



EFFECT OF PEER-TO-PEER TEACHING STRATEGY ON JUNIOR SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN BASIC SCIENCE AND TECHNOLOGY IN JOS, NIGERIA

Ozji Bernadette Ebele, PhD

mbozorji@yahoo.com

Salihu Zubaidah Sani

salihuzubaidah@gmail.com

Chollom Grace Azumi, PhD

ngocolom@gmail.com

Department of Science and Technology Education

Faculty of Education

University of Jos,

Plateau State, Nigeria

Dung Mohammed Dauda, PhD

dungmohamed@gmail.com

Department of Integrated Science

Federal College of Education Pankshin,

Plateau State, Nigeria

ABSTRACT

This study investigated the effect of peer-to-peer teaching strategy on junior secondary school students' achievement in Basic Science and Technology in Jos North Local Government Area of Plateau State, Nigeria. The pre-test, post-test quasi-experimental design was adopted in the study. A sample comprising one public and one private junior secondary schools was used for the study. Two arms of JSS 2 class in each of the selected schools were randomly assigned to experimental and control groups. The sample size of students used in the study consisted of 120 students in four intact classes. Two research questions and two null hypotheses guided the study. The instrument used for data collection was a Basic Science and Technology Achievement Test (BASTAT). The BASTAT was validated by three experts, two in Science Education unit and one in Research, Measurement and Evaluation, all from the Faculty of Education, University of Jos, Nigeria. The reliability of BASTAT was established as 0.80 using Kuder-Richardson formula 20. The experimental group was taught with peer-to-peer teaching strategy while the control group was taught with the lecture strategy. Mean and standard deviation were used to answer research questions while Analysis of Covariance was used to test the hypotheses. Results of the study revealed that peer-to-peer teaching strategy significantly improved the achievement of students in Basic Science and Technology. The results further showed that school type had no significant effect on students' achievement in Basic science and Technology. The study recommended that teachers should incorporate peer-to-peer teaching strategy into methods of teaching Basic Science and Technology for improved achievement in the subject.

Keywords: Achievement, Basic Science and Technology, Peer-to-peer teaching strategy.

INTRODUCTION

Science is the bedrock on which modern day technological breakthrough is hinged. Through science and technology education, a nation develops its manpower to drive the critical sectors of the economy, such as, health, agriculture, security, power and education. For any nation to attain sustainable development and technological advancement she must not toy with the provision of functional science education for the citizenry.

In recognition of the importance of science and technology education to national development, the Nigerian government included science and technology programme in the school curriculum at the basic, secondary and higher education levels. The goals of secondary education in Nigeria as stipulated by the national policy on education (Federal Republic of Nigeria [FRN], 2014) include preparation of individuals for useful living within the society and for higher education. To actualize these goals, the federal government accorded a compulsory status to science and technology at the basic level of education so as to lay the required foundation for the study of these courses at the higher levels of education. Other efforts by the government to give science education the deserved attention include provision of science kits to secondary schools, establishment of more universities of technology, training of science teachers abroad in the technical aid programme, establishment of special science schools in each geo-political zone of the country and the 60:40 ratio in admissions into the nation's conventional, and 80:20 ratio into technology-based tertiary institutions in favour of science and technology courses.

Despite the importance of basic science and technology and the country's quest for technological advancement, evidences from studies show that students have not been achieving as expected in Basic Science and Technology. For instance, the Basic Certificate Examinations (BECE) results from 2013 to 2019 as reported by Ishaku (2020) were poor. Underachievement in Basic Science and Technology has been attributed to a number of factors, such as, the use of stereotyped, traditional and ineffective teaching methods, such as, the expository method generally known as the lecture method by teachers (Alabi, 2014; Samuel, 2017); students' lack of skills in answering Basic Science and Technology questions (Education Resource Center, 2017).

