

Effects of Teachers' Communication Model on Junior Secondary Two Students' Achievement in Basic Science and Technology in Jos North, Nigeria

Rashidat Kikelomo Ibrahim

Department of Science and Technology Education
Faculty of Education, University of Jos.
rashidat.ibrahim.kike@gmail.com

Prof. Grace .A Chollom

Department of Science and Technology Education
Faculty of Education, University of Jos.
ngocolom@gmail.com

Dr. Blessing S. Dawal

Department of Science and Technology Education
Faculty of Education, University of Jos.
DOI: 10.56201/rjmcit.vol.11.no2.2025.pg47.59

Abstract

This study investigated the effects of teachers' communication model on junior secondary two students' achievement in Basic Science and Technology in Jos North, Nigeria. The study adopted a quasi-experimental design, specifically, the non-randomised pre-test and post-test control group design. A total of 82 Junior Secondary Two students from two schools out of a population of 1226 students in 22 schools participated in the study. The two schools used were randomly assigned to an experimental group and a control group. The students were used in their intact class settings and, as such, were not sampled. A Basic Science and Technology Achievement Test (BSTAT) with a reliability index of 0.883 was used to collect data from the students. Two research questions were raised and two hypotheses formulated to guide the study. The experimental group was taught Basic Science and Technology concepts for eight weeks using a teacher communication model, while the control group was taught the same concepts for the same length of time using the lecture method. Research questions were answered using mean and standard deviation, while hypotheses were tested using analysis of covariance (ANCOVA) at the 0.05 level of significance. Results of the study showed that students taught using the teachers' communication model have achieved significantly higher than students taught using the lecture method. Gender was found to have no significant influence on students' achievement in Basic Science and Technology. It was concluded that the use of the teachers' communication model was more effective in enhancing students' achievement in Basic Science and Technology than the lecture method. It was recommended that

teachers should incorporate the use of the teachers' communication model into Basic Science and Technology classrooms to enhance students' achievement in the subject.

Keywords: *Achievement, Basic Science and Technology, Teachers' communication model.*

Introduction

Science is a systematic way of studying the universe and all that is in it. It is a study of man's interaction with the environment to generate knowledge and organise it for an explanation of natural phenomena and application to human endeavours. Technology is the application of scientific knowledge and skills to improve the standard of human living in society. Science and technology have made the natural world more interesting to live in, and this is because the results of scientific knowledge and technological explorations have drastically changed human lifestyles and have provided solutions to difficult challenges that affect human lives in society. Engawa (2014) is of the view that transportation, marketing systems, agricultural sectors, medical care, and means of communication have all been shaped by science and technology. This implies that science and technology play a vital role in society's development and contribute immensely to nation and national development. Due to the recognition of the indispensability of science and technology to nations and national development, Basic Science and Technology has been made mandatory as a subject for all pupils and students in primary and junior secondary schools in Nigeria.

Basic Science and Technology is a subject that lays a solid foundation for pupils and students to learn scientific knowledge and skills at the primary and junior secondary levels. It prepares students in junior secondary to study science subjects such as agriculture, biology, chemistry and physics at the senior secondary level and also to study science courses at tertiary institutions (Dawal & Jantur, 2019). This implies that Basic Science and technology are important for students to get along with scientific concepts, principles, theories and laws which are further explained in the core sciences. The fundamental knowledge acquired in Basic Science and Technology at the junior secondary level has helped in the transformation of the world through dramatic advances in almost all fields, including medicine, engineering, electronics and aeronautics, among others (Sunday, 2021). Basic science and technology serve as the bedrock which provides the required training in scientific skills to meet the growing needs of society.

