International Journal of Innovative Social & Science Education Research 13(1):74-82, Jan.-Mar., 2025

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doi:10.5281/zenodo.14883289

Exploring Ethno Science Based Teaching In Enhancing The Academic Achievement Of Basic Science Students In Ikwerre Local Government Area of Rivers State

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ABSTRACT
This study investigated the effectiveness of ethno science based teaching in enhancing students' academic achievement in basic science. Ethnoscience, a pedagogical approach that integrates indigenous knowledge with formal science education, has the potential to bridge the gap between students' cultural experiences and the scientific concepts they learn. The research design used was the pre-test post-test quasi experimental design, which involved the study of two groups of students: one exposed to the ethnoscience strategy and another following traditional teaching method. Two research questions and one hypothesis guided the study. Students' achievement was assessed through pre-test, post-test assessments. The data collected were analysed using mean, standard deviation and t-test. Findings from the study showed the positive impact of ethnoscience strategy on students' understanding of scientific concepts and overall academic performance., in favour of the ethnoscience group. The results of this research contribute to the growing body of literature on culturally relevant pedagogy and its potential to improve student outcome in science education. It was recommended among others that curriculum developers and education experts should incorporate ethno-science as a core instructional method for teaching basic science at the junior secondary school level.
Keywords: Ethno science, academic achievement, enhancing, exploring

INTRODUCTION

Science education has long been considered a critical component of students' academic development, contributing to the cultivation of scientific literacy and problem-solving skills. However, traditional science curricula often emphasize abstract concepts and generalized knowledge that may not directly relate to students' lived experiences. This has led to an emerging interest in localizing science education

that is integrating local contexts, cultures, and environments into science teaching to make learning more relevant and meaningful. The goal is to enhance students' engagement, motivation, and ultimately, their academic achievement in science. The localization of science education has gained attention for its potential to enhance students' academic performance by making science more relevant, engaging, and accessible. Local context-based teaching, also known as ethno science refers to the study and incorporation of indigenous knowledge systems within the teaching and learning of science. It emphasizes the integration of local cultural practices and beliefs with formal scientific concepts, creating a bridge between students' cultural backgrounds and modern science (Aikenhead, 1996). Ethno-science aligns with the broader framework of culturally responsive pedagogy, which advocates for teaching methods that consider students' cultural identities and experiences (Ladson-Billings, 1994).This is an instructional approach that integrates students' cultural, environmental, and community experiences into the science curriculum. This method is designed to make science more relevant to students' lives, enhancing engagement and understanding, and ultimately improving academic achievement.

Components of Contextualized science (ethno science)

Cultural Relevance: Cultural relevance refers to the alignment of science education with the cultural backgrounds and practices of students. This component emphasizes the importance of incorporating local knowledge, traditions, and values into science teaching to make it more relatable and accessible to diverse student populations.

Local Contexts and Applications: This component focuses on linking scientific concepts to local issues and applications. The goal is to make science education relevant to students' immediate environments and everyday lives, emphasizing practical problem-solving.

Historical and Sociopolitical Context: This component emphasizes the importance of understanding the historical and sociopolitical factors that shape the development and application of scientific knowledge. It involves examining how science has been influenced by, and in turn influences, broader societal and political forces.

Interdisciplinary Connections: Contextualized science emphasizes the integration of science with other disciplines, such as history, sociology, economics, and art. This interdisciplinary approach helps students see the connections between science and other areas of knowledge, making science more holistic and relevant. (Roth and Lee 2004).

Student-Centred Learning: This component of contextualized science shifts the focus from teacher-led instruction to student-centred learning, where students actively participate in the construction of knowledge. This approach encourages inquiry, exploration, and the application of scientific concepts to issues that matter to students.

Community Engagement: Contextualized science education often involves engaging with the local community, including parents, elders, and local experts, to make science learning more relevant and grounded in the local context. This engagement helps bridge the gap between formal education and the community's knowledge and practices.

While the empirical evidence supports the positive impact of local context-based teaching on students' academic achievement, some studies also highlight challenges associated with this approach. For example, Costa (1995) noted that teachers may face difficulties in aligning localized curricula with standardized testing requirements, which often emphasize broad, decontextualized knowledge. Additionally, teachers may require specialized training and resources to effectively implement context-based teaching, particularly in culturally diverse classrooms. Parsons, et al. (2009), also warned that localized science education could potentially limit students' exposure to global scientific concepts if not carefully balanced with broader curricula. Therefore, successful implementation of local context-based teaching requires careful planning to ensure that students are both connected to their local environments and adequately prepared for national and global science standards. Other challenges are: resistance to change and quality assurance, overcoming traditional approaches to science education and research can be difficult.

