

Ethnomathematics: The Key to Optimizing Learning and Teaching of Mathematics

¹Iluno, C. And ²Taylor, J.I

Department of Mathematics, Lagos State Polytechnic, Ikorodu, Lagos State.

Abstract: *This study determined the prominent role of Mathematics as a key to optimize teaching and learning of mathematics in Nigeria. The study was carried out in Lagos State, Nigeria using a sample size of 350 students of institution of higher learning. It was a non- equivalent quasi experimental study which was guide by two hypotheses. Ethno mathematics Achievement Test(EMAT) instrument with a reliability coefficient of 0.78 was used as pre, post and delayed tests through reshuffling of the selected questions each time. The data obtained were analyzed using mean and standard deviation while the hypotheses were tested at 0.05 significant level using a Two-way Analysis of Co-variance(ANOCOVA). Results showed that students exposed to ETA performed highly than those taught with convectional teaching approach(CTA). There were significant differences between the mean score of students taught through ETA and CTA. Therefore, the study recommended training of mathematics teachers on the use of ethno mathematics. Also, researchers should carry out more experiment on the effect of using Computer Assisted Instruction(CAI)and ETA simultaneously in teaching and learning of mathematics in institution of higher learning.*

Keywords: *Ethno mathematics, performance, achievement, retention, conventional approach, creativity.*

I. Introduction

Today's children are living in a civilization that is dominated by mathematically based technology and unprecedented means of communication. The need to acquire knowledge in mathematics in the world over has become very obvious .But much of the content of current mathematics programs does little to help students learning the information and skills necessary to function successfully inn this new world. This is evidence in the failure rate of mathematics at all level of our education cadre and mathematics courses in our institution of higher learning. The rate is so high that Nigeria was found to occupy the second to the last position when compared with the eleven other English speaking West African Countries in Mathematics School Certificate Examination (Abakpa and Agbo Egwu, 2008). Many Mathematics education researchers in Nigeria agreed with the observations that the method of teaching mathematics in Nigeria is completely unrelated with the background and local environments of the learners, making Mathematics learning more abstract to an average Nigeria students. The Nigeria mathematics curriculum depend purely on foreign nature, has no focus on Nigeria culture and purely derived from euro-centric culture.(Obodo1997; Kurumeh, 2004; Uloko and Imoko, 2007). One of the consequences of depending on this euro-centric curriculum and teaching methods is the seemingly lack of basic mathematical principles which results to rote-learning and low performance in students.

Researchers(Obodo1997; Kurumeh, 2004; D'Ambrosio 2001) stressed that active participation of learners, practical oriented, project-oriented and applicable should be incorporated into any method that can ensure effective learning of Mathematics. Everyday life is impregnated in the knowledge and practices of a culture. At all times individuals are comparing, classifying ,quantifying ,measuring , explaining, generalizing, inferring and in some way evaluating using material and intellectual instrument that belong to culture. Therefore, conciliating the need to teach the dominant mathematics and at the same time give recognition to the ethnomathematics of their tradition is the great challenge for Mathematicians.

II. Ethno Mathematics

The term Ethnomathematics requires a dynamic interpretation because it describes concepts that are themselves neither rigid nor singular that is "ethno" and "mathematics"(D'Ambrosio 1987). The term ethno refers to identifiable cultural identity of a group such as languages, codes, values, jargons, beliefs, food, dress, habits and physical traits. Mathematics expresses broad views of courses which include ciphering, arithmetic, classifying, ordering, inferring and modeling patterns arising in the environment. According to Davidson(2000) Ethnomathematics is the art or technique of explaining, knowing and understanding diverse culturally related learning styles which is found to develop the learners in mathematics.(Gilmer and Mulwankee ,2001; Knijinik, 1997; Mogari ,2002).

Therefore, thegoal of mathematics should be to foster students ability successfully using modern technology to solve problems and communicate their thinking and answers as they gain an awareness of the

capabilities and limitations of technological instruments. We can help students realized their full mathematical potentials by acknowledging the importance of culture to the identity of the child and how culture affects the students thinking and learning. We must teach students to value diversity in the mathematics classroom and to understand both the influence that culture has on mathematics and how this influence results in different ways in which mathematics is used and communicated.

