EFFECT OF ETHNO-MATHEMATICS AND CONVENTIONAL TEACHING APPROACHES ON STUDENTS' ACHIEVEMENT, INTEREST AND RETENTION IN GEOMETRY IN SELECTED SECONDARY SCHOOLS IN MAKURDI METROPOLIS, BENUE STATE, NIGERIA

By

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This study examine the effect of ethno-mathematics and conventional teaching approaches on students' achievement, interest and retention in geometry in selected secondary schools in Makurdi metropolis, Benue State, Nigeria. Quasi experimental research design and survey research design which follows quantitative methodology were adopted for the study. The sample of 270 respondents was used for the study. The researcher used primary data obtained by the use of a structured questionnaire. The data collected were analyzed using inferential statistics such as simple linear regression and analysis of covariance (ANCOVA). The result of the study indicates that a negative effect was established between ethno-mathematics teaching approach and students' achievement in geometry. The effect is not statistically significant ($p>0.05$) and the effect is in line with a priori expectation. For the second and third model of the study, ethnomathematics teaching approach have a positive and significant effects ($p<0.05$) on students' interest and students' retention in geometry in selected secondary schools in Makurdi Metropolis, Benue State, Nigeria. Male had less achievement than female student taught geometry using of ethno-mathematics teaching approach than the conventional teaching approach and this difference is statistically significant. Also, female had more interest in geometry taught using ethno-mathematics teaching approach than the conventional approach and the difference is statistically significant. For the third model of the study, there are difference in retention between male and female students taught geometry using of ethno-mathematics teaching approach than those taught using the conventional teaching approach s and the difference is statistically significant. It is concluded that ethnomathematics is beneficial in the teaching of geometry as it has a positive effect on interest and retention. It is recommended among others that Mathematics instruction in general should be handled in such a way that students are actively involved in the learning processes, enabling them to see Mathematics as a natural extension of their daily life activities, hence improving students' interest and retention in geometry in the study area.

Keywords*: Ethnomathematics, Geometry, Students, Achievements, Interest, Retention.*

1.0 INTRODUCTION

Over the years, teaching and learning mathematics have consistently generated interest among scholars, educators, and students. The need to acquire knowledge of mathematics in the world has become very obvious. This is because mathematics is relevant to everyday life and in various disciplines. Some researchers have suggested that there is a need to adopt efficient and effective teaching and learning approaches to stimulate problem-solving skills and instructional techniques at all levels of education in Nigeria. As a result of its importance to humanity, mathematics is important to all disciplines and fields of human endeavour. Mathematics teaching and learning in secondary school has been disappointing, resulting in failures in West African Examinations Council (WAEC), Senior Secondary Certificate Examinations (SSCE), National Examination Council (NECO), and Joint Admissions and Matriculation Board (JAMB) result of the poor performance of students from Junior Secondary School (JSS), which has more to do with the approaches to teaching than the content of the curricular of the school mathematics education and learning are critical to the improvement, sustainability, and economic growth of human existence (Abiam, Abonyi, Ugama & Okafor, 2016).

Geometry is a branch of mathematics concerned with the study of shapes. These shapes might be solid or flat. A plane shape is a geometric shape in which the straight line connecting any two (2) points lies entirely on the surface. On the other hand, a solid shape is defined by surfaces that may not be entirely reproduced on a plane surface. According to statistics, the difficulty of teaching and mastering mathematics, particularly geometry, has resulted in widespread examination failure. The widespread failure of mathematics examinations is genuine, and the performance of students has been declining in recent years (Omenka, 2013). Despite the topic's relevance, it is extremely disheartening that students' achievement in the subject has remained persistently low. This has been attributed to teaching approach. Conventional teaching approach which refers to an activity involving face-to-face interaction between instructors and students in a class, where students passively receive information and replicate the information in an examination is what has been in practice. However, they have been an advocacy for the adoption of ethno-mathematics teaching approach which is a strategy that emphasizes the usage of materials outside of a specific cultural context. It has been said that this may pique students' attention and contribute to a more successful outcome (Abonyi, 2016). The ethnomathematics approach makes use of the mathematics observed in people's cultural activities. To improve the learner's achievement and interest in mathematics, it is necessary to develop a mathematics teaching style that takes into account the learner's cultural background and bridges the divide between indigenous mathematics and Euro-centric mathematics.

