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Research Article

Nurturing Creative Thinking In Basic Science Among Dissimilar-Ability Basic-8 Students By Ethnoscience Teaching Strategy In Makurdi, Nigeria

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ABSTRACT

Nurturing creative thinking in Basic Science among different-ability basic-8 students by ethnoscience teaching strategy in Makurdi, Benue State, Nigeria was studied using a pre-test post-test quasi-experimental design. Two research questions and two hypotheses guided the study. A multistage sample of 40 students was drawn from a population of 1,613 basic-8 students in the 25 public Schools in Makurdi. Torrance Test of Creative Thinking adapted by the researchers was validated by two experts with a reliability coefficient of 0.9 analysed with Pearson Product Moment Correlation statistic was used for data collection. Data were analysed using mean, standard deviation and one-way ANCOVA. Findings showed significant mean difference in the creative thinking level among students taught Basic Science by ethnoscience teaching strategy and those taught by discussion method, F (1, 37) = 56.010, ρ (0.000) < 0.05. However, no significant mean difference existed in the creative thinking level among high, average and ability students taught Basic Science by ethnoscience teaching strategy, F (2, 16) = 3.085, ρ (0.74) > 0.05. In conclusion, creative thinking is not dependent on student academic ability level. The study recommended among others that ethnoscience teaching strategy should be used in teaching Basic Science for developing students' creative thinking.

Keywords:
Basic Science, Creative Thinking, Dissimilar-Ability, Ethnoscience Teaching Strategy.

INTRODUCTION

Science education plays an essential role in the development of the modern society. The effective teaching and learning of science are a major determinant of the revolutionary and evolutionary changes happening in the society. One of the roles of science education is to prepare students to think responsibly, critically, and creatively in responding to societal issues caused by the impact of science and technology on life and society (Stuckey et al., 2013). The foundation of science teaching in Nigeria educational systems begins with Basic Science at the basic education level. Basic Science formerly known as Integrated Science is the first form of science learning a child is exposed to under formal education (Agbidye, 2015). It combines the different disciplines of science into an integrated 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 (Nwankwo, 2021).

One of the main problems of Basic Science students is the perception that a lot of their science lessons are neither interesting, engaging, nor relevant (Anderhag et al., 2016; Ayua & Jato, 2012). This is

in line with Nwankwo (2021) who discussed that learning of science is perceived not to be relevant in the view of students and thus becomes unpopular to them. As a result of this, students put more effort to acquire certificate than learning the actual science happening in their surroundings. Scholars in the field of science education have observed some of these problems and suggested various contributions to eliminate them. A good example is Ayua (2019b) who recommended that the drive for paper certification/grades by students and the school system should be shifted to acquisition of sound knowledge and applicable competencies.

To improve the relevance of science education, science teaching requires new ways in the curriculum and pedagogy beyond the mere learning of science theories and facts (Stuckey et al., 2013; Ayua, 2019a). Science learning should be based on everyday life and societal situations that frame conceptual learning to enable students to appreciate the meaningfulness of science in their surroundings/society. In line with this, Ikyernum et al. (2022) insisted that Basic Science should be taught in a way that would enhance students creative thinking abilities for functional living in the 21st century world. Every nation has its cosmological ways of acquiring scientific knowledge, which could be associated with ethnoscience.

One of the ways that could be explored in improving students' scientific, and creative thinking skills is by integrating ethnoscience or local wisdom into learning materials as a sociocultural and educational developmental approach. According to Okwara and Upu (2017) ethnoscience refers to the materials, ideas, beliefs and technology in a given society or environment, that is derived from the past and present cultural practices or traditions. The approach emphasizes the role of culture and social interaction in shaping students' cognitive development to better their creative thinking.

