



Effect of Ethnomathematics on Junior Secondary School Student's Performance in Mathematics in Olamaboro Local Government Area of Kogi State

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ABSTRACT

This study investigated the effectiveness of the Ethno mathematics Teaching Method on junior secondary school students' academic performance in mathematics in Olamaboro Local Government Area, Kogi State, Nigeria. The research employed a quasi-experimental design, involving 120 Junior Secondary School II (JSS2) students who were purposively selected from four schools and randomly assigned into two groups: an experimental group taught using the Ethno-mathematics approach and a control group taught using the conventional method. The study utilized a Mathematics Performance Test (MPT) as the primary instrument for data collection, validated by experts and shown to have a high reliability coefficient ($r = 0.87$). Pre-test and post-test scores were collected and analyzed using mean, standard deviation, and t-test to assess performance differences and test hypotheses at a 0.05 significance level. The results revealed that students exposed to the Ethno-mathematics Teaching Method achieved significantly higher performance gains compared to those taught using conventional methods. Gender analysis showed no statistically significant difference in performance between male and female students within the experimental group, indicating that the method is inclusive and effective across gender lines. The findings support the conclusion that integrating culturally relevant teaching strategies enhances students' comprehension, engagement, and academic outcomes in mathematics. The study underscores the need for teacher training in ethno mathematics, curriculum reforms to incorporate indigenous knowledge systems, and policy support for culturally contextualized education, especially in rural areas. Based on these outcomes, the study recommends wider adoption of Ethno-mathematics and further research into its long-term and cross-disciplinary impacts.

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INTRODUCTION

Education is a critical process that shapes individuals and societies by imparting knowledge, skills, and values essential for personal development and societal progress (Achimugu, Njoku & Sunday, 2023). According to Daniel (2017), education is a fundamental human right and a key driver of sustainable development,

contributing to economic growth, social inclusion, and environmental protection. Historically, education has evolved from traditional forms of oral learning and apprenticeship to formal systems characterized by structured curricula and standardized assessments Bola (2020). In the 21st century, education has become increasingly globalized, with a focus on technology and digital

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learning, which has opened new opportunities and challenges (Selwyn, 2016). Additionally, access to quality education remains a challenge in many parts of the world, with issues such as gender inequality, poverty, and regional disparities affecting educational outcomes (World Bank, 2018). Education, therefore, plays a pivotal role in shaping the future, fostering innovation, and promoting social equity and cohesion.

Mathematics is a science of magnitude and number as well as the science that sustains the daily practices of man. It is the only core science subject that acts as pivot on which national development and wealth of any nation is created. Competency in Mathematics learning is vital and sustainable to every individual's meaningful and productive life. Mathematics learning is very important in enhancement and sustainability of human existence because Mathematics is all about finding solutions to human problems and physical challenges. All these are indications that Mathematics is useful in domestic and business deals, scientific discoveries, and technological breakthrough, problem-solving and decision-making in different situations in life (Samuel & Sunday, 2024 and National Council of Teachers of Mathematics (NCTM), 2015).

It may be due to this vital usefulness of Mathematics that Nigeria government made the study of Mathematics compulsory at all the levels of the 6-3-3-4 system of education in Nigeria by National Policy on Education (2017) provision. Mathematics has evolved from a study of natural phenomenon like geometry, trigonometry and mensuration (Sammud, 2018). But since the 20th century, Mathematics has become the backbone of all scientific investigations and activities. It is the only language and culture common to all studies and human development (Akanmu, Sunday & Ayila, 2016). The importance of Mathematics in Nigeria's educational system cannot be overemphasized because it is the core of science and technology which every country needs to improve its human, material and natural resources. Where Mathematics is already faulty, the nation is faced with reduction in both scientific and technological input and output.

