International Journal of Educational Studies (INJEDS)
Vol. 3 Is. 1 (July 2025)
EISSN: 3092-8990
Website: https://www.injeds.com

EFFECT OF ETHNO-SCIENCE TEACHING ON CREATIVE THINKING LEVEL AMONG SCIENCE STUDENTS OF DIFFERENT-ABILITY IN BENUE STATE NIGERIA.

Dr. Joseph Olaiya Fatoki
Department of Science and Mathematics Education,
Benue State University, Makurdi-Nigeria

Dr Benjamin A. Fakolade
General studies unit, airforce institute of technology,
Kaduna

Mrs. Veronica Enemarie
Department of Science and Mathematics Education,
Benue State University, Makurdi-Nigeria

&

Harrison Ighodalo Okonofua
Department of Science and Mathematics Education,
Benue State University, Makurdi-Nigeria

.

Abstract

This study investigated the effect of ethno-science teaching on creative thinking among science students in Makurdi Township. The study employed a pretest and posttest quasi experimental design. The study was guided by two research questions and two hypotheses. The study's population was made up of the 1613 Upper basic II students from the 25 UBE JSS in Makurdi Local Government Area of Benue State. Two schools were selected from the population using multistage sampling technique. The schools were randomly assigned into experimental and control groups containing male and female students with varied ability that was derived from their previous term examination score. The experimental groups were taught Science concepts using ethno-science teaching while the control groups were taught using discussion method. The groups were further posttested to determine their creative thinking after the treatment. Torrance Test of Creative Thinking (TTCT) with a reliability coefficient of 0.948 at 0.05 level of significance was used to measure students' creative thinking. The research questions were answered using descriptive statistics (Mean, Standard Deviation and Mean Differences). The hypotheses were tested using two-way ANCOVA at significance level of 0.05. Findings shows that there is significant mean difference in the creative thinking level among different-ability

students taught Science using ethno-science teaching and those taught using discussion method (F (1, 33) = 73.035, p (0.000) < 0.05), there is no significant mean difference in the creative thinking level between male and female students of different ability level taught Science using ethno-science teaching (F (2, 13) = 0.655, ρ (0.536) > 0.05). The study concluded based on the findings that Ethno-science instruction is gender friendly and also efficient for the improvement of students' creative thinking level. The study recommends among others that the facilitators of the learning process should make utilize ethno-science teaching for instruction as to enhance the development of students' creative thinking level.

Keyword: Ethno-science, Science, Creative thinking, Gender and Different ability.

Introduction

Science education occupies a pivotal position in the advancement of contemporary society; the significance of both learning and teaching science serves as a crucial determinant of the revolutionary and evolutionary transformations taking place within society. One of the primary functions of science education is to equip students with the ability to think responsibly, critically and creatively in addressing societal issues that arise from the influence of science and technology on life and society (Stuckey, Hofstein, Mamlok-Naaman & Eilks, 2013). The foundation of science instruction in the Nigerian educational system commences with Basic Science at the elementary level. Basic Science, which was once referred to as Integrated Science, represents the initial exposure to scientific concepts that a child encounters at the secondary school level (Agbidye, 2015). Furthermore, as outlined in the National Policy on Education (FRN, 2014), the goals of science education encompass: fostering an interest in science and technology, acquiring fundamental scientific and technological skills, applying scientific and technological knowledge to address individual and societal needs, seizing career opportunities presented by science and technology and preparing for future academic pursuits in these fields. However, the effectiveness of these educational objectives can be hindered by various factors, including resource limitations and teaching methodologies.

The attainment of these objectives depends on several factors: the curriculum, instructors, learners, the learning environment (or situation), society and the teaching strategy. However, each of these elements plays a crucial role. Although the curriculum is important, the effectiveness of instructors can greatly influence outcomes. Because learners also bring their individual backgrounds and experiences, this diversity affects the overall learning process. But, the learning environment must not be overlooked, as it can either facilitate or hinder educational success. Beyond only studying scientific theories and facts, science education necessitates innovative approaches in curriculum and pedagogy (Eilks & Hofstein, 2015). For students to

understand the significance of science in their environment and society, science instruction should be grounded in real-world experiences and social contexts that frame conceptual understanding. According to Ayua, Ikyernum, and Terhemba (2021), basic science instruction should foster students' capacity for creative thought so they can function in the twenty-first century. Every country has its own unique methods for learning science, which may be related to the term ethno-science.

