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

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Abstract

Improving achievement gains of students has been a major concern for teachers all over the world. Varying students' learning strategies, amount of time spent on academic materials, and active participation in the classroom have been observed to impact learning outcomes. The study compared the influence of textbook 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 one hundred and twenty (120) at-risk mathematics students randomly selected through purposive randomization from twelve (12) junior secondary schools across the three senatorial districts 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 textbook. Furthermore, the retention ability of at-risk mathematics students taught with peer-provided activity was significantly better than those taught with textbook. 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 shows that peer tutoring fosters improved learning outcomes, better competence, and improved cooperation among at-risk mathematics students.

Keywords: teaching strategy, at-risk mathematics students, peer tutoring, textbook

Introduction

Teachers are daily engaged in the task of improving students' academic achievement because it is a major indicator of teachers' classroom effectiveness. All students learn at different rates and for learning outcome to improve, a progressive teaching strategy as well as a conducive atmosphere to the task of teaching and learning are essential. As a result, attentions have been focused on those teaching strategies that are student centered in which students' individual differences and learning needs are put into consideration. One of such teaching methods is the peer tutoring strategy.

Peer tutoring is a program that pairs students in classroom learning. According to Gaustad (1993), peer tutoring occurs when the tutor and tutee are the same age. In cross-age tutoring, the tutor is older than the tutee. However, sometimes the term peer tutoring is used to include both types. Together they review coursework that the teacher has already taught. This extra time spent on coursework gives both the tutor and tutee the opportunity to make educational improvement (Cardenas, 2017).

Webb and Master (2003) defined peer tutoring as people from similar social grouping who are not professional teachers, helping each other to learn and learning themselves by teaching. 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.

Both tutor and tutee have shown to benefit academically from peer and cross age tutoring in elementary mathematics (Britz, Dixon, and McLaughlin, 1998). Mathematics skills addressed in their research included ratio, proportion, and perspective taking among others.

In Physical education, peer teaching structure have been investigated in different aged target groups. These studies have shown increased student response and increased percentages in students' performance (Johnson and Ward, 2001). They discovered that low-skilled students as well as high skilled students benefit from peer tutoring.

Mathematics is a compulsory subject in the Nigeria Secondary School Curriculum. This is important because of the contribution of the subject to a child's education for technological development of any nation. Therefore, the teaching of Mathematics is made compulsory in our secondary school in Nigeria. 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, Bianchi, Wolfe, Schmidt, and Houang, 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.

Jeje, Gbenro, and Aladesaye (2018) in their study on the influence of lecture method and peer tutoring found 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. The study further revealed that there was no significant difference between the posttest scores of male and female students taught with lecture method and peer-tutoring. There was a significant difference between the retention ability of at-risk Mathematics students taught with lecture method, and those taught with peer-tutoring.

Ojo (2015) observed that there was significant effect of treatment on students' reflective thinking achievement in Basic Science. That is, there was significant difference in the posttest reflective thinking achievement scores of those in the Think-Pair-Share and those in the control group. He stated further that the observed difference may be due to the fact that the Think-Pair-Share method had a structured format where students were taught, monitored, and evaluated one another. That is, students were part of the educational process and were able to prepare instructional materials, plan the lesson, deliver the lesson, receive feedback from peers and reflect after the lesson to identify where problems arose with probable solutions provided against other classes. Thus the students functioned both as tutor and as tutee while the teacher acted as a facilitator (Clarke, 2007).

Statement of Problem

All students learn at different rate due to their individual difference and learning needs. This puts some students at advantage over others. At-risk Mathematics students are particularly at disadvantage because of their peculiar challenges regarding essential mathematical concepts. The conventional teaching method has not shown any hope of rescuing students in this category from their predicament because it is designed for the survival of the fittest in the classroom setting. Students who have demonstrated adaptability to the traditional teaching method are those who after receiving instruction in the classroom were able to mentally process such information, apply at and move on to the next concept. However, some students may require more personalized instruction before they could make meaning out of what was taught. Thus the need to utilize the much available human resources in the classroom; students helping each other to learn. Hence, the study is designed to investigate how peer tutoring impact learning outcomes of at-risk Mathematics students compared with the use of textbooks by the students.