The issue of poor achievement in Basic Science and Technology is at variance with the demand of the 21st century science and technology classroom which is laying, interactive and collaborative environments needed by new generation of students. Researchers, such as, Osokoya (2013), Alabi (2014), Kabutu, Oloyede and Ogunsola-Bandele (2015) and Samuel (2017) attested to the fact that the poor instructional strategies employed in the teaching of Basic Science and Technology by teachers contribute to students' underachievement. Poor achievement in science will definitely not promote the attainment of the countries laudable objectives and goals of developing a scientific and technologically literate citizenry. Moreover, the dream of the government to become one of the big economies of the world would not be feasible. Furthermore, it would be difficult to produce a formidable workforce to drive the nation in the area of science and technology. Therefore, the need to teach science and technology subjects with interactive, innovative and engaging strategies does not require any emphasis. Learning will be more successful if there is provision of these strategies, to enable students explain and clarify their own cognitions and ideas with one another. Such strategies include: jigsaw, and computer-mediated instructional strategies, laboratory method and peer to peer teaching strategy.

Peer-to-peer teaching strategy involves two or more students working together face to face in a classroom setting towards achieving a mutual goal of learning a particular task. Scholars (Bukunola & Idowu, 2012; Osokoya, 2013; Alabi, 2014 Samuel, 2017) opined that peer-to-peer strategy is one of the effective methods of teaching students at the junior secondary school level, and it has been commended by researchers for its positive role in classroom-based learning. Osokoya observed that one way of enabling students to learn and understand science and the science processes is to teach science with peer-to-peer teaching strategy.

Peer to peer method of teaching or tutoring in science and technology classrooms is used for various tutoring activities, particularly, when students study or learn in pairs in order to help each other attain specific tasks in the subject. Peer tutoring usually leads to improved learning outcomes. Organized peer tutoring can give greater positive results as compared to unorganized peer tutoring. Peer-to-peer teaching strategy is very effective when science and technology teachers make good pairs of students to teach each other in schools. This strategy can be employed both in urban and rural settings, in public as well as private school settings.

School type is one of the factors that affect students' achievement in science. Aransi (2018) found that school type is one of the factors that influence the distribution of educational resources. Studies show inconclusiveness on the influence of school type on achievement of students in science and technology (Kalu, 2018; Achimugu; Yakubu, Danja & Faruk, 2019). The problem of this study, therefore, was to find out if peer to peer teaching strategy as an identified strategy could enhance the achievement of JSS 2 students in Basic science and Technology.

Objectives

The Specific objectives of the study were to:

- i. Determine the difference between the mean achievement scores of junior secondary two students exposed to peer-to-peer teaching strategy and those not exposed to the strategy in Basic Science and Technology.
- ii. Determine the effect of peer-to-peer teaching strategy on junior secondary two students' achievement in Basic Science and Technology in private and public schools in Jos, Plateau State, Nigeria.

Research Questions

The following research questions were raised:

- ii. What is the difference in mean achievement scores of JSS 2 students taught Basic Science and Technology using peer to peer teaching strategy and those taught using lecture strategy?
 - ii. What is the difference between the mean Basic Science and Technology achievement scores of JSS two students in public and private schools taught using the peer-to-peer teaching strategy?
- Hypotheses

The following hypotheses were tested at 0.05 level of significance:

- i. There is no significant difference between the mean achievement scores of JSS two students taught Basic Science and Technology using peer to peer teaching strategy and those taught using the lecture method.
- ii. There is no significant difference between the mean achievement scores of JSS two students in private and public schools taught Basic Science and Technology with peer-to-peer teaching strategy.

METHODOLOGY

Design of the Study

This study adopted the pre-test, post-test quasi experimental research design. The population of this study comprised JSS 2 students in government approved private and public co-educational secondary schools in Jos North Local Government Area of Plateau State.

Participants

The purposive sampling technique was used to select two junior secondary schools in Jos North Local Government Area of Plateau State as the sample of schools for the study. That is, one public junior secondary school and one private junior secondary school. Two arms of JSS 2 class in each of the selected schools were randomly assigned to experimental and control groups. The sample size of students used in the study was the number of students in the four intact classes totaling 120. The experimental group was made up of 63 JSS 2 students, while the control group was made up of 57 JSS 2 students.