Another factor that affects achievement, interest and retention as the ongoing debate rages on the choice between the conventional teaching approach and ethno-mathematics teaching approach is gender. Gender is a socially constructed trait that separates females and males. Numerous research findings in Nigeria indicate that boys perform better than girls in mathematics on average, despite being placed in the same school environment. Boys achieved much more than girls in mathematics as a result of their retention rate (Abiodun & Nchelem, 2015). For a long time, educators and researchers have been concerned about the effect of gender on pupils' academic achievement, but no consistent outcome has emerged. The researcher wishes to examine the effect of ethno-mathematics and conventional teaching approach on students' achievement, interest, and retention in geometry in Benue State, Nigeria.

Statement of the Problem

Perpetual failure and poor performance in mathematics have been attributed to an ineffective instructional strategy. Mathematics educators, scholars, parents, the government, and the general public have long been concerned about students' low performance in mathematics, particularly geometry. Recent advances in mathematics teaching and learning necessitate a conceptual shift away from the traditional teaching style, which emphasizes rote learning of mathematics, particularly geometry. Thus, the study would likely investigate the effect of ethno-mathematics and conventional teaching approaches on students' achievement, interest, and retention in geometry in selected secondary schools in Benue State, Nigeria. The purpose of this study was to determine whether students of all genders would likely enhance their achievement, interest, and retention in geometry as a result of the employment of an ethno-mathematics teaching approach.

Objective of the Study

The study's primary purpose is to determine the effect of ethno-mathematics and conventional teaching approaches on students' achievement, interest, and retention in geometry in selected secondary schools in Makurdi, Benue State, Nigeria. The specific objectives of the study are to:

i. Determine the effect of ethno-mathematics teaching approach on students' achievement in Geometry.
ii. Determine the effect of ethno-mathematics teaching approach on students' interest in geometry.
iii. Determine the effect of ethno-mathematics teaching approach on retention ability of students in geometry.
iv. Determine the difference in achievement between male and female students taught geometry using of ethno-mathematics teaching approach and the conventional teaching approach.
v. Determine the difference in interest between male and female students taught geometry using of ethno-mathematics teaching approach and the conventional teaching approach
vi. Determine the difference in retention between male and female students taught geometry using of ethno-mathematics teaching approach and the conventional teaching approach.

IILITERATURE REVIEW

Conceptual Framework

Ethno-mathematics Teaching Approach (ETA)

Ethno-mathematics was a word coined in 1986 by Ubiratan D'Ambrosio, a Brazilian mathematics instructor. This concept is strongly ingrained in Paul Freire's beliefs and philosophy. Simply put, ethno refers to the "culture environment," mathematics to "explain," "know," or "understand," and tics to technology, which is founded in art and practices as well. Thus, ethno-mathematics, as defined by Davidson (2010), is the art or approach of explaining, knowing, and comprehending multiple cultural situations. Additionally, Shirley (2015) asserts that ethno-mathematics has evolved to encompass the documentation and research of culturally specific learning techniques. It is discovered to aid in the development of mathematics students, particularly female student. Ethno-mathematics assumes that mathematics, like many other human endeavors, is a cultural product of human experience, that it varies between groups, and that it is contingent upon social power relations.

Conventional Teaching Approach to learning Mathematics/Geometry: The conventional teaching approach is that approach where the teacher prepares the lesson plan and comes to the class, expressing the knowledge to the students who passively take it down with regard to whether the student understands it or not. Without active participation, a traditional teaching technique reduces students to passive learners in the classroom. As a result, they are unable to explain themselves or inquire (Terry, 2011). The traditional approach to mathematics education is concentrated on the instructor and is more group-oriented and teacher-centric. The usual approach of teaching mathematics is the most ancient. It necessitates that the teacher enter the classroom, explain the subject development line by line, and allow students to listen and copy. In a teaching and learning environment, the instructor adopts the role of being all-knowing and offers information that he believes students lack.

