EFFECT OF ETHNO-MATHEMATICS ON SENIOR SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN MATHEMATICS

PAUL AIGHEGBESE EBHOMIEN[1]*

[1] DEPARTMENT OF SCIENCE EDUCATION AND INSTRUCTIONAL TECHNOLOGY, FACULTY OF EDUCATION, AMBROSE ALLI UNIVERSITY, EKPOMA, EDO STATE, NIGERIA

Corresponding author: ebhospaul@yahoo.com.

To cite this article (APA): Ebhomien, P. A. (2026). Effect of ethno-mathematics on senior secondary school students' academic achievement in mathematics. AAU Journal of Business Educators, 6 (1), 72–77,

ABSTRACT

This study examined the effect of ethno-mathematics on senior secondary school students' academic achievement in mathematics. Two research questions were examined and two null hypotheses were formed in the study. One hundred and seventy-three (173) senior secondary school students were sampled from a population of 32,967 students. The sample consisted of 87 students in the treatment group and 86 students in the control group. The treatment group was taught mathematics using ethno-mathematics while the control group was taught using the conventional method (i.e., chalk and talk method). A quasi experimental research design was employed to achieve the central aim of the study. The instrument used for the collection of data was test in mathematics achievement (TMA). The test consisted of 25 multiple choice questions. The instrument was validated by a team of experts. A reliability coefficient value of 0.75 was obtained using the KR-20 formula. The research questions were answered using descriptive statistics such as mean and standard deviation, while the hypotheses were tested using inferential statistic such as analysis of co-variance (ANCOVA). The results showed that there was a significant difference in the mean achievement score of the students taught mathematics using ethno-mathematics and the conventional method. The result also showed a significant difference in the mean achievement score of male and female students taught mathematics using ethno-mathematics. The author recommended, among others, that mathematics teachers should endeavour to use ethno-mathematics method in the teaching of mathematics as it would help to improve students' achievement in the all importance subject.

Keywords: Achievement, Ethno-mathematics, Gender, Senior Secondary school.

Introduction

Mathematics is one subject that has generated serious and consistent interest over the years by stakeholders in the education sector. It is an important subject in human endeavour with many educational values aside its technological importance. It offers vast number of structures such as numbers, algorithms, shapes, ratios, functions and data that helps to understand physical realities. Mathematics is a human activity built upon intuitive understandings, cultures and agreed conventions externally fixed with many unanswered questions (Age, 2021). It helps to encourages setting arguments by evidence and proof. Mathematics demonstrates how important it is to subject a familiar thing to detailed study and to study something that seems hopelessly intricate (Abonyi, 2016).

Ebhomien (2017) however stressed that the nation was heading towards having a generation of graduates that are not mathematically baked which can be detrimental to her sustainable scientific and technological advancement and growth. This again has shown the importance of mathematics in science and technology. Mathematics is the basis for all scientific development and is indispensable because it has applications in all other human activities including science and technology based subjects. This is because, material world is completely based on science and technology and its application is becoming an integral part of human life. It makes each and every activity very smooth for human life. This view agrees with Adeyegbe in Ebhomien, Oriahi and Idiahi (2012), who observed that there is hardly any area of science that does not make use of mathematical concepts to explain its own concepts, theories or models. This implies that mathematics is a major tool available for formulating new theories in science related areas as well as in other fields of study. The role of mathematics in commercial, scientific and technological development of any civilized nation, and the general acceptance that mathematics methods are central to the solution of most problems have rightly enhanced the importance of mathematics instruction in secondary schools (Galadima, 2002).

The importance of mathematics in every aspect of human life is so expedient that there is no school or a National Development Planning that would take place without taking cognizance of the role of mathematics. This probably explains why in the last decade, the importance of mathematics in business, economic, sociology,

biology, medicine, agriculture and information technology has grown tremendously. Its usefulness, power and beauty have been recognized and acknowledged by researchers. According to the Federal Republic of Nigeria (FRN, 2013) in its education policy document, the major aims of secondary education are; preparation for useful living within the society and preparation for higher education among others. To achieve these aims, secondary school students should be inculcated with the necessary mathematics skills for proper academic achievement in mathematics. The inculcation of mathematics skills in secondary school students can only be achieved through the use of proper method of teaching and learning of mathematics.

