INFLUENCE OF LECTURE METHOD AND PEER-PROVIDED ACTIVITIES ON LEARNING OUTCOMES OF AT-RISK MATHEMATICS STUDENTS IN JUNIOR SECONDARY SCHOOLS

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Abstract: ***The study compared the influence of lecture method and peer-provided activities on the performance of at-risk mathematics students among the junior secondary schools in Ekiti state. A quasi-experimental pretest-posttest design was adopted. The sample for the study consisted of two hundred (200) at-risk mathematics students randomly selected through purposive randomization from twenty (20) junior secondary schools in Ekiti State. The at-risk mathematics students were selected based on their performance in the General Mathematics Ability Test (GMAT) conducted two weeks prior to the commencement of the experiment. A Mathematics Achievement Test (MAT) was used to collect the data for the study. Four research questions were formulated and the research hypotheses were tested using analysis of variance (ANOVA), and Analysis of Covariance (ANCOVA) at the 0.05 level of significance. The study revealed that learning outcomes of at-risk mathematics students improved significantly with the use of peer-provided activities than with the use of lecture method. Furthermore, the retention ability of at-risk mathematics student with taught peer-provided activity was significantly better than those taught with lecture. The study recommended that mathematics teachers in junior secondary schools should adopt peer tutoring strategy to enhance performance of at-risk mathematics students. The findings of this study indicated that peer tutoring enhances improved learning outcomes, better retention, and cooperation among at-risk mathematics students***

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Keywords: Teaching strategy, At-risk mathematics students, Peer tutoring, Learning outcome, Lecture method.

Introduction

Mathematics is a compulsory subject in the Nigeria Secondary School Curriculum. Mathematics as one of the core subjects is very important because of the contribution of the subject to a child's education, for technological development of any nation. The teaching and learning of Mathematics is made compulsory in secondary schools in Nigeria. Mathematics is useful in domestic and business deals, scientific discoveries, technological breakthrough, problem solving and decision making in different situations in life (Kolawole and Oluwatayo, 2005; Harbor Peter, 2000).

From many years back, students have been facing the problem of poor performance in Mathematics. What has also become a main concern is the negative attitude of students towards mathematics. In the National Policy on Education (2004), Mathematics is one of the leading core and compulsory subjects in the Junior and Senior Secondary School Curricula.

Okereke (2002) observed that despite the place of Mathematics in the development of a nation, students and pupils acclaim the subject to be very difficult and thus dreaded. There is no doubt that students believe that Mathematics is abstract and difficult to understand.

Bolaji (2005) found that teachers' characteristics and activities have great effects on students' attitudes towards Mathematics. Seweje and Idiga (2003) also pointed out to the evidence that students working together in peer learning groups develop better collaboration skills than students in other types of classrooms, are more motivated with better attitudes towards a subject and more likely to grow in the use of higher order thinking skills.

Students spend much of their time in classroom working on mathematical tasks chosen from textbook. In recognition of the central importance of textbook, the framework of the third international Mathematics and science study (TIMSSS) included large-scale cross-national analysis of Mathematics curricula and textbooks as part of its examination of mathematics education and attainment in almost 50 nations (Valverde et al, 2002). They claim that textbook are the print resources most consistently used by teachers and their students in the course of their common work. Textbooks are major sources of provision of these educational opportunities.

Jeje (2015) opined that there are many attributes of a textbook that can affect the attitude and achievement of a learner. These are the structure, the organization, the presentation format which includes the colour, the front type, the front size, the illustrations, the content, the examples, the task-range and order. There are attributes that can contribute to like or dislike, interest of disinterest, attraction or repulsion and ultimately increases positive or negative attitude of learners and users.

Webb and Master (2003) defined peer tutoring as a people from similar social grouping who are not professional teachers, helping each to learn and learning themselves by teacher. Peer tutoring also known as peer teaching is the system of instruction in which students works in pair to support each others' learning. This format has been extensively studied in general education which was founded to enhance students cognitive and social learning. Calhoon and Fucks (2003) found that peer-assisted learning strategies improved computation Mathematics skill for the secondary school students with disabilities. Also, the peer tutoring improved currency skills for student with moderate mental retardation. The effectiveness of peer tutoring on Mathematics learning for students with learning at-risk still need to be investigated.