Measures

A multiple-choice test instrument was used for data collection, namely, Basic Science and Technology Achievement Test (BASTAT). The BASTAT consisted of two sections namely, A and B. Section A sought personal information of the students, such as name and school type, while section B contained 35 multiple choice items. The BASTAT items were used for pre-test and later re-numbered for post-test. The BASTAT items were based on the JSS 2 syllabus covering skeletal system, respiratory system, and digestive system. The BASTAT was adapted from past Basic Education Certificate Examinations (BECE) questions. It was validated by a senior lecturer from the Department of Science and Technology Education (Integrated Science Education unit), and one senior lecturer from the Department of Educational foundations (Research, Test and Measurement unit) all from the Faculty of Education, University of Jos. The validators scrutinized the BASTAT to ascertain the adequacy, appropriateness, comprehensiveness and coverage of the instrument. The reliability of the BASTAT was established as 0.82 using the Kuder Richardson Formula 20.

Procedure

The Basic Science and Technology Achievement Test was administered on the experimental and control groups as pre-test by the Basic Science teachers in the schools who were coordinated and used as research assistants. The pre-test (BASTAT) was administered to the experimental and control groups before students were exposed to peer-to-peer strategy and the conventional method. The pre-test lasted for 50 minutes. Researchers marked students' scripts, collated the scores for analysis using SPSS version 25.0. This exercise provided pre-test data on students' achievement in BASTAT.

The experimental group was exposed to treatment (taught using peer-to-peer-teaching strategy) for four weeks and the control group was taught using the lecture method of teaching for the same period of time. Each lesson lasted for a period of forty-five minutes and, then ninety minutes for a double period. After the four weeks teaching exercise, post-test was administered on the experimental and control groups by the researchers and research assistants for 50 minutes. Students' scripts were marked, the scores collated and set aside for analysis. Each item a student answered correctly was scored 2.5 while wrongly answered item was scored zero. Descriptive statistics (mean and standard deviation) were used in answering research questions while Analysis of Covariance (ANCOVA) was used to test

hypotheses at 0.05 level of significance.

FINDINGS

The findings of the study were presented in line with the research questions and the hypotheses formulated to guide the study as follows:

Research Question One

What are the mean achievement scores of JSS 2 students taught basic science and technology in the experimental and control groups? The result is presented in Table 1 as follows:

Table 1: Mean and standard deviation scores of students in experimental and control groups

Group	N	Pre-test		Post-test		Mean gain
		1 SD ₁		2 SD ₂		
Experimental	63	40.94	14.09	72.75	13.17	31.81
Control	57	39.33	12.69	48.11	9.56	8.78
Mean Difference		1.61		24.64		23.03

The results in Table 1 reveal that the pre-test mean achievement scores of the experimental and control groups were 40.94 and 39.33 respectively with standard deviation scores of 14.09 and 12.69 respectively. The post-test mean achievement scores of the groups were 72.75 and 48.11 respectively, with standard deviation scores of 13.17 and 9.56, respectively. The post-test mean difference between the two groups was 24.64 in favour of the experimental group.

Research Question Two

What are the mean achievement scores of JSS 2 students taught biology using peer-peer teaching strategy in public and private schools? The result is presented in Table 2 as follows:

Table 2: Mean achievement scores of JSS 2 students taught using peer-peer teaching strategy in private and public schools

School Type	N	Pre-test		Post-test		Mean gain
		1 SD ₁		2 SD ₂		
Private	63	40.62	14.36	72.10	13.24	31.48
Public	57	38.09	12.24	69.75	16.09	30.66
Mean Difference		2.53		2.35		0.82

The results in Table 2 reveal that the pre-test mean achievement scores of JSS 2 Basic Science and Technology students in private and public junior secondary schools were 40.62 and 38.09 respectively, with standard deviation scores of 14.36 and 12.24, respectively. The post-test mean achievement scores of the students were 72.10 and 69.75, accordingly with standard deviation scores of 13.24 and 16.09, respectively. The post-test mean difference between the two groups was 2.35.

