

EFFECTS OF TRADITIONAL GAMES ON STUDENTS ACADEMIC ACHIEVEMENT IN MATHEMATICS

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ABSTRACT

The study investigated the effect of traditional games on students' academic achievement in mathematics. A total of two hundred and eighty nine (289) junior secondary one (JS1) mathematics students were involved in the study. Three research questions and hypotheses guided the study. The study employed non-equivalent pretest, post-test control group design. A researcher's developed Mathematics Achievement Test (MAT) was used for the study. Data collected were analyzed using mean scores, standard deviation and analysis of co-variance (ANCOVA). Findings from the study shows that students who were taught Mathematics with traditional games achieved higher than those taught with conventional approach. Again, the use of traditional games favored both male and female students. Also the use of traditional games favored rural and urban students. It was recommended that the use of traditional games should be incorporated into the mathematics curriculum.

INTRODUCTION

Teaching and learning of mathematics have consistently generated interest amongst scholars over the years as a result of the importance of mathematics to humanity. Mathematics is an intellectually stimulating subject that affects every face of human activity such as politics, economy, science and technology.

Abakpa and Iji (2011) described it as a precursor of scientific discoveries and inventions. The learning of mathematics has become informative in every society; if the citizens are to cope with the fast changing development in science and technology. The importance of mathematics to man may account for its inclusion in school curriculum as a compulsory subject for every child of

school age to acquire the appropriate mathematical skills that will enable him cope with life challenges. (Adenejan 2010).

Despite the relevance of mathematics in national development, analysis of school certificate mathematics examination results, shows that students have scores, consistently low as less than 45% of the registered candidates obtain credit pass in West African Examination Council. (Ebele and Sam 2011).

Many variables had been identified by Imoko and Agwagah (2006), Iyekekpor (2007), Anyagh and Okwu (2010) as responsible for students' low academic achievement in mathematics, such variables include, curriculum, examination bodies, teacher-student environment and textbooks. Also

Olunloye (2010) identified poor primary school background, lack of interest, large class syndrome, psychological fear of the subject, teaching methods and lack of qualified teachers as causes of poor achievement in mathematics.

Although the indispensability of mathematics in the development of our society has been universally acknowledged, the output of its teaching and learning is still not encouraging. The above assertion was supported by several researchers and educators like Agwagah, (2004); Mauabum and Odili, (2006); WAEC, (2018); Olunloye, (2010); Abakpa and Iji, (2011) to mention but a few. This poor performance has been observed to affect both male and female students. Some research reports reveals that male students achieved higher than their female counterparts when exposed to some mathematics activities (Eniayeju, 2010; Vale, 2009; Shafi and Areelu, 2010; Musa, 2006). However there are other reported results which do not support the findings above. Agwagah (1994) reported females achieved significantly better than males in mathematics achievement as a result of instruction in mathematics reading. This is supported by Salau, (2011), Adeyemi, (2006) and Okafor, (2007). Although the gender related achievement reports above showed a disparity, some in favour of males, and others in favour of females, there are still some reports which do not agree with any of them. Etukudo (2002), Memeh (2006), Awofolaju (2006), Galadima and Okogbenin (2012) reported that both male and female performances are at par after exposing them to some mathematics activities. In respect to the above reports on gender parity or disparity in mathematics achievement, there is need for further investigation on gender issue as it relates to mathematics

achievement, especially when the students are exposed to certain approaches like the use of mathematical games in the teaching and learning of mathematics.

School location in this context refers to the environment where a school is found. It can be either rural or urban environment. Rural communities are predominantly inhabited by low socio-economic groups while urban communities have more of high socio-economic groups. Okoye (2009) reports that the location of a school has a significant effect on the academic performance of the students and also maintains that most rural schools lack qualified teachers, lacks basic laboratory and library facilities. However, Abdulcarismo (2009) reports that the achievement gap that exist between rural and urban schools can be bridged if the required strategy is identified and applied. Nateinyin (2011) also maintains that schools in the rural environment are in a much more favourable position for teaching mathematics because of the availability of cultural games and play with mathematical ingredients that can arouse interest and stimulate learning.

