

IMPROVING INTEREST AND ACHIEVEMENT IN MATHEMATICS: A QUASI-EXPERIMENTAL STUDY OF PEER TUTORING AMONG PRIMARY SCHOOL PUPILS IN NIGERIA

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Abstract

Improving learners' academic achievement in core subjects is on the front burner of educational discourse. Researchers have taken to investigations to discover the best teaching-learning strategy to improve learners' achievement in mathematics. Hence, the study examined the effect of peer tutoring on pupils' academic success and interest in mathematics in Enugu State, the study utilized a quasi-experimental study design, guided by two research questions and two hypotheses. A purposive sampling technique was employed to arrive at the sample size of 163 primary (5) five pupils in four intact classes. The instruments for data collection were the Mathematics Achievement Test (MAT) and Pupils Interest Scale (PIS), which was face validated by three experts. The reliability indices of the instrument were 0.87 and 0.89 respectively, using Cronbach alpha formula. Data collected were analyzed using mean and standard deviation to answer the research questions, while analysis of covariance was used to test the null hypotheses at a 0.05 level of significance. The findings of the study revealed that peer tutoring improved the mathematics achievement of primary school pupils. The study also found out that gender is not a significant variable when it comes to pupils' interest in mathematics and peer tutoring. The study concluded that primary school peer tutoring has positive effect on the academic achievement of pupils and improves pupils' interest in mathematics irrespective of gender. The study therefore, recommended that primary school teachers ought to employ peer tutoring strategy so as to improve their pupils' academic achievement in mathematics.

Keywords: Peer Tutoring, Pupils, Academic Achievement, Interest, Mathematics.

Introduction

Mathematics as the substratum of knowledge is required for any advanced studies in science courses. For this reason, educators and education stakeholders are worried about a decline in academic success and disinterestedness in mathematics among learners at all levels of education. Nwachukwu (2019) lamented that interested parties in education and national development are troubled about the declining number of students who are interested in mathematics and sciences, insisting that females are worst hit in this condition. Mathematics is a very important school subject that is directly involved in the individuals' daily life. Yadav (2019) while pointing out that mathematics is at the centre of human life insisted that without mathematics no one can even count the number of his/her family members. This statement underlines the importance of mathematics in human life. Echoing the same sentiments Valero and Knijnik (2016) stated that mathematics is a core school subject in elementary schools education as well as in a wide range of tertiary education courses including vocational and science education, pure sciences among others. The mathematical ingenuity of the citizens seems to be essential for the sustenance of contemporary technology and standard of living. Achievement in mathematics is a vital indicator of educational success, which translates to

personal and societal development and progress. It is on this note that Helmenstine (2019) declared that mathematics is a universal language insisting that the shapes, equation and symbols are the same all over the world, and that it is the language of science. This is an indication that mathematics has a lot to share with other sciences: biology, chemistry, physics among others.

The learning of mathematical concepts requires the use of principles and formulas. To improve the learners' grasp and skill to internalize the essential concepts as well as appreciate mathematical principles and formulas, there is the need to apply suitable instructional materials and varied teaching methods (Okenyi, 2022). It is obvious that the success or failure of such teaching activities and use of resource materials are largely dependent on the instructional strategies the classroom teacher employed. In Nigeria, the prevalent teaching method in mathematics classrooms is lecture method (chalk and talk method). This method is teacher centered and as such is carried out without any significant involvement of the learners. Chalk and talk strategy denies the learners active participation, thereby lowering achievements and killing the learner interest in the subject (Ojekwu & Ogunleye, 2020). The authors further lamented the poor performance of students and pupils in mathematics and sciences. Obviously, the learners' abysmal performance in elementary mathematics and basic science is an indicator of a negative future of science and technology (Ugwuanyi & Okeke, 2020).