Students' Achievements in Mathematics/Geometry: Students' achievement in geometry can be defined as an individual's level of competency and knowledge displayed following study. Aremu (1998), emphasizes the need of assessing an individual's academic performance through examinations and thorough observation. Academic achievement can be classified as superior or inferior. When academic accomplishment is quantified, it can be defined as high when a student excels and performs exceptionally well in mathematics, as seen by a high grade. However, when students perform poorly in mathematics and earn extremely low grades, their mathematics achievements are considered to be low. In mathematics, achievement is measured mostly on the basis of students' bad performance.

Students' Interest in Mathematics/Geometry: Interest is related to a student's preparedness or mastery of subject matter background knowledge that enables the learner to cope with more or subsequent higher levels of subject matter or related learning task learning. This shows that the mathematics interest test for junior secondary school students is concerned with developing the necessary skills in junior secondary school (JSS) level mathematics to enable JSS pupils to succeed at the next higher level of mathematics instruction. According to Chianson (2018), factors influencing interest in geometry include student factors, teacher factors, mathematics anxiety, government, and a lack of teaching and learning infrastructures.

Students' Retention of Mathematics/Geometry: Retention has been defined as the process of ensuring the continued availability of a replica of newly acquired knowledge or repeated performance by a learner who has paid for the knowledge (Siemon, Beswick, Brady, Clark, Faragher and Warren, 2011). Retention also refers to the capacity to recall and apply previously learned knowledge and abilities, as well as knowledge, habits, attitudes, and other responses. Retention is critical for the efficient application of what is learned. Students' low retention in geometry may be related to the prevalence of rote learning in schools. Geometry concepts cannot be fully learned through memorizing or rote learning since human beings have a limited capacity for memory.

Gender Issues in Mathematics/Geometry: The problem of gender in mathematics has garnered educators' and academics' attention. Gender refers to sex-related culturally patterned behaviors, either actual or conventional. Uloko & Imoko (2017) noticed that girls score better in mathematics than boys in the first through third grades. According to Uloko & Imoko (2017), when instructors are contacted, they feel that the achievement gap between boys and girls exists because guys are more rational, and hence have inherent advantages over girls in mathematics. Also, boys excel with greater confidence in their mathematics talents because they perceive mathematics as a male-dominated field.

Theoretical Framework

Social Constructivist Theoretical Framework

The study is underpinned by the social constructivist theoretical framework propounded by Vygotsky in 1978. Ethno-mathematics approaches fit well within the social constructivist theory of having learners construct understanding and knowledge through what they have previously learned and been exposed to before. Ethno-mathematics approaches subscribe to the social constructivist view that emphasizes a situated and contextualized teaching and learning process. In a geometry classroom guided by social constructivism, learners are encouraged to solve problems that resemble those in the real-life situations. Instead of solving geometry problems that are out of context, learners are challenged with contextualized problems. These enable them to link previous geometrical knowledge with new knowledge and also to transfer the new knowledge and their understandings to real-life situations.

Vygotsky's (1978), Social Constructivist Theory is connected to ethno-mathematics approaches. The study puts more emphasis on the role played by culture and the environment in learners' development and learning of geometry and the importance of the learners' interaction with social beliefs and features in learning geometry. Consistent with social constructivist theory, learners first obtain cultural geometry concepts from their environment, which in reality mediates the learners' social beliefs and notions, and continue to attain and solidify their acquired knowledge in schools. Ethno-mathematics approaches are grounded in the social situation of the learner; therefore, they are based on the life experience of the learner and rely on the theory of social constructivism. Ethno-mathematics and social constructivism share common ground in two (2) important instructive assumptions that have implications for mathematics teachers (Matang, 2009).

Review of Previous Studies

Achor *et al.*, (2012) on their study improving some Nigeria Secondary Students' Achievement in geometry used a non equivalent pre-test, post-test control group quasi experiment design, on intact classes assign to the experimental and control groups. The population consisted of 7,184 SS1 students out of which a sample of 288 students was selected from four (4) secondary schools. Two (2) of the selected schools were assigned as experiment group while the other two (2) were the control group geometry construction achievement test (GCAT) was the main instrument used for data collection and it is a 30 items multiple choice objectives test with four (4) options (A,B,C&D) ANCOVA was used to analyze the data that there was a significant difference between the mean achievement of the group taught geometry using team approach and the group that interacted with their class teachers using problem solving approach. (F_1, 287=117.96, $p<0.05$). However, male and female students taught geometry did not differ in the their mean achievement significantly (F_1, 287=9,690, $p>0.05$). There was significance interaction effect of gender and method on student achievement in geometry.