Traditionally, in mathematics classrooms, the relevance of culture has been strangely absent from the content and instruction. The result is that many students and lecturers unquestioningly believe that no connection exists between mathematics and culture. Failing to consider other possibilities, they believe that mathematics is acultural, a discipline without cultural significance. Thisacultural mathematical perspective is reflected during instruction in several ways. First, in many classrooms, students are not permitted to construct a personal understand of the mathematics that is presented. The values, traditions, beliefs, language, and habits reflective of the culture of the students are ignored. In such situations, the ways that students might invent personally meaningful conceptualizations are not respected.

In most of our higher institution of learning, students are expected to assimilate prescribed procedures by rote without necessarily gaining deeper and conceptually significant understands of the mathematics that they are studying. This style of instruction unfortunately restricts learning to the length of time that students accurately remember the procedures. An application of the learning is also often context specific and poorly generalized because it is limited to the types of problem s practiced when the procedures were taught. When cultural characteristics of the children invention, experience and application of mathematics are realized and respected, then these students more closely will resemble the budding Mathematicians desired.

III. Statement Of Problem.

The alarming rates of failure in mathematics courses in institution of higher learning have really caused a lot of damage to our technological growth and development. From findings it shows that Nigeria students are competing for the last position and not the best. Researchers have also emphasized on the use of a new methods for teaching and learning mathematics at higher level apart from the lecture method but to no avail.

IV. Research Questions.

The research work was guided by the following research questions:

- What is the relative effect of the use of ethno mathematics and convectional teaching method on students' mean performance scores?
- What is the relative effect of the use of ethno mathematics teaching approach and convectional teaching methods on the students' mean retention and creativity scores?

V. Hypotheses.

1. There is no relative difference between the mean performance scores of students taught using ETA and those taught using the conventional approach.
2. There is no relative difference in the mean retention scores of students taught with ETA and those taught with the conventional approach.

VI. Research Method

This study was a nonequivalent quasi-experimental design due to the large coverage involved and randomizing might not be effective intact classes were used. The population comprised of students of Lagos State Polytechnic. The choice of this population was because polytechnic is the bedrock of science and technology of a nation. The sample for the study was 350 students multi-stage sampling was involved. First, two schools were sample out of six schools (School Of Technology, School of engineering). The School Of Technology was randomized and assigned the experimental group while School Of Engineering was assigned control group. The experimental group were taught with Ethno mathematics Teaching Approach (ETA) while the control group were taught with the Convectional Teaching Approach (CTA). The control group comprised 171 male and female students while the experimental group comprise of 179 male and female students.

The instrument used in the study was called Ethno mathematic Achievement Test (EMAT) whose content was validated by mathematics experts. EMAT was used for pretest, posttest and delayed tests to collect data. But note in each cases the questions were reshuffled. A50- items EMAT was develop and tested based on table of specification .The pre-test was given to the entire group before the commencement of the teaching and learning. After four weeks of teaching and learning, EMAT was rearranged and administered again after five weeks of teaching and learning to measure creativity and retention ability. The reliability enough for this study. Total numbers of four lecturers were used. The lecturers were taught the use of Ethno mathematics Teaching Approach (ETA). The lecturers to teach the control groups used the Conventional Teaching Approach (CTA).

The two groups were taught the same topics-probability and games, sequence and series, conic sections, algebra. But the experimental group was taught probability and games through the popular Ayo game in Yoruba-land ,Sequence and series was taught using the method of making Aso oke in Yoruba-land Akwete in Igbo- land ,these two methods deals with the making of cloth using patterns, combination of colour and mixture of designs to create a very good design well accepted and adapted by the two culture . While the conic section was taught using the local and tradition shapes in building a hut considering every bit of measurement. Finally, Algebra was taught using local puzzles and games. Questions selected for the EMAT were picked from the topics listed above. Length of teaching was equally distributed and each classroom section was supervised by the researchers.

TABLE 1:Show the raw data classified into various groups under Pre-test, Post-test, and Delayed test.