Despite the known importance of mathematics, it is a known fact that for some pupils and students shy away from mathematics. Showing lack of interest and little or no success in mathematics seems to be the order of the day. Makondo and Makondo (2020) identified poor attitude of the learners towards the subject, economic condition, lack of appropriate instructional strategy and teachers' attitudes among other variables as causes of poor learners' achievement and low interest in mathematics. Chand et al. (2013) insisted that among other variables, chalk and talk method of teaching tops the list as the cause of poor achievement and low attention to mathematics among high school learners. Since failure in mathematics has persisted, it has become necessary that other teaching-learning techniques, which can enhance adequate mastery of mathematical formulas and concepts as well as arouse the learners' interest in mathematics, should be adopted especially in the primary schools being the foundation levels and bedrock of education (Okenyi, 2022).

A learning strategy where teachers and learners play active roles in the teaching-learning process is considered more adequate. In a learner-centered strategy, the learners play active part in their own learning, while the teacher plays the role of a facilitator. (Yemi et al., 2018) pointed out that there are various learner-centered instructional strategies, such as field trips, modular instructions, cooperative learning, peer tutoring, active learning methods, inductive methods and project techniques among others. Despite the fact that these strategies could be used to improve learners' achievements, most teachers are still inclined to the use of chalk and talk method with its antecedent inadequacies (Okenyi, 2022). On this note therefore, the study considered the use of peer tutoring learning strategy in improving pupils' accomplishment and interest in mathematics.

Peer tutoring is a cooperative teaching-learning strategy where by learners of the same aptitude or status helps each other. Peer tutoring is a general nomenclature that refers to a

teaching-learning process, where students with higher learning ability help others (Calderwood & Sturdivant, 2021). It is the responsibility of the teacher to impart knowledge on the learners but fellow learners can as well provide support to less advantaged learners. Peer tutoring is a teaching strategy that allows learners to assist other learners and learn while teaching others (Anderson, 2017). The implication of this is that, more intelligent learners are paired with less intelligent ones of the same level to help the less intelligent ones learn some difficult concepts. These learners being of the same level and age bracket may communicate and learn in play form. Since learners' especially younger ones learn more effectively through play (Marrison, 2022). Peer tutoring is therefore, a teaching-learning strategy whereby the teacher delegates brilliant learner (tutor) to help less brilliant learners (tutees) to learn especially difficult concepts. The tutor and the tutee may be in the same class. The basic difference between the tutor and the tutees is intelligence. The tutor also develops and learns more as he/she teach other learners. In peer tutoring, children enjoy a dynamic and engaging learning experience that enhances attitude and interest towards learning with epitomized achievement (Fink, 2020). Peer tutoring seems to be the most appropriate teaching method for young children.

Appropriate and learner centered instructional strategy profoundly affects learners' performance and achievement in school subjects. Ojekwu and Ogunleye (2020) pointed out that existing studies have revealed that appropriate teaching methods have positively influenced students' academic achievement and interest in various ways. It is important to note that appropriate and learner centered instructional method, stimulates the learners' interest in school activities. In teaching-learning endeavour, the learner's interest is a critical variable. This is because interest seems to be the intrinsic motivation that stimulates curiosity, which leads to the resilience in learning. Ojekwu and Ogunleye revealed that curiosity, positive attitude, determination and commitment, which breed success, are all products of interest. The implication of this is that the zeal to learn is inspired by interest. Numerous studies have shown that active participation kindles and sustains students' interest in learning and learning outcomes (Trust et al., 2016). This relationship underlines the paradigm of peer tutoring method that engage the learners as the drivers of, and active participants in the teaching-learning process. The development of interest often leads to a vigorous involvement, attentiveness, focused engagement, enhancement of intellectual capacity, and goal oriented behaviour among students (Marackiewicz et al., 2016). Based on the view that interest motivates learners to focus on learning activities and such relationship impacts on the learners' academic achievement it becomes pertinent to carry out this study. Thus, the study aimed at determining the outcome of peer tutoring on pupils' academic achievement and interest in mathematics in Enugu State, Nigeria.