Educational reforms in Mathematics teaching at both pre-secondary and secondary school levels in Nigeria follows from philosophers in science like Sternberg (2015) who advocated for replacement of traditional cumulative view of scientific knowledge with an experiential change view. Consequent upon this philosophical viewpoint, Sam (2016), insisted that in order to develop intelligent behavior as a significant outcome of education, intelligent behavior must be interpreted along a continuum of experience and that intelligent behavior is defined by the sociocultural context in which it takes place and which leads students towards meaningful learning of Mathematics is integration of ethno-mathematics teaching materials into the classroom. It is seen as a tool for generation, transmission and diffusion of knowledge with emphasis on sociocultural environment of the learner. Fostering a culturally inclusive learning environment encourages all individuals regardless of age, gender, ethnicity, religious affiliation, socio-economic status, sexual orientation or political beliefs to develop personal contacts and effective intercultural skills to work harder and achieve better results.

Mathematics has four major branches, which are algebra, number theory, geometry and Arithmetic. Geometry is a branch of Mathematics that studies the sizes, shapes, positions, angles and dimensions of things. Sunday et al (2023), states that in reality, most students do not easily understand the concept of geometry due to the weak practice of teaching geometry in the classroom. Akanmu et al (2014), states that learning geometry is very important for students because it helps humans have a complete appreciation of their world. Geometry exploration can help develop problem-solving skills. Geometry plays a major role in other mathematical fields and it is full of challenges and interesting. To heed this call, a variety of teaching methods have been employed by different research studies. Such methods include discovery, expository, laboratory, inquiry (Kurumeh, 2015). Target-tasks, delayed formalization, computer-aided instructions, mathematical modeling and problem-solving method (Sunday, Akanmu & Fajemidagba, 2017).

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Despite these numerous innovations, literature and available data indicate that while students' performance in mathematics has improved, their understanding and engagement with the subject remain significantly limited. This limited involvement can frequently be linked to the mismatch between abstract mathematical principles taught in the classroom and the real-life applications that students experience in their everyday lives. Without seeing the relevance of mathematics to their own experiences, students struggle to grasp its importance, leading to a lack of motivation and interest in the subject. This suggests that a more culturally relevant approach, such as integrating ethno-mathematics into the curriculum, could provide a solution by linking mathematical learning to students' local traditions, knowledge, and daily practices.

The term "Ethno-mathematics" is used to express the relationship between culture and Mathematics. The term requires a dynamic interpretation because it describes concepts that are themselves neither rigid nor singular – namely, ethno and Mathematics (Ambrosio, 2016). The term ethno describes "all of the ingredients that make up the cultural identity of a group; language codes, values, jargon, beliefs, food and dress, habits and physical traits". Mathematics expresses a "broad view of mathematics which includes ciphering, arithmetic, classifying, ordering, inferring and modeling". Many educators may be unfamiliar with the term, yet a basic understanding of it allows teachers to expand their mathematical perceptions and more effectively instruct their students.

Academic performance refers to the measurable outcomes of students' achievement, typically assessed through grades, test scores, and their overall progress in mastering mathematical concepts. In the context of Mathematics education, academic performance encompasses a student's ability to understand and apply mathematical principles, solve problems, and perform well in assessments. When ethno mathematics is incorporated into the learning process, it has the potential to positively influence academic performance by connecting mathematical concepts to the students' cultural

backgrounds, making learning more meaningful and relevant. By recognizing the value of students' cultural contexts and relating mathematical concepts to their everyday lives, ethno mathematics helps bridge the gap between the formal mathematical system and local cultural practices. This approach can increase students' engagement, motivation, and understanding of mathematics, which are key drivers of academic success.

For example, students in Olamaboro Local Government Area may already have a foundational understanding of mathematical concepts embedded in their cultural practices, such as measurements used in traditional farming, construction, or trade. When these familiar practices are connected to formal mathematical concepts, students may find it easier to grasp abstract concepts like geometry, measurement, or fractions, because they can see the direct connection between what they already know and what is being taught. This cultural connection can foster greater confidence and interest in the subject, ultimately improving academic performance

STATEMENT OF THE PROBLEM

The performance of junior secondary school students in mathematics has long been a concern in many parts of Nigeria, including Olamaboro Local Government Area of Kogi State. Despite efforts to improve mathematics education, students continue to struggle with understanding mathematical concepts, resulting in poor academic performance in the subject. Traditional teaching methods, which often focus on abstract, formalized content disconnected from students' cultural and everyday experiences, may be a contributing factor to this underperformance. Ethno-mathematics, which explores the relationship between mathematics and culture, offers a potential solution to this issue.