The conventional teaching approach is described as teacher centered and didactic with learners simply listening, copying notes, doing class work and doing assignments. It allows some interactions between the teacher and the students in terms of asking and being asked question on the topic of discussion. Dotun (2005), reports that the conventional methods of teaching mathematics are no longer adequate to meet the demands of modern mathematics education. Dotun (2005) further stated that in order to develop the skills reiterated in the National Policy on Education and provide practical experience of mathematical concepts, assumptions, assertions and rules,

a strategy for teaching mathematics and suitable platform to use such strategy is the need of the day. Also the WAEC Chief Examiners (2018) suggested that teachers should help students improve their achievement and develop interest in mathematics by reducing the abstractness in mathematics and remove their apathy and fears on the subject. Therefore, it has become necessary to find their outcome in terms of achievement in mathematics, using common traditional games.

Traditional games refer to those games that are peculiar to the people of a particular locality. In Africa and Nigeria in particular, research on the use of traditional games is widely recognized as noted by Abdulcarismo (2009), Okechwuku and Julius (2011), and Galadima et al. (2012) and exploration of the educational potential on the use of traditional games with mathematics ingredients' has been strongly investigated.

Nembe ethnic group of Bayelsa State have a very rich culture and so many traditional games with mathematics ingredients peculiar to their culture and locality (Alagoa, 2000). Before the advent of the Western Education in Nigeria, the Nembe had a defined counting and measurement systems which is transferred from one generation to another.

Two examples of cultural games with mathematics ingredients that will be used for this study are:

1. Kpokirikpo
2. Balligele

KPOKIRIKPO

The kpokirikpo consist of a rectangular board with 12 holes, arranged in 2 rows and stones or seeds used to fill the holes. It is a count and capture game, played by two persons, each

having the 6 holes nearest to him/her as home.

A player commences by scooping up the entire content of one hole in his home and dropping the seeds in the following holes, dropping one seed in each hole and moving in an anticlockwise direction. A player only makes a capture if this move ends in a hole in the other player's home and the finishing hole is found to contain two or three seeds. The player further captures, as a bonus, the content of the hole immediately preceding the finishing hole if it is found to contain two or three seeds. This 'bonus moves' can continue provided the consecutive holes contain two to three seeds and there is no break in the chain or until at least one hole in the opponent's side is left with stones in it. All captured seed are removed from the board and kept by the player who made the capture. The game ends when there are only two, three or four seeds remaining on the board, and these tends to circulate endlessly without the possibility of any capture. At this point each player adds to his captured seeds those seeds which remain in his home. The player who captured the largest number of seeds wins the game. Kpokirikpo is a mathematics game. It involves counting, basic arithmetic operations and builds problem-solving skills.

It is suitable for teaching the following aspects of mathematics;

1. Counting in base 10.
2. Arithmetic Operations.
3. Probability.

BALLIGELE

This game consists of a wooden pole, rope, plastic ball and rectangular wooden baton. The rope is tired to the top of the wooden pole that is fixed to the ground. The other end of the rope is attached to the plastic ball. The rectangular wooden baton measures 2" by 4" and the wooden pole is

normally between 4 to 5 feet high. A player commences by striking the tennis ball to wrap the wooden pole, while the other player strikes the tennis ball to unwrap the counterparts own and at the same time wraps the rope in the opposite direction. The game is played by only two people at a time. The player who has the highest turns is the winner.

Balligele is a mathematics game because it involves activities that stimulate thinking and curiosity. It is suitable for teaching probability and the concept of circumference in mensuration in mathematics. Therefore this paper is aimed at studying the effects of traditional games on students' academic achievement in mathematics, in Nembe/Brass Local Government Area of Bayelsa State.

PURPOSE OF THE STUDY

The aim of this study is to determine the effects of traditional games on students' academic achievement in Mathematics. Specifically, the study sought to compare;

1. Mean scores of students taught mathematics using traditional games and those taught using conventional teaching method.
2. Mean scores of male and female students taught with traditional games and conventional teaching method.
3. Mean scores of rural and urban students taught with traditional games and conventional teaching method.

