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PEER TUTORING AND ACADEMIC PERFORMANCE OF PUPILS IN MATHEMATICS

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ABSTRACT

The research investigated the effect of peer tutoring on the academic performance of Primary 5 pupils in Mathematics in Uyo Local Government Area of Akwa Ibom State. To conduct the study, the researcher adopted a pre-test-post test (quasi-experimental) research design. The population of this study consisted of all Primary 5 pupils in public primary schools in Uyo Local Government Area of Akwa Ibom State estimated at four thousand, seven hundred and two (4,702) pupils. A sample size of four hundred and seventy primary five pupils was drawn from the population through purposive sampling technique. Three hypotheses were formulated for the study and tested at 0.05 level of significance. The instruments for data collection were Primary Mathematics Achievement Test (PMAT) and Mathematics Retention Test (MRT) duly validated by experts and subjected to reliability test using Kuder Richardson 21 method. The data collected were subjected to analysis and interpretation using the independent t-test. Findings of the study reveal that peer tutoring enhances the performance of pupils in Mathematics with males performing better than females. Based on the findings of this study, recommendations were made which includes that classrooms should be structured by teachers to encourage interaction among pupils.

INTRODUCTION

The dream of every good Nigerian is to see our nation develop scientifically and technologically. This earnest craving for scientific and technological development will only be attainable if it is backed up with good foundation in Science and Mathematics. This is because, as stated by Anyaegbu (1998), science and technology are interrelated and Mathematics is the intersection of the two. Obodo, Ukwungwu and Eze (1990) posited technology as the application of scientific laws and principles and their conversion into arts. These laws and principles should be introduced to learners in an interesting manner right from the primary school level.

Primary education forms the foundation on which all other facets of education are built. Therefore, to enhance technological development, serious attention should be paid to foundation subjects in Science and Mathematics especially at the primary school level. The National Policy on Education states that Mathematics is one of the core subjects to be taught at the primary school level (FRN, 2004). This compulsory nature of Mathematics carries with it the assumption that the knowledge of the subject is essential for all members of our society. Agwagah (2005) believed that the most fundamental reason

much emphasis is placed on Mathematics is its usefulness. Actually, Mathematics is important to everything about life. For instance, every occupation which a student may choose to pursue and much of his/her everyday life is full of opportunity and the need to apply Mathematics.

In spite of the fact that Mathematics is considered a very important subject and even made compulsory at the primary and secondary school levels Ado, Akinbobola and Inyang (2006) noted that the poor state of Mathematics education has been a concern to everyone who looks forward to the scientific and technological advancement of our dear nation. It is very disappointing to note that pupils' performance in the subject at both internal and external examinations has remained consistently poor. Ogomaka (2003) concluded that even at the close of the last millennium, the situation had not changed significantly. Awodeyi (1999) opined that pupils were inadequately exposed to Mathematics in the early formative stages of life and consequently, the children get to the secondary school discouraged in Mathematics learning.

Udousoro (2001) observed that students' academic performance in sciences in general and Mathematics in particular have been very poor. According to West African Examination Council (WAEC) Chief Examiner's Reports (2004-2006), low academic performance in sciences has been attributed to many factors some of which are instructional strategies adopted by teachers and students' attitude to the science subjects. However, the report (2004-2006) also indicated that between 32% and 42% of the candidates passed Biology, Chemistry and Physics at credit level in the 3-year period. The report concluded that the generally poor performance of candidates over the three-year period is indicative of poor (an perhaps, declining) quality of education at the secondary school level in Nigeria.

Several factors have been advanced as affecting pupils' performance in the subject at the primary school level. These factors, as noted by Odili (2000), include the teacher factor, the society factor and instructional strategy employed by the teacher. Of all these factors, instructional strategy appears overbearing because it is the most easily manipulatable. Thus, this study is primarily focused on the search for a means of achieving effective teaching and learning of Mathematics. This involves an examination of the effects of peer tutoring on the academic performance of pupils in Mathematics.

Peer tutoring is an instructional strategy in which one learner instructs another learner in material on which the first is an expert and the second is a novice (Sharan & Sharan, 1990). It is a process whereby learners teach learners. According to Udousoro (2001), the concept of peer tutoring is an instructional process whereby classmates who have demonstrated high level of mastery of knowledge and skills in specific content areas are used to assist their mates to acquire and develop skills and knowledge in the subject.