Kurumeh *et al.,* (2012), carried out a study on Improving Students' Retention in Junior Secondary School Statistics using the ethno-mathematics Teaching Approach in Obi and Oju Local Government Areas of Benue State, Nigeria. The study employed Quasi- experimental design of non-equivalent but culturally homogenous group. Intact classes were used for both the experimental and control groups. The experimental group was taught using the ethno-mathematics approach while control group was taught using conventional approach. Two (2) research questions and two (2) research hypotheses were formulated to guide this study. The results revealed among others that the ethno-mathematics teaching approach was more effective in facilitating and improving students' retention in statistics than the conventional approach.

Unodiaku (2013) study was conducted to ascertain the effect of ethno-mathematics teaching materials on students' achievement in mathematics. The sample for the study was 156 Senior Secondary Schools two (SSS 2) students, which were randomly selected from 16 Senior Secondary Schools in Igbo-Etiti Local Government Area of Enugu State, Nigeria through multi-stage sampling technique. The instrument used for the study was ethno-mathematics Achievement Test (ETHNOMAT). The data obtained with the instrument were analyzed using mean and Analysis of covariance (ANCOVA). Mean was used to answer the research questions posed, while ANCOVA statistic was employed in testing the null hypothesis at 0.05 significant level. Findings of the study showed that the ethno-mathematic Achievement Test was effective in enhancing students' achievement in mensuration with particular reference to volumes of cylinder and hemisphere.

Ozofor & Onos (2018) examined the Effect of Ethno-mathematics on Senior Secondary School Students' Achievement in Ikwuano Local Government Area, Abia State, Nigeria. This study is designed to determine the efficacy of ethno-mathematics (mathematics in a cultural context) on senior secondary school students' achievement in mathematics. It is also aimed at determining whether any of the sexes (male or female) benefited more than the other from the teaching. The study employed the nonequivalent control group quasi experimental design. Four (4) research questions and four (4) null hypotheses guided the study. The experimental and control groups were taught probability using ethno-mathematics and conventional approaches respectively. The researcher constructed instruments-mathematics achievement test on probability (MATP) and mathematics interest inventory on probability (MIIP) were used for data collection. Mean and standard deviation were used to answer the research questions while t-test statistics was used to answer the hypotheses at alpha level < 0.05. The results revealed among others that ethno-mathematics approach was more effective in facilitating students' achievement. Both gender benefited significantly in achievement using ethno-mathematics approach. The study revealed that interaction effect between method and gender was significant in interest. These revelations had serious implications for mathematics teachers and stakeholders in mathematics education.

Imoko (2005) investigated the effect of concept mapping on students' achievement and interest in trigonometry. It also examined the differential effect of concept mapping on the achievement and interest of male and female students as well as urban and rural students. Fourteen (14) research questions and fourteen (14) hypotheses were formulated to guide the study. Data were collected from 297 SSS2 students using two (2) instruments, the trigonometry achievement Test (TAT) and the trigonometry interest inventory (TII). Concept maps and lesson plans on Sine and Cosine rules were used for the treatment. The research questions were answered using mean and standard deviation scores, while the hypotheses were tested at 0.05 level of significance using a 3-way analysis of covariance (ANCOVA). Results from the study revealed that students exposed to the concept mapping strategy achieved higher and showed greater interest in

trigonometry than those who were not. Also, the urban students were significantly higher in both achievement and interest. The study however revealed no significant gender difference.

Fouze & Amit (2019) examined ethno-mathematics and geometrical shapes in Bedouin, women's traditional dress Negev, South of Israel. The study used explanatory research design and content analysis in examining the previous literature on the subject matter. According to the study, ethno-mathematics asserts that in addition to the formal, academic mathematics which was developed in the West, there are other forms of mathematics which developed in many other societies and cultures around the world. Much research and educational experience has shown that combining Ethno-mathematics with formal mathematics teaching in the classroom improves the achievements of students from various ethnic and cultural groups; it strengthens their self-image and reinforces their motivation for mathematical study and research. This study aims mainly to offer an ethno-mathematical analysis of Bedouin embroidery samples taken from traditional dresses made by Bedouin women from the Negev area in the south of Israel. It also aims to describe how ethno-mathematical elements are incorporated in the teaching of mathematics for Bedouin students in the Negev, and how this contributes to their learning of mathematics.