However, the influence of ethno-mathematics on junior secondary school students' performance in mathematics has not been extensively studied, particularly in rural areas like Olamaboro. It is unclear whether incorporating ethno mathematical approaches into the teaching

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of mathematics can improve students' academic performance, enhance their engagement, and promote better understanding of mathematical concepts. This study aims to address this gap by investigating how ethno-mathematics influences the performance of junior secondary school students in mathematics in Olamaboro Local Government Area of Kogi State, to assess whether this approach can effectively improve students' mathematical skills and help overcome the difficulties they encounter in learning mathematics.

Research Questions

The following research questions were raised to guide the study.

1. What is the effect of ethno-mathematics on the performance scores of junior secondary school students in Mathematics within Olamaboro Local Government Area?
2. What is the effect of ethno-mathematics on the performance mean scores of male and female students taught using ethno-mathematics based instruction?

Research Hypotheses

The following hypotheses were formulated and tested:

H₀₁: There is no significant effect of ethno-mathematics on the performance scores of junior secondary school students in Mathematics within Olamaboro Local Government Area.

H₀₂: There is no significant difference in the performance scores of male and female students taught using ethno-mathematics-based instruction.

METHODOLOGY

This study adopted a quasi-experimental research design. The design was appropriate because it allowed the researcher to compare the performance of students exposed to the ethno-mathematics teaching method with those taught using the conventional method. The design involved pre-test and post-test evaluations for two groups: an experimental group (taught using ethno-mathematics) and a control group

(taught using the traditional method). The population of the study comprised all 1,465 junior secondary school students in Olamaboro Local Government Area. Specifically, the study focused on Junior Secondary School II (JSS2) students, as they were at a critical stage of building foundational knowledge in mathematics. Teachers who handled mathematics at this level also formed part of the study population for insights into instructional practices. A sample of 120 students was selected for the study, drawn from four junior secondary schools in Olamaboro Local Government Area.

The schools were chosen using a purposive sampling technique to ensure representation of diverse cultural settings within the area. The students were then randomly assigned to the experimental and control groups, with 60 students in each group. The main instrument for data collection was a lesson plan and Mathematics Performance Test (MPT) which was developed by the researcher. The test consisted of 20 multiple-choice items covering the topic *fractions*, which was common at the JSS2 level. The test was designed to assess students' understanding and application of mathematical concepts the validity of the instrument was established through a review by two mathematics educators, who assessed the content for relevance, clarity, alignment with the curriculum, and adherence to the Table of Specifications (TOS).

The TOS ensured that the test items were systematically distributed across different cognitive levels, comprehension, and application covering all necessary learning objectives. After validation by the experts, their corrections and recommendations were implemented before conducting the pilot study, and the data collected were used to determine the reliability coefficient value. After the validation process, the validators provided constructive feedback on the instrument. Based on these insights, several modifications were implemented to improve the instruments overall quality and accuracy, ensuring its effectiveness in assessing students' understanding of algebraic concepts (Thomas, et al, 2026). The reliability of the instrument was





determined through a pilot study involving 20 students from a school outside the study area.

The test-retest method was employed, with the MPT administered twice, separated by a two weeks interval. The Kuder-Richardson formula was used to calculate the reliability coefficient, and a value of 0.87 was considered indicative of high reliability the study began with training of teachers in the experimental group on ethno-mathematics-based teaching. Both groups took a pre-test before instruction, with the experimental group using culturally integrated lessons while the control group followed traditional methods.

