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### THE IMPACT OF ETHNOMATHEMATICS ON GENDER AND LOCATION IN KANO STATE.

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#### ARTICLE INFO

#### ABSTRACT

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*The study was carried out to determined the impact of ethnomathematics on gender and location in kano state Junior secondary schools. The research design used tranguation. A simple experimental which involves control and experimental groups was used. A researcher made test earlier validated by team of English, Mathematics and curriculum specialists was used. The test has a reliability coefficient of  $r=0.89$  obtained through the use of KR 21 formulation. The three (3) null hypotheses were rejected. A major finding from the study there is significant difference in the level of academic performance between male and female students when taught using ethnomathematics. It was recommended that many socio-cultural elements should be used in our schools especially at lower basic level.*

#### INTRODUCTION

The world is becoming more technical and scientific. As such life is now getting more sophisticated while nations are advancing rapidly .The key to their progress is the mastery of science and technology(Isa, 2017). Indeed, no nation can develop without science and there could be no science without mathematics (Isa, 2017). However, it is regrettable that African countries have the problem of low level of attainment in mathematics in addition to the widespread mathematics anxiety. Teachers and pupils consider the subject as both a strange and foreign one (Gerdes, 1991).This might be connected to the fact that the content and goals of our mathematics curricular do not

conform to the culture and needs of the African people (Gerdes, 1991).

To avert such problems, mathematics educators established the relationship between culture and mathematics at the (ICME 5) in 1984 in Australia. This gave birth to what is popularly known as Ethnomathematics. Curriculum would develop from activities in the learner's surroundings and move seamlessly into the school as the process of inducting young people into mathematical aspects of the culture. . Such type of curriculum as Gilmer (2000) argued, would respond to the needs of many students who ordinarily feel like failures in the society. Ethnomathematics has several benefits to

students. Such benefits include among several

- a) It creates a personal connection that other teaching styles or methods do not provide;
- b) It allows students to develop a sense of pride in their culture which might translate to better self-confidence;
- c) It helps students to foster tolerance and acceptance of the fact that each culture is valuable (Dyal, 2003).

This study intends to identify and determine some cultural elements that have mathematical value as out of school mathematics (ethnomathematics) for inclusion into the conventional J.S.S mathematics in Kano state.

Thus, the objectives of the study are:

- a) To identify some mathematical elements present in Hausa socio-cultural environment of Kano;
- b) To determine the mathematical values of the identified elements present in Hausa cultural set-up;
- c) To determine the effectiveness of using such elements in the teaching of mathematics at JSS level.

Thus, the study attempts to find answers to the following null hypotheses:

**H<sub>01</sub>:** There is no significant difference in the level of academic performance between Male and female students when taught mathematics with socio-cultural elements;

**H<sub>02</sub>:** There is no significant difference in the level of academic performance between urban and rural female students when taught mathematics with socio-cultural elements;

**H<sub>03</sub>:** There is no significant difference in the level of academic performance between urban and rural male students when taught mathematics with socio-cultural elements.

#### **Methodology**

Two methods were used in designing this study. A survey was carried out to find some socio-cultural elements that could be used in the teaching of mathematics at JSS1 level. Geometrical shapes like box (*Akwati*), mat (*Tabarma*), measuring instruments such as (human body, bottle (*kwalba*) and fractions were identified .

others the following: -

Having identified the socio-cultural elements which determine their mathematical values, a simple experiment was used to determine the effectiveness of the use of such elements.

#### **Population and Samples**

The population for this study consists all the 54, 749 students (KERD, 2005) spread across the ten (10) Education zones in Kano State. The population is heterogeneous comprising of both boys and girls whose ages range between 12 and 15 years. The population is assumed to be normally distributed with regards to socio-economic status, home background and the curriculum used.

A male and a female schools were randomly selected from each of the ten (10) zonal Education Areas in the State. This gave ten (10) male and ten (10) female schools randomly selected, giving a total of twenty (20) schools. From each school selected, using students' attendance register, forty (40) students were randomly selected for the study. In essence, a total of eight hundred (800) students from twenty (20) schools were selected and used in the study. Also, from the ten (10) male and ten (10) female schools selected, five (5) males and five (5) females were randomly selected as control and experimental groups. Thus, five (5) male and five (5) female schools formed the experimental and control groups. This gives four hundred (400) samples in each group. Samples of eight hundred (800) students were chosen in line with the Morgan & Krijce suggestions.