The term ethno-science is derived from the word “Ethnos,” which means nation and “Scientia,” which denotes knowledge. According to Okwara and Upu (2017) ethno-science refers to the materials, ideas, beliefs and technology in a given society or environment, that is derived from the past and present cultural practices and traditions. Ethno-science has been defined as an attempt "to reconstitute what serves as science for others, their practices of looking after themselves and their bodies, their botanical knowledge, but also their forms of classification, and making connections". One way that can be used to improve students’ scientific literacy skill, creative thinking and entrepreneur skills is by integrating ethno-science or local wisdom into learning materials and classes. When combined with scientific knowledge, ethno-science's simplicity can help students investigate social facts and phenomena (Melyasari, Sutoyo & Widodo, 2018). Because ethno-science is connected to students' own local identities, it can stimulate their curiosity and foster more innovative thinking.

Creative thinking involves students learning to generate and apply 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 outcome (Ayua, Ikyernum & Kwaghfan 2021). Creative thinking according to Walid (2020) is a way of observing problems or situation from a fresh perspective. This means unorthodox solutions (which may look unsettling at first). Creative thinking are often stimulated both by an unstructured process like brainstorming, and by a structured process like heuristic program. Moreover, it can mean

observing something through a new way. It's the very definition of "thinking outside the box." It is the power to perceive patterns that aren't obvious.

The variation in students' capacities can be traced to various factors which include different ability level such as high, average and low (Ayua, 2021). Academic ability or ability level is defined as the level of skill demonstrated in educational activities (Laura, 2021). Since learners have either high, average or low ability level then learning activities must be designed according to students' learning level to minimize or eradicate the achievement gap between students with high and low abilities. The ability levels of students must be accommodated by introducing novel learning strategies.

Research has remained focused on the role of gender in science education (Agbidye, 2015). Humans are essentially divided into two genders by nature: male and female. Each gender has unique characteristics, such as physical, biological, behavioral, emotional, and other differences. The topic of gender differences is not new to academics; numerous research have been conducted on the subject, with a variety of conclusions. For example, girls and boys taught Basic Science using Science-Technology-Society (STS) did not significantly differ in their mean levels of Entrepreneurial Creativity, according to Ayua and Agbidye (2020). Nwankwo (2021) discovered that students' performance in Basic Science is influenced by both gender and teaching styles.

Results of studies on gender and its influence on science learning have remained inconclusive since male and female students possess indigenous knowledge and understand the cultural practice of their society. There is the need to further examine gender difference in creative thinking of students.

Statement of the Problem

In secondary schools, students' level of creative thinking has not been quite appreciable (Laura 2021) and (Ode, Ayua & Alabi, 2019). This situation coupled with poor formation of science

concepts among students, poor interest in science, and overall poor academic achievement of secondary school students in science raise doubts on the efficacy of the existing instructional approaches in science (Ochu & Haruna, 2015). Despite the National Policy on Education (FRN, 2014), objectives of science education which include to: develop interest in science and technology, acquire basic science and technology skills, apply scientific and technological knowledge and skills to meet individual and societal needs, take advantage of the career opportunities offered by science and technology and become equipped for future studies in them. The reality on ground shows that the current approaches to science instruction in Nigeria can be criticized as incapable of achieving it objectives and to bridging the gap between the initial background of the learners and the expected creative thinking from students. The current instructional models have been accused by Afful-Broni, Anamuah-Mensah, Raheem, and Dei (2020) of estrangement and lacking in indigenized approaches.

This seems to call for the option of innovative instructional strategy which focuses on students' background, their cultural setting and practices as well as their indigenous environments. For this cause this study seeks to investigate the effect of ethno-science teaching on the creative thinking level of different ability science students with the following objectives;

1. To determine the creative thinking level among different-ability students taught Science using ethno-science teaching and those taught using discussion method.
2. To examine the creative thinking level between male and female students with different-ability taught Science using ethno-science teaching.

Research Questions

1. What is the mean difference in the creative thinking level among different-ability students taught Science using ethno-science teaching and those taught using discussion?
2. What is the mean difference in the creative thinking level between male and female students with different- ability taught Science using ethno-science teaching?

Hypotheses

1. There is no significant mean difference in the creative thinking level among different-ability students taught Science using ethno-science teaching and those taught using discussion method.
2. There is no significant mean difference in the creative thinking level between male and female students with different- ability taught Science using ethno-science teaching.