A post-test was then used to assess learning outcomes, and statistical analysis was conducted to determine the effectiveness of the ethno-mathematical approach. The MPT was administered under the supervision of the

researcher and trained research assistants. Standardized instructions were provided to ensure consistency in test administration. The research assistants monitored the process to minimize distractions and ensure that students completed the test independently. The data collected were analyzed using mean and standard deviation to answer research questions, and Analysis of Covariance (ANCOVA) was used to test the hypothesis at the 0.05 significance level.

RESULTS

Research Question One:

Is there any difference between performance mean scores of students taught with Ethno mathematics teaching method and those taught with the conventional method?

Table 1: Mean Performance Scores of Experimental and Control Groups

Group	N	Pre-Test Mean	Post-Test Mean	Mean Gain
Experimental	60	42.30	78.45	36.15
Control	60	41.85	59.20	17.35

Table 4.2 above shows the mean scores of the experimental and control groups before and after the intervention. The experimental group taught using the Ethno-mathematics teaching method had a higher mean gain (36.15) compared to the control group (17.35). This suggests that the ethno-mathematics significantly improved

students' performance compared to the conventional method.

Research Question Two:

What is the effect of ethno-mathematics on the performance mean scores of male and female students taught using ethno-mathematics-based instruction?

Table 2: Mean Performance Scores by Gender

Group	Gender	N	Pre-Test Mean	Post-Test Mean	Mean Gain
Experimental	Male	32	43.10	79.20	36.10
	Female	28	41.20	77.50	36.30
Control	Male	34	42.00	60.50	18.50
	Female	26	41.50	57.20	15.70

Table 2 above reveals that in the experimental group, both males and females achieved similar mean gains (36.10 and 36.30, respectively). In the control group, males had a slightly higher mean gain (18.50) than females (15.70). This indicates that the Ethno-

mathematics Teaching Method is equally effective for both genders, while the conventional method showed some gender disparity.

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Hypothesis One (H_{01})

There is no significant difference in the performance mean scores of students taught

using the Ethno-mathematics Teaching Method and those taught using the Conventional Method.

Table 3: Independent Samples T-Test and Group Statistics for Hypothesis One

Groups	N	Mean ($\bar{x}$)	SD	df	t-value	p-value
Experimental Group	60	75.35	6.50	118	5.94	0.000
Control Group	60	68.10	2.45			

Significant at $p < 0.05$

The results in Table 3 show that there is a statistically significant difference in the performance mean scores between students taught using the Ethno-mathematics Teaching Method ($M = 75.35$, $SD = 6.50$) and those taught using the Conventional Method ($M = 68.10$, $SD = 7.10$). The independent samples t-test yielded a t-value of 5.94 and a p-value of 0.000, which is less than the 0.05 level of significance. This result indicates that the difference in mean scores is statistically significant. Therefore, the null hypothesis (H_{01}) is rejected. This implies that the teaching method significantly affected students'

academic performance in mathematics. Students taught using the Ethno-mathematics Teaching Method performed significantly better than those taught using the Conventional Method. This finding supports the effectiveness of the Ethno-mathematics approach in improving students' understanding and achievement in mathematics.

Hypothesis Two (H_{02})

There is no significant difference in the performance scores of male and female students taught using ethno-mathematics-based instruction.

Table 4: Independent Samples T-Test and Group Statistics for Hypothesis Two

Groups	N	Mean ($\bar{x}$)	SD	df	t-value	p-value
Male	32	38.08	3.60	48	2.76	0.650
Female	28	34.28	2.58			

Significant at $p < 0.05$

Table 4 presents the result of the t-test analysis to examine gender-based differences in students' performance when exposed to the Ethno-mathematics and Conventional Teaching Methods. The analysis yielded a t-value of 2.76 with 48 degrees of freedom and a p-value of 0.650, which is greater than the 0.05 level of significance. Since the p-value exceeds 0.05, the result indicates that there is no statistically significant difference between the performance mean scores of male students ($M = 38.08$, $SD = 3.60$) and female students ($M = 34.28$, $SD = 2.58$) in the study. Therefore, the null hypothesis (H_{02}) is not rejected. This means gender does not have a significant influence on the effectiveness of the teaching methods. Both male and female students

benefitted equally from the instructional approaches, especially the Ethno-mathematics Teaching Method. This suggests that the strategy is inclusive and suitable for improving mathematics performance regardless of gender.