Creative thinking could be referred to as the ability to generate innovative, novel, and valuable ideas through an open-minded, flexible, and imaginative thought process that combines existing knowledge and experiences in fresh and surprizing ways. Heriyanto et al. (2020) and Ikyernum et al. (2022) see creative thinking as the ability for an individual to generate new ideas in specific contexts, seeing existing situations in a new way, identifying alternative, explanations, and seeing or making new links that generate a positive novel product. creative thinking is a way of observing problems or situation from a fresh perspective. It is often stimulated both by an unstructured process like brainstorming and by a structured process like heuristic program irrespective of gender.

Dissimilar-ability as used in this study denotes the diverse academic performance levels of basic-8 students in Basic Science, which is grouped into high, average, and low based on their past academic scores. Ayua (2021) and Agbidye et al. (2023) maintained that ability grouping is determined by teachers' assessments of students' abilities; and when assigning students to varied tracks, their prior test scores or performance measures from preceding grades are considered in placing their ability levels. Thus, Basic-8 students' ability levels for this study were based by the Benue State Ministry of Education – BSME (2023) and Benue State Examinations Board – BSEB (2023) grading system for basic schools. The grading system is as follows: High Ability Level (A = 75-100% and B = 65-74%), Average Ability Level (C = 55-64% and D = 45-54%) and Low Ability Level (E = 40-44% and F =0-39%). This grading system was used by the researchers in distinguishing and grouping the students based on their academic ability levels in Basic Science. Okoro and Onyike (2021) lamented that teaching methods like ethno-science need to be adaptable to cater for these different ability levels to ensure inclusive learning. Research shows that traditional teaching methods often benefit high-ability students more, while inclusive strategies like ethnoscience teaching can better engage students across all ability levels (Akinyemi & Yusuf, 2022). These teaching methods provide varied entry points to learning, allowing students of all abilities to connect with the material at their respective levels of understanding.

Empirically, Sumarni and Kadarwati (2019) examined the impact of ethno-Science, Technology, Engineering and Mathematics (STEM) project-based learning on creative thinking skills and the result showed that the ethno-STEM project-based learning was able to improve the average creative thinking skills of students in all indicators varying from low to medium categories. Also, Ramdan and Marei (2020) examined effect of computer games on the fifth-grade students' achievement and creative thinking in science in the UNRWA (United Nations Relief and Works Agency) schools for Palestine Refugees in the Near East and the results showed that there were statistically significant differences between the achievement of the experimental group and the control group due to teaching method in favour of the experimental group. Khoiri et al. (2019) carried out a study which was titled: How is students' creative thinking skills? An ethnoscience learning implementation" who discovered that ethnoscience learning is effective in increasing student creativity than traditional method. Ayua et al. (2022), Ikyernum et al (2022) and Agbidye et al. (2023) studies on creative thinking among students

with varied academic ability levels found no significant difference in students' creative thinking based on their academic ability levels.

In spite of the increasing need for integrating cultural knowledge into science education, there is seemly limited research on how ethnoscience teaching strategy could affect the creative thinking skills of students with dissimilar academic abilities. Laura (2021) lamented that in Nigeria, the secondary schools, students' level of creative thinking has not been quite explored; despite the fact that creative thinking is indispensable for success in science education. Thus, it is necessary to explore the teaching methods that could nurture creative thinking skills across students with dissimilar-ability. It is on this premise that nurturing creative thinking in Basic Science among dissimilar-ability basic-8 students by ethnoscience teaching strategy in Makurdi, Benue State, Nigeria was studied using a pre-test post-test quasi experimental design with the following specific objectives:

1. To determine the difference in the creative thinking of students taught Basic Science by ethnoscience teaching strategy and those taught by discussion method.
2. To find out the difference in the creative thinking of high, average and low anility students taught Basic Science by ethnoscience teaching strategy.