Peer tutoring was developed from social-psychological studies of cooperation and competition in human behaviour (Deutsch, 1949). Since the early 1970s, peer tutoring has been one of the most often implemented and researched instructional movements across various subject matters (Hertz-Lazarowitz & Miller, 1992; Sharon, 1994; Ukadike & Okobia, 2006). It is based on the social constructivist theory which stresses that learning is more effective in a cooperative rather than in a competitive situation. It is an educational procedure in which children act as teachers to other children

(Vasta, Lightfoot & Cox, 1995).

Mathematics occupies a central place in the primary school curriculum but as noted by Hogan (2000), most pupils do not perform very well in Mathematics examinations because they are afraid of the subject. This fear, as noted by Adeyegbe (2004), stems from inefficient teaching methods adopted by teachers. Granted that the learner's desire to understand a topic is as high as the teacher's need to produce intelligent pupils, there is an increasing quest for better approaches and diverse means of obtaining improved results in classroom activities. This quest compels this study to search backward to see if any earlier theory can, if applied in teaching Mathematics in primary schools, yield appreciable results.

Statement of the Problem

Over the years, the conventional 'chalk-talk' approach of teaching where the teacher becomes the expert information provider and pupils 'seat-work' individually as observed by Odili (2000) is predominant in our schools and this does not attract many pupils to the subject. The question therefore is: Are there no alternative ways of teaching Mathematics in schools in order to introduce the needed motivation in the learners and prepare them with relevant Mathematics skills for higher levels of education? With this question, it therefore becomes imperative to search for an approach for teaching Mathematics that would assist pupils learn complex conceptual information and acquire knowledge and skills through team work. To this end, can peer tutoring as an instructional strategy influence pupils' performance in Mathematics?

Purpose of the Study

The purpose of this study is to determine the effects of peer tutoring on pupils' academic performance in Mathematics. This study has the following specific objectives:-

(1) To compare the performance of pupils taught through peer tutoring with those taught by individual teachers in Mathematics.
(2) To compare the performance of male and female pupils taught through peer tutoring with those taught by individual teachers in Mathematics.
(3) To determine the difference in the rate of retention of Mathematical information between pupils taught using peer tutoring and those taught by individual teachers.

Research Hypotheses

The following hypotheses were formulated and tested at 0.05 significance level:-

1. The academic performance of pupils peer tutored and those taught by individual teachers in Mathematics do not differ significantly.
2. There is no significant difference in the academic performance of male and female pupils taught Mathematics using peer tutoring and those taught by individual teachers.
3. There is no significant difference in the rate of retention of Mathematical information between pupils taught with peer tutoring and those taught by individual teachers.

Research Methodology

The study is a quasi-experimental research which adopts a pre-test post test research design. The population of the study consisted of all primary 5 pupils in the 47 public primary schools in Uyo Local Government Area of Akwa Ibom State estimated at 4,702 pupils.

A total of four hundred and seventy (470) pupils took part in the study. This comprised 248 males and 222 females. Purposive sampling technique was used to select schools from the population. The criteria were:

(i) Schools with at least one specialised Mathematics teachers; and

(ii) Schools with at least two streams of primary 5 pupils.

Eight schools satisfied these criteria. A random sampling technique using balloting was carried out to select four out of the eight schools that met the criteria. The four schools were randomly assigned experimental and control groups. Two schools were used as experimental while the other two were used as control groups.

The instruments used for the study were the Primary Mathematics Achievement Test (PMAT) and Mathematics Retention Test (MRT). Both instrument were researcher made. The PMAT was a twenty five (25) item multiple choice test constructed to cover geometry, statistics, algebra and numerical operations. The current curriculum for Primary 5 Mathematics was used to form the questions. The PMAT had four (4) options lettered A-D; three distracters and one correct option. The test was developed to measure the pupils' academic performance in Mathematics. It served as pretest and post test except that the post test was deliberately rearranged with different figures.

The Mathematics Retention Test (MRT) was also a twenty five (25) item multiple choice test developed to measure pupils' retention of Mathematics knowledge. The test was derived from the content and same specification of similar difficulty and same format as the PMAT.

