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# APPRAISAL OF ETHNOMATHEMATICS HAUSA INSTRUCTIONAL STRATEGY ON PERFORMANCE AND RETENTION OF GEOMETRIC CONCEPTS AMONG UPPER BASIC STUDENTS IN SOKOTO STATE, NIGERIA

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**ABSTRACT**

*This paper investigated the effects of new designed and developed Ethnomathematics Hausa Teaching Strategy on Academic Performance and Retention of Geometric Concepts among Upper Basic Students in Sokoto State. Four (4) schools with a total of 536 upper basic 3 students were sampled for the study using stratified sampling techniques. 277 were male and 259 female students according to their gender and category in the state. Three research questions and three null hypotheses were raised to guide the conduct of the study. Two instruments GSPT and AFDJYH with reliability indices 0.87 and 0.84 respectively were adapted for data collection. T-test statistical analysis at $\alpha = 0.05$ level of significance was used to test the hypotheses. Two null hypotheses were retained and one was rejected. Since the results of teaching through the use of Ethnomathematics Hausa teaching strategy was proved to be better than traditional method, it was therefore recommended that Ministry of Educations (MOEs), Universal Basics Education Board Sokoto (SUBEB), Curriculum planners and Developers should review their policies to inculcate this strategy in teaching mathematics in the 9-year basic education curriculum in Nigeria.*

**Keywords: Appraisal, Ethnomathematics, Hausa Instructional Strategy, Performance, Retention, Geometric Concepts, Upper Basic Students.**

## Introduction

Geometry is the topic that constitutes the backbone of mathematics and it contributes to other disciplines like engineering, science, technology, architecture, buildings and computer education. It is a very vital branch of mathematics that is available in every aspect of school mathematics curriculum, in Nigeria. It constituted 60% to 70% of mathematics curriculum (Madugu and Bature, 2017).Geometry is concerned with the study of those spatial objects, relationships and transformations that have been mathematised and the axiomatic expression

that have been developed to represent them (Nasiru, 2021). These areas of study play a major role in the development of world today.

Importance of geometry to learners in busting their educational pursuit in science and technology cannot be overemphasized. Geometry helps students in the area of problem solving skills and addressing problems related to space and other areas like technology and science (Zakaria, 2013). In view of this importance, almost all countries in the world including Nigeria, consider geometry in their mathematics curriculum.

**Statement of the Problem**

Despite the importance attached to mathematics in Nigerian educational system, researchers found that it is the subject mostly failed by students in both their internal and external examinations due to lack of basic understanding of geometric concepts. Examiners' reports of WAEC (2017-2022) shows that many students avoided questions in geometry and geometry related questions and those attempted them, recorded very low marks in their mathematics examinations as a result of language of instruction. The use of conventional strategy in teaching geometry and other mathematics topics was found to be a major factor associated with the poor performance of students in mathematics. Most of terminologies used in teaching mathematics are either English words or barrowed words from other foreign languages such as Greeks, Latin, Hebrew, etc, They are completely foreign in nature, has no bearing with the Nigerian culture and native language of the learners (Nasiru, 2021). In this study therefore new instructional strategy was ethnomathematically designed in Hausa language which was used in teaching geometric concepts to upper basic students in Sokoto State.

**Objectives of the Study**

The objectives of this study are to:

1- To determine the effects of Ethnomathematics Hausa teaching strategy on academic performance of upper basic 3 students on geometric concepts in Sokoto State, Nigeria.
2- To find out if difference exists in the academic performance between Male and Female upper basic 3 students taught geometry using Ethnomathematics Hausa teaching strategy Sokoto State
3- To determine the effects of Ethnomathematics Hausa Teaching Strategy on retention of upper basic 3 students taught geometric concepts in Sokoto State.

**Research Questions**

The following research questions were raised to guide the conduct of this study:

1- Is there any difference in academic performance between upper basic 3 students taught geometry using Ethnomathematics Hausa teaching strategy and those taught using conventional lecture method in Sokoto States?
2- Is there any difference in academic performance between Male and Female upper basic students taught geometry using Ethnomathematics Hausa teaching strategy in Sokoto State?
3- Is there any difference in retention among upper basic 3 students taught geometry using Ethnomathematics Hausa teaching strategy in Sokoto State?

