000 | 341 | | | | |
| Corrected Total | 4490.909 | 340 | | | | |

a. R Squared = .053 (Adjusted R Squared = .042)

Table 4 results reveal that the location have F-value of 2.618 and p-value of 0.132 which is greater than the alpha-value of 0.05 (i.e. $p = 0.05 < 0.132$). With this result, the null hypothesis two which stated that there is no significant mean difference between achievement scores of urban and rural students taught Basic Science and Technology using ethnoscience blended instructional strategy is upheld. This implied that there is no significant difference in the mean achievement scores of urban and rural students in the experimental group. This indicates that although there is a slight observed high mean gain in rural students, the mean difference is not significant. The effect size between groups was

investigated which gave computed value of partial eta squared of 0.044 which implies that there is small effect size between the achievement of urban and rural students that was taught BST using EBIS.

Research Question Three

What is difference in the mean retention scores of urban and rural students taught Basic Science and Technology using EBIS?

Basic Science and Technology Mean Retention Scores of urban and rural students is presented in the Table 5.

Table 5: Mean Retention Scores and Standard Deviation on Urban and Rural Students in BST.

| Location | N | Pre-BSAT | | BSRT | |
|---------------------------|------------|----------|------|-------|------|
| | | Mean | SD | Mean | SD |
| Urban | 178 | 32.43 | 1.03 | 48.91 | 103 |
| Rural | 163 | 32.55 | 1.08 | 47.94 | 1.09 |
| Total | 341 | | | | |
| Mean retention difference | | | | 0.97 | |

Table 5 shows that the mean retention score of urban students taught Basic Science and Technology with EBIS was 48.91, while the mean retention score of the rural students was 47.94 with the mean difference of 0.97. This indicates that there is a slight high mean retention scores in urban students. The result was further investigated by testing hypothesis 3.

Research Hypothesis Two

There is no significant mean difference between retention scores of urban and rural students taught Basic Science and Technology using ethnoscience blended instructional strategy.

Table 6: Analysis of Covariance on Urban and Rural Students' Retention in BST

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. | Partial Eta Squared |
|------------------|-------------------------|-----|----------------|---------------|-------------|---------------------|
| Corrected Model | 17877.391 ^a | 2 | 8938.700 | 265.993 | .000 | .578 |
| Intercept | 53305.038 | 1 | 53305.038 | 1586.223 | .000 | .803 |
| Pretest | 54.873 | 1 | 54.873 | 1.633 | .171 | .004 |
| Location* | 874.418 | | 874.418 | 26.020 | .087 | .043 |
| Error | 13038.574 | 388 | 33.605 | | | |
| Total | 1552375.000 | 341 | | | | |
| Corrected Total | 30915.965 | 340 | | | | |

a. R Squared = .578 (Adjusted R Squared = .575)

Table 6 indicates that Location yielded an F-value is 26.020 at the p-value of 0.087 which is greater than the alpha-value of 0.05. Hence, hypothesis eight is not rejected. This

confirms that there is no significant difference in the mean retention scores of urban and rural students in BST. The computed value of partial eta squared 0.043 which implies that there is a low effect size between the retention of urban and rural students that were taught BST using EBIS.

Discussion

The main purpose of this study was to find out whether the use of ethnoscience blended instructional strategy is effective in improving the interest, achievement and retention of upper 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 objective by objective.

The results of the finding of this study in respect to interest of urban and rural students in showed that there was no significant difference in their interest. This implies that ethnoscience blended instructional strategy had improved the interest of both the students in rural and urban schools. Although there was no significant difference in the mean interest ratings of urban and rural students, a critical look at mean interest ratings shows that mean interest ratings of rural students were slightly higher than urban students. The observed higher mean interest ratings of rural students could be attributed to the nature of the ethnoscience blended instructional strategy which incorporates culturally practices the students are familiar with that could arouse and sustained their interest in the learning process. This finding was supported by Peni (2015) who reported no significant difference in the mean interest ratings of students from urban and rural schools. The author concluded that the difference often observed by researchers in students' academic achievement cannot be attributes to their environment, but to the nature of instructions (teaching approach) the students were exposed to. The finding of this study however, contradicted that of Ehiane (2014) who established that rural and urban students' interest in science varies with location in favour of students in urban schools. It was also contrary to the findings of and Fassasi (2017) who confirmed that the difference in interest between urban and rural schools was due to the availability of technology in the urban areas. Thus, if this reason was the cause of the difference in the interest of urban and rural students in science, ethnoscience blended instructional strategy, in this study, has been able to bridge the gap created by the lack of technology and provided the rural students with the boost to catch up with their urban counterparts.

The results of the finding of this study, in respect to the achievement of urban and rural students in experimental group showed that there was no significant difference in their academic achievement. This implies that ethnoscience blended instructional strategy had improved the achievement of both the students in rural and urban schools. The improvement in achievement of rural students as observed in this study was attributed to the nature of the ethnoscience blended instructional strategy which incorporates culturally relevant practices the students are familiar with in the learning of Basic Science and Technology. This finding was supported by Peni (2015) who reported no significant difference in the academic achievement of students from urban and rural schools. The

author also concluded that the difference some researchers observed in the urban and rural students' academic achievement cannot be attributed to their environment, but to the nature of instructions (teaching approach) the students were exposed to. The finding of this study disagreed with Sudarmin (2015) and Ugwu and Diovu (2016) who established that the difference in the achievement of urban and rural students were due to the availability of technology in the urban areas. Therefore, if this reason was the cause of the difference between the achievement of urban and rural students, ethnoscience blended instructional strategy, in this study, has been able to bridge the gap created by the lack of technology and provided to rural students a booster to catch up with their urban counterparts.

The essence of learning is to bring about a long-lasting change in the learner. This means that if a student learns and forgets easily, such learning may not be worthwhile. Results from the testing of the null hypothesis three revealed no significant difference of urban and rural students' retention of Basic science and Technology. The implication is that ethnoscience blended instructional strategy has created long lasting effects on urban and rural students to retain the learned concepts of Basic Science and Technology. This finding agrees with Peni (2015) who found that ethnoscience-enrich-instruction provides very rich experiences to the students from rich environment and cultural activities embedded in the classroom that can bring about equal knowledge retention irrespective of the location of the schools. The author maintained that students will always have greater retention when directly engaged in the learning process with familiar practices. This implies that students do not gain the desired retention ability unless when concerted efforts are made to identify and use instructional strategies that appeal to their interests and have bearing to their cultural heritages. Thus, in this study, ethnoscience blended instructional strategy had proved to enhance the desired retention of learnt concept among urban and rural students.

Conclusion

Based on the results of the findings the researchers concluded that ethnoscience blended instructional strategy enhanced both urban and rural students' interest, achievement and retention in Basic Science and Technology.

Recommendations

Based on the findings of this study, the following recommendations are made: That ethnoscience blended instructional strategy is effective strategy therefore it should be implemented by science teachers for the teaching of Basic Science and Technology at all levels of basic education. 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 ethnoscience based instructional strategies for effective teaching of science and technology particularly at basic levels of education.

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