III RESEARCH METHODOLOGY

Research Design

This study will adopt quasi experimental research design and survey research design which follows quantitative methodology. The researchers organized a training programme for the regular class teachers who were used as research assistants for the study. Two (2) sets of instructional packages (lesson plans) for teaching the units of geometry was prepared by the researchers. The instructional package for the treatment group focused on using an ethno-mathematics teaching approach; while the others for the control group focused on the conventional teaching approach in teaching geometry. Both the treatment and control groups was Administered Achievement Test in Geometry (ATG) as pre-test before the commencement of teaching by the regular teachers and the post-test at the end of six (6) weeks of teaching. The teachers was closely supervised to ensure that they used the instructional packages as provided by the researchers. The survey research design and quasi experimental research deign was carried out to provide the information needed to investigate objectives (i)- (vi) while the quasi experimental research design was used to provide the data need to evaluate objective vi of this study. The population of the study is six (6) junior secondary schools in Makurdi Metropolis chosen from public and private secondary schools operating in the study area, three (3) from each category. Forty five (45) students was used from each school bringing the population of the study to two hundred and seventy (270) students was used for the study as respondents.

The sample of the study was made up of two hundred and seventy (270) Junior Secondary School (JSS1) one students. Multistage sampling technique was used in the study. First, the schools was stratified; Makurdi Local Government area was considered as a stratum and also based on whether the school is public or private. Three (3) public and three (3) private schools in the study area was drawn using a simple random sampling and assigned to both control and experimental groups, making a total of six (6) junior secondary schools for the study. The use of the intact class was done to ensure that the academic programmes of the schools were not disrupted during the time of the experimental study. The experimental group was taught geometry using ethno-mathematics teaching approach while the control group was taught geometry using conventional teaching approach. Achievement Test in Geometry (ATG) and a close ended structured questionnaire was administer to the target respondents in the study area Structured questionnaire was administered to the selected respondents so as to obtain the needed information to answer the research questions.

Validation of Instrument

In this study, the two (2) most common types of validity, which are content and construct validity, were considered. While content validity was carry out through the expert contributions in the field of research methodology, construct validity was tested with the use of Factor analytical tool that considered Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity (BTS). Having constructed the instrument to be used to collect information for the study, the researcher will make sure that it measured the rational categories or variables for the intended purpose. To establish the validity of the instrument, a pilot test technique is therefore employed and the result of the pilot study was used to estimate the reliability and validity of the instrument as shown below.

Table 2: Kaiser-Meyer-Olkin and Bartlett's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.958
Bartlett's Test of Sphericity	Approx. Chi-Square	8.866
	Df	6
	Sig.	.018

Source: Authors Computation using SPSS Version 23.0

A pilot study was conducted. The input variable factors used for this study were subjected to exploratory factor analysis to investigate whether the constructs as described in the literature fits the factors derived from the factor analysis. From Table 2, factor analysis indicates that the KMO (Kaiser-Meyer-Olkin) measure for the study's four (4) variable items is 0.958 with Barlett's Test of Sphericity (BTS) value to be 6 at a level of significance p=0.018. Our KMO result in this

analysis surpasses the threshold value of 0.50 as recommended by Hair, Anderson, Tatham, and Black (1995). Therefore, we are confident that our sample and data are adequate for this study.

Table 3: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.677	41.932	41.932	1.677	41.932	41.932	1.439	35.964	35.964
2	1.173	29.337	71.268	1.173	29.337	71.268	1.412	35.304	71.268
3	.748	18.707	89.975						
4	.401	10.025	100.000						

Extraction Method: Principal Component Analysis.