Methodology

A pre-test post-test quasi experimental design was used for the research. Forty (40) students and two schools were selected through multi stage (Purposive, stratified and random sampling) sampling technique from the population of 1613 upper basic II students from the 25 UBE JSS in Makurdi Township of Benue State. Torrance Test of Creative Thinking (TTCT) was the instrument used to collect data for the study, The instruments was adopted by the researcher, validated by two expert in the department of Science and Mathematics education at Benue State University and found to be reliable with coefficients of r= 0.948 at 0.05 level of significant through the pilot test that was conducted on 10 students from a different school outside the sampled school under standard examination condition. The two selected schools were pretested with the instrument to ensure that the students were of equivalent creative thinking level. The schools were randomly assigned into experimental and control groups. Each group contained 20 male and female students of high, middle and low ability level determined by their previous term examination (A/B is high, C/D is average and E/F is low) from schools in Makurdi township. The experimental groups were taught Science concepts using ethno-science teaching while the control groups were taught same concepts using discussion method. The treatment

was conducted in four weeks. After the four weeks teaching, the posttest was administered with the same TTCT. The TTCT scores were subjected to Two Way Analysis of Variance, Independent Sample t-test and mean deviation to answer the research questions and test the null hypotheses.

Results

Research Question One: What is the mean difference in the creative thinking level among different-ability students taught Science using ethno-science teaching and those taught using discussion method?

Table 1: Creative Thinking Level of Different-Ability Students Based on Teaching Method.

Different Ability	Sample (n)	Teaching Method	Pre-TTCT		Post-TTCT		$\bar{x}$ Gain	$\bar{x}$ Gain Difference
			$\bar{x}$	SD	$\bar{x}$	SD		
HAL	10	ES	21.65	2.4327	28.80	2.214	7.15	5.68
	11	DM	21.80	2.622	23.27	2.137	1.47	
AAL	6	ES	21.50	3.271	33.25	2.318	11.75	9.95
	5	DM	24.80	1.095	26.60	0.894	1.8	
LAL	4	ES	23.63	3.092	34.38	5.056	10.75	8.25
	4	DM	23.00	0.816	25.50	0.95	2.5	
Cluster		**ES**	**22.26**		**32.14**		**9.88**	**7.96**
		DM	**23.2**		**25.12**		**1.92**	

Group: ES (Experimental Group taught using Ethno-science), DM (Control Group taught using Discussion Method), $\bar{x}$ (Mean), SD (Standard Deviation), $\bar{x}$G (Mean Gain) and $\bar{x}$GD (Mean Gain Difference).

The result in Table 1 shows homogeneity in the creative thinking level among different-ability students, taught Science using ethno-science and those taught Science using discussion method with cluster means of 22.26 and 23.2. The Table also shows that all the creative thinking mean scores among different-ability students taught Science using ethno-science teaching were higher than those in the discussion method with cluster mean gain difference of 7.96.

Hypothesis one: There is no significant mean difference in the creative thinking level among different-ability students taught Science using ethno-science teaching and those taught using discussion method.

Table 2: Summary of Two-Way ANCOVA on Creative Thinking Scores of Different-Ability Students Based on Teaching Methods.

Source	Type III Sum of Squares	Df	Mean Square	F	P	Partial Eta Squared
Corrected Model	623.880[a]	6	103.980	17.597	.000	.762
Intercept	260.405	1	260.405	44.070	.000	.572
Pre PBST	4.299	1	4.299	.728	.400	.022
Teaching Method	431.562	1	431.562	73.035	.000	.689
Ability Level	114.229	2	57.115	9.666	.000	.369
Teaching Method * Ability Level	18.900	2	9.450	1.599	.217	.088
Error	194.995	33	5.909			
Total	31899.500	40				
Corrected Total	818.875	39				

a. R Squared = .762 (Adjusted R Squared = .719)

The ANCOVA result in Table 2 showed no significant difference in the creative thinking mean scores among different-ability students within those taught Science using ethno-science and those taught using discussion method, F (2, 33) = 1.599, ρ (0.217) > 0.05. The null hypothesis was therefore, not rejected. However, the table showed that students' creative thinking mean scores in the ethno-science was better than those in the discussion method, F (1, 33) = 73.035, p (0.000) < 0.05. This implies that ethno-science teaching enhances creative thinking and it is not dependent on students' different-ability.

Research Question Two: What is the mean difference in the creative thinking level between male and female students with different- ability taught Science using ethno-science teaching?

Table 3: Creative Thinking Level of Different-Ability Students Based on Gender.