Despite the importance of mathematics in today's modern or digital society, researchers such as Oriahi, Longe and Ebhomien (2010) and Ebhomien and Aigbiremhon (2012) have observed that the achievements of students at the senior secondary school have shown an acute declined over the years. Many reasons have been attributed for students' poor academic achievement in mathematics which include among other things poor teaching method. This factor contributes to process errors which secondary school students commit in solving mathematical problems. On the basis of this problem, researchers in mathematics education have sought for a more interactive and traditional teaching method that will help to improve the teaching, learning and interest of students in mathematics which will also lead to an improvement in the academic achievement of. It is in the light of the above, Kurumeh, (2006), Uloko and Usman, (2008) showed that ethno-mathematics is key and fundamental to solving this problem and that it significantly improve the academic achievement of students in mathematics. Ethno-mathematics referred to the study of the relationship between mathematics and culture. It is often associated with "cultures without written expression". It may also be defined as "the mathematics which is practiced among identifiable cultural groups" (D'Ambrosio, 1984). It refers to a broad cluster of ideas ranging from distinct numerical and mathematical systems to multicultural mathematics education (Malloy, 2017). The goal of ethno-mathematics is to contribute both to the understanding of culture and the understanding of mathematics and mainly to lead to an appreciation of the connections between the two.

The term "ethno-mathematics" was introduced by the Brazilian educator and mathematician Ubiratan D'Ambrosio in 1977 during a presentation for the American Association for the Advancement of Science. Since D'Ambrosio put forth the term, many researchers - D'Ambrosio included - have struggled with its meaning ("An etymological abuse leads D'Ambrosio to use the word ethno to refer to Ethnic" or "cultural context" and mathema to mean "to explain" or "to know" or "understand" and tics from "techne"). Omenka, (2013) showed that Ethno-mathematics significantly improve the academic achievement of secondary school students in mathematics which include the documentation and study of cultural related learning style. In his submission, Masingila, (1997) examined how people learn and use mathematics in distinct cultures and in everyday situations within cultures. In this context, Masingila, (1997) think of culture as acquired knowledge transmitted among groups. It is shared meaning but not necessarily consensus. It includes taken-for-granted values and beliefs seen in what people do, what they know, and the tools they use (Malloy, 2017). From this concept of culture, race is not a proxy for culture and "ethno" in ethno-mathematics is not a proxy for ethnic.

Since ethno-mathematics is oriented to the masses and the multitude of ways in which mathematical ideas are used on a regular basis in the community, the concept expands our understanding of what mathematics is and of who creates it. In Ethno-mathematics the focus is on the concepts and techniques actually used by a cultural group rather than the possible mathematical theories available (Abonyi, 2016). The concepts and techniques are usually learned without formal schooling but are actively transmitted from one generation to another. Through this cultural interaction, there develops an instinctive kind of common mathematical knowledge among adults and children who belong to the same cultural group (Gilmer, 2015).

An ethno-mathematics curriculum would develop from activities in the learners' surroundings and move seamlessly into the formal school as the process of inducting young people into mathematical aspects of their culture. A mathematics curriculum oriented to the ethno-mathematics of the learners' culture would respond to the needs of increasing numbers of students who feel like failures for not understanding something few of them will ever use but without which there is the perception of a bleak future for them. If we acknowledge that mathematics is not culture free, then mathematics educators might be transmitting the values of a single culture (foreign culture) while teaching children of many cultures in the same classroom. What are the consequences of mathematics learning for children whose cultural experiences are being ignored? The consequences might be mass failure and disaffection with the subject owing to cultural conflicts or school failure, since students develop different models for understanding mathematics based upon their cultural backgrounds and experiences.

In spite of acute decline in mathematics achievement over the years, academic achievement of male and female secondary school students in mathematics may differ significantly. Abiodun and Fijujigbe (2010) and

Ogbu (2006), in their separate studies revealed a no significant Impacts of Ethno-mathematics and gender on the academic achievement of secondary school students in mathematics while Shafi (2010) and Suleiman (2010) found a significant Impact of Ethno-mathematics and gender on the academic achievement of secondary school students in mathematics. This study therefore attempts to find out the Impacts of Ethno-mathematics on secondary school students' academic achievement in mathematics.