According to Benjamin (2010) the effect of peer-tutoring is that a struggling student can be benefited greatly from having to prepare and teach other students of the same age group the topic s/he is struggling with. In physical education, peer teaching structure have been investigated in different aged target groups in general. These studies have shown increased student response and increased percentages of correct student performance (Johnson & Ward, 2001). They discovered that low-skilled students as well as high skilled students benefit from peer tutoring. However, out of all peer tutoring strategies, is one of the most commonly employed in Physical educations setting (Moston, & Arhworth, 2002).

Statement of Problem

The teaching and learning process does not only concern teachers and students but also the nature of interaction between them in the classroom. Among what characterizes this interaction is the teaching method adopted by the teacher. Some authors have claimed that in the teaching process, it is not the teacher that is most important but the teaching method. These have led to the development of different teaching methods in relation to students' learning abilities. The study therefore seeks to investigate how different teaching strategies influence learning outcomes of at-risk mathematics students.

The study would attempt to provide meaningful answers to the following questions:

i. Would there be any difference between the performance of students taught with lecture method, and peer-tutoring?
ii. Which of these strategies is more effective in teaching at-risk mathematics during mathematics lessons?

Significance of Study

The study seeks to proffer remedy to the problem of poor academic performance of at-risk mathematics students in mathematics at the junior secondary school level. In other words, the study is intended to find how to improve the learning outcomes of at-risk mathematics students. Hence, the findings in this study will be of tremendous benefits to mathematics teachers in the adoption of the teaching methods that will reduce, or more desirably, eradicate the learning difficulties experienced by at-risk mathematics student and thus improve their academic performance in mathematics.

Purpose of the Study

The purpose of this study was to examine the influence of lecture method and peer-provided activities on learning outcomes of At-risk Mathematics students in Ekiti State Secondary Schools.

Scope of Study

The study investigated the influence of lecture method, and peer-provided activities on learning outcomes of junior secondary school students who scored below 40% in the General Mathematics Ability Test (GMAT). These set of students were referred to as "At-risk Mathematics Students". Students identified as gifted or average in mathematics were not included in the study.

Limitation of the Study

Not all schools in the three senatorial districts considered for sampling have covered the same topics in the mathematics curriculum for Junior Secondary School three (JSS III). This led to the adoption of purposive randomization in sampling technique in order to ensure that the students in the experimental and control groups are at the same level prior to the experiment.

Furthermore, due to financial constraints, the study was limited to at-risk mathematics students in Ekiti State.

Research Questions

The research seeks to proffer answers to the following questions:

(i) Is there any significant difference between the pretest scores of at-risk mathematics students taught with lecture method, and those taught with peer tutoring?
(ii) Is there any significant difference between the post-test scores of at-risk mathematics students provided with lecture method, and those taught with peer tutoring activities?
(iii) Is there any significant difference between the posttest scores of male and female at-risk mathematics students taught with lecture method, and those taught with peer tutoring?
(iv) Is there any significant difference between the retention ability of at-risk mathematics students taught with lecture method, and those taught with peer tutoring?

Research Hypotheses

The following null hypotheses were generated for the study:

(i) There is no significant difference between the pretest scores of at-risk mathematics students taught with lecture method, and those taught with peer tutoring.
(ii) There is no significant difference between the post-test scores of at-risk mathematics students provided with lecture method, and those taught with peer tutoring activities.
(iii) There is no significant difference between the posttest scores of male and female at-risk mathematics students taught with lecture method, and those taught with peer tutoring.
(iv) There is no significant difference between the retention ability of at-risk mathematics students taught with lecture method, and those taught with peer tutoring.

Methodology

A quasi-experimental pretest-posttest design was adopted for the study. The main population for this study included secondary school students in Ekiti State. One school each from the three senatorial district were selected. There were 177 public junior secondary in Ekiti State as at the time of the study.

The sample for the study consisted of 200 junior secondary school three (JSS III) students randomly selected from the three senatorial districts of Ekiti State. General Mathematical Ability Test (GMAT) was conducted for a school each from each of the three senatorial districts to identify the at-risk Mathematics students. It was due to this ability test that the researcher identify the sample of 200 students who could not obtain a minimum score of 40%. It was from these three schools that the researchers now have 40 students from each school that served as the at-risk Mathematics students.