The experimental groups were taught for five (5) weeks using the identified socio-cultural elements while those in the control groups were taught conventionally for the same period.

#### **Data Collection Instrument**

A researcher developed test was constructed to measure students' performance in mathematics. The test instrument initially consisted of forty two (42) test items designed in accordance with the JSS1 (Basic Seven) mathematics curriculum. However, based on advice from English, Curriculum and Mathematics Education Experts, the test items were reduced to twenty five (25).

The advisers opined that some items were wrongly constructed and that for the pupils age **Data analysis Techniques** In researches designed to test differences between groups; t-tests were used given the fact that some conditions were met. Such conditions include normality, homogeneity of variance and the data which should minimally be at interval level. The data collected from this study were analyzed using t-test. It should be noted that the test scores collected satisfied the ratio scale of measurement. Each student was from one school and was tested once and the schools are normal in terms of socio-economic status, cultural background , curriculum used as well as age brackets.

**The Pilot Trial**

One of the major advantage of pilot-testing is to enable the researcher to try the materials, collect feedback as well as taking the feedbacks into account. It was in this light that a pilot-trial of the test instrument was carried out.-The schools from five different Education Zones were used. While the experimental group was taught with the identified socio-cultural elements for 2weeks, the control group was taught conventionally. A major finding from the pilot trial is the significant difference noticed in academic performance of the experimental group over the control group.

Pilot trials were conducted to determine:

- The appropriateness of the instruments, and
- Other problems that are likely to affect the conduct of the main study.

Thus, for this study, the pilot trials have proved useful with regard to the appropriateness of the instrument as it was observed that there was the need to increase the instrument period from

level, 25 test items were recommended.

three (3) to five (5) weeks so as to cover wider areas of the curriculum.

**Validity and Reliability of the Instrument**

The test instrument was validated by a team of three (3) experts comprising of one (1) Mathematics Educator, one (1) curriculum Expert and one (1) English Language Expert. Each expert was requested to validate the instrument and offer suggestions for improvement (i.e. face and logical validity). Based on their advice, test items were reduced to twenty five (25) items from the initial forty two (42) test items.

An item analysis was performed and the discriminating index for each item calculated.

It should be noted that upper group here means those students who performed better while the lower group means those who performed relatively lower in the test. Since a test retest was not possible in this study, the top 25% (top twenty one students) and the lower 25% (bottom twenty one students) were used as suggested by Talmage (1976). The discrimination indices range from 0.45 to 0.93.

Reliability refers to the consistency of the instrument and consistency is mainly reported by a correlation coefficient called a *reliability coefficient*. In this study, the Kuder-Richardson method was used to determine the reliability coefficient of the instrument. The Kuder-Richardson formula 21 was used.

**Results**

To test hypothesis 1: There is no significant difference in the level of academic performance between male and female students when taught mathematics with cultural elements.

**Table 1: t-test for independent Samples (Male and female)**

Variable	N	Mean	SD	T-value	Df	T <sub>Critical</sub>
Boys	400	66.79	13.946	23.086	798	1.960
Girls	400	41.24	17.674			

P ≤ 0.05

Results in table 1 suggests that the boys with mean and SD of 66.79 and 13.05 respectively performed significantly better than the girls with 41.24 and 17.67 as mean and SD

respectively. In simple terms, the range of the boys is 79.84-53.74 while that of the girls is 58.91 - 23.57.

When the t-value (23.09) is compared with the  $t_{critical}$  (1.96), it could be seen that there is significant difference in the level of academic performance between the male and female students used in the study.

The second hypothesis  $H_{02}$  is that, there is no significant difference in the level of academic performance in mathematics between urban and rural female students when taught using socio-cultural elements.