The main objective of teaching Basic Science and Technology in Nigeria, as stated in the curriculum of Basic Science and Technology, is to develop students' interest in science and technology to acquire basic knowledge and skills of science and technology in meeting up with societies needs. The Federal Republic of Nigeria, in her National Policy on Education (FGN, 2014), emphasised that the aim of teaching Basic Science and Technology knowledge is to provide students with process skills, inquiry techniques, desirable scientific attitudes and critical thinking

skills to communicate and contribute effectively in the classroom and society at large. This implies that the teaching of Basic Science and Technology must be done to promote effective communication and interaction between teacher and students or among students in the classroom.

The federal government of Nigeria, in her effort to promote the use of effective communication aimed at improving the teaching of Basic Science and Technology introduced several programmes towards improving the quality of science teachers. Some of the programmes organised in collaboration with the National Teachers Institute (NTI) Kaduna include the training of teachers on how to prepare and deliver interactive lesson activities that promote effective communication with the aid of instructional materials. Similarly, the federal government of Nigeria, in collaboration with the Japanese International Agencies (JICA), trained Basic Science and Technology teachers on how to improve their pedagogical skills and how to use student-centred methods, strategies and approaches to promote effective communication in the classroom.

Despite the efforts made by the federal government and non-government bodies to improve the teaching of Basic Science and Technology, students' achievement in the subject has been quite discouraging, and the lecture method is still predominantly used in teaching Basic Science and Technology in junior secondary schools in Nigeria (Dawal, 2016). The lecture method used in teaching Basic Science and Technology in junior secondary schools in Nigeria does not expose students to meaningful communication, as well as give feedback as evidence of learning and understanding of science concepts. Musa, Achor and Ellah (2021) also revealed that Basic Science and Technology instructions in Nigerian junior secondary schools fall short of the required standard. This may be a result of the teachers' incompetence in designing interactive instructions and using a lecture method that does not promote effective communication and interaction between Basic Science and Technology teachers and students or among students in the classroom. Oguejiofor (2020) found that the lecture method used in teaching has led to the loss of students' interest in Basic Science and Technology at the junior secondary school level and ultimately poor achievement of students.

Taking a comprehensive look at Basic Science and Technology Basic Education Certificate examination (BECE) statistics summary results from 2019 to 2022 for Jos North, Local Government Area (LGA), Plateau State, it showed that few students obtained an excellent 'A' grade (2.82%, 2.15%, 22.82% & 16.94%). This implies the percentage of students who were outstanding (obtained an excellent 'A' grade) in Basic Science and Technology is not up to 25 % from the years 2019 to 2022. Similarly, Babalola (2019) pointed out that reports from many states in Nigeria still indicated students' poor achievement in Basic Science and Technology examination. Most of the failures recorded are attributed to inadequate preparation of teachers and students, inability to comprehend questions, ineffective teaching methods, gender insensitivity, lack of students' interest, and lack of qualified science teachers (Balarabe, 2016).

However, student-centred methods of teaching are employed to bridge the gaps found in students' understanding of difficult scientific concepts, and it must be done to facilitate effective communication in a manner that promotes students' understanding and achievement (Agbo, 2023). Student-centred methods, strategies and approaches that communicate concepts meaningfully to students during interactions are good for teaching Basic Science and technology in schools to improve students' achievement (Nwankwo & Okoli, 2019). No wonder teacher training institutions in Nigeria have emphasised the use of exploratory, investigatory and child-centred approaches in the training of pre-service science teachers (Chollom, 2016). This is because the activities embedded in the approaches help students to develop problem-solving skills and enhance students understanding, achievement and retention of scientific concepts. It is in the realisation of this that the Federal Government of Nigeria emphasises the use of student-centred methods which are activity-based in teaching Basic Science and Technology in junior secondary schools to promote interaction and communication in the classroom for improved achievement in Basic Science and Technology.