The following research instruments were used for data collection:

i. General Mathematical Ability Test (GMAT), this consisted of 25 item multiple choice questions. The items were used to identify the at-risk Mathematics students from one school in each of the three senatorial districts of Ekiti State.

ii. Mathematics Achievement Test (MAT) was used by the researcher. The MAT consisted of 25 multiple choice questions. These items were used both as pre-test and post-test for the purpose of data collection.

The face and content validity of the instruments were ascertained by three test and measurement experts from College of Education, Ikere-Ekiti. The reliability of the instruments were determined by administering the instruments to 20 JSS II mathematics students randomly selected from two schools in Ondo state. The data collected was subjected to a split half test using Spearman brown prophecy and a reliability estimate of 0.78 was obtained for MAT and 0.69 for GMAT.

Results

This section explains the results of data analysis and its interpretation. The four hypotheses formulated were tested using t-test statistic and Analysis of Covariance (ANCOVA) at the 0.05 significance level. The t-test was used to test for significant difference in the pre-test scores of the two groups while ANCOVA was used to test significant difference in the post-test scores because it serves to adjust the post-test scores for the pre-test differences.

Hypothesis 1: There is no significant difference between the pretest scores of at-risk mathematics students taught with lecture method, and those taught with peer tutoring.

Table 1: t-test analysis of performance of at-risk mathematics students in pre-test.

Variable	N	Mean	SD	Df	$t_{cal.}$	$t_{cal.}$	Decision
Lecture method	100	7.50	1.35	118	0.14	1.96	Not significant
Peer-tutoring	100	7.47	1.75				

P < 0.05 significance level

Table 1 shows the result of analysis of performance of at-risk mathematics students in pre-test. The table revealed that mean score for students taught using lecture method (7.50) was greater than the mean score of students taught using peer tutoring (7.47) with a mean difference of (0.03). The t-test revealed that t-calculated (0.14) was less than the critical t-value (1.96) at the 0.05 significance level. Hence, the null hypothesis was upheld. This means that there is no significant difference between the performance of at-risk mathematics students provided with lecture method and those taught with peer tutoring before the treatment was applied.

Hypothesis 2: There is no significant difference between the post-test scores of at-risk mathematics students provided with lecture method and those taught with peer tutoring activities.

Table 2: ANCOVA of performance of students provided with lecture method, and peer tutoring activities.

Source	Type III sum of squares	df	Mean square	F	Sign	Partial η^2
Corrected model	808.636[a]	2	404.318	148.225	0.000	0.601
Intercept	502.729	1	502.729	184.303	0.000	0.483
Pretest	167.816	1	167.816	61.522	0.000	0.238
Strategy	647.100	1	647.100	237.230	0.000	0.546
Error	537.364	197	2.728			
Total	31114.000	200				
Corrected total	1346.000	199				

[a]R squared=0.601 (Adjusted R square= 0.597)

A one-way between subject analysis of covariance (ANCOVA) was conducted to compare the impact of the two teaching methods on the performance of at-risk mathematics students in the post-test score of mathematics test as shown in Table 2 above.

After adjusting for pre-test scores, there was a significant difference between the performance of at-risk mathematics students taught with lecture method and those taught with peer-tutoring $F(1,197) = 237.230$, $p<0.05$, Partial $\eta^2 = 0.546$. hence, the null hypothesis was not upheld.

Table 3: Mean, standard deviation and gain in achievement of experimental and control group.

		Pretest		Posttest		
Group	N	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$ gain
Lecture	100	7.50	1.35	10.35	1.64	2.85
Peer-tutoring	100	7.47	1.75	13.99	2.43	6.52

Analysis in Table 3 reveals that the control group (lecture method) and the experimental group (peer-tutoring) obtained a score of 7.50 and 7.47 respectively in the pre-test while they obtained a score of 10.35 and 13.99 respectively in the posttest. This shows that there is an increment of 2.85 for the control group and 6.52 for the experimental. Hence, the mean performance gain of at-risk mathematics student taught with peer tutoring was higher than that of those taught with lecture method.

Hypothesis 3: There is no significant difference between the posttest scores of male and female at-risk mathematics students taught with lecture method, and those taught with peer tutoring.

Table 4: Two-way ANCOVA of the effect of gender on post-test performance of students taught with lecture method, and peer tutoring.