In a study that investigated the efficiency of on students' academic achievement in comprehension, Ullah and Kaleem (2020) discovered that peer tutoring is beneficial to both the tutors and tutees in improving academic achievement. In another but related study that investigated the effect of peer tutoring on academic achievement of undergraduate sports science students, Comfort and McMahon (2014) revealed that peer tutoring significantly enhanced sports science students' achievement in practical sports programme. In another study that investigated the relationship between academic achievement and peer tutoring in primary and secondary schools, Alegre et al. (2020) demonstrated that in mathematics peer tutoring indicated comparable assistances in primary and secondary levels of education.

Furthermore, in another but related study, Alegre et al. (2019) found out that peer tutoring had a significant effect in enhancing students' achievement and interest in learning mathematics especially in a moderate class size. In a related study, Etsu and Manko (2019) discovered that peer tutoring is operative in improving the academic success, zeal and interest of slow learners in secondary school geometry than chalk and talk method of teaching. However, in an investigation that compared the effect of peer tutoring and faculty tutoring on the academic achievement and interest of first year university mathematics students, Ghanie (2020) indicated that no significant difference existed in the mean scores and zeal or interest of students taught mathematics using peer tutoring strategy and those taught using faculty tutoring method. Nevertheless, Moliner and Alegre (2020) in an empirical study found out that reciprocal peer tutoring among same age learners had a significant positive effect on the learners' mathematics self-confidence. From the literature review, it is obvious that little or no work of this nature has been carried out with primary school pupils.

Research Questions

1. What are the mean scores of pupils taught mathematics using peer tutoring instructional strategy and those taught using chalk and talk method.
2. What are the mathematics interest scores of pupils taught mathematics using peer tutoring instructional strategy and those taught using chalk and talk method.

Hypotheses

1. There is no significant difference in the mathematics achievement scores of pupils taught using peer tutoring strategy and those taught using chalk and talk method.
2. There is no significant difference in the mathematics interest scores of pupils taught using peer tutoring instructional strategy and those taught using chalk and talk method.

Methods

The study adopted a pretest-posttest control group quasi-experimental research design. The population of the study involved all the 27,058 primary five (5) pupils in Enugu state. The sample size of the study included 163 pupils drawn through purposive sampling technique from Enugu West and Igbo-Etiti central local Education Authorities respectively. Four (4) intact classes were purposefully drawn from the two education authorities (one control and one experimental group from each education authority). Consequently, to avoid disrupting the pupils' school programme, there was no randomization of the sample, since the experiment was carried out during school periods in accordance with the school calendar. The control group has 82 pupils while the experimental group has 81 pupils. In the experimental groups the more brilliant pupils took turns in teaching others mathematics after the teacher has introduced the topic and demonstrated the activity, while the experimental groups were taught using talk and chalk method solely by the teachers. For the purpose of data collection, the researchers developed two sets of instruments: Mathematics Achievement Test (MAT) and Pupils' Interest Scale (PIS). The MAT is a 15 multiple choice test items intended to measure the pupils' achievement in mathematics, while the PMS is a 20-item instrument with four-point Linkert scale of Strongly Agree (4 points), Agree (3 points), Disagree (2 points) and Strongly Disagree (1 point). The instruments validated by three experts in the areas of educational psychology, measurement and evaluation, and childhood education. The internal

consistency reliability indices of the instruments were estimated to be 0.87 and 0.89 for MAT and PIS respectively using Cronbach Alpha method.

Prior to beginning of treatment a pretest of the MAT and the PIS were administered to the sampled pupils to serve as the baseline data. Afterwards, the experimental classes were taught mathematics applying peer-tutoring strategy while the control group classes were taught using talk and chalk method solely by the teachers. The treatment lasted for 5 weeks. At the commencement of each mathematics lesson, the experimental groups would introduce the topic demonstrate the activity by teaching the lesson, thereafter the classes are split into smaller groups where the more brilliant ones take turns teaching others, helping their peers to grasp the concept taught by the teacher. At the end of the sixth week, the MAT and the PIS were administered to the participants as post-tests after being rearranged. Mean and standard deviation were used to analyze the data collected in order to answer the research questions while independent samples t-test was utilized to test the hypotheses at 0.05 level of significance.