Hypothesis One

There is no significant difference between the mean achievement scores of JSS 2 students taught Basic Science and Technology in experimental and control groups. The result of the hypothesis test is presented in Table 3 as follows:

Table 3: Summary of ANCOVA test between the achievement of experimental and control groups

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	18169.487 ^a	1	18169.487	135.052	.000
Intercept	437055.687	1	437055.687	3248.603	.000
Group	18169.487	1	18169.487	135.052	.000
Error	15875.305	118	134.536		
Total	481175.000	120			
Corrected Total	34044.792	119			

a. R Squared = .534 (Adjusted R Squared = .530)

Table 3 presents the summary of ANCOVA test of the significant effect of peer-to-peer teaching strategy on the achievement of JSS 2 students in Basic Science and Technology. The F-calculated value was 135.052 with a p-value of 0.000. The null hypothesis was therefore rejected since the p-value is less than the 0.05 level of significance ($p = 0.000 < 0.05$). It was concluded that there was a significant difference between the mean achievement scores of JSS 2 students taught Basic Science and Technology using peer to peer teaching strategy and those taught using the lecture method in favour of the experimental group which had a mean difference of 24.64 (see Table 1) from the control group.

Hypothesis Two

There is no significant difference between the mean achievement scores of JSS 2 students in private schools taught Basic Science and Technology and their counterparts in public schools. The result of the hypothesis test is presented in Table 4 as follows:

TABLE 4: Summary of ANCOVA test of comparison between achievement of private and public junior secondary schools

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	12.089 ^a	1	12.089	.056	.813
Intercept	603784.089	1	603784.089	2792.243	.000
School	12.089	1	12.089	.056	.813
Error	25515.878	118	216.236		
Total	630164.000	120			
Corrected Total	25527.967	119			

a. R Squared = .000 (Adjusted R Squared = -.008)

Table 4 presents the summary of ANCOVA analysis of the significant effect of peer-to-peer teaching strategy on achievement of JSS 2 students in public and private schools. The F-value obtained was 0.056 with a p-value of 0.813. The hypothesis was therefore accepted since the p-value is greater than the 0.05 level of significance ($p=0.813 > 0.05$). It was therefore concluded that there was no significant difference between the mean achievement scores of JSS 2 students in private schools taught Basic Science and Technology and their counterparts in private schools.

DISCUSSION

The study investigated the effect of peer-to-peer teaching strategy on JSS 2 students' achievement in Basic Science and Technology. The result in Table 1 showed a significant difference between the mean achievement scores of JSS 2 students taught Basic Science and Technology using peer to peer teaching strategy and that of students taught using the lecture method. This means that JSS 2 students who were taught Basic Science and Technology using peer to peer teaching strategy achieved higher than those taught using the lecture method. The implication of this findings is that the use of peer-to-peer teaching strategy improved students' achievement in Basic Science and Technology more than the lecture method. The finding of this study is in agreement with an earlier finding by Kunsch, Jitendra, and Sood (2007) who observed that students usually study and learn in pairs in order to help each other. The authors further opined that peer tutoring usually leads to better understanding of academic concepts. Improvement in achievement of students in Basic Science and Technology must have been as a result of engagement in critical thinking and reflection, as well as sharing understanding and ideas in the course of peer tutoring by students.

On the contrary, the results in Table 4 revealed no significant difference between the achievement of students in private and public schools taught using per-to-peer teaching strategy. This result is at variance with the findings of Kalu (2018), Achimugu, (2018) and Yakubu, et al. (2019) on students' academic achievement which showed significant differences between the academic achievement of students in private and public secondary schools. Lack of significant difference between the mean achievement scores of JSS 2 students in private and public schools exposed to the peer-to-peer teaching

strategy in the present study, showed the efficacy of the strategy which was interactive, activity-based and engaged the students in asking questions, sharing ideas and cognitions, and clarifying doubts from one another. The strategy must have engaged the students in creative and critical thinking too, as well as, in-depth learning and understanding of basic science concepts. The findings of this study therefore, not only implies that peer-to-peer teaching strategy significantly improves achievement outcomes of students in basic science and technology, but that, if appropriate environments are provided in science and technology classes through activity-based and innovative strategies, such as, the peer-to-peer teaching strategy, disparity due to school type in academic achievement in Nigerian schools, particularly, in science-related subjects may become history.

CONCLUSION

From the findings of the study, it was concluded that peer-to-peer teaching strategy was effective in improving students' achievement in Basic Science and Technology. Moreover, school type had no influence on the achievement of JSS 2 students exposed to peer-to-peer teaching strategy.

RECOMMENDATIONS

The following recommendations were made based on the findings of the study:

- i. Basic Science and Technology teachers should incorporate peer-to-peer teaching strategy into Basic Science and Technology classrooms for improved achievement in the subject.
- ii. Government should provide adequate funding for provision of enabling environments in public schools for improved achievement outcomes in Basic Science and Technology.