METHODS

The design was used for this study was a pre-test post-test quasi experimental. The population for this study consisted of 1,613 (781 males + 832 females) basic eight students from the 25 Universal Basic Education Junior Secondary Schools (UBE-JSS) in Makurdi (Benue State Universal Basic Education Board, Makurdi, 2023). A multistage sample of 40 (11 high + 17 average + 12 low) students in two intact classes was drawn for the study. Thus, the 25 schools were first stratified by location (North and South Bank). Then, only schools which are co-educational with one-arm standard class-size and at least one Basic Science teacher with first degree were purposively selected from each location. Thereafter, one school was drawn from each stratum and placed into experimental and control groups at random. Torrance Test of Creative Thinking (TTCT) figural-B was adapted from Torrance (1966) and used for data collection. The TTCT had two sections. Section A, generated the biodata of respondents. Section B, had three activities on picture formation, picture completion and repeated images. Each activity was scored a maximum of 15 marks based on the marking scheme with regards to fluency, originality, elaboration, abstractness of titles, and resistance to premature closure. These five segments in each of the three activities were scored at maximum of 3 marks for each. The TTCT was validated and trial tested with a reliability coefficient of 0.9, which was determined by the Pearson's Product Moment Correlation. Both the experimental and control groups were pre-tested before a 4-week treatment administered by trained research assistants (regular Basic Science teachers). The use of research assistants to administer pre-test, treatment, and post-test in this study was to help maintain: Objectivity, consistency for equal treatment across participants, reliability, blindedness, treatment loyalty/protocol adherence, data quality, and efficiency. Both groups were taught concepts of thermal energy, boiling and evaporation by ethnoscience teaching strategy (experimental) and discussion method (control) before administration of post-test. Mean and standard deviation were used in answering the research questions. Meanwhile, the null hypotheses were tested using one-way analysis of covariance (ANCOVA) at 0.05 level of significance. These statistics were deemed suitable for analysis because the study's data are of interval scale with dependent variable and covariate being continuous, normally distributed, no significant outliers, equal intervals, homogeneity of variance, independent observations, and equal sample sizes across groups.

RESULTS AND DISCUSSION

The results were presented in other of research questions and hypotheses as follows:

Research Question One: What is the mean difference in the creative thinking between students taught Basic Science by ethnoscience teaching strategy and those taught by discussion method?

The result in Table 1 shows disparity in the creative thinking between students taught Basic Science by ethnoscience teaching strategy and those taught by discussion method (mean gains of 5.38 and 2.07 respectively) with a mean gain difference of 3.31 in favour of ethnoscience teaching strategy.

Table 1: Mean and Standard Deviation of Students' Creative Thinking based on Teaching Methods

Teaching Method	Sample (n)	Pre-CT		Post- CT		$\bar{x}$ Gain	$\bar{x}$ Gain Difference
		$\bar{x}$	SD	$\bar{x}$	SD		
Ethnoscience	20	24.52	3.226	29.90	2.568	5.38	3.31
Discussion	20	23.43	3.302	25.50	2.960	2.07	

x̄ (Mean), SD (Standard Deviation), CT (Creative Thinking)

Research Question Two: What is the mean difference in the creative thinking among high, average and low ability students taught Basic Science by ethnoscience teaching strategy?

The result in Table 2 shows homogeneity in the creative thinking among high, average and low ability students taught Basic Science by ethnoscience teaching strategy with means gains of 5.91, 5.71 and 5.89 respectively and a negligible mean gain difference range of 0.02 to 0.20.

Table 2: Mean and Standard Deviation of Students' Creative Thinking based on Dissimilar-Ability in Ethnoscience Group

Dissimilar-Ability Level	Sample (n)	Pre-CT		Post-CT		$\bar{x}$ Gain	$\bar{x}$ Gain Difference
		$\bar{x}$	SD	$\bar{x}$	SD		
High (H)	5	27.09	1.080	33.00	1.225	5.91	
Average (A)	8	26.67	1.075	32.38	2.200	5.71	0.02 ≥ 0.20
Low (L)	7	25.98	1.143	31.87	2.274	5.89	

$\bar{x}$ (Mean), SD (Standard Deviation), CT (Creative Thinking), $\bar{x}$ Gain Difference [Between H&A (0.20), H&L (0.02), A&L (0.18)].

Hypotheses One: There is no significant mean difference in the creative thinking between students taught Basic Science by ethnoscience teaching strategy and those taught by discussion method.