**Null Hypotheses**

The following null hypotheses were generated to guide the conduct of the study:

1- $\boldsymbol{H_{01}}$: There is no significant difference between the academics performance of upper basic 3 students taught geometry using Ethnomathematics Hausa teaching strategy and those taught using conventional English lecture method in Sokoto State.
2- $\boldsymbol{H_{02}}$: There is no significant difference in academic performance between Male and Female upper basic 3 students taught geometry using Ethnomathematics Hausa teaching strategy in Sokoto State.
3- $\boldsymbol{H_{03}}$ There is no significant difference in retention among upper basic 3 students taught geometry using Ethnomathematics Hausa teaching strategy in Sokoto State.

**Concept of Ethnomathematics**

The term ethnomathematics is the link of the prefix "ethno" onto the word mathematics. The prefix ethno came from the word ethnology, which according to Oxford Advance Learner's English Dictionary sixth edition (2000), define ethnology as the scientific comparison of different culture of different people. Mathematics on the other hand is defined by the same dictionary as the study of the relationships among numbers, shapes, and quantities using numbers and symbols, signs, and proofs. This includes arithmetic, algebra, calculus, geometry, and trigonometry.

According to D'Ambrosio (2010) ethno describes all of the ingredients that make up the cultural identity of a group such as language, codes, values, culture, beliefs, food and dress, habits, and physical traits. Mathematics on the other hand expresses a broad view of mathematics which includes; arithmetic, classifying, ordering, inferring, and modeling. Therefore Ethnomathematics Teaching Strategy refers to an approach used in teaching mathematics within the context of culture and the native language of the immediate environment to which learners belong.

**Review of Related Empirical Studies**

Some researches were conducted in area of ethnomathemtics teaching approach. The research conducted by Akaazua (2021) examined the effect of ethnomathematics on Junior Secondary School students' achievement and retention in geometry in Benue State, Nigeria. The findings shows that students taught geometry using ethnomathematics teaching approach performed significantly better than those taught through traditional method and no gender difference observed. The finding also shows high retention of geometric concepts among students taught using ethnomathematics teaching approach. Modesta and Anthony (2021) also investigated the effects of Ethnomathematics Instructional Approach on students' achievement and interest in Mathematics. The findings revealed that the students exposed to Ethnomathematics Instructional Approach showed superiority in their achievement than those exposed to conventional approach and no gender difference in performance.

Adamu (2022) also conducted similar study in Makurdi metropolis, Benue State, Nigeria. The findings indicated a significant difference between students taught geometry through Ethnomathematics teaching approach and those students taught geometry through traditional approach. No gender difference in students' performance was found. Omere and Precious (2022) also conducted a study to investigate the effect of Ethnomathematics teaching method on mathematics students' achievement in Geometry in Akoko Edo Local Government Area, Edo State, Nigeria. The findings revealed that Mathematics students' achievement mean

scores in Geometry were high when taught with Ethnomathematics. The study also revealed that female students performed better than their male counterparts.

Yasha'u (2018) investigated the impacts of using ethnomathematics in teaching on performance and retention in mathematics among primary III pupils in Lere Education district, Kaduna State, Nigeria. Results of the study indicated that primary III pupils taught using ethnomathematics teaching performed and retained mathematical concepts better than those taught with conventional teaching method. The result also revealed no significant difference in gender performance and retention of primary III pupils taught mathematical concepts using ethnomathematics teaching strategy.

Umar, Tudunkaya and Muawuya (2019) conducted their study to determine the Effects of Ethnomathematics Teaching Approach on Students' Performance and Retention in Trigonometry in Zaria Local Government Area of Kaduna State, Nigeria. The data collected was analyzed using t-test analysis at $\alpha = 0.05$ level of significance. The findings revealed that students exposed to ethnomathematics teaching approach were superiors in performance and retention than those taught using conventional approach.

The gap seen between this study and the previous studies reviewed is that, the culture and native language that served as vital ingredients for effective mathematics teaching was not practically and adequately used in the previous studies. In this study therefore the researchers designed a new Hausa teaching strategy ethnomathematically for teaching geometry to upper basic students in Sokoto State. The contents, materials, methods of delivery, activities of teachers and learners were culturally and ethnomathematically designed in Hausa.

**Population of the Study**

The target population of this study was the whole Upper Basic 3 Students in Sokoto, State, Nigeria. It was found that there are two hundred and ninety one (291) upper basic schools with a total of forty one thousand five hundred and eight (41,508) upper basic 3 students in Sokoto state. Twenty six thousand eight hundred and eighty four (26,884) were male students while fourteen thousand six hundred and twenty four (14,624) were female students

**Sample and Sampling Techniques**

Four (4) schools with an estimated population of 3,492 upper basic 3 students were sampled for the study using stratified sampling techniques. Two (2) schools with a total of 141 male and 144 female students were sampled as experimental and another two(2) schools with a total of 136 males and 115 female students were sampled as control schools according to their gender and category in the state. This sampling technique was in accordance with the advice given by Sambo (2005).