The instruments were administered on a pilot group of twenty five (25) pupils who did not participate in the study but who were found to be equivalent to the pupils in the study. The data obtained from the administration of PMAT and MRT were subjected to analysis using Kuder-Richardson formular 21 to determine the reliability coefficient. The achievement instrument was 0.903 while a K-R 1 coefficient of 0.965 was obtained for the retention instrument.

After selecting and assigning samples to experimental and control groups, a pretest was administered on both groups for one hour. The result of the pre-test was used as measures to control for possible pre-existing differences among the groups. After this, the researcher taught all groups of pupils using same instructional units and the same content outline based on duly validated instructional packages developed by the researchers for that purpose. The teaching was carried out for four (4) weeks of two periods (40 minutes per period) each per class.

One week after the teaching, a post test was administered on both groups and two weeks later, a parallel retention test was administered on both groups (experimental and control) to measure retention of Mathematical information.

Both the PMAT and MRT had twenty five items and four answer options each. Each correct answer, was scored two (2) marks, making a total maximum score of fifty for each test while the minimum was zero (0). The data obtained were analysed using

independent t-test.

Results

Hypothesis 1: There is no significant difference in the academic performance of pupils peer-tutored and those taught by individual teachers in Mathematics.

Table 1: Independent t-test analysis of the academic performance of pupils peer-tutored and those taught by individual teachers in Mathematics.

Variable	N	$\bar{X}$	SD	t
Peer tutoring approach	232	35.9310	4.912161	
				12.050
Individual learning approach	238	30.9160	4.08161	

Significant at 0.05 level, df = 468; critical t-value = 1.96

Table 1 presents the t-test value as comparing it with the critical t-value at 0.05 level with 468 degrees of freedom. The obtained t-value (12.050) is greater than the critical t-value (1.96). Hence, the result is significant. The result therefore means that there is a significant difference in academic performance of pupils taught using peer tutoring and those taught by individual teachers in Mathematics. Looking at the means, pupils taught with peer tutoring approach performed higher than their counterparts who were taught only by individual teachers.

Hypothesis 2: There is no significant difference in the academic performance of male and female pupils taught Mathematics using peer tutoring and those taught by individual teachers.

Table 2: Independent t-test analysis of male and female pupils taught using peer-tutoring and individual learning approaches.

Variable	N	$\bar{X}$	SD	t
Individual learning approach:				
Male	126	31.4762	3.93693	
				2.265*
Female	112	30.2857	4.16642	
Peer tutoring:				
Male	122	36.3525	4.89716	
				1.379^{Δ}
Female	110	35.4636	4.90960	

Significant, $^{\Delta}$Not significant at 0.05 level, df = 468. Critical t-value = 1.96

Table 2 presents the t-test values as 2.265 for individual learning approach and 1.379 for peer tutoring approach. These values were tested for significance by being compared with the critical t-value of 1.96 at 0.05 level with 468 degrees of freedom. The obtained t-value of 2.265 for individual learning approach is greater than the critical t-value of 1.96.

Hence, the result is significant. This implies that gender significantly influences pupils' academic performance in Mathematics when taught by individual teachers with females (4.1662) performing better than males (3.93693). Table 2 also presents the obtained t-value of 1.379 for peer tutoring approach which is less than the critical t-value of 1.96.

Hypothesis 3: There is no significant difference in the rate of retention of Mathematical information between pupils taught using peer tutoring and those taught by individual teachers.

Table 3: Independent t-test analysis of the influence in the rate of retention of Mathematical information between pupils taught using peer tutoring and those taught by individual teachers.

Variable	N	$\bar{X}$	SD	t
Peer tutoring approach	232	40.6767	4.35977	14.785*
Individual learning approach	238	34.9160	4.08575	
Total	470	37.76	5.61421	

Significant at 0.5 level, df = 468, critical t-value = 1.96

Table 3 presents the t-test value of 14.785. This was tested for significance by comparing it with the critical t-value of 1.96 at 0.05 level with 468 degrees of freedom. The obtained t-value (14.785) is greater than the critical t-value of 1.96. Hence, the result is significant. The result therefore means that there is a significant difference in the rate of retention of Mathematical information between pupils taught by individual teachers and those taught using peer tutoring. The rate of retention of the pupils peer tutored is higher than their counterparts who were taught by individual teachers, from observation of their means.