Different Ability	Sample (n)	Gender	Pre-TTCT		Post-TTCT		$\bar{x}$ Gain	$\bar{x}$ Gain Difference
			$\bar{x}$	SD	$\bar{x}$	SD		
HAL	5	Male	20.50	3.202	30.20	2.414	9.7	0.8
	5	Female	22.60	2.074	31.50	4.243	8.9	

AAL	3	Male	23.00	2.000	35.00	4.583	12.0	0.16
	3	Female	19.33	2.082	31.17	3.329	11.84	
LAL	1	Male	24.00	0.000	30.00	0.000	6.0	1.17
	3	Female	24.50	2.598	29.33	5.033	4.83	
Cluster		**Male**	**22.5**		**31.73**		**9.23**	**0.71**
		Female	**22.14**		**30.66**		**8.52**	

Group: ES (Experimental Group taught using Ethno-science), $\bar{x}$ (Mean), SD (Standard Deviation), $\bar{x}G$ (Mean Gain) and $\bar{x}GD$ (Mean Gain Difference).

The result in Table 3 shows homogeneity in the pre-creative thinking mean scores among different-ability male and female students taught Science using ethno-science with cluster means of 22.5 and 22.14. The table also shows that the creative thinking mean scores in the post test were homogeneous between male and female students with cluster mean gains of 9.23 and 8.52 respectively.

Hypothesis two: There is no significant mean difference in the creative thinking level between male and female students with different- ability taught Science using ethno-science teaching.

Table 4: Summary of Two-Way ANCOVA on Creative Thinking Scores of Different-Ability Students Based on Gender.

Source	Type III Sum of Squares	Df	Mean Square	F	P	Partial Eta Squared
Corrected Model	61.013[a]	6	10.169	.630	.704	.225
Intercept	187.353	1	187.353	11.613	.005	.472
Pre PBST	.396	1	.396	.025	.878	.002
Ability Level	24.304	2	12.152	.753	.490	.104
Gender	4.435	1	4.435	.275	.609	.021
Ability Level * Gender	21.125	2	10.563	.655	.536	.092
Error	209.737	13	16.134			
Total	19802.000	20				
Corrected Total	270.750	19				

a. R Squared = .225 (Adjusted R Squared = -.132)

The ANCOVA result in Table 4 reveals that no significant difference existed in the creative thinking mean scores among different-ability male and female students taught Science using ethno-science teaching, F (2, 13) = 0.655, ρ (0.536) > 0.05. The null hypothesis was therefore,

accepted. This implies that ethno-science teaching enhanced creative thinking in both male and female equivalently.

Discussion of Findings

Finding on the determination of creative thinking level among different-ability students taught Science using ethno-science teaching and those taught using discussion method. Show that the students with different ability level in the experimental groups taught Science concepts using the ethno-science instruction had higher creative thinking scores than their counterparts in the control group who were taught same concepts using discussion method. This suggests the effectiveness of the ethno-science instruction at enhancing different ability level learners' creative thinking over discussion method. This is probably because the ethno-science instruction involved practices which the learners are familiar with in the experimental group. The introduction of such familiar activities in classroom interaction generates a novel situation that influenced the students' inquisitiveness towards learning and as a result increases their creative thinking level than those in the control group who show little inquisitiveness towards learning. The finding of this study agrees with Sumarni and Kadarwati (2019) who found out Ethno-STEM Project-Based learning has a significant effect on the improvement of students' critical and creative thinking skills. It also agrees with Khoiri, Nulngafan, Sunarno and Sajidan (2019) who found out that ethno-science learning is effective in increasing student creativity than traditional method. Similarly it's in line with Noh and Lee(2019) and Ozkan and Topsakal (2019) study which reveals a significant difference in the creative thinking level of students taught using innovative methods.

As regard to the second objective of this study which is to examine the creative thinking level between male and female students with different- ability taught Science using ethno-science teaching. The findings reveal that no significant difference existed in the creative thinking level

among different-ability male and female students taught Science using ethno-science. This implies that ethno-science is gender friendly; hence it enhanced the creative thinking in both male and female Science students. This may be as a result of the fact that ethno-science practices in the society is being carried out by both male and female and even in the classroom where it was introduce, male and female students participate with all eagerness as a result demonstrating their individual creative thinking. This finding is in consistent with that of Ayua, Terhemba and Ikyernum (2022) who reported that no significant difference existed in the creative thinking level of varied ability level students based on gender. It however disagreed with the findings of Ramdan and Marei (2020) and also with Noh and Lee (2019) which shows a significant improvement in the creativity level of girls than boys.

Conclusion and Recommendation

Based on the findings of the study it is concluded that the use of ethno-science teaching will improve the creative thinking level of both male and female students with varied ability level.

Recommendations.