Teachers' communication model is known to promote the use of student-centred methods of teaching, as it gives students and teachers opportunities to communicate effectively in the classroom (AlAhmad, 2021). This implies the teachers' communication model is a set of interactive approaches designed to guide and expose students to a series of activities in the learning process, and these activities involve receiving instructions from their teachers, manipulation of instructional materials, sharing ideas with peers and questioning during classroom interaction. The teachers' communication model also involves students in observing science phenomena, recording observations in different forms and giving feedback to questions posed by the teachers. This enhanced a greater understanding of the lesson through effective communication and promoted students' achievement in Basic Science and Technology. Teachers' communication model allows teachers to ask students thought-provoking questions that direct students thinking to the hidden parts of the lesson (Chollom, Maichibi, Garba & Achi, 2023). This helps students discover knowledge of the lesson, manipulate and use instructional materials, and as well make students give feedback in response to the questions posed by their teachers. Methods such as demonstration, discussion, inquiry, discovery, project and cooperative learning strategies are some of the student-centred methods that promote students' achievement since they give them opportunities to communicate effectively at all levels of classroom interactions (Tang, 2023).

Achievement of students can either be suppressed or improved in the classroom due to the kind of interactions and communication that teachers and students engage in, and this is a relationship with the teachers' teaching methods. Ani, Kalu, Iketaku and Obodo (2020) revealed that male students achieved better than their female counterparts in Basic Science and Technology whereas the study by Stoet and Geary (2018) revealed there is no significant difference in overall achievement of male and female students in Basic Science and Technology. Workman and Heyder (2020) found that female students achieved better than their male counterparts in science subjects, including Basic Science and Technology. These inconsistencies in students' achievement in Basic Science

and Technology based on gender imply that one cannot disregard gender as one of the factors that affect students' achievement in Basic Science and Technology. Hence, there is a need for more empirical studies using teachers' communication models to determine the influence of gender on the achievement of students in Basic Science and Technology. This study, therefore, seeks to determine the effects of teachers' communication model on junior secondary two students' achievement in Basic Science and Technology.

Statement of the Problem

Available evidences have shown that students' achievement in Basic Science and Technology is low. For example, available Basic Science and Technology BECE statistics summary results from 2019 to 2022 for Jos North, LGA, Plateau State showed that a few students obtained an excellent, 'A' grade (2.82%, 2.15%, 22.82% & 16.94%). This implies the percentages of students who were outstanding (obtained an excellent, 'A' grade) in Basic Science and technology were not up to 25 % from year 2019 to 2022. Similarly, Babalola (2019) pointed out that reports from many states in Nigeria still indicated students' poor achievement in Basic Science and Technology examination. The reasons held responsible for students' low achievement in Basic Science and Technology include students low interest in Basic Science and Technology, gender and students' background, teaching methods used by teachers in teaching Basic Science and Technology concepts, teachers' incompetence in designing interactive lesson plan, qualifications of teachers teaching Basic Science and Technology, nature of Basic Science and Technology concepts and inadequate preparation of teachers and students.

The consequence of not addressing the problem of low achievement of students in Basic Science and Technology is that many students may not be qualified to read science at the senior secondary schools, and this implies many Nigerian students will not be capable of studying science and technology courses at tertiary institutions. Also, there may be a high rate of students' dropping out of schools, and students may not be self-reliant because they will be unable to take numerous career opportunities and skills offered by science and technology. This implies that the objectives of teaching Basic Science and Technology have not been fully achieved because the objectives are aimed at producing highly skilled students who will be capable of further studies in science-related subjects and courses with the aim of developing the society and Nigeria at large. Hence, the need to conduct the study on the effect of teachers' communication model on junior secondary two students' achievement in Basic Science and Technology in Jos North, Nigeria, becomes imperative. This study therefore seeks to answer the broad question: What is the effect of teachers' communication model on junior secondary two students' achievement in Basic Science and Technology in Jos North, Nigeria?

Aim and Objectives of the Study

The aim of the study was to investigate the effects of teachers' communication model on junior secondary two students' achievement in Basic Science and Technology in Jos North, Nigeria. The objectives of the study were to:

1. ascertain the pre-test and post-test achievement mean scores of junior secondary two students in Basic Science and Technology in the experimental and control groups
2. find out the pre-test and post-test achievement mean scores of junior secondary two students in Basic Science and Technology in the experimental group based on gender.