Scores	PRE-TEST		POST TEST		DELAYED TEST	
	Experimental Group	Control Group	Experimental Group	Control Group	Experimental Group	Control Group
0-19	60	65	22	40	08	33
20-39	58	43	25	45	26	48
40-59	46	32	44	55	40	58
60-79	15	31	78	31	78	32
80-79	-	-	10	-	27	-
	179	171	179	171	171	

TABLE 2: Mean Performance Scores and Standard Deviation of students in the Experimental and Control group.

TEACHING METHOD	TYPE OF TEST	N	MEAN (\bar{X})	STANDARD DEVIATION
Ethnomathematics Approach(ETA)	Teaching Pre-test	179	31.29	19.17
	Post- test	179	52.74	45.38
	Delayed-test	179	69.55	31.07
Conventional Approach(CTA)	Teaching Pre-test	171	32.89	25.48
	Post- test	171	38.50	20.76
	Delayed- test	171	39.90	19.09

TABLE 3: Two way ANOCOVA results on subjects performance scores in EMAT.

Source of Variance	Type III Sum of squares	DF	Mean Square	F	Sig	REMARK
Corrected Model	5554.400	4	1110.880	53.1152	.001	s
Intercept	12250.000	1	12250.000	56.124	.000	s
PRE EMAT	6.400	1	6.400	.306	.000	s
Method	5548.000	4	1387.000	66.364	.001	s
Error	83.600	4	20.900			
Total	17888.000					
Corrected Total	5638.000					

S = Significant at $\alpha = 0.05$.

TABLE 4 : Two way ANOCOVA results on subjects performance scores in EMAT for retentive and creativity

Source of Variance	Type III Sum of squares	DF	Mean Square	F	Sig	REMARK
Corrected Model	5036.600	5	1007.320	18.069	.004	s
Intercept	12816.000	1	12816.000	229.891	.000	s
POST- EMAT	.000	1	.000	.000	.000	s
Method	5036.600	4	1259.000	22.586	.001	s
Error	223.000	4	55.750			
Total	18076.000					
Corrected Total	5259.000					

S = Significant at $\alpha = 0.05$.

VII. Results.

The results of the study were presented according to the research questions and hypotheses.

Question 1

What is the relative effect of the use of ETA and CTA on students' mean performance scores. From Table 1 and 2 the answer to this question is found Table 1 shows the raw scores of the students in column 2 and 3 were raw data of scores were tabulated. The Experimental group performance was outstanding after the administration of the post test. Also Table 2 shows the mean scores of students taught by ETA as 52.74 while standard deviation was 45.38 also when the mean score of students taught through CTA was 38.50 and the standard deviation was 20.76. This shows that ETA is more efficiency than CTA.

Hypothesis 1.

There is no relative significant difference between the using of ETA and those taught using the conventional approach.

The analyzed data for test hypothesis 1 is found in Table 3. Result in table 3 shows that the difference between the mean performance scores of those taught with ETA and those taught with the conventional approach is significant at 0.05 alpha level. Therefore, the hypothesis 1 was rejected.

Question 2

What is the relative effect of the use of Ethnomathematics teaching approach and conventional teaching methods on the student mean creativity scores?

From table 1, the raw score of the students under the experimental and control group were shown. Table 1 shows that the experimental group performed highly and the rate of student that scored 60-99 was extremely high. Also, the column for the control group showed that the student scored low marks compared to the post test column.

Table 2 showed the mean score and standard deviation for the delayed test. For the experimental group we have 69.55 and 31.07 respectively which shows that ethnomathematics (ETA) is more efficiency and effectively in teaching Mathematics for concretize and creative learning.

Hypothesis 2

There is no relative difference in the mean retention scores of students taught with ETA and those taught with the conventional approach.

The analyzed data for the test hypothesis 2 is shown in table 4. The table shows that the hypothesis 2, was rejected.