Academic achievement refers to the degree of success an individual attains in formal education, often measured by standardized tests, grades, or performance metrics. This concept is multi-dimensional and reflects various factors including cognitive development, skill acquisition, and personal growth within an educational setting.

The key aspects of academic achievement include:

Cognitive Performance: Academic achievement primarily involves mastery of content in subjects like math, science, and language. It reflects a student's ability to understand, apply, and engage with complex ideas (Slavin, 2006).

Assessment Metrics: Grades, test scores, and other formal assessments are common tools used to measure academic achievement. These metrics provide quantifiable evidence of a student's success in meeting educational standards (Guskey, 2001).

Holistic Development: Some scholars argue that academic achievement should encompass not only intellectual growth but also emotional and social development. These non-cognitive skills contribute to long-term success (Duckworth and Seligman, 2005).

Influencing Factors: Academic achievement is influenced by a variety of factors including personal motivation, family background, teacher quality, and socio-economic status. Research shows that supportive home environments and access to resources can significantly impact student outcomes (Sirin, 2005).

Long-term Implications: High academic achievement is linked to better future opportunities, including access to higher education and improved career prospects. It is also associated with broader societal benefits, such as increased civic engagement and economic productivity (Rumberger, 2011).

Research has shown that local context-based teaching can lead to significant improvements in students' academic performance and conceptual understanding. In a study conducted by Barton and Tan (2010), students in urban middle schools participated in science lessons that were connected to community issues, such as local health concerns and environmental justice. The study found that students who engaged in these context-based lessons scored higher on science assessments than those who received traditional instruction. The localized approach helped students to better understand scientific concepts by relating them to familiar, real-world experiences. Oludipe (2014) conducted a similar study in Nigerian secondary schools, examining the effect of local context-based teaching on students' achievement in biology. The study involved teaching biology concepts using examples from the local environment, such as indigenous plants and animals. The findings indicated that students who were taught using this localized approach performed significantly better on biology exams than students who received traditional, non-contextualized instruction. This suggests that local context-based teaching can enhance students' academic achievement by making science more relatable and understandable. Lee and Buxton (2013) examined the impact of culturally and contextually relevant science education on English Language Learners (ELLs). The study found that when science lessons were tailored to reflect students' cultural and linguistic backgrounds, they demonstrated significant improvements in academic performance. The localized approach made science more accessible and engaging for students who might otherwise struggle with decontextualized, mainstream curricula. Jegede and Aikenhead (1999) also explored the role of culturally responsive science education for indigenous students. Their study showed that integrating indigenous knowledge and practices into the science curriculum helped students to better understand and relate to scientific concepts. This localized approach resulted in higher achievement scores, as students were able to connect science to their cultural experiences.

Local context-based teaching not only improves academic performance but also enhances students' ability to apply scientific knowledge to real-world problems. Buxton, (2010), conducted a study in which students were engaged in science lessons focused on local environmental issues, such as water quality and conservation. The study found that students who participated in these context-based lessons demonstrated a deeper understanding of environmental science concepts and were better able to apply their knowledge to solve community problems. This hands-on, real-world application of science was linked to improved academic outcomes, as students were able to see the practical relevance of what they were learning.

Aikenhead and Jegede, (1999), found that students who were taught using examples and issues from their local communities were more engaged in learning science than those who were taught using traditional, decontextualized curricula. The study argued that students are more motivated to learn when they see the relevance of science to their everyday lives.Similarly, Bouillion and Gomez (2001) conducted a study in urban schools where science lessons were linked to local environmental issues, such as pollution in nearby rivers. Students participating in these localized lessons demonstrated higher levels of interest and involvement in science activities, which led to improved academic outcomes. The researchers concluded that local context-based teaching can bridge the gap between students' experiences and scientific concepts, making science more meaningful and increasing academic achievement. Jegede and Okebukola (1991) conducted a study in Nigeria comparing the performance of students taught Basic Science using ethno-scientific methods versus traditional methods. The results showed that students exposed to ethno-scientific instruction demonstrated significantly higher achievement in science tests. The study concluded that ethno-science helped students to connect scientific concepts with their cultural background, enhancing their understanding and retention.