Discussion of the Findings

The result of the data analysis in Table 1 is significant due to the fact that the obtained t-value (12.050) is greater than the critical t-value (1.96) at 0.05 level with 468 degree of freedom. This result implies that there is significant difference in academic performance of pupils taught using peer tutoring and those taught by individual teachers in Mathematics.

The significance of the result is in agreement with the opinion of Igbo (2009) that peer tutoring is basically a cognitive apprenticeship between an expert and a novice. It was also in agreement with the opinion of Bender (1992) that it is an instructional method that assists in the development of both academic and social skills among children with learning disabilities.

The findings of this study are in line with the findings of Johnson and Johnson (1990) that pupils in cooperative learning environments consistently out performed pupils in competitive and individualistic learning environment on achievement measures. It also corroborates the findings of Akinbobola (2004) that physics students taught with cooperative learning strategy performed significantly better than those taught with competitive learning strategy. The significance of the result caused the null hypothesis to be rejected while the alternative one was accepted.

It is also in agreement with the opinion of Ediger (2001) that teaching

Mathematics requires the securing of pupils' attention, having pupils understand what is taught, guiding pupils to perceive reasons for learning that which is stated in the objective, and sequencing learning opportunities in the teaching of Mathematics.

The result of the data analysis in Table 2 was significant due to the fact that the obtained t-value of 2.265 for individual learning approach was higher than the critical t-value of 1.96 at 0.05 level with 468 degree of freedom. Though the obtained t-value of 1.379 for peer tutoring approach was not significant at 0.05 level with 468 degree of freedom and critical t-value of 1.96, a close observation of the overall mean scores of males and females in the two groups (peer tutoring and individual learning approaches) shows that male pupils (67.8287) performed better than their female counterparts (65.7493) in Mathematics when taught using peer tutoring and individual learning approaches.

The findings of this study are also in line with the findings of Oyesoji (1999) that male subjects achieved higher scores than the female subjects in their academic performance. Also, this finding agrees with that of Ewona (2002) that there is accumulated evidence from large number of studies in Mathematics that this has largely demonstrated that male students are superior to the female counterparts in quantitative courses especially numerical reasoning. The significance of the result caused the null hypothesis to be rejected while the alternative one was accepted.

The result of the data analysis in Table 3 was significant due to the fact that the obtained t-value (14.785) was greater than the critical t-value (1.96) at 0.05 level with 468 degree of freedom. This result implies that there is a significant difference in the rate of retention of Mathematical information between pupils taught with peer tutoring and those taught by individual teachers.

The significance of the result is in agreement with the opinion of Johnson (1999) that engaging in discussion over controversial issues improves recall of important concepts by students. Gange (1978) in Ukwungwu and Olarinoye (2004) contended that retrievable information forms a basis for many cognitive processes, such as comprehension, implementation of intellectual skill, creative thinking and attitude change among others.

The higher retention ability as observed in this study is in agreement with the findings of Akinboboye (2004) that students who were taught with peer tutoring method learned and retained significantly more information than students taught with individualistic methods in secondary school general Mathematics.

Conclusions

Based on the findings of this study, it is concluded that there exists a significant difference in the academic performance of pupils in Mathematics when taught using peer tutoring and individual learning approaches and that peer tutoring approach enhances pupils' performance in Mathematics. Also, the study has revealed that there exists a significant difference between the performance of male and female pupils in Mathematics when taught using peer tutoring and individual teaching approaches. The male pupils performed better than the females when taught using peer tutoring and individual learning approaches.

It is also evident from the result of this study that there exists a significant

difference between the Mathematical information retention ability of pupils taught using peer-tutoring and those taught with individual teaching approach. Pupils peer-tutored in Mathematics had higher information retention ability than their counterparts who were taught by individual teachers.

Recommendations

Based on the results of the study, the following recommendations are made:

1. Classrooms should be structured by teachers to give room for effective interaction among pupils. Teachers should establish the guidelines and expectations for working cooperatively with pupils, and must observe and interact with group, moderating and clarifying conflicting ideas in the class.
2. The findings of this study reveal that peer tutoring enhances academic performance of pupils in Mathematics. Therefore, the state ministry of education should organize seminars and workshops for Mathematics teachers to acquaint them with the use of peer tutoring with a view to popularising the approach.

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