VIII. Discussion

This study has shown that students taught with ETA had a higher mean performance score (52.74) than their counterparts taught with conventional approach with (45.38) mean performance score. This was further evident in Table 3 which reveals the difference in performance between the experimental and control groups which was significant ($F_{1,4} = 66.364$ $p < 0.001$). It was noticed that the students taught with ETA were able to actualize and concretize the concepts and skills taught easily, since there was a link between the content and their immediate culture and environment with the foreign aspect of the learning. This finding was in accordance with Uloko and Ogwuche, (2007). The teaching was done in a practical-oriented way and it flows in two traffic ways that is, from home to school and from school to one's everyday living. Thus, the abstract nature of teaching and learning mathematics concept have been reduced to minimum/zero level. The high performance of student taught with ETA had shown that ETA is a practical oriented teaching approach which imbibed into itself problem-solving and it could be an effective teaching approach to curb poor performance of mathematics students in institution of higher learning in Nigeria which is due to inappropriate teaching approach.

Table 4 reveals that the difference between the retention and creativity mean scores of experimental and control groups is statistically significant ($F_{1,4} = 22.586$ $p < 0.001$). This finding is in agreement with that of Achor E, Imoko B, Uloko (2009) and disagrees with Iji (2002) who in his study found that the differences was not statistically significant.

IX. Conclusion And Recommendation

This study exposed the fact that Ethno mathematics Teaching Approach is more effective than the Conventional Teaching Method. However, it is recommended that researchers should endeavor to carry out study on the effectiveness of using computer assisted packages with cultural background and ethno mathematics

teaching approach simultaneously in teaching and learning mathematics. Secondly, it is recommended that mathematics lecturers should be trained on the use of ETA for a better future.

References

- [1]. Abakpa B.O, Agbo-Egwu A O (2008). The effect of small group co-operative learning on students' achievement tests. *Benue J. Res Science Education* (1): 71-90.
- [2]. Anchor et al(2009) Effect of ethnomathematics teaching approach on Senior Secondary Students' achievement and retention in locus. *AcademicJournal*.
- [3]. Asher, M.(1991).Ethno mathematics : A Multicultural View of Mathematical Idea. Pacific Groove, Brooks.
- [4]. D'Ambrosio(1987). Reflections on Mathematics.International Study Group on Ethno mathematics Newsletter 3(1).
- [5]. D'Ambrosio (2001).What I ethnomathematics and how can it help in schools? *Teaching Children*
- [6]. Mathematics. In V.T. Beston (Ed.) National Council of Teachers of Mathematics NCTM.
- [7]. Davidson D M (2000). An ethno mathematics approach to teaching language minority students center for excellence in Education, North American University.
- [8]. Gilmer G F, Milwankee M T(2001). Ethnomathematics: An African American Perspective on developing women in mathematics;<http://www.goggle.com>. retrieved online.
- [9]. Gilmer G F, Milwankee MT(2001) Ethnomathematics:An African American perspective on developing women in mathematics; retrieved <http://www.goggle.com>.
- [10]. Hornby AS (2001). Oxford advanced learners' dictionary of current English.Italy: Oxford University press.
- [11]. Iji CO (2002) .Effects of logo and basic programmes on achievement and retention in geometry of junior secondary school students. Unpublished Ph. D Thesis. University of Nigeria, Nsukka.
- [12]. Imoko B (2004).Mathematics education and information technology:Accessibility and adaptability in Nigeria. *Benue State Univ.J Educ*.5:1 -5.
- [13]. Knijinik G (1997). Ethnomathematics:challengingeuro centralism in mathematics education.New York: Sunny Press.
- [14]. Kurumeh M S (2004). Effects of ethno mathematics teaching approach on students' achievement and interest in geometry and mensuration.Unpublished Ph. D Thesis. University of Nigeria, Nsukka.
- [15]. Mogari D (2002). An Ethnomathematical approach to teaching and learning of some geometrical concepts.University of Witwatersrand, Johannesburg.
- [16]. Obodo GC (1997). Principles and Practice of mathematics education in Nigeria. Enugu:General studies division , University of Science and Technology Pub.
- [17]. Uloko ES, Imoko BI (2007)Effects of ethno mathematics teaching approach and gender on students' achievement in Locus. *J. Natl. Assoc.Sci. Humanity. Educ. Res.* 5(1):31-36.
- [18]. Uloko E S, Ogwuche J (2007). A practical approach of the use of ethno mathematics in teaching Locus. In M.J Adejoh & C O Iji, *Innovations in teaching and learning Makurdi: Adeka printing and publishing company Ltd.* pp276-288.