Results

Table 1: Mean analysis of the mathematics test scores of the pupils of the experimental and control groups

Treatment	n	Pretest		Posttest		Mean gain
		Mean	SD	Mean	SD	
Experimental	81	13.02	1.81	24.02	3.54	11.00
Control	82	13.00	1.85	14.31	1.20	1.31

Table 1 shows that pupils exposed to peer tutoring had mean mathematics test score of ($M = 13.02$, $SD = 1.81$) at the pretest and ($M = 24.02$, $SD = 3.54$) at the posttest, while the pupils exposed to talk and chalk method had mean mathematics test score of ($M = 13.00$, $SD = 1.85$) at the pretest and ($M = 14.31$, $SD = 1.20$) at the posttest. Mean gain scores of 11.00 and 1.31 for the experimental and control groups respectively indicate that pupils exposed to peer tutoring had higher posttest mean mathematics test score than their control group counterparts.

Table 2: Analysis of covariance for the effect of treatment on the mathematics test scores of the pupils in mathematics

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Squared	Eta
Corrected Model	3840.578 ^a	2	1920.289	274.039	.000	.774	
Intercept	1105.220	1	1105.220	157.723	.000	.496	
Pretest	.530	1	.530	.076	.784	.000	
Treatment	3839.261	1	3839.261	547.890	.000	.774	
Error	1121.177	160	7.007				
Total	64682.000	163					
Corrected Total	4961.755	162					

Table 2 revealed that there is a significant difference in the mathematics test scores of pupils taught using peer tutoring instructional strategy and those taught using chalk and talk method in favour of those taught using peer tutoring, $F(1, 160) = 547.890, p = .000$. This led to the rejection of the null hypothesis, implying that peer tutoring had an effect size of .774 (77.4%) on the mathematics test scores of pupils. Thus, 77.4% change in the mathematics test scores of the pupils can be attributed to the effect of peer tutoring.

Table 3: Mean analysis of the interest scores of the pupils of the experimental and control groups

a. R Squared = .774 (Adjusted R Squared = .771)

Treatment	n	Pre-interest		Post-interest		Mean gain
		Mean	SD	Mean	SD	
Experimental	81	26.09	3.16	59.79	9.56	33.7
Control	82	25.95	2.89	35.00	4.49	9.05

Table 3 shows that pupils exposed to peer tutoring had mean mathematics interest score of ($M = 26.09, SD = 3.16$) at the pretest and ($M = 59.79, SD = 9.56$) at the posttest, while the pupils exposed to talk and chalk method had mean mathematics interest score of ($M = 25.95, SD = 2.89$) at the pretest and ($M = 35.00, SD = 4.49$) at the posttest. Mean gain scores of 33.70 and 9.05 for the experimental and control groups respectively indicate that pupils exposed to peer tutoring had higher posttest mean mathematics interest score than their control group counterparts did.

Table 4: Analysis of covariance for the effect of treatment on the mathematics interest scores of pupils in mathematics

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Squared	Eta
Corrected Model	25069.655 ^a	2	12534.828	224.594	.000	.737	
Intercept	5594.837	1	5594.837	100.246	.000	.385	
Pre-interest	27.676	1	27.676	.496	.482	.003	
Treatment	25067.737	1	25067.737	449.154	.000	.737	
Error	8929.756	160	55.811				
Total	398971.000	163					
Corrected Total	33999.411	162					

a. R Squared = .737 (Adjusted R Squared = .734)

Table 4 revealed that there is a significant difference in the mathematics interest scores of pupils taught using peer tutoring instructional strategy and those taught using chalk and talk method in favour of those taught using peer tutoring, $F(1, 160) = 449.154, p = .000$. This led to the rejection of the null hypothesis, implying that peer tutoring had an effect size of .737 (73.7%) on the mathematics interest scores of pupils.