**Research Methodology**

Quasi Experimental design in the form of intact class was adopted using pre-test and post-test control design. 4 classrooms with a total of 195 of Upper Basic 3 students were selected to participate in the study.107 were male students while 88 were female students.

**Instrumentation**

Two instruments were adapted by the researchers for the purpose of collecting data for this study. These are Geometric Students Performance Test (GSPT) and Auna Fahimtar Dalibaiakan Jomitiri da Yaren Hausa (AFDJYH).The first instrument was adapted in English language while the second instrument was adapted in Hausa language. GSPT and AFDJYH instruments contained two sections. Section A contains thirty (30) objective items, and section B contains three (3) theory questions for students to attempt any two.

**Validity of the Instruments**

The two instruments were validated by experts in Usmanu Danfodiyo University Sokoto (UDUS), Shehu Shagari College of Education Sokoto (SSCOE). Base on the advice made by the experts some items were removed and some were modified. Section Aof GSPT and AFDJYH which contains thirty (30) objective items were reduced to twenty (20) objectives questions while section B remains the same three (3) theory questions. Marking schemes were also adjusted to marks (3marks) while each theory question attract twenty marks (20marks) which will be sum up to 100 maximum marks.

**Reliability of the instruments**

Test and re-test method were conducted to obtained the reliability index of GSPT and AFDJYH questionnaires. Pearson's Product Moment Correlation was used to determine the reliability index of the two instruments and was found to be 0.87 and 0.84 respectively.

**Administration of the instruments**

A pre-test was administered to all sampled students on the same day with the help of research assistance in each school. Answered scripts were collected and marked immediately after the test is over. After marking, researchers carried out moderation of scripts to ensure that marking is strictly adhered to the marking scheme and marks were allocated accordingly. The Experimental Groups were taught geometry using Hausa language as the medium of instruction for six weeks. The controls Group (CG) were taught using traditional methods for the same equal period of time as in the experimental groups. Post-test was then administered using GSPT for CG and AFDJYHfor EG.After two weeks post-post-test was again re-administered to Experimental Groups to ascertain the level of their retention.

**Data Analysis**

The presentation of data was based on the two research questions and two null hypotheses generated from the two objectives of the study. The pre-test conducted for both the (CG) and (EG) show that their performance before giving the treatment was homogeneous.

**Null Hypothesis one $H_{01}$:**

There is no significant difference between the academics performance of upper basic 3 students taught geometry using Ethnomathematics Hausa teaching strategy and those taught using conventional English lecture method in Sokoto State.

**Table 1: Summary of T-test analysis of null hypothesis one ($H_{01}$)**

| Groups | No. of Students | Mean ($\bar{x}$) | SD ($\sigma$) | SD Error ($\bar{x}$) | Mean Difference | $df$ | $t_{cal}$ | $P$ | Decision |
|---|---|---|---|---|---|---|---|---|---|
| Experimental Group | 112 | 57.11 | 13.63 | 1.28 | 21.38 | 193 | 11.93 | 0.000 | $H_{01}$ Rejected |
| Control Group | 83 | 35.72 | 10.42 | 1.14 | | | | | |

Source: *Field work, 2021* $\alpha = 0.05$

Table 1 shows t-test analysis with $P - value = 0.000$ less than the $\alpha - value = 0.05$. By the rule, if p-value is less than the alpha value, the null hypothesis is rejected, This implies that null-hypothesis one is rejected.

**Null Hypothesis Two ($H_{02}$)**

There is no significant difference in academic performance between Male and Female upper basic 3 students taught geometry using Ethnomathematics Hausa teaching strategy in Sokoto State. This hypothesis was tested using t-test analysis at $\alpha = 0.05$ and the results were as follows

**Table 2: Summary of T-test analysis of null hypothesis Two ($H_{02}$)**

| Gender | No. of Students | Mean Score ($\bar{x}$) | SD ($\sigma$) | Standard Error ($\bar{x}$) | Mean Difference | $df$ | $t_{cal}$ | $P$ | Decision |
|---|---|---|---|---|---|---|---|---|---|
| Male Students | 58 | 57.12 | 13.50 | 1.77 | 2.05 | 113 | -0.79 | 0.430 | $H_{02}$Retained |
| Female Students | 54 | 58.16 | 13.81 | 1.87 | | | | | |

Source: *Field work, 2024* $\alpha = 0.05$

Table 2 shows t-test analysis null hypothesis two with $P - value = 0.430$greater than the $\alpha - value = 0.05$. By the rule, when p-value is greater than the alpha value the null hypothesis is not rejected. This implies that null-hypothesis two is retained. This reveals that, there was no significant difference between the academic performances of Male and Female upper basic 3 students taught geometry using Ethnomathematics Hausa teaching strategy in Sokotostates.