SUMMARY OF FINDINGS

1. There was a statistically significant difference in the mean performance scores of students taught using the Ethno-mathematics Teaching Method and those taught using the Conventional Method. Students in the Ethno-mathematics group performed significantly better.
2. There was no statistically significant difference in the mean performance

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scores of male and female students taught using the Ethno-mathematics Teaching Method, indicating that gender did not influence students' academic performance.

3. The Ethno-mathematics Teaching Method improved students' mathematics performance irrespective of gender, confirming its effectiveness and inclusivity.

DISCUSSION OF FINDINGS

The findings of the study indicate that students taught with the Ethno-mathematics Teaching Method performed significantly better than those taught with the conventional method. This outcome supports Hypothesis One, which was rejected based on the statistically significant difference in mean performance scores between the experimental and control groups. The result aligns with earlier studies such as those by Adolphus and Omeodu (2018), who observed that students taught using ethno-mathematics-based strategies outperformed their counterparts taught through traditional methods. Their findings affirm that contextualizing mathematical instruction using local culture and real-life applications enhances student comprehension and achievement.

This study also supports the work of John and Sim (2016), who reported improved academic achievement and retention when students were taught using the Ethno-mathematics approach. These scholars similarly observed that culturally relevant teaching makes mathematical concepts more relatable and memorable, thus improving performance. In addition, the findings revealed no significant difference between the performance of male and female students taught using the Ethno-mathematics Teaching Method, thus validating Hypothesis Two, which was not rejected. This suggests that the method is gender-inclusive and equally beneficial to all students regardless of gender. This observation aligns with Uche (2018), who found that the ethno-mathematics approach yielded significant performance gains without any noticeable gender disparity among junior

secondary school students in Delta State. In contrast, the finding challenges earlier conclusions such as those by Sunday et al (2017), who reported that male students generally performed better than female students in algebra under conventional teaching methods. The present study's results suggest that incorporating cultural relevance into mathematics instruction can neutralize such gender-based performance gaps, allowing both male and female students to benefit equally from the learning process.

Furthermore, the higher mean scores recorded by the experimental group, regardless of gender, reinforce the conclusion that the Ethno-mathematics Teaching Method is effective in enhancing conceptual understanding and mathematical performance. These findings are consistent with the studies of Akogun and Sunday (2023) and Asipita et al (2024), who also reported significant improvement in students' mathematics achievement through ethno-mathematics-based instruction. However, while Okafor focused primarily on attitude and performance, this study extends the analysis by showing how embedding cultural elements directly contributes to academic performance, particularly in a rural setting such as Olamaboro Local Government Area.

CONCLUSION

The findings of this study provide compelling evidence that the Ethno-mathematics Teaching Method significantly improves students' performance in mathematics. This method's ability to integrate cultural relevance into teaching makes mathematical concepts more relatable and engaging, fostering better understanding and retention. Additionally, its equitable impact on both male and female students underscores its suitability as an inclusive teaching strategy.

RECOMMENDATIONS

Based on the findings, the following recommendations are made:

1. Adoption of Ethno-Mathematics: Schools should adopt the Ethno-mathematics Teaching Method to improve students' engagement and performance in mathematics.

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2. Teacher Training Workshops: Government and educational stakeholders should organize workshops and seminars to train teachers on how to effectively implement Ethno-mathematics in their classrooms.
3. Policy Support: Education policymakers should advocate for and fund the development of resources and training programs to support the integration of Ethno-mathematics into the educational system.
4. Curriculum Development: Mathematics curricula should be revised to incorporate culturally relevant content and problem-solving approaches.

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