RESEARCH QUESTIONS

1. What is the difference in mean achievement scores of students taught Mathematics using traditional games and those taught with conventional teaching method?
2. What is the difference in mean achievement scores of female and male

students taught Mathematics using traditional games?

3. What is the difference in mean achievement scores of rural and urban students taught mathematics using traditional games?

RESEARCH HYPOTHESIS

- HO1. There is no significant difference in the mean achievement scores of students taught Mathematics using traditional games and those taught with conventional teaching method.
- HO2. There is no significant difference in the mean achievement scores of male and female students taught Mathematics using traditional games.
- HO3. There is no significant difference in the mean achievement scores of rural and urban students taught mathematics using traditional games.

METHODS

The study employed a quasi-experimental design of non-equivalent pre-test, post-test control group design. Intact classes were used to avoid disrupting school programmes for experimental purposes. The population was made up of one thousand and twenty-five (1,025) Junior Secondary two (JS2) Mathematics Students in the 25 Government owned secondary schools of Brass (9 schools) and Nembe (16 schools) educational zone of Bayelsa State. A total of two hundred and eighty nine (289) JS2 Mathematics students took part in the research. The two model schools in the zone were purposively selected, because they are the only urban schools in the two local government areas, respectively. Simple random sampling technique, through hat-draw method was used to select two (2) schools each from the two Local Government Areas of interest, making a total of six (6) schools from the area. Allocation of

classes into experimental and control groups was done by random sampling through balloting, which results to three (3) classes assigned to experimental group and the other three (3) to the control group.

The instructional tools consisted of the instrument which is a Mathematics Achievement Test (MAT), Marking Guide, traditional games and lesson packages. The instrument was validated by three (3) experts (lecturers), two from the Mathematics Education Department and one from the Measurement and Evaluation Department and their suggestions were used in the final draft.

The Mathematics Achievement Test (MAT) consisted of ten items each on *Numbers and Numeration, and Mensuration*, which gives a total of twenty (20) multiple choice items. The instrument was developed, based on Bloom Taxonomy. Each item had four (4) options (A-D) which comprised three detractors and one correct option. The principles of item analysis, item difficulties and effectiveness of detractors were followed. The questions on knowledge in the Mathematics Achievement Test constituted 8 items which are 1, 2, 3, 4, 5, 6, 7, and 15, of the total questions. This was to enable the researcher to determine the extent to which concepts learnt using traditional games could be easily recalled or remembered. Questions on application in the Mathematics Achievement Test constituted 5 items which are; 8, 9, 10, 12, 13, of the total items. This was to enable the researcher determine the extent to which the students can apply the acquired knowledge, when taught with traditional games. Questions on comprehension in the Mathematics Achievement Test constituted 4 items which are 11, 14, 16, and 20 of the total questions.

This was to enable the researcher determine the students' ability to comprehend, when taught with traditional games. The researcher scored the instrument of which each correct option was scored 5marks, which totals 100% at maximum. The instrument and tools were trial tested using four classes from other schools that did not participate in the research, but were of equal status with the schools sampled. The reliability coefficient was computed using Kuder-Richardson K-R₂₀ and reliability coefficient of 0.72 was obtained. The two traditional games used are; *Kpokirikpo* and *Balligele* respectively, for teaching *Numbers and Numeration, and Mensuration* from JS2 mathematics syllabus (NERDC, 2005) for four (4) weeks involving four contacts of 35 minutes each week.

Six regular teachers were engaged. The MAT was administered as pre-test and the teachers taught the experimental group with games and lesson packages after the pre-test and the control group was taught without the traditional games, but with then lesson packages only. The re-organized version of MAT was administered as post-test in both control and experimental group.

METHOD OF DATA ANALYSIS

The 3 research questions were answered descriptively using mean and standard deviation while formulated null hypotheses were tested inferentially using analysis of covariance (ANCOVA) at 0.05 levels of significance.

RESEARCH QUESTION ONE

What is the difference in mean achievement scores of students taught Mathematics using traditional games and those taught conventional method?