Source	Type III sum of squares	Df	Mean square	F	Sign	Partial η^2
Corrected model	767.540[a]	4	191.885	51.786	0.000	0.515
Intercept	576.829	1	576.829	155.675	0.000	0.444
Pretest	122.518	1	122.518	33.065	0.000	0.145
Gender	2.890	1	2.890	0.780	0.378	0.004
Strategy	620.612	1	620.612	167.491	0.000	0.462
Gender * strategy	0.001	1	0.001	0.000	0.988	0.000
Error	722.540	195	3.705			
Total	30966.000	200				
Corrected total	1490.080	199				

[a]R squared= 0.515 (Adjusted R square = 0.515)

The result in Table 4 above shows the effect of students' gender on posttest performance of student taught with textbook and peer-tutoring. The ANCOVA reveals that students' gender have no effect on their performance in the posttest since $F(1,195) = 0.000$, $p<0.05$, Partial $\eta^2 = 0.000$. Hence, the null hypothesis was upheld. This implies that there is no significant difference between the posttest scores of male and female students provided with textbook and peer-tutoring.

Hypothesis 4: There is no significant difference between the posttest scores of at-risk mathematics students of different age group taught with lecture method, and those taught with peer tutoring.

Table 5: Two-way ANCOVA of the effect of age on post-test performance of students taught with lecture method, and peer tutoring.

Source	Type III sum of squares	Df	Mean square	F	Sign	Partial η^2
Corrected model	782.954[a]	6	130.492	35.616	0.000	0.525
Intercept	525.796	1	525.796	143.508	0.000	0.426
Pretest	125.873	1	125.873	34.355	0.000	0.151
Age	15.267	1	7.633	2.083	0.127	0.021
Strategy	551.008	1	551.008	150.390	0.000	0.438
Gender * Age	3.061	1	1.530	0.418	0.659	0.004
Error	707.126	193	3.664			
Total	30966.000	200				
Corrected total	1490.080	199				

[a]R squared= 0.525 (Adjusted R square = 0.511)

The result in Table 5 above shows the effect of students' age on posttest performance of student taught with lecture method and peer-tutoring. The ANCOVA reveals that students' age have no effect on their performance in the posttest since $F(1,193) = 0.418$, $p < 0.05$, Partial $\eta^2 = 0.004$. Hence, the null hypothesis was upheld. This implies that there is no significant difference between the posttest scores of students of different age group provided with lecture method and peer-tutoring.

Hypothesis 5: There is no significant difference between the retention ability of at-risk mathematics students taught with lecture method, and those taught with peer-tutoring.

Table 6: One-way ANCOVA of retention ability of at-risk mathematics students provided with lecture method, and peer tutoring.

Source	Type III sum of squares	Df	Mean square	F	Sig	Partial η^2
Corrected model	1260.185[a]	2	630.092	278.959	0.000	0.739
Intercept	130.634	1	130.634	57.853	0.000	0.227
Posttest	197.580	1	197.580	87.747	0.000	0.307
Strategy	236.897	1	236.897	104.881	0.000	0.347
Error	444.970	197	2.259			
Total	24539.000	200				
Corrected total	1705.155	199				

[a]R squared= 0.739 (Adjusted R square = 0.736)

Table 6 shows the result of one-way ANCOVA of retention test scores of at-risk mathematics students provided with lecture method, and peer-tutoring activity. The analysis reveals that $F(1,197) = 104.881$, $p < 0.05$, Partial $\eta^2 = 0.347$. This means that there is significant difference in the retention ability of at-risk mathematics students provided with lecture method, and peer-tutoring activity. Hence, the hypothesis was not upheld.

Discussion

The findings of this study compared the influence of lecture method and peer-tutoring on academic achievements of at-risk mathematics students. The background of students was equal across the two groups.