Source: Authors Computation using SPSS Version 23.0

The Total Variance Explained table shows how the variance is divided among the four (4) possible factors. Two (2) variable factors have Eigenvalues (a measure of explained variance) greater than 1.0, which is a common criterion for a factor to be useful. When the Eigenvalue is less than 1.0 the factor explains less information than a single item would have explained. Table 2 shows that the Eigenvalues are 1.677 and 1.173 are all greater than 1. Component one (1) produced a variance of 35.964 while component two (2) produced a variance of 35.304. The cumulative of the rotated sum of squared loadings section indicates that three (3) components i.e component 1 and 2 jointly accounts for 71.268 percent of the variance of the whole variables of the study. This shows that the instrument has strong construct validity.

Reliability of Instrument

Table 4: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.822	.958	4

Source: Authors Computation using SPSS Version 23.0

Table 4 shows the reliability statistics which indicates that the overall Cronbach Alpha value is 0.822. Reliability Cronbach Alpha statistics of 0.70 is considered adequate and reliable for study. Hence, the variables of this study fall above the limit of a reliable instrument for this study.

Model Specification

Objectives one (i) to three (iii) is modeled using simple linear regression analysis. The implicit and the explicit functional relationship between the variables of the study shows the mathematical relationship between them as depicted below:

$SAG = f(ETA)$ (1)

$SIG = f(ETA)$ (2)

$SRG = f(ETA)$ (3)

Where,

ETA = Ethno-mathematics teaching Approach

SAG = Student Achievement in Geometry

SIG = Student Interest in Geometry

SRG = Student Retention of Geometry

The explicit form of the model can be stated as follows.

$SAG = b_0 + b_1ETA + U_t$ (4)

$SIG = b_0 + b_1ETA + U_t$ (5)

$SRG = b_0 + b_1ETA + U_t$ (6)

Where,

b_0 = Regression intercept

b_1 = Regression Coefficients

U_t = Stochastic error terms

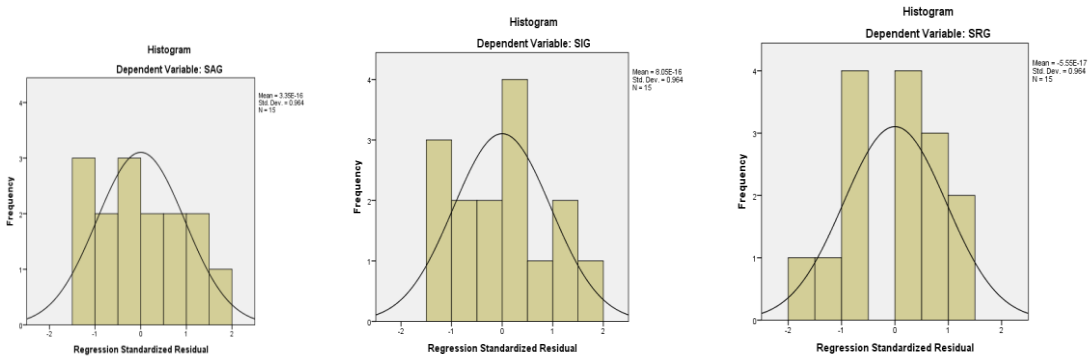
***A priori* expectation**

The estimate b_1 is expected to have a positive effect on student's achievement, interest and retention. Thus, it is expected to be positively signed in line with *a priori* expectation.

Techniques of Data Analysis

The data for the study was collected, coded and analyzed using computer-based Statistical Package for Social Sciences (SPSS version 23.0 for Microsoft Windows). Simple linear regression analysis was used to estimate the effect of the independent variable on the sets of three (3) dependent variable of the study in objective (i) to (iii). The probability value of the regression estimate was used to test hypotheses (i) to (iii) of this study. Specific objectives (iv) to (vi) was analyzed using analysis of covariance (ANCOVA). While the hypotheses (iv) to (vi) was tested using the probability value of the test estimate.

IVRESULTS AND DISCUSSION



Source: Authors Computation using SPSS Version 23.0

Fig 1: Regression Standardized Residuals

The graph of the standardized regression residual shows a histogram of the residuals with a normal curve superimposed. The residuals look close to normal, implying a normal distribution of data. The histogram indicates no problems with the assumption that the residuals are normally distributed at each level of the dependent variable and constant in variance across levels of the independent variable.