Table 1: Mean achievement scores, standard deviations and adjusted mean scores of the experimental and control group in mathematics.

Group	No. of Cases	Pre-Test		Post-Test		Mean Difference
		Mean	Standard Deviation	Mean	Standard Deviation	
Control	156	11.81	7.84	19.92	9.37	8.11
Experimental	142	10.21	6.48	32.17	7.81	21.96

The result shows that the control group had a mean achievement score of 11.81 and standard deviation of 7.84 while experimental group had a mean and standard deviation of 10.21 and 6.48 respectively. Similarly, in Post-MAT, mean achievement score and standard deviations of control group are 19.92 and 9.37 respectively, while mean achievement scores and standard deviation of experimental group are 32.17 and 7.81 respectively. The mean difference between Pre-MAT and Post-

MAT for control and experimental groups are 8.11 and 21.96 respectively. This implies that students taught mathematics using traditional games performed better than those taught with the conventional teaching method.

RESEARCH QUESTION TWO

What is the difference in mean achievement scores of female and male students taught mathematics using traditional games?

Table 2: Mean scores, standard deviations and mean differences of male and female students taught using the traditional games.

TYPES OF TEST	SEX			
	Male		Female	
	Mean	S.D.	Mean	S.D.
Pre-MAT	9.76	5.51	8.30	4.30
Post-MAT	31.60	7.30	30.17	7.81
Mean Difference	21.84		21.87	

The result shows that the male students had a mean achievement score of 9.76 and standard deviation of 5.51 in Pre-MAT while the female students had a mean and standard deviation of 8.30 and 4.30 respectively. Similarly, in Post-MAT, mean achievement score and standard deviation of male students are 31.60 and 7.30 respectively, while mean achievement scores and standard deviation of the female students are 30.17 and 7.81 respectively.

The mean difference between Pre-MAT and Post-MAT for male and female students are 21.84 and 21.87 respectively. This implies that male and female students improved when taught mathematics using traditional games.

RESEARCH QUESTION 3

What is the difference in mean achievement scores of rural and urban students taught mathematics using traditional games?

Table 3: Mean scores, standard deviations and mean difference of rural and urban students taught using traditional games.

TYPES OF TEST	SEX			
	Rural		Urban	
	Mean	S.D.	Mean	S.D.
Pre-MAT	10.15	5.76	10.29	7.13
Post-MAT	32.44	7.21	31.92	8.38
Mean Difference	22.29		21.63	

The result shows that the students in rural area had a mean achievement score of 10.15 and standard deviation of 5.76 in the Pre-MAT while students in urban area had a mean and standard deviation of 10.29 and 7.13 respectively. Similarly, in Post-MAT, mean achievement score and standard deviation of students in rural area are 32.44 and 7.21 respectively, while mean achievement scores and standard deviation of students in urban area are 31.92 and 8.38 respectively. The mean difference between Pre-MAT and Post-MAT for students taught

in rural and urban areas are 22.29 and 21.63 respectively. This implies that students taught mathematics in rural and urban areas improved when taught using traditional games.

HYPOTHESES TESTING

Ho₁: There is no significant difference in the mean achievement scores of students taught Mathematics using traditional games and those taught with conventional teaching method.

Table 4: Analysis of Co-variance (ANCOVA) for students' overall scores by instructional approach and by gender

Source of Variance	Sum of Squares	Df	Mean Square	F _{cal}	F _{crit}
Covariates	2524.168	1	2524.168	46.163	
Effects	9723.314	2	4861.657	88.911	
	9714.530	1	9714.530	177.662	3.96
Methods Gender	2.003	1	2.003	0.037	3.96
2 Way Interaction	44.954	1	44.954	0.822	3.96
Method* Gender					
Explained	12292.437	4	3073.109	56.202	
Residual	4702.465	86	54.680		
TOTAL	16994.901	96	188.832		

Summary of data analysis presented in table 4 shows that the main effect, teaching approach

has F-calculated value of 177.662 and it is greater than the table value of 3.96 at 0.05

level of significance. This is based on 1-degree of freedom for numerator and 267-degree of freedom for denominator. Thus, the null hypothesis is rejected. This implies that the mean achievement scores of students taught mathematics using traditional games is statistically significant than those taught with the conventional teaching method.