Similarly, Aikenhead, (1996), investigated the impact of culturally relevant science instruction on indigenous students in Canada. The study found that students who were taught science through ethno-scientific methods showed marked improvements in both academic performance and engagement. Aikenhead emphasized that culturally responsive teaching methods like ethno-science can help reduce the alienation that indigenous students often feel in conventional science classrooms. In another study, Adeyemi and Adeoye (2014) examined the effects of ethno-science on Nigerian students' achievement in Basic Science. Their research revealed that students who received ethno-scientific instruction outperformed their peers who were taught using traditional methods. The authors attributed this improvement to the cultural relevance of the teaching materials, which made science concepts more understandable and meaningful to the students. Ogunniyi (2007) explored the implementation of ethno-scientific approaches in South African classrooms and found that students who were taught using ethno-science achieved higher scores in science assessments. This study highlighted the potential of ethno-science to make science education more inclusive and effective for students from diverse cultural backgrounds.

Vygotsky's sociocultural theory supports ethno science by emphasizing the role of social interaction and cultural tools in learning. According to Vygotsky, learning is a social process, and students learn best when instruction is situated within their cultural context. Ethno-science leverages students' cultural tools—such as language, practices, and beliefs—to enhance the learning of scientific concepts.

Statement of the Problem

The teaching of Basic Science often relies on standardized methods and content that may not resonate with students' local experiences and environments. As a result, students may find it challenging to connect abstract scientific concepts with their daily lives, leading to disengagement and poor academic performance. The ethno science method which adapts science education to reflect the cultural, environmental, and social contexts of students has been suggested as a way to make science more relevant and accessible. However, there is limited research on the effectiveness of this approach in improving students' academic performance. This study seeks to examine the impact of the ethno-science method of teaching on the academic achievement of Basic Science students.

Research Questions

Two research questions guided the study:

1 what is the mean difference in achievement in basic science between students in the ethno science group and those in the non-ethno science group?

2 what is the mean difference in the academic achievement of male and female students in the ethnoscience and non-ethno science groups?

Research Hypothesis

$H_0$1: There is no significant interaction effect between instructional groups and gender on the academic achievement of basic science students.

METHODOLOGY

Research Design: The study adopted the quasi experimental pretest, posttest non-equivalent control group design. It was considered ideal for this study because participants were already constituted into permanent classes hence they were not randomly selected individually for this research purpose.

Population and sample: The population for this consisted of all the junior secondary school students in Ikwerre Local Government Area of Rivers State, Nigeria. Two co-educational secondary schools were randomly selected for the study. Purposefully, two intact classes were selected for the study. Since all the schools have more than one class of J.S.S II, the intact classes were obtained through balloting, one from each sampled school. One hundred (100) basic science students formed the sample size of the study.

Instrument for Data Collection

The instrument used for data collection was a 20 item Basic Science Achievement Test on ethno science based instruction developed by the researcher to ascertain the effect of ethno science based teaching on the students' academic achievement .which was face and content validated by validated by an expert in the department of Integrated science, Ignatius Ajuru university of Education. The basic science teachers in the sampled schools helped in administering the achievement test to the students before and after the treatment.

Method of data analysis:

Mean and standard deviation were used in answering the research question while t-test was used in testing the hypothesis at 0.05 level of significance

RESULTS AND DISCUSSION

Research question 1: *What is the mean difference in achievement in basic science between students in the ethno science group and those in the non-ethno science group?*

Table 1: Pretestand Post-test mean achievement and standard deviation scores of ethno science and non- ethno science groups

Group	N	Pretest		Post test		Mean gain	SD
		Mean	S. D	Mean	S. D		
ES	50	33.76	11.67	49.84	8.65	16.08	10.20
NES	50	36.83	12.34	42.26	10.38	5.43	13.20

ES Ethno science
NES Non ethno-science

The table indicates that the students taught with ethno science approach had a mean gain in achievement of 16.08 (S.D = 10.20) while those in the non-ethno science group had a mean gain of 5.43 (S.D = 13.20). The result showed a notable difference in the mean achievement in basic science between the students in the ethno science group and those in the non-ethno science group (NES). Those who were exposed to the ethno science approach showed a higher mean gain of 16.08 as compared with those in the non-ethno group with mean gain of 5.43. This indicates that ethno science approach had a more positive effect on the students' academic achievement.

Research question 2: *What is the mean difference in the academic achievement of male and female students in the ethno science and non-ethno science groups?*

Table 2: mean and standard deviation of the academic achievement of male and female students in ethno science and none ethno science groups

Group	Gender	N	Pretest		Post test		Mean gain	SD
			Mean	S. D	Mean	S. D		
	Male	20	32.36	10.94	48.71	9.19	16.36	10.05
	Female	30	35.55	12.57	51.27	7.89	15.73	10.61
ES	Male	20						
	Female	30	31.98	11.21	49.12	10.05	17.14	9.98
			34.12	12.09	50.93	7.74	16.81	10.26
NES	Male	20	32.74	10.67	47.29	9.33	14.55	8.78
	Female	30	36.68	12.92	51.61	8.09	14.93	9.42

ES Ethno science
NES Non Ethno Science

Table 2 above showed a breakdown of the academic achievement difference in basic science between the ethno science (ES) and (NES) groups based on gender.