Discussion

The findings of the study reveal that at the posttest, the pupils exposed to peer tutoring had a mean mathematics test score of ($M = 24.02$, $SD = 3.54$), while the pupils exposed to talk and chalk method had mean mathematics test score of ($M = 14.31$, $SD = 1.20$). Furthermore, the mean gain scores of 11.00 and 1.31 for the experimental and control groups respectively indicate that pupils exposed to peer tutoring had higher posttest mean mathematics test score than their control group counterparts. Further analysis revealed that a significant difference existed in the mean mathematics test scores of pupils exposed to peer tutoring, and those taught using chalk and talk method in favour of those taught using peer tutoring. The findings of the study support the findings of Comfort and McMahon (2014) revealed that peer tutoring significantly enhanced sports science students' achievement in practical sports programme. Furthermore, the findings of the study validated the findings of Ullah and Kaleem (2020), who revealed that peer tutoring is beneficial to both the tutors and tutees in improving academic achievement and on intellectual development of secondary school students.

Again, the findings of the study revealed that that pupils exposed to peer tutoring had mean mathematics interest score of ($M = 59.79$, $SD = 9.56$) at the posttest, while the pupils exposed to talk and chalk method had ($M = 35.00$, $SD = 4.49$) at the posttest. Further, the mean gain scores of 33.70 and 9.05 for the experimental and control groups respectively indicate that pupils exposed to peer tutoring had higher posttest mean mathematics interest score than their control group. Further analysis revealed that peer tutoring has a significant impact on pupils' mathematics interest scores as indicated in table four. The findings of the study are in line with the findings of Etsu and Manko (2019) discovered that peer tutoring is more effective in enhancing the academic achievement, zeal and interest of slow learners in secondary school geometry. Again, the result of the study validated the findings of Alegre et al. (2019) found out that peer tutoring had a significant effect in enhancing students' achievement and interest in learning mathematics especially in a moderate class size. In addition, the findings of the study supported the findings of Moliner and Alegre (2020), who revealed that reciprocal peer tutoring among same age learners had a significant positive effect on the learners' achievement in mathematics and self-confidence. However, the findings of the study contradicted the findings of Ghanie (2020) who indicated that there was no significant difference in the mean scores for zeal or interest of university students taught mathematics using peer-tutoring strategy and those taught using faculty tutoring method.

Conclusion/Recommendations

The major conclusion of the study is that peer tutoring has a positive effect on primary school pupils' academic achievement in mathematics as well as enhances the pupils' interest in mathematics irrespective of the pupils' gender. It is therefore, recommended that primary school teachers desirous of improving the children's academic achievement in mathematics should introduce peer tutoring in the classroom. Again, teachers ought to improve the pupils' interest in mathematics through the introduction of peer tutoring in mathematics class.