Ho₂: There is no significant difference in the mean achievement scores of male and female

students taught Mathematics using traditional games.

Table 4 shows that the Gender has F-calculated value of 0.037, while the critical value is 3.96. This means that the null hypothesis is accepted at 0.05 level of significance. That is the difference in mean achievement scores between male and female students taught with traditional games is not statistically significant.

Table 5: Analysis of Co-variance (ANCOVA) for students' overall scores by instructional approach and school location

Source of Variance	Sum of Squares	Df	Mean Square	F _{cal}	F _{crit}
Covariates	24588.883	1	2458.883	51.259	
Main Effects	15889.857	2	7944.928	165.622	
Methods	15788.883	1	15788.883	329.140	3.96
Location	73.681	1	73.681	1.536	3.96
2 Way Interaction	19.210	1	19.210	0.400	3.96
Method* School Location					
Explained	18367.950	4	4591.987	95.726	
Residual	4125.435	86	47.970		
TOTAL	22493.385	96	249.926		

Ho₃: The summary of ANCOVA in table 5 shows that school location has F-calculated value of 1.536, which is less than the table value of 3.96. This implies that the null hypothesis is accepted. That is the difference in mean achievement scores of Rural and urban students taught mathematics using traditional games is not statistically significant.

DISCUSSION OF FINDINGS

The result of this study reveals that students in the experimental group improved in achievement more than those in the control

group which may be attributed to the use of traditional mathematics games. This finding is in agreement with the findings of Harbor-Peters (2001), Abdulcarismo (2009), Okechukwu et al. (2010), Ugwanyi and Agwagah (2011) who reports that the performance of students exposed to mathematics games is significantly different from those taught mathematics using the conventional teaching methods. On the other hand, the result disagrees with the report of Ezeamenyi (2010) who stated that the achievement of students exposed to mathematical games is not significantly

different from those that were not exposed to mathematical games.

In addition, the result shows improved achievement scores of both male and female students in Post-Test which may be attributed to the effective students' involvement in the instructional process. The non-significant difference in the mean achievement scores is an indication that the traditional games reduce gender differences. This gender parity in the achievement of the experimental group is in line with the findings of Memeh (2006) which reports that there is no significant difference between achievement levels of boys and girls taught with guided scoring strategy. It also agrees with the Vale (2009), Imoko and Agwagah (2006), Anyagh and Okwu (2010) who stated that there is no significant difference between achievement levels of male and female mathematics students when the appropriate teaching strategy is used.

Finally, the findings of this study shows that the traditional games influences both rural and urban mathematics students to achieve high in mathematics Achievement test, as students at both location improved in their mean scores. This also re-affirmed the findings of Galadima et al. (2012), whose result revealed no significant difference in the performance of rural and urban students taught with mathematical games.

RECOMMENDATIONS

On the basis of the findings of this study, it is recommended that;

1. More games should be developed and used by teachers to teach mathematical concept, so as to improve the students' achievement in mathematics.
2. Mathematics educators in teacher training colleges should be encouraged to use traditional games peculiar to the locality in which they work.

3. Curriculum planners and textbook authors should help provide guidelines in their teachers' guide on the use of traditional games to teach mathematical concepts.
4. Curriculum planners should incorporate in our mathematics the basis indigenous mathematical concepts, approaches and paradigms necessary for effective appreciation of mathematics approaches that are free from Western hegemony and imperialism.
5. Ministry of Education should embark on in-service training, seminars and workshop to acquaint the already serving teachers with the skills needed to develop and use games.

CONCLUSION

The teaching strategy for instructional delivery has the potential to make or mar students' achievement. The use of traditional mathematics games is found to improve students' achievement in mathematics better than the conventional teaching approach. Furthermore, traditional games help to bridge the gap between male and female student's as well as students in rural and urban locations.

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