In the ethno science (ES) group, the pre-test score for the male was 31.98 with a standard deviation of 11.21. after the treatment, the post mean score was 49.12 with a standard deviation of 10.05. On the average the male students in the ethno science group had a mean gain of 17.14 with a standard deviation of 9.98. The female students in the experimental group had a pre-test mean score of 34.12 with a standard deviation of 12.09. After the treatment the average post-test mean score became 50.93 with a standard deviation of 7.74, the female students had a mean gain score of 16.81 and a standard deviation of 10.26.

In the non-ethno science (NES) group, the male students had a pre-test mean score of 32.74 and standard deviation of 10.67. After the treatment, their average post score became 47.29 with a standard deviation of 9.33 with a mean gain score of 14.55 and standard deviation of 8.78. The female students in the non-ethno science group had a pre-test mean score of 36.68 with a standard deviation of 12.92 and a post-test mean score of 51.61 with a standard deviation of 8.09. They had a mean gain score of 14.93 and standard deviation of 9.42. the result showed that both the ethno science group and non-ethno science group saw an improvement in their academic achievement.

Hypothesis 1: There is no significant interaction effect between instructional groups and gender on the academic achievement of basic science students.

Table 3: Independent sample t-test results for interaction effect between instructional groups and gender.

Group	Gender	Mean	S. D	N	t-value	DF	P-value	Result
ES	Male78.2		9.15	20	3.63	98	0.001	Significant
ES	Female	81.5	8.7	30				
NES	Male	74.6	10.3	20	2.57	98	0.02	Significant
NES	Male	77.8	9.8	30				

Table 3 showed the result of the independent t-test that evaluated the interaction effect between the instructional groups and gender. In the ethno science group, the result showed a significant difference between male and female students' academic achievement in basic science. The male students achieved a mean score of 78.2 with female students having a slightly higher average score of 81.5. The ethno science group had a t-value of 3.6 with 98 degree of freedom which resulted in a p-value of 0.001 which is less than the significant level of 0.05, therefore, the null hypothesis is rejected. This result indicates a significant interaction effect between instructional groups and gender with regards to the ethno-science group. In the non-ethno science group, it is observed that there is a significant variation in academic achievement of male and female students, with males having a mean score of 74.6 and 77.8 for the females, with a t-value of 2.57, degree of freedom 98and p-value of 0.002. the p-value being less than 0.05., therefore the null hypothesis is also rejected for the non-ethno science group. This result indicates that there is a significant interaction effect between the instructional group and gender for the non-ethno science group.

DISCUSSION

Table 1 indicates a higher achievement in favour of those exposed to ethno-science, this result is in agreement with the work of Adeyemi and Adeoye (2014) who examined the effects of ethno-science on Nigerian students' achievement in Basic Science. Their research revealed that students who received ethno-scientific instruction outperformed their peers who were taught using traditional methods. The authors attributed this improvement to the cultural relevance of the teaching materials, which made science concepts more understandable and meaningful to the students.it is also in agreement with the work of Ogunniyi, (2007), who explored the implementation of ethno-scientific approaches in South African classrooms and found that students who were taught using ethno-science achieved higher scores in science assessments. This finding also agrees with Lee and Buxton, (2013), who examined the impact of culturally and contextually relevant science education on English Language Learners (ELLs). The study found that when science lessons were tailored to reflect students' cultural and linguistic backgrounds, they demonstrated significant improvements in academic performance. The localized approach made science more accessible and engaging for students who might otherwise struggle with decontextualized, mainstream curricula.

Results in table 2 showed that the female students outperformed the male students both in the experimental and control groups, this result disagrees with Godpower-Echie and Ihenko, (2017), who found that gender has no significant effect on students' interest and academic achievement in basic science. The result is also in disagreement with Tiedemann, (2000), whose finding showed the boys outperforming the girls as a result of teachers perceiving the boys as being more competent in science and mathematics, which madethe teachers to provide more opportunities for boys to participate in science-related activities. This bias resulted in boys receiving more attention and resources, which contributes to their higher achievement in science.