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

i. Would there be any difference between the performance of students provided with textbooks, 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 find a lasting solution to the problem of poor academic performance of at-risk Mathematics students in Mathematics at the junior secondary school level. More precisely, the study is intended to find how to improve the learning outcomes of at-risk Mathematics students and at the same time ease the burden of teaching on teachers. Hence, the findings in this study will help Mathematics teachers in the adoption of the teaching methods that will alleviate the learning difficulties experienced by at-risk Mathematics student and thus improve their performance in the subject.

Purpose of the Study

The purpose of this study was to examine the influence of textbook 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 textbook, 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

The sample for the study was limited to schools in the three senatorial districts that 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. In addition, due to financial constraints, the study was limited to at-risk Mathematics students in Ekiti State.

Research Question

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 textbook, and those taught with peer tutoring?

(ii) Is there any significant difference between the post-test scores of at-risk Mathematics students provided with textbook, 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 textbook, and those taught with peer tutoring?

(iv) Is there any significant difference between the retention ability of at-risk Mathematics students taught with textbook, 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 textbook, and those taught with peer tutoring.

(ii) There is no significant difference between the post-test scores of at-risk Mathematics students provided with textbook, 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 textbook, and those taught with peer tutoring.

(iv) There is no significant difference between the retention ability of at-risk Mathematics students taught with textbook, and those taught with peer tutoring.

Research Design

Population, sample and Sampling Techniques

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 120 junior secondary school three (JSS III) students randomly selected from the three senatorial districts of Ekiti State.

Research Instruments

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 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 as a result of this ability test that the researcher identify the sampling of 120 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.

Furthermore, 20 students who obtained a minimum score of 80% in the GMAT were also selected from each of the three schools and then served as tutors for the at-risk mathematics students in the experimental group.

Validity and Reliability of the Instrument

The validity of the adopted attitude questionnaire was carried out by giving it to three experts who are researchers in this area. They were required to rate each item of the instruments. The reliability of the instrument was determined by administering the Mathematics Achievement Test (MAT). The instruments were subjected to a split half method using Spearman brown prophecy as a reliability estimate of 0.75 for the MAT.

Results and Discussion

In this section, the results of data analysis and its interpretation are presented. 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 textbook, 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
Textbook	60	7.43	1.35	118	0.45	1.96	Not significant
Peer-tutoring	60	7.57	1.84				

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 textbook (7.43) with a mean difference of (0.14). the t-test revealed that t-calculated (0.45) 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 textbook 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 textbook and those taught with peer tutoring activities.

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

Source	Type III sum of squares	df	Mean square	F	Sign	Partial η^2
Corrected model	496.761[a]	2	248.381	91.991	0.000	0.611
Intercept	308.669	1	308.669	114.320	0.000	0.494
Pretest	107.961	1	107.961	39.985	0.000	0.255
Strategy	371.219	1	371.219	137.486	0.000	0.540
Error	315.905	117	2.700			
Total	18576.000	120				
Corrected total	812.667	119				

[a]R squared=0.611 (Adjusted R square= 0.608)

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 textbook and those taught with peer-tutoring $F(1,117) = 137.486$, $p<0.05$, Partial $\eta^2 = 0.540$. hence, the null hypothesis was not upheld.

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

		Pretest		Posttest		
Group	N	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$ gain
Textbook	60	7.43	1.35	10.41	1.69	2.98
Peer-tutoring	60	7.57	1.84	13.93	2.08	6.36

Analysis in Table 3 reveals that the control group (textbook) and the experimental group (peer-tutoring) obtained a score of 7.43 and 7.57 respectively in the pre-test while they obtained a score of 10.41 and 13.93 respectively in the posttest. This shows that there is an increment of 2.98 for the control group and 6.36 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 textbook.