**Null Hypothesis Three ($H_{03}$)**

There is no significant difference in retention among upper basic 3 students taught geometry using Ethnomathematics Hausa teaching strategy in Sokoto State

**Table 3: Summary of Paired Sample T-test of Null hypothesis Three($H_{03}$)**

| Type of Test | No. of Students | Mean Score | SD ($\sigma$) | Mean Difference | Paired Correlation | $df$ | $t_{cal}$ | P | Decision |
|---|---|---|---|---|---|---|---|---|---|
| Post-test | 112 | 57.11 | 13.62 | 0.3578 | 0.980 | | | | $H_{03}$ |
| | | | | | | 111 | -1.40 | 0.163 | Retained |
| Post Post-test | 112 | 57.46 | 13.58 | | | | | | |

Source: *Field work, 2024* $\alpha = 0.05$

Table 3 is the summary of paired sample t-test analysis for the difference between the academic performance of Sokoto state upper basic students 3 taught geometry through ethnomathematic Hausa teaching strategy The results of the analysis showed that $P = 0.116$ is greater than the $\alpha = 0.05$. From the rule, when P – value is greater than the $\alpha = value$, the null hypothesis is accepted. Therefore null hypothesis three is also accepted. The result reveals that, there is no significant difference in retention between upper basic students taught geometry using Ethnomathematics Hausa Teaching Strategy in Sokoto State.

**Summary of the Major Findings**

From the analyses, the major findings were summarized as follows:

1- There was significant difference between the academic performances of upper basic 3 students taught geometry using ethnomathematics Hausa teaching strategy and those taught using conventional English method in Sokotostate.
2- There was no significant difference between the academic performances of Male and Female upper basic 3 students taught geometry using Ethnomathematics Hausa teaching strategy in Sokoto State.
3- There was no significant difference in retention between upper basic students taught geometry using Ethnomathematics Hausa Teaching Strategy in Sokoto State.

**Decision**

The first finding revealed that, there was significant difference between the academic performances of upper basic 3 students taught geometry using ethnomathematics Hausa teaching strategy and those taught using conventional English method in Sokotostates. This finding agreed with the finding of Modesta and Anthony (2021), Akaazua (2021), Adamu (2022), Omere and Precious (2022). However the finding disagreed with the finding of Yasha'u (2018).

The second finding revealed that there was no significant difference between the academic performances of Male and Female upper basic 3 students taught geometry using Ethnomathematics Hausa teaching strategy in Sokotostate. This finding agreed with the finding of Modesta and Anthony (2021), Akaazua (2021), Adamu (2022), and Ya'u (2018). However, the finding disagreed with the finding of Omere and Precious (2022), Umar, Tudunkaya&Muawuya (2019).

The third finding reveals that, there is no significant difference in retention between upper basic students taught geometry using Ethnomathematics Hausa Teaching Strategy in Sokoto state.This finding was in line with the findings of Omere and Precious (2022), Umar,

Tudunkaya&Muawuya (2019), Akaazua (2021). However, the finding was not inconformity with the finding of Ya'u (2018), Modesta and Anthony (2021),

**Conclusion**

Based on the findings of this study, the paper concludes thus:

1- The use of ethnomathematics teaching strategy resulted in higher performance over traditional method in the teaching of geometry to upper basic students in SokotoState.
2- There was no significant difference found in academic performances betweenMale and Female upper basic 3 students taught geometry using Ethnomathematics Hausa teaching strategy in Sokotostate.
3- Students taught geometry using Ethnomathematics Teaching Strategy can retained what they learned for a very long period of time.

**Recommendations**

Based on the findings of this research study the following recommendations were made:

1- Since Ethnomathematics has proved to be a viable option in promoting meaningful learning in geometry with high students' retention, it is recommended that teachers should be trained through refresher course on the use of Ethnomathematics Hausa Teaching Strategy in their lessons.
2- It was also recommended that curriculum planners should use the findings of the study to improve on their policies towards teaching and learning Science, Mathematics and Basic Technology subjects designed in the 9-year basic education curriculum in Nigeria.
3- The parents should also use the benefits of this finding to understand that education is not associated with the ability to speak foreign language (English) only, but their own rich culture and native language are the most important factors for educating their children.

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