CONCLUSION

The research on the impact of ethno-science on the academic achievement of basic science students highlights the significant benefits of integrating cultural knowledge systems into science education. The findings indicate that the ethno-science approach not only enhances students' understanding of scientific concepts but also fosters greater engagement in the subject by connecting science to their cultural experiences and everyday lives. The approach promotes inclusivity and makes learning more relatable, leading to improved academic performance among students. Therefore, the adoption of ethno-science as a teaching strategy in basic science has the potential to bridge cultural and educational gaps, ultimately contributing to better academic outcomes and a deeper appreciation of science among students at the junior secondary school level.

RECOMMENDATIONS

1.Curriculum developers and education experts should incorporate ethno-science as a core instructional method for teaching Basic Science at the junior secondary school level.

2 Junior secondary school teachers should receive training to effectively and proficiently implement the ethno-science approach, enhancing the teaching and learning of Basic Science.

3 Government, stakeholders, and NGOs should collaborate to provide the necessary facilities and resources that will support and promote the use of the ethno-science teaching approach at the junior secondary level.

REFERENCES

Adeyemi, A. A., & Adeoye, F. A. (2014). Impact of ethno-science-based instructional model on learners' interest and achievement in junior secondary school Basic Science. *Journal of Education and Practice*, 5(1), 45-53.

Aikenhead, G. S. (1996). Science education: Border crossing into the subculture of science. *Studies in Science Education*, 27(1), 1-52.

Aikenhead, G. S., &Jegede, O. J. (1999). Cross-cultural science education: A cognitive explanation of a cultural phenomenon. *Journal of Research in Science Teaching*, 36(3), 269-287.

Barton, A. C., & Tan, E. (2010). We be burnin'! Agency, identity, and science learning. *The Journal of the Learning Sciences*, 19(2), 187-229.

Bouillion, L. M., & Gomez, L. M. (2001). Connecting school and community with science learning: Real-world problems and school-community partnerships as contextual scaffolds. *Journal of Research in Science Teaching*, 38(8), 878-898.

Buxton, C. A. (2010). Social problem solving through science: An approach to critical, place-based, science teaching and learning. *Equity &Excellence in Education*, 43(1), 120-135.

Costa, V. B. (1995). When science is "another world": Relationships between worlds of family, friends, school, and science. *Science Education*, 79(3), 313-333.

Duckworth, A. L., & Seligman, M. E. P. (2005). Self-discipline outdoes IQ in predicting academic performance of adolescents. *Psychological Science*, 16(12), 939-944.

Godpower-Echie, **G.** & Ihenko, S. (2017). Influence of gender on interest and academic achievement of Integrated Science students in Obio/Akpor Local Government Area of Rivers State. *European Scientific Journal*, *13*(10), 272- 279.

Guskey, T. R. (2001). *Grading policies that work against standards... and how to fix them*. *NASSP Bulletin*, 85(620), 20-29.

Jegede, O. J., &Aikenhead, G. S.(1999). Transcending cultural borders: Implications for science teaching. *Journal for Multicultural Education*, 7(1), 1-9.

Jegede, O. J., &Okebukola, P. A. (1991). The effect of concept mapping on students' anxiety and achievement in biology. *Journal of Research in Science Teaching*, 28(4), 341-350.

Ladson-Billings, G. (1994). *The dreamkeepers: Successful schools for African American children*. Jossey-Bass.

Lee, O., & Buxton, C. A. (2013). Integrating science education for English language learners in diverse contexts. *Theory into Practice*, 52(1), 36-42.

Ogunniyi, M. B. (2007). Teachers' stances and practical arguments regarding a science-indigenous knowledge curriculum: Part 1. *International Journal of Science Education*, 29(8), 963-986.

Oludipe, D. (2014). The effects of local context-based teaching on students' achievement in biology. *International Journal of Science Education*, 36(12), 2037-2053.

Parsons, E. C., Hewson, P. W., &Lemberger, J. (2009). Cultural diversity and the learning of science: The implications of the research on learning for policy and practice. *Studies in Science Education*, 45(1), 1-34.

Roth, W.-M., & Lee, S. (2004). "Science Education as/for Participation in the Community." *Science Education*, *88*(2), 263-291.

Rumberger, R. W. (2011). *Dropping out: Why students drop out of high school and what can be done about it.* Harvard University Press.

Sirin, S. R. (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. *Review of Educational Research*, 75(3), 417-453.

Slavin, R. E. (2006). Educational psychology: Theory and practice. Allyn & Bacon.

Tiedemann, J. (2000). "Parents' gender stereotypes and teachers' beliefs as predictors of children's concept of their mathematical ability in elementary school." *Journal of Educational Psychology, 92*(1), 144-151.