Research Questions

The following research questions were raised to guide the study:

1. What are the pre-test and post-test achievement mean scores of junior secondary two students in Basic Science and Technology in the experimental and control groups?
2. What are the pre-test and post-test achievement mean scores of junior secondary two students in Basic Science and Technology in the experimental group based on gender?

Hypotheses

The following hypotheses were raised and tested at the 0.05 level of significance:

1. There is no significant difference between the post-test achievement mean scores of junior secondary two students in Basic Science and Technology in the experimental and control groups.
2. There is no significant difference between the post-test achievement mean scores of junior secondary two students in Basic Science and Technology in the experimental group based on gender.

Method

The study adopted a quasi-experimental design, specifically, the non-randomised pre-test and post-test control group design. The population for the study comprised 1226 public junior secondary two students in the study area. The simple random sampling technique was used to select two public schools out of 22 public schools present in Jos North, Plateau State. A total of 82 (39 males & 43 females) Basic Science and Technology students constituted the sample for the study. The schools chosen were randomly assigned to experimental and control groups, and intact classes were used in two selected schools. The experimental group had a total number of 46 students (22 males and 24 females), and the control group had a total number of 36 students (17 males and 19

females). The instrument for data collection was the Basic Science and Technology Achievement Test (BSTAT). The instrument comprised two sections, namely, section A and section B. Section A sought information on the demographic variables of the participants, such as name of school, class and gender. Section B of the Basic Science and Technology Achievement Test (BSTAT) had paper I, II and paper III. Paper I comprised six practical item questions, paper II comprised 50 multiple-choice item questions with options A-E, and paper III comprised six essay questions, and students were allowed to answer any four questions of their choice. The instrument was validated, and the internal reliability coefficient of BSTAT was established to be 0.883 using the test-retest reliability method. Research questions were answered using mean and standard deviation, while hypotheses were tested using analysis of covariance (ANCOVA) at the 0.05 level of significance. The BSTAT were administered to the experimental and control groups as a pre-test. Thereafter, the experimental group was taught the concepts of habitat, uniqueness of man, growth and development, developmental changes and chemicals. The control group were taught the same concepts using the lecture method. After eight weeks of teaching exercise, both groups of students were exposed to a post-test on BSTAT.

Results

Research Question One

What are the pre-test and post-test achievement mean scores of junior secondary two students in Basic Science and Technology in the experimental and control groups?

Table 1

Pre-test and Post-test Achievement Mean Scores of JSII students in Basic Science and Technology in the Experimental and Control Groups

Group	N	Pre-test		Post-test		Mean Gain	Mean Gain Difference
		Mean	SD	Mean	SD		
Experimental	46	17.33	5.566	68.00	11.413	50.67	30.39
Control	36	18.94	7.083	39.22	9.502	20.28	

Table 1 shows the result of the pre-test and post-test achievement mean scores of junior secondary two students in Basic Science and Technology in the experimental and control groups. The experimental group has a mean score of 17.33 with a standard deviation of 5.57 in the pre-test and a mean score of 68 with a standard deviation of 11.41 in the post-test, with a mean gain of 50.67. This means that there was an improvement in the achievement of students after treatment. The control group has a mean score of 18.94 with a standard deviation of 7.08 in the pre-test and a mean score of 39.22 with a standard deviation of 9.50 at the post-test, with a mean gain of 20.28. The findings reveal that students in the experimental group had a higher achievement mean score after treatment using the teachers' communication model as against those in the control group who

were not given treatment, with a mean difference of 30.39. This indicates that teachers' communication model does improve students' achievement in Basic Science and Technology.

Research Question Two

What are the pre-test and post-test achievement mean scores of junior secondary two students in Basic Science and Technology in the experimental based on gender?