Result in Table 3 shows a significant difference in the creative thinking mean scores among students taught Basic Science by ethnoscience teaching strategy and those taught by Discussion Method, F (1, 37) = 56.010, ρ (0.000) < 0.05. The null hypothesis was therefore, rejected. This implies that ethnoscience teaching strategy enhances creative thinking.

Table 3: ANCOVA Summary of Students' Creative Thinking Based on Teaching Methods

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	401.748[a]	2	200.874	88.849	.000	.828
Intercept	76.454	1	76.454	33.816	.000	.478
Pretest TTCT	208.148	1	208.148	92.066	.000	.713
Teaching Method	126.630	1	126.630	56.010	.000	.602
Error	83.652	37	2.261			
Total	31177.000	40				
Corrected Total	485.400	39				

R Squared = .828 (Adjusted R Squared = .818)

Hypothesis Two: There is no significant mean difference in the creative thinking among high, average and low ability students taught Basic Science by ethnoscience teaching strategy.

Result in Table 4 indicates no significant difference in the creative thinking among dissimilar-ability students taught Basic Science by ethnoscience teaching strategy, F (2, 16) = 3.085, ρ (0.74) > 0.05. The null hypothesis was therefore, not rejected. This implies that although ethnoscience teaching strategy nurtures creative thinking, it is not dependent on students' academic ability.

Table 4: ANCOVA Summary of Students' Creative Thinking based on Dissimilar-Ability in Ethnoscience Group

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	87.255[a]	3	29.085	12.232	.000	.696
Intercept	10.003	1	10.003	4.207	.057	.208
Pretest TTCT	37.188	1	37.188	15.640	.001	.494
Ability Levels	14.674	2	7.337	3.085	.074	.278
Error	38.045	16	2.378			
Total	18005.500	20				
Corrected Total	125.300	19				

a. R Squared = .696 (Adjusted R Squared = .639)

The finding showed that the students in the experimental group taught Basic Science concepts by the ethnoscience teaching strategy had higher creative thinking level than their counterparts in the control group who were taught same concepts by discussion method. This suggests the effectiveness of the ethnoscience teaching strategy in nurturing learners' creative thinking over discussion method. This could be attributed to the fact that ethnoscience teaching strategy involved practices which the learners are familiar with in the experimental group. The introduction of such familiar activities in classroom interaction generated a novel situation that influenced the students' inquisitiveness towards learning, hence, increases their creative thinking level than those in the control group who show little inquisitiveness toward learning. The finding is similar to that of Sumarni and Kadarwati (2019) who found that ethno-STEM project-based learning showed a significant effect on the improvement of students' critical and creative thinking skills. Also, the finding agrees with that of Khoiri's et al. (2019), Ramdan and Marei (2020) and Ikyernum et al. (2022) that ethnoscience learning is effective in increasing student creativity more than teacher-centred teaching methods.

Based on dissimilar-ability students, the result revealed no significant difference in creative thinking levels among high, average and low ability students when taught Basic Science by ethnoscience teaching strategy. This infers that ethnoscience teaching strategy nurtures creative thinking regardless of students' academic ability. This may result from the circumstance that ethno-science practices or activities in the society involves all category of children or individuals without recourse to their academic standing. Even in the classroom where it was introduced, students with dissimilar-ability enthusiastically participated in the teaching and learning activities; and thus, demonstrating their individual creative thinking. This finding is in agreement with that of Ayua et al. (2022), Ikyernum et al (2022) and Agbidye et al. (2023) who reported no significant difference in the creative thinking level of varied ability students.

CONCLUSIONS

Based on the findings of the study, it was concluded that:

1. The use of ethnoscience teaching strategy in teaching Basic Science is more effective for nurturing creative thinking among Basic-8 students than discussion method.
2. Besides, ethnoscience teaching strategy's effectiveness in nurturing creative thinking is not on students' academic ability levels.

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CONFLICT OF INTEREST

The authors do not have any conflict of interest.

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