**Table 2: t-test for independent samples (Urban and Rural female students)**

Variable	N	Mean	SD	T-value	df	T <sub>Critical</sub>
Urban (female)	200	54.61	19.72	1.82	398	1.96
Rural (female)	200	50.67	23.36			

Table 2 above, table  $p = 0.05$  compared the performance of urban and rural female students when taught using socio-cultural elements. While the mean and SD of the urban girls are 54.61 and 19.72 respectively, the mean and the SD of the rural female students stood at 50.67 and 23.36 respectively. In other words, the ranges of performance are 74.33 - 34.87 and 74.03 - 27.41 for the urban and rural female

students respectively. Also the table showed that  $t_{cal} < t_{critical}$  ( $1.82 < 1.96$ ). Thus, the null hypothesis was upheld while rejecting the alternate hypothesis.

$H_{03}$  There is no significant difference in the level of academic performance between urban and rural male students in mathematics when taught using socio-cultural elements having mathematical values.

**Table 3: t-test for independent Samples (Urban and Rural male students)**

Variable	N	Mean	SD	T-value	Df	T <sub>Critical</sub>
Urban (Male)	160	58.11	17.58	2.62	398	1.63
Rural (Male)	240	53.15	18.51			

Table 3 showed a better performance of the urban male students as compared with the rural male students. 75.69 - 40.53 and 71.66 - 34.64 stood as the range for the urban and rural male students respectively. The  $t_{cal} > t_{crit}$  (i.e.  $2.68 > 1.63$ ). This means rejecting the null hypothesis and accepting the alternate hypothesis. Which means that, there is significant difference in academic performance between urban and rural male students in mathematics when taught using cultural elements, as urban boys significantly performed better than rural male students.

**Discussion**

Gender differences in mathematics performance are issues intensively discussed globally and extensively .In fact, Gender and Mathematics

were the major focus of the International Congress on Mathematical Education (ICME-6) in Budapest, Hungary in 1988 (Knijnik, 1996). Though gender differences in mathematics education seem to be narrowing in several countries, males tend to perform higher on mathematics achievement tests than females do (Erciken, Mccreith and Lapointe, 2005). Nevertheless, the results of this study regarding male and female

students showed no significant difference between the male and female students lending support or credence to the fact that disparity in narrowing down. It is against the assertions of the likes of Leder and Brandwell (2002). Gender differences in perceptions of mathematics as a

male domain is still evident but narrowing. Another interesting observation was the fact that, there is no difference between girls in urban and rural areas. Thus, no difference existed between the two groups teaching mathematics with socio-cultural elements. Table 2 showed that the range of the urban and rural girls as 74.33 - 33.87 and 74.03 - 27.41 respectively. A look at the two means (54.61 and 50.67) might be of help. The findings of this study strongly lend credit to the arguments of Bishop (1994) that teaching mathematics with socio-cultural elements is capable of significantly aiding the understanding of the subject. This assertion was in line with those of Gerdes (1988), Knijnik (1996) and Abbas (2000). However, different result was noted among urban and rural boys when taught with identified socio-cultural elements having mathematical values. Thus, looking upon their respective means and SD scores where urban boys have 75.69 - 40.53 and 71.66 - 34.64. The  $t_{cal} 2.62 > 1.63$  at  $p \leq 0.05$   $df 398$ .

### Conclusion

The study shows that identification of relevant socio-cultural elements with mathematical values as well as their inclusion into the conventional mathematics would: -

- a) Create a personal connection lacking in other teaching methods, i.e. students would see the value of learning materials presented to them and would see and feel their benefits;
- b) Create a sense of pride in their culture - i.e. when they see the contributions their culture could make to the subject and thus would make

down.

them develop self-confidence through the use of socio-cultural elements, learning mathematics would take the following sequence: -

Understand the value of what I need to learn; Hearing what I need to learn; Seeing what I need to learn; Talking about what I need to learn; and Doing what I need to learn

Studies like this one tend to support the fact that there is the need to have an ethnomathematics curriculum that "would develop from activities in the learners' surroundings and more seamlessly into the school as the process of inducting young people into mathematical aspects of the culture" (Gilmer, 2000. p.3). In fact a mathematics curriculum that took care of learners' culture would help in responding to the needs of more students who feel like failures in the subject.

### Recommendations

The following recommendations were made:-

- a) Mathematics teachers especially at the lower basic levels should use socio-cultural elements in classes.
- b) Teacher-Education Colleges and Universities should place more emphasis on ethnomathematics.
- c) Publishers should use such socio-cultural elements in their books.
- d) Ministries of Education should organize on regular basis, vocation courses for mathematics with particular attention to ethnomathematics.

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