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

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

Source	Type III sum of squares	df	Mean square	F	Sign	Partial η^2
Corrected model	502.002[a]	4	125.500	46.457	0.000	0.618
Intercept	314.456	1	314.456	116.403	0.000	0.503
Pretest	109.724	1	109.724	40.617	0.000	0.261
Gender	2.623	1	2.623	0.971	0.327	0.008
Strategy	357.829	1	357.829	132.459	0.00	0.535
Gender * strategy	0.131	1	0.131	0.049	0.826	0.000

Error	310.665	115	2.701
Total	18576.000	120	
Corrected total	812.667	119	

[a]R squared= 0.618 (Adjusted R square=0.604)

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 $F(1,115) = 0.049$, $p<0.05$, 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 retention ability of at-risk mathematics students taught with textbook, and those taught with peer-tutoring.

Table 5: One-way ANCOVA of retention ability of at-risk mathematics students provided with textbook, and peer tutoring.

Source	Type III sum of squares	df	Mean square	Sign.	F	Partial η^2
Corrected model	822.479[a]	2	411.239	0.000	216.429	0.787
Intercept	27.391	1	27.391	0.000	14.415	0.110
Posttest	164.471	1	164.471	0.000	86.559	0.425
Strategy	93.221	1	93.221	0.000	49.061	0.295
Error	222.313	117	1.900	0.000		
Total	14805.000	120				
Corrected total	1044.792	119				

[a]R squared= 0.787 (Adjusted R square=0.784)

Table 5 shows the result of one-way ANCOVA of retention test scores of at-risk mathematics students provided with textbook, and peer-tutoring activity. The analysis reveals that $F(1,117) = 93.221$, $p<0.05$, Partial $\eta^2 = 0.295$. This means that there is significant difference in the retention ability of at-risk mathematics students provided with textbook, and peer-tutoring activity. Hence, the hypothesis was not upheld.

Discussion

The findings of this study compared the influence of textbook and peer-provided activities on performance of at-risk mathematics students. The background of students was equal across the two groups.

The result presented in Table 1 showed that the t-test of at-risk students that were provided with textbook and peer activities shows that there was no significant difference in the performance of at risk students. 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 Jeje et al. (2018) and Ojo (2015). The test of Hypothesis 2 revealed that there was significant difference between the post-test scores of at-risk mathematics students provided with textbook and those taught with peer-tutoring activities. This result is in line with that of Jeje et al. (2018) and Okereke (2006). The test of Hypothesis 3 revealed that there is no significant difference between the posttest scores of male and female students provided with textbook and peer-tutoring. This result corroborates the findings of Jeje et al. (2018), Ojo (2015), and Okereke (2006). The test of Hypothesis 4 indicated that there was significant difference between the retention ability of at-risk

mathematics students taught with textbook, and those taught with peer-tutoring. This result is in line with that of Jeje et al. (2018) and 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 findings of this study have demonstrated the need for a paradigm change from the age long pedagogy of students' reliance on the teacher and textbooks to the progressive strategy where the students serve as tutors and tutees in the classroom setting. Students were a lot free with one another and were able to freely ask questions, share ideas among themselves while the teacher acts as facilitator in the classroom rather than the sole repository of knowledge. The use of mathematics textbooks in itself is insufficient for the learning of mathematics by at-risk mathematics students. When pair tutoring activities are encouraged among the at-risk mathematics students, the classroom becomes lively due to their active participation and learning becomes easy and exciting.

Recommendation

In order for Mathematics teachers to justify the time and energy devoted to the teaching of the Mathematics, the peer tutoring strategy should be adopted with no further delay because it would reduce the burden of teaching on the teacher while students' achievement would be improved. Both public and private schools in Ekiti state should be encouraged by the government and proprietor to use peer provided 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.

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