Purpose of the Study

The overall purpose of the study is to determine the effect of ethno-mathematics on secondary school students' academic achievement in mathematics. Specifically, sought to examine:

1. the mean achievement score of students' taught mathematics using ethno-mathematics and conventional method.
2. the mean achievement score of male and female students' taught mathematics using ethno-mathematics and conventional method.

Research Questions

The following research questions were examined:

Research Question 1: What is the mean achievement score of students' taught mathematics using ethno-mathematics and conventional method?

Research Question 2: What is the mean achievement score of male and female students' taught mathematics using ethno-mathematics and conventional method?

Research Hypotheses

The following hypotheses were formed and tested at a 0.05 level of significance.

Research Hypothesis 1: There is no significant difference in the mean achievement score of students' taught mathematics using ethno-mathematics and conventional method.

Research Hypothesis 2: There is no significant difference in the mean achievement score of male and female students' taught mathematics using ethno-mathematics and conventional method.

Methods

Research Design

This study employed a quasi-experimental research design (also known as a non - randomized, non – equivalent, pre – test, post – test, control group design). The choice of this design was considered appropriate when the true experimental design was not possible.

Population and Sample

The sample consists of 173 senior secondary school students from eight co- educational secondary schools. Four schools each were assigned to both treatment and control group.

Instrument for Data Collection

The instrument for data collection was Test in Mathematics Achievement (TMA) developed by the researcher. The TMA consist of two sections. Section A elicited demographic information while section B consist of 25 well structured questions from mathematics. The instructional packages were lesson plan prepared by the researcher based on Ethno-mathematics.

Validation and Reliability of Instrument

The instrument was validated with a reliability index of 0.75. Both groups were pre – tested on their pre – knowledge of mathematics. The treatment group was later exposed to treatment package (ethno-mathematics) while the control group was taught using the conventional (Chalk and Talk) method. Both groups were finally post tested using TMA. A reliability coefficient value of 0.75 was obtained using the KR-20 formula.

Data Analysis

The research questions were answered using descriptive statistics such as mean and standard deviation, while the hypotheses were tested using inferential statistic such as analysis of co-variance (ANCOVA).

Results

Answering Research Questions

Research Question 1: What is the mean achievement score of students' taught mathematics using ethno-mathematics and conventional method?

Table 1: Mean achievement score of ethno mathematics and conventional method

Group	N	Pre-test Mean	Pre-test SD	Post-test Mean	Post-test SD	Mean Gained
Ethno-Maths	87	40.38	5.89	72.61	6.29	32.23
Conv_Meth	86	40.36	2.96	41.66	3.10	1.30
Mean Diff		0.02		30.95		30.93

Table 1 revealed that the post-test mean achievement scores of the ethno-mathematics group was 72.61 and standard deviation of 6.29, while conventional method was 41.66 and standard deviation of 3.10. The mean difference between the two groups for the pre-test and post-test were 0.02 and 30.95 respectively. The mean gains for the ethno-mathematics group was 32.23 and lecture method group was 1.30. This showed that the mean gain of 30.93 between ethno-mathematics and conventional method group was in favour of the ethno-mathematics (treatment group).

Research Question 2: What is the mean achievement score of male and female students' taught mathematics using ethno-mathematics and conventional method?

Table 2: Mean achievement score of male and female students in mathematics

Group	N	Pre-test Mean	Pre-test SD	Post-test Mean	Post-test SD	Mean Gained
Male	76	38.65	4.25	65.60	5.75	26.95
Female	97	36.30	2.20	43.26	3.42	6.96
Mean Diff		2.35		22.34		19.99

Table 2 revealed that the post-test mean achievement scores of male students was 65.60 and standard deviation of 5.75, while female students was 43.26 and standard deviation of 3.42. The mean difference between the two groups for the pre-test and post-test were 2.35 and 22.34 respectively. The mean gains for the male students were 26.95 and female students was 6.96. This revealed that the mean gain of 19.99 between male and female students was in favour of the male students.

Testing Research Hypotheses

Research Hypothesis 1: There is no significant difference in the mean achievement score of students' taught mathematics using ethno-mathematics and conventional method.