References

- Alegre, A., Moliner, L., Maroto, A. & Valentin G. L. (2019). Peer tutoring and mathematics in secondary education: literature review, effect sizes, moderators, and implications for practice. *Heliyon*, 5(9), 1-8. <https://www.researchgate.net/publication/336124201>
- Alegre, A., Moliner, L., Maroto, A. & Valentin G. L. (2020). Academic Achievement and Peer tutoring in mathematics: A comparison between primary and secondary education. *SAGE Open*, 10(2), <https://doi.org/10.1177/2158244020929295>.
- Anderson, K. (2017). *What is peer tutoring, and why it assumes relevance?* <https://www.hospitalitynet.org/opinion/4083733.html>
- Calderwood, B. & Sturdivant, L. (2021). Peer tutoring concept and purpose. <https://study.com/academy/lesson/peer-tutoring-definition-pros-cons.html>
- Chand, S., Chaudhary, K., Prasad, A. & Chand, V. (2021). Perceived causes of students' poor performance in mathematics: A case study at Ba and Tavua secondary schools. <https://doi.org/10.3389/fams.2021.614408>
- Comfort, P. & McMahon, J. J. (2014). The effect of peer tutoring on academic achievement. <https://www.researchgate.net/publication/262009850>
- Etsu, S. M. & Manko, U. A (2019). Effects of mathematics peer tutoring strategy on geometry achievement of slow learners among junior secondary school students in Niger State. *Abacus (Mathematics Education Series)*, 44(1), 551-558. <https://www.mannigeria.org.ng/issues/ABA-EDU-2019-65.pdf>
- Fink, S. (2020). *Benefits of peer teaching*. <https://www.summertech.net/benefits-of-peer-teaching/>
- Ghanie, S. (2020). Peer versus faculty tutoring's impact on mathematics performance of first-year university students. *IOSR Journal of Research & Method in Education (IOSR-JRME)*, 10(6), 49-59. <https://www.iosrjournals.org/iosr-jrme/papers/Vol-10%20Issue-6/Series-1/H1006014959.pdf>
- Helmenstine, A. M. (2019). *Why mathematics is a language*. <https://www.thoughtco.com/why-mathematics-is-a-language-4158142>
- Makondo, P. V. & Makondo, D. (2020). Causes of poor academic performance in mathematics at ordinary level: A case of Mavuzani High School, Zimbabwe. *International Journal of Humanities and Social Science Invention (IJHSSI)*, 9(1), 10-18 <http://doi.org/10.35629/7722-0906011018>
- Marackiewicz, J. M., Smith, J. L. & Priniski, S. J. (2016). *Interest matters: The importance of promoting interest in education*. <https://doi.org/10.1177/2372732216655542>
- Marrison, N. (2022). *Children learn more through play than from teachers-led instruction*. <https://www.forbes.com/sites/nickmorrison/2022/01/12/children-learn-more-through-play-than-from-teacher-led-instruction/>
- Moliner, L. & Alegre (2020). Effects of peer tutoring on middle school students' mathematics self-concepts. <https://doi.org/10.1371/journal.pone.0231410>
- Nwachukwu, J. (2019). *Mathematical sciences: Stakeholders decry poor interest among females*. <https://nnn.ng/mathematical-sciences-stakeholders-decry-poor-interest-among-females/>
- Ojekwu, I. N. & Ogunleye, B. O. (2020). Effects of jigsaw learning strategy on science students' performance and interest in biology in selected schools in Rivers State, Nigeria. *Sapientia Foundational Journal of Education, Sciences and Gender Studies*, 2 (3), 325-334. <http://doi.org/10.13140/RG.2.2.16936.60168>

- Okenyi, E. C. (2022). Impact of instructional materials on pupils' academic achievement in social studies in Enugu State, Nigeria. *Contemporary Journal of Education and Development*, 2(6), 1–9. <https://cirdjournal.com/index.php/cjed/article/view/749>
- Rahaeem, Y. A., Yusuf, H. T. & Odutayo, A. O. (2017). Effect of peer tutoring on students' academic performance in economics in Ilorin South, Nigeria. *Journal of Peer Learning*, 10(7), 95-102. <https://ro.uow.edu.au/ajpl/vol10/iss1/7>
- Trust, T., Krutka, D. G. & Carpenter, J. P. (2016). "Together we are better": Professional learning networks for teachers. *Journal of Computers and Education*, 102, 15-34. <https://doi.org/10.1016/j.compedu.2016.06.007>
- Ugwuanyi, C. S. & Okeke, C. I. O. (2020). A multimedia instructional package on for enhancing achievement in basic science. *International Journal of Advanced Science and Technology*, 136(1), 51-60. <http://dx.doi.org/10.33832/ijast.2020.136.05>
- Ullah, I. & Kaleem, M. (2020). Effectiveness of peer tutoring on the academic achievements of tutors and tutees with respect to knowledge, comprehension and application level of cognitive domain. *FWU Journal of Social Sciences*, 14(4), 68-79. <https://doi.org/10.51709/FW12726>
- Valero, P. & Knijnik, G. (2016). Mathematics education as a matter of policy. *Encyclopedia of Education Philosophy and Theory*. https://doi.org/10.1007/978-981-287-532-7_523-1
- Yadav, S. (2019). Role of mathematics in the development of society. *International Journal of Research and Analytical Reviews (IJRAR)*, 6(4), 295-298. <https://www.researchgate.net/publication/343775504>.
- Yemi, T. M., Azid, N. B. H. & Ali, M. R. M. (2018). Effect of jigsaw strategy of cooperative learning on mathematics achievement among secondary school students. *European Journal of Education Studies*, 4(2), 51-61. <https://doi.org/10.5281/zenodo.1167888>