Table 2

Pre-test and Post-test Achievement Mean Scores of JSII students in Basic Science Technology in the Experimental Group Based on Gender

Group	Gender	N	Pre-test		Post-test		Mean Gain	Mean Gain Difference
			Mean	SD	Mean	SD		
Experimental	Male	22	18.36	5.260	68.41	11.915	50.05	1.2
	Female	24	16.38	5.777	67.63	11.178	51.25	
	Male	17	19.53	6.606	39.24	9.510	19.71	
Control	Female	19	18.42	7.625	39.21	9.756	20.79	1.08

Table 2 shows the result of the pre-test and post-test achievement mean scores of junior secondary two students in Basic Science and Technology in the experimental group based on gender. From the result, males had a pre-test mean score of 18.36 with a standard deviation of 5.26 and a post-test achievement mean score of 68.41 and a standard deviation of 11.92 with a mean gain of 50.05 in the experimental group. The females also had a pre-test mean score of 16.38 with a standard deviation of 5.78 and a post-test achievement mean score of 67.63 in the experimental group with a mean gain of 51.25. The findings show that male students had a higher achievement mean score (68.41) than the female students, who have a mean score of 67.63, when exposed to the teachers' communication model, with a mean difference of 1.2.

For the control group, male had a pre-test mean score of 18.53 with a standard deviation of 6.61 and the post-test achievement mean score of 39.24 and standard deviation of 9.51 with a mean gain of 19.71 in the control group. The females also had a pre-test mean score of 18.42 with a standard deviation of 7.63 and a post-test achievement mean score of 39.21 in the control group with a mean gain of 20.79. The finding shows that male students have almost the same post-test mean score (39.24) as the female students, who had a mean score of 39.21 in the control group, with a mean gain difference of 1.08.

Hypothesis One

There is no significant difference between the pre-test and post-test achievement mean scores of junior secondary two students in Basic Science and Technology in the experimental and control groups.

Table 3

ANCOVA Result on the Pre-test and Post-test Achievement Mean Scores of JSII Students in Basic Science and Technology in the Experimental and Control Groups

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	16919.710 ^a	2	8459.855	75.711	.000	.657
Intercept	28925.817	1	28925.817	258.871	.000	.766
Covariate	194.908	1	194.908	1.744	.190	.022
Group	15991.638	1	15991.638	143.117	.000	.644
Error	8827.314	79	111.738			
Total	277108.000	82				
Corrected Total	25747.024	81				

a. R Squared = .657 (Adjusted R Squared = .648)

Analysis of Covariance (ANCOVA) was conducted to determine if there is a significant difference between the pre-test and post-test achievement mean scores of junior secondary two students in Basic Science and Technology in the experimental and control groups. Table 3 shows that $F(1, 79) = 143.12$, $P < 0.05$. Since the P-value of .000 is less than .05, the null hypothesis was therefore rejected. It was concluded that there is a significant difference between the pre-test and post-test achievement mean scores of junior secondary two students in Basic Science and Technology in the experimental and control groups. The result further shows an adjusted R-squared value of .648, which means that 64.8% of the variation in the dependent variable, which is students' achievement, is explained by variation in treatment, while the remaining 35.2% is due to other factors not included in this study. This means that teachers' communication model can help to improve the achievement of students in Basic Science and Technology.

Hypothesis Two

There is no significant difference between the pretest and posttest achievement mean scores of junior secondary two students in Basic Science and Technology in the experimental group based on gender

Table 4
ANCOVA Result on Pretest and Post-test Achievement Mean Scores JSII Students in Basic Science and Technology in Experimental Group Based on Gender

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	40.035 ^a	2	20.017	.148	.863	.007
Intercept	20382.032	1	20382.032	150.538	.000	.778
Co-variate	32.978	1	32.978	.244	.624	.006
Gender	13.316	1	13.316	.098	.755	.002
Error	5821.965	43	135.395			
Total	218566.000	46				
Corrected Total	5862.000	45				

a. R Squared = .007 (Adjusted R Squared = -.039)

Table 4 shows the result of the difference between the pre-test and post-test achievement mean scores of junior secondary two students in Basic Science and Technology in the experimental group based on gender. From the result, the F-value for gender is .098 with a significant P-value of .755, which is greater than the .05 level of significance. The null hypothesis was retained; it was concluded that there was no significant difference between the pre-test and post-test achievement mean scores of male and female students taught Basic Science and Technology using teachers' communication model. The result further shows an adjusted R-squared value of -.039, which means that 3.9% of the variation in the dependent variable, which is students' achievement, is explained by variation in gender, while the remaining is due to treatment and other factors not included in this study. This implies that teachers' communication model can help improve the achievement of students in Basic Science and Technology with no gender difference.

Discussion

The finding of the study showed that students taught with the teachers' communication model achieved significantly better than the students taught using the lecture method. The significant difference could be as a result of teachers' communication model, which has provided interactive guidelines for students to communicate effectively and discover knowledge through findings and discussion. It could also be due to the fact that the teachers' communication model is an interactive form of instruction that gives students the opportunity to interact with each other and their teacher to learn more and give feedback, therefore improving their achievement in Basic Science and Technology. The foregoing findings are in line with the previous research findings by Chollom, Maichibi, Garba and Achi (2023), which indicated that teachers' communication model also allows teachers to ask students thought-provoking questions that direct students thinking to the

hidden parts of the lesson, and this makes students discover knowledge of the lesson, manipulate and use instructional materials, and also make students give feedback in response to the questions posed by their teachers. The result of the findings showed that gender had no significant influence on students' achievement in Basic Science and Technology. Therefore, the teachers' communication model captured students' attention and helped them to learn meaningfully and achieve well in the subject.

Conclusion

It was concluded that teachers' communication model was more effective in enhancing students' achievement in Basic Science and Technology than the lecture method.

Recommendation

Based on the findings of the study it was recommended that teachers should incorporate the use of teachers' communication model into Basic Science and Technology classrooms to enhance students' achievement in the subject.

References

- Agbo, F. O., (2023). Pedagogical dimensions: Breaking the barriers to science teaching and learning through interpersonal communication. University of Jos Inaugural lecture series No 104, 28th March 2023.
- AlAhmad, H. (2021). The role of educational communication in promoting a student-centered learning style in multicultural classrooms: A reflective essay on learning and teaching in higher education. *International Journal of Research in Education and Science (IJRES)*, 7(3), 838-851.
- Ani M. I., Kalu, I. A., Iketaku., R. I., & Obodo, A. C. (2020). Effect of analogies as an innovative approach in enhancing students' achievement and interest in geometry concepts among technical School Students in Benue State, Nigeria. *African Journal of Theory and Practice of Educational Research*, 8 (1), 108-118.
- Babalola, O. E. (2019). *Developing and nurturing a productive reading culture among primary school in Ondo state, Nigeria*. Unpublished Bachelor's Degree Project. Adeyemi College of Education, Ondo, Nigeria
- Balarabe, M. (2016). Effects of psycho-social factors on the students' academic achievement in basic science. *Journal of Research in Science Teaching*, 5 (1), 234-240.
- Chollom, G., A. (2016). *Effects of questioning behaviour modification programme on primary five Basic Science teachers and pupils questions and pupils achievement in Science in Jos South of Plateau State, Nigeria*. Unpublish Ph.D. Dissertation, University of Jos, Plateau State
- Chollom, G.A., Maichibi, P.I., Garba, S., & Achi, M. (2023). Effects of training model on teachers' classroom management behaviours, pupils' feedback, and achievement in basic science, Jos South Plateau State Nigeria. *GPA International Journal of Educational Research*, 6 (4), 54-69
- Dawal, B.S. (2016). Effects of Mastery Learning Approach on Performance of Public Primary School Pupils in Basic Science and Technology in Jos Metropolis, Nigeria. Unpublish Ph.