1. Curriculum planners, developers and implementers should consider the use of ethno-science teaching for science instruction.
2. The government should train and retrain science instructors with the object of stimulating students' creative thinking level.
3. Regular conference, seminars and workshops should be organized by the ministry of education at the national educational authorities, zonal educational authorities, and local educational authorities in order to educate pre and in-service teachers on the importance of ethno-science teaching and how to incorporate it into the Science classroom.

References

Afful-Broni, A., Anamuah-Mensah, J., Raheem, K., & Dei, G. J. S. (Eds.). (2020). Africanizing the school curriculum: Promoting an inclusive, decolonial education in African contexts. Myers Education Press.

Agbidye, A. (2015). Challenges and Prospects in the teaching of Basic Science at the upper basic level in Nigeria. *Journal of qualitative education*, 11(1), 1-8.

Ayua, G. A. & Agbidye, A. (2020). Effect of science-technology-society strategy on entrepreneurial creativity among upper-basic school students. *Journal of Science Technology and Education,* 4(9), 105-113.

Ayua, G. A. (2021). Impact of teacher-learner improvised material on performance in Basic Science among mixed-ability middle-basic school pupils. *Benue State University Journal of Science, Mathematics and Computer Education,* 2(1), 105-114.

Ayua, G. A., Ikyernum, G. S., & Terhemba, W. (2022). Effect of Teacher-Learner Improvised Material on Creative Thinking Among Varied-Ability Upper Basic Science Students in Makurdi Metropolis.

Eilks, I., & Hofstein, A. (Eds.). (2015). Relevant chemistry education: From theory to practice. Springer.

Ethno-science. *wikipedia*. https://en.wikipedia.org/wiki/Ethnoscience. Retrieved 06 April 2023.

Federal Republic of Nigeria - FRN. (2014). National policy on education. Yaba, Lagos: Nigeria Educational Research and Development Council (NERDC) Printing Press.

Khoiri, A., Nulngafan, N., Sunarno, W., & Sajidan, S. (2019). How is Students' Creative Thinking Skills? An Ethnoscience Learning Implementation. *Journal Ilmiah Pendidikan Fisika Al-BiRuNi,* 8(2), 153-163.

Laura, D. (2021). The content of aliefs. Synthese, 198(9), 8503-8520.

Melyasari, N. S., Sutoyo, S., & Widodo, W. (2018). Scientific literacy skill of junior high school studentusing Ethnoscience based learning. In Seminar Nasional Kimia-National Seminar on Chemistry (SNK 2018). Atlantis Press.

Noh, J., & Lee, J. (2020). Effects of robotics programming on the computational thinking and creativity of elementary school students. *Educational technology research and development*, 68, 463-484.

Nwankwo, G. U. (2021). Effects of Ethno-science Instructional Strategy on Junior Secondary School Students' Achievement in Basic Science. *Journal of Science, Technology & Mathematics Education,* 6(1), 50-56.

Ochu, A. N. O., & Haruna, P. F. (2015). Challenges and Prospects of Creativity in a Basic Science Classroom: The Perception of the basic science teachers. *British Journal of Education Society and Behavioural Science,* 5(2), 237-243.

Ode, J. O., Ayua, G. A., & Alabi, A. O. (2019). Towards enhancing the entrepreneurial skills of primary school pupils through creative teaching of basic science. In Proceedings of the Annual Conference on Creativity, Innovation and Entrepreneurship Education.

Okwara, O. K., & Upu, F. T. (2017). Effects of Ethno-science instructional approach on students' achievement and interest in upper basic science and technology in Benue State, Nigeria. *International Journal of Scientific Research in Education,* 10(1), 69-78.

Ozkan, G., & Topsakal, U. (2021). Exploring the effectiveness of STEAM design processes on middle school students' creativity. *International Journal of Technology and Design Education*, 31, 95-116.

Ramdan, M., & Marei, S. (2019). Effectiveness of using educational computer games on the fifth grade students' achievement and creative thinking in science in the UNRWA schools. *An-Najah University Journal for Research-B (Humanities)*, 34(12), 2147-2182.

Stuckey, M., Hofstein, A., Mamlok-Naaman, R., & Eilks, I. (2013). The meaning of 'relevance'in science education and its implications for the science curriculum. Studies in Science Education, 49(1), 1-34.

Sumarni, W., & Kadarwati, S. (2020). Ethno-stem project-based learning: Its impact to critical and creative thinking skills. *Journal Pendidikan IPA Indonesia*, 9(1), 11-21.

Walid, W. (2020). Analisis kemampuan berpikir kreatif siswa sekolah menegah pertama. In PRISMA, Prosiding Seminar Nasional Matematika, 3, 587-590.