Table 1: Statistical Significance of the Model

Model	Variable	F-stat	p-value
I	[SAG]	3.372	.022
II	[SIG]	2.858	.041
III	[SRG]	4.089	.006

Source: Authors Computation using SPSS Version 23.0

The F-ratio in the ANOVA Table 1 tests whether the overall regression models are a good fit for the data. The table thus shows that the independent variable of ethnomathematics statistically significantly predicts the dependent variable F (1, 13) = 3.372, 2.858 & 4.089, p =0.022, 0.041 & 0.006[b] (i.e., the regression models are good fit of the dataset).

Table 2: Regression Coefficients for the three Models

Model	Variable	Unstandardized Coefficients	t-stat	p-value
I	Students achievement in geometry [SAG]	-.187	-.610	.552
II	Students interest in geometry [SIG]	.370	3.394	.001
III	Students retention in geometry [SRG]	.449	3.376	.016

Source: Authors Computation using SPSS Version 23.0

The result of the simple regression analysis for three models of the study is shown in Table 2. For the first model of the study, a negative effect was established between ethnomathematics teaching approach and students' achievement in geometry. The effect is not statistically significant (*p>0.05)* and not is in line with *a priori* expectation. This means that an increases in ethnomathematics teaching approach will result to a corresponding decrease in students' achievement in geometry in selected secondary schools in Makurdi metropolis, Benue State, Nigeria by a margin of 0.187. Using the probability value of the estimate, p (b_1) > critical value of 0.05 confidence level. Thus, we accept the null hypothesis. That is, we accept that the estimate b_3 is not statistically significant at the 5% level of significance. This implies that ethnomathematics teaching has no significant effect on students' achievement in geometry in selected secondary schools in Makurdi metropolis, Benue State, Nigeria. For the second and third model of the study, ethnomathematics teaching approach have a positive and significant effects on students' interest and students' retention in geometry in selected

secondary schools in Makurdi metropolis, Benue State, Nigeria. Using the probability value of the estimate, we reject the null hypotheses for the two model and accept the alternative hypothesis. This means that ethnomathematics teaching have significant effects on students' interest and retention in geometry in selected secondary schools in Makurdi Metropolis, Benue State, Nigeria. The finding of the first model of the study is not in tandem with that of Unodiaku (2013) whose study was conducted to ascertain the effect of ethno-mathematics teaching materials on students' achievement in mathematics. The researcher found that ethno-mathematic achievement test was effective in enhancing students' achievement in mensuration with particular reference to volumes of cylinder and hemisphere. The negative effect of ethnomathematics on achievement of students in ethnomathematics could be due to several factors such as lack of teachers to effectively deliver the subject matter to the students to efficiently comprehend. Ozofor & Onos (2018) who examined the effect of ethno-mathematics on senior secondary school students' achievement in Ikwuano Local Government Area, Abia State, Nigeria found similar result for the second model of the study. Also, Imoko (2005) who investigated the effect of concept mapping on students' achievement and interest in trigonometry found that students exposed to the concept mapping strategy achieved higher and showed greater interest in trigonometry than those who were not. Finally, the study by Kurumeh *et al.,* (2012) provide a support for the positive effect of the use of the ethno-mathematics teaching approach on student retention.

Table 3: ANCOVA Coefficients for Models I, II & III

Model I [SAG] SEX	**Mean**	**Levene's Test of Equality of Error Variances[a] [F-stat]**	***p*- value**
1.00 = male	28.5000	.420	0.401
2.00 = female	30.6000		
Model II [SIG] SEX			
1.00 = male	33.7000	.570	.360
2.00 = female	37.0000		
Model III [SRG] SEX			
1.00 = male	35.3000	.044	.375
2.00 = female	24.2000		