The result presented in Table 1 shows that the t-test analysis of at-risk students that were taught with lecture method and peer-tutoring. The result shows that there was no significant difference in the performance of at-risk mathematics students in the two groups. This means

that at-risk mathematics students in the experimental and control groups were at the same level before treatment was applied. The result of this findings agrees with that of Ojo (2015). The test of Hypothesis 2 shows that there was a significant difference between the post-test scores of at-risk mathematics students taught with lecture method and those taught with peer-tutoring activities. This result is in line with that of Okereke (2006). The test of Hypothesis 3 reveals that there is no significant difference between the posttest scores of male and female students taught with lecture method and peer-tutoring. This result corroborates the findings of Ojo (2015), and Okereke (2006). The test of Hypothesis 4 reveals that there is a significant difference between the retention ability of at-risk mathematics students taught with lecture method, and those taught with peer-tutoring. This result is in line with that of Okereke (2006). Hence, the mean difference of at-risk students in both groups is in favour of students provided with peer activities as the mean values was greater than their counterparts under textbooks.

Conclusion

The results of this finding showed that the at-risk mathematics students taught with peer-tutoring strategy performed significantly better than those taught with lecture method, and had a higher retention ability.

Recommendations

It is recommended that mathematics teachers should be encouraged by government and schools to use peer-tutoring activities in their teaching of mathematics in the classroom. As this has been found to improve the learning outcomes of students. Workshops and seminars should be organized for mathematics teacher to train them on how to effectively utilized the benefits of peer-tutoring in their classes.

References

[1] Benjamin, S. (2010). What is peer-to-peer tutoring? http://study-guide-service-review.toptenreview.com/what is peer-to-peer tutoring.html

[2] Bolaji, C. (2005). The need for problem solving in our school Mathematics. Paper presented at the national conference on recent development in Mathematical sciences, organized by Mathematics association of Nigeria held at Osiele Abeokuta 2nd - 6th September. p2.

[3] Calhoon, M. B., & Fucks (2003). The effects of peer-assisted learning strategies and curriculum based measurement on the Mathematics performance of Secondary students with disabilities. Journal of Remedial and Special Education. 24(4), 235-245.

[4] Federal Republic of Nigeria (2004): National Policy on education, federal Ministry of Science and technology, Abuja.

[5] Harbor – Peters, V.S. (2000) Mathematics as a tool for UBE: Implication to the Society. In J.S. Sadiku (Ed). Proceedings of the Annual Conference of Mathematical Association of Nigeria (MAN) (Pp. 100-107). Ilorin, Nigeria, Unilorin Press.

[6] Jeje, O. S. (2015). Influence of Teacher, Text-book and Peer-provided Activities on learning outcomes of at-risk Mathematics students. Unpublished M.A. (Ed), Thesis, Obafemi Awolowo University, Ile Ife.

[7] Johnson, M., & Ward P. (2001). Effects of Class peer tutoring on correct performance of striking skills in 3rd grade physical education. Journal of teaching in Physical education. 20, 247-263.

[8] Kolawole, E.B. and Oluwatayo, J.A. (2005) Mathematics for everyday Living: Implication for Nigerian Secondary Schools. ABACUSS. *The Journal of National Mathematical Association of Nigeria. 30 (1) 51-57.*

[9] Moston, M., & Arhworth, S. (2002). Teaching Physical education (5th ed.) San Francisco: Benjamin Cummings.

[10] Ojo, T. A. (2015). Effects of Think-Pair-Share Collaborative Inquiry as One of Classroom Practices for Improving Students' Reflective thinking Skills in Basic Science. Journal of Education and Policy Review. 7(1) :11 –27.

[11] Okereke, S. A. (2002). Impact of Familiar Quantities on pupils Achievement in Mathematics, STAN proceedings of the Annual Conference and Inaugural Conference of CASTME Africa, 358 – 363

[12] Okereke, S. C. (2006). Effects of Prior Knowledge Tasks/Concepts to Career Types and

[13] Gender on Students' Achievement: Interest and Retention. In. U. Nzewi (Ed) STAN Proceeding of the 47th Annual Conference. 253-259.

[14] Seweje, R.O., & Idiga, D. (2003). An investigation into the readability of the Integrated Science textbooks. Journal of the Curriculum Studies Department, University of Ado Ekiti, Nigeria. 2(10), 205-210.

[15] Valverde, G., Bianchi, L.J., Wolfe, R., Schmidt, W.H., & Houang, R.T., (2002).

[16] According to the book-using Timss to investigate the translation of policy into practice through the world of textbook. Dordrecht: Kluwer academic publishers Webb, N. M., & Master, A. M. (2003). The developments of Students helping and learning in peer directed small group. Cognition and instruction 2(4), 361-428.