REFERENCES

- Afuwape, R.F., & Olatoye, A. (2014). *A comparison of achievement and retention by college junior students in an Earth science course after learning under massed and spaced conditions [Ph.D. dissertation]*. Pennsylvania State University.
- Alabi, M.J. (2014). Improving the quality of integrated science and introductory technology curricular in secondary schools. *Nigerian Journal of Teacher Education and Teaching*, 4 (1), 304-311.
- Achimugu, A. (2018). Influence of gender, school location and school type on students' academic achievement in chemistry in Dekina local government area of Kogi State. In Z.C. Njoku, U.M. Nzewi, & C.V. Nnaka. *Perspectives on science and technology education in Nigeria* (pp. 102-111). Great AP Express Publishers Ltd.
- Anekwe, J. U. (2016). *Effect of constructivist-based instructional model on students' interest and academic achievement in French in Anambra State*. Unpublished PhD Thesis, University of Port Harcourt.
- Aransi, W.O. (2018). The influence of school types, class classification and gender on academic achievement in economics among high school students: A comparative analysis. *International Journal of Progressive Sciences and Technologies*, 8 (2), 120-128.

- Bukunola, B.I & Idowu, E.S. (2012). Effect of ethno-mathematics teaching approach on Senior Secondary Students' achievement and retention in locus. *Educational Research and Review*, 4 (8), 385-390. Federal Republic of Nigeria (2014). National Policy on Education. NERDC Press.
- Ishaku, S.L. (2020). *Effects of pictorial and questioning organizers on basic science and technology perceived difficult concepts and students' achievement in Plateau State, Nigeria*. Unpublished thesis, University of Jos.
- Kabutu, F.R., Oloyede, O.I., Ogunsola-Bandele, M.F. (2015). The achievement of junior secondary school students taught integrated science using cooperative learning strategy in Nigeria. *International Journal of Physics and Chemistry Education*, 7 (2), 63-73.
- Kalu, I. (2018). Student gender, school proprietorship, school type, and secondary school students' perception of the constructivist learning environment of biology classrooms. In Z.C. Njoku, U.M. Nzewi, & C.V. Nnaka. *Perspectives on science and technology education in Nigeria* (pp. 150-159). Great AP Express Publishers Ltd.
- Omotayo, A., & Akindele, B (2020). Investigated effect of peer tutoring on pre service teachers' performance in Basic Science in Nigerian Colleges of Education. *Journal of Educational Research*, 1 (2), 67-88.
- Osokoya, M.M. (2013). Teaching methodology in basic science and technology classes in South-West, Nigeria. *Asian Journal of Education and e-learning*, 1 (4), 206-214.
- Samuel, M.O. (2017). Effects of computer assisted instruction on secondary school students' performance in biology. *The Turkish Journal of Educational Technology*, 9(1), 62-69.
- Samuelson, J. (2010). *The effect of peer collaboration on children's arithmetic and self-regulated learning skills*. Linkoping University Press.
- Serkan, H., Nuri, A., Abdullah, M., Bibigul, O., & Omar, K (2020). Effect of peer instruction method on the first course mathematics education students' academic achievement and the attitudes of students by using peer instruction method. *Asian Journal of Educational Research*, 4 (3), 70-89.
- Simpson, R. D., & Troost, K. M., (2012). Influence of commitment to learning of science among adolescence students. *Science Education Journal*, 66 (5), 763-781.
- Stephens, J.C. (2011). The effect of a diagnostic-prescriptive teaching strategy on students' achievement and attitude in biology. *Journal of Research in Science Teaching*, 18 (6), 515-523.
- Udoh, N. M. (2015). *Effects of Computer simulation and charts on biology students' academic performance and retention on the concept of nervous coordination*. Unpublished M.Sc. Dissertation. University of Uyo.
- Yakubu, I.A., Danja, M., & Faruk, Y.U. (2019). School type and academic achievement in biology among senior secondary school students in Zaria, Nigeria: Analysis of difference and relationship. *ATBU Journal of Science Technology and Education*, 7 (4), 156-160.