Source: Authors Computation using SPSS Version 23.0

The result of the analysis of covariance (ANCOVA) shows that there is a difference in achievement between the mean rating of male (28.5000) and female (30.6000) students taught geometry using of ethno-mathematics teaching approach than those taught using the conventional teaching approach and this difference is statistically significant. Levene's test of equality of variances is used in meeting the statistical assumption of homogeneity of variance in between-subjects designs was used to test the hypothesis. As shown in model I, male (28.5000) had less achievement than female (30.6000) taught geometry using of ethno-mathematics teaching approach than those taught using the conventional teaching approach and this difference is statistically significant. This implies that the null hypothesis for model IV is rejected and model V and VI. Also, the same scenario presented in Model II where the mean rating for male respondents (33.7000) are more than the female respondents (37.0000). This means that female has more interest than male in geometry using ethno-mathematics teaching approach than those taught using the conventional teaching approach. For model IV of the study, there are difference in retention between male and female students taught geometry using of ethno-mathematics teaching approach than the conventional teaching approach. Male has higher level of retention than female and the difference is statistically significant. Hence, the three models of the study are rejected there are significant difference between the mean achievement, interest and retention scores of male and female students taught geometry using ethno-mathematics teaching approach than those taught using the conventional teaching approach. These findings are in line with those of Achor *et al.,* (2012) who examined achievement in geometry in secondary schools in Nigeria using a non equivalent pre-test, post-test control group quasi experiment design, on intact classes assign to the experimental and control groups. ANCOVA was used to analyze the data and the result shows that there was a significant difference between the mean achievement of the group taught geometry using team approach and the group that interacted with their class teachers using problem solving approach. (F_1, 287=117.96, $p<0.05$). However, male and female students taught geometry did not differ in the their mean achievement significantly (F_1, 287=9,690, $p>0.05$). Also, Kurumeh *et al.,* (2012) who carried out a study on improving students' retention in junior secondary school statistics using the ethno-mathematics teaching approach in Obi and Oju Local Government Areas of Benue State, Nigeria found similar result.

VCONCLUSION AND RECOMMENDATIONS

The study focused on the effect of ethno-mathematics and conventional teaching approaches on students' achievement, interest and retention in geometry in selected secondary schools in Makurdi metropolis, Benue State, Nigeria. The findings were based on inferential statistics of data collected. For specific objectives one to three, ethnomathematics showed a positive and significant effect on students interest and retention in selected secondary schools in Makurdi metropolis, Benue State, Nigeria. Also, result from the analysis of covariance (ANCOVA) indicates that for model III,

IV and V, they was a significant difference between male and female achievement, interest and retention of geometry taught using ethno-mathematics than those taught using the conventional teaching approach. More specifically, for model IV, female had more achievement in geometry being taught using ethno-mathematics than their male counterpart. In model V, female equally had more interest in geometry being taught using ethno-mathematics than those taught using the conventional teaching approach. However, in model VI, male had more retention of geometry taught using ethno-mathematics than their female counterpart who are taught geometry using the conventional approach. The finding of the study has shown that ethno-mathematics is beneficial in the teaching of geometry as it has a positive effect on interest and retention. It has also shown that female gender shows more interest and achieves more when geometrical concepts are taught using ethno-mathematical concepts than when the conventional approach is used.
It is recommended among that:

1. Appropriate emphasis should be paid to the application of mathematical concepts to real-world situations in our environment or society through the usage of geometrical symbols to pique students' interest.

2. Mathematics instruction in general should be handled in such a way that students are actively involved in the learning processes, enabling them to see Mathematics as a natural extension of their daily life activities, hence improving students' academic performance and retention.

3. The study's findings indicate that students exposed to ethno-mathematics in the teaching of geometry performed better and retained more concepts than those taught using the usual approach. As a result, an ethnomathematical approach should be adopted in schools.

4. Teachers should be taught in the application of ethno-mathematical approaches in the teaching of geometry in selected secondary schools in Makurdi, Benue State, Nigeria. An ethno-mathematical approach has been demonstrated to be a viable choice for encouraging meaningful learning in trigonometry. As a result, it is advised that Mathematics teachers receive training in the use of ethno-mathematics teaching approaches through workshops, conferences, and seminars.

5. Male students in selected secondary schools in Makurdi metropolitan, Benue State, Nigeria should be given special consideration, since the ANCOVA revealed that they did not perform well in terms of achievement and interest when taught geometry using an ethno-mathematical approach.
6. Additional research is needed to determine how to effectively transmit geometrical principles to students using an ethno-mathematical teaching approach that enables them to grasp the concepts and apply them to real-world problems.

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