Research Hypothesis 2: There is no significant difference in the mean achievement score of male and female students' taught mathematics using ethno-mathematics and conventional method.

Table 3: ANCOVA of method and gender using ethno-mathematics

Sources of Variation	Sum of Squares	df	Mean Squares	F	Sig.	Decision
Main Impacts	34967.133	3	11655.711	414.049	0.000	
Method	34498.477	1	34498.477	1225.500	0.000	S
Gender	31.778	1	31.778	1.129	0.000	S
2 way interactions	60.513	3	20.171	0.717	0.543	
Method & location	44.003	1	44.003	1.563	0.213	S
Method & gender	11.799	1	11.799	0.419	0.518	NS
Location & gender	3.023	1	3.023	0.107	0.744	NS
Explained	36125.230	8	4515.654	160.411	0.000	
Residual	4616.689	164	28.151			
Total	40741.919	172	236.872			

Key: S = Significant, NS = Not Significant

Based hypothesis 1, Table 3 revealed that F-calculated value of 1225.500 and F-critical value or significant value of 0.000. It can be seen that F-calculated value of 1225.500 is greater than F-critical of 0.000 at 0.05 level of significance. Hence, the null hypothesis is hereby rejected. Therefore, there is a significant difference in the mean achievement score of students' taught mathematics using ethno-mathematics and conventional method.

Based hypothesis 2, Table 3 revealed that F-calculated value of 10.290 and F-critical value or significant value of 0.000. It can be seen that F-calculated value of 10.290 is greater than F-critical of 0.000 at 0.05 level of significance. Hence, the null hypothesis is hereby rejected. Therefore, there is a significant difference in the mean achievement score of male and female students' taught mathematics using ethno-mathematics and conventional method.

Discussion

Result of this study showed that mean achievement scores of students taught mathematics using Ethno-mathematics differ significantly from the mean achievement scores of those taught using the conventional method and that there is a significant difference in favour of the treatment group. The finding is in agreement with Omenka (2013) who indicated significant achievement difference in the mean scores of students using Ethno-mathematics to affect a conceptual change strategy. Kurumeh, (2006) equally reported positive significant difference in students' achievement scores that were exposed to the ethno-mathematics strategy. This could be that, as students focus was on the concepts and techniques actually used by their cultural group rather than the possible mathematical theories available, they gained more knowledge. The idea of considering mathematics to be too abstract was also put away. By so doing the students' had greater understanding of the materials being learned. Their cultural interaction also helped the students to develop an instinctive kind of common mathematics knowledge that could be handed over to their next generation.

This study also revealed that mean achievement scores of male and female students taught mathematics using Ethno-mathematics differ significantly in favour of the male students. The finding is in agreement with Shafi (2010) and Suleiman (2010) who found a significant Impact of Ethno-mathematics and gender on the academic achievement of secondary schools students in mathematics.

This could be that, as male students focus on the concepts and techniques actually used by their cultural group rather than the possible mathematical theories available, they gained more knowledge when compared to the female students who will be involved in cooking and other domestic work associated with female. By so doing the male students' had greater understanding of the materials being learned. Their cultural interaction also helped the male students to develop an instinctive kind of common mathematics knowledge that could be handed over to their next generation when compared to their female counterparts. This is contrary to previous studies of Abiodun and Fijujigbe (2010) and Ogbu (2006), who in their separate studies revealed a no significant difference in the mean achievement score of male and female students taught mathematics using Ethno-mathematics.

Conclusion

The result showed that ethno-mathematics as a teaching method is more impactful in secondary school mathematics compared to the conventional method of teaching. So we can say that Ethno-mathematics create interactive learning environment for the learners to learn. These also provide immediate feedback on the performance of the students. It also helps to maintain high interest level and sufficient motivation for the learners. Ethno-mathematics have enriched features such as self-explanatory, self-directed, self- motivating and self-evaluating which help to cater to the needs of individual difficulties.

Recommendations

The following recommendations were proffered.

1. Mathematics Teachers should endeavor to use ethno-mathematics method in teaching mathematics in order to improve students' achievement in the all importance subject.
2. Periodic government sponsored in-service training, in form of long vacation training programmes, workshops, conferences and seminars on the nature, scope and use of Ethno-mathematics should be organized periodically for male and female teachers.

Acknowledgement

This research was an Institutional-Based Research (IBR) sponsored by Tertiary Education Trust Fund (TETFund) intervention. The author wishes to specially appreciate the Management of Ambrose Alli University Ekpoma for the approval and opportunity to carry out this research. The author of this study wish to express its profound appreciation and gratitude to all the teachers and students who took out time to participate in the research.

References

Abiodum, A. P., & Fijuyigbe, K. T. (2010), Impacts of activity-based and inquiry methods on the academic performance and attitude of junior School Students towards computer science. Proceedings of the Annual Conference of Mathematical Association of Nigeria (MAN) Lafia. August, pp 280-289.

Abonyi, O.S (2016). Impacts of Ethno-mathematics based instructional approach on primary school pupils' achievement in geometry. Journal of Scientific Research 9 (2), 1-15.

Age, T. J. (2021). The impact of ethno-mathematics on junior secondary school students' achievement and retention in Geometry in Benue State, Nigeria: A corona Virus Pandemic case study. International Journal of Research and Innovation in Applied Science, 6(4), 95 – 100.

D'Ambrosio, U. (1984). The relationship between culture and mathematics: A paper Presented on the first international conference on Ethno-mathematics at ICME 5 Adelaide, Australia.

Ebhomien, P. A. (2017). Impacts of computer assisted instruction on senior secondary school students' academic achievement in mathematics simultaneous equations in Edo State. The Journal of the Mathematical Association of Nigeria, 42(2), 109 – 115.

Ebhomien, P. A., & Aigiremhon, A. A. (2012). The impacts of teachers' professional qualification on students' academic performance in mathematics. Efua Journal of Multidisciplinary Research, 1(1), 81 – 87.

Ebhomien, P. A., Oriahi, C. I., & Idiahi, S. A. (2012). Influence of continuous assessment in the teaching of mathematics in secondary schools in Edo State. Current Research Journal of Social Sciences, 4(5), 350 – 353.

Federal Government of Nigeria (2013). National Policy on Education (2013 Ed.), Lagos. Nigerian Education Research and Development Council (NERDC) Press.

Galadima, I. (2002). The relative Impacts of heuristic problem solving instructions on secondary school students' (ABACUS). Journal of the Mathematical Association of Nigeria, 27 (1), 57 – 65.

Gilmer (2015). Socio-cultural influences on learning, American Perspectives on the Fifth International Congress on Mathematical Education (ICME 5) Edited by Warren Page.Washington, D.C. The Mathematical Association of America.

Kurumeh, M. S. (2006). Improving students' achievement and retention in solving algebraic word problems using aesthetic value approach (ABACUS). Journal of Mathematical Association of Nigeria, 30 (1), 54 – 62.

Malloy, C. E. (2017). Including African American students in the mathematics community. multicultural and gender equity (Ed.) Margaret Kenney: National Council of Teachers of Mathematics, Inc, Reston, VA. pp. 23-33.

Masingila, J. O. (1997). Using Ethno-mathematics as a Classroom Tool. Multicultural and Gender.

Ogbu, S. (2006). Impact of simulation games on students' achievement and interest in mathematics. Unpublished M.sc Thesis, Enugu State University of Science and Technology, Enugu.

Omenka, J. E. (2013). Impact of ethno-mathematics on students' mathematics achievement in junior secondary schools in Benue State. African Journal of Arts, Science and Educational Issues, 1(1), 9-16.

Oriahi, C. I., Longe, B. O., & Ebhomien, P. A. (2010). The impacts of teaching aids on students' academic achievement in senior secondary school. Duncan Multidisciplinary Journal, 3(2), 24- 30.

Shafi, A. (2010). The impact of improvised instructional materials on students' achievement in solid geometry (ABACUS). Journal of the Mathematical Association of Nigeria, 35 (1), 46 – 51.

Suleiman, B. (2010), Impacts of e-learning method on teaching mathematics. Implication of Attainment of basic Science Goals and Objectives. ABACUS. Journal of mathematical Association of Nigeria, 35 (1), 91-96.

Uloko, E. S., & Usman, K. O. (2008). Impact of ethno-mathematics teaching approach and interest on students' achievement in locus. Benue. Resource in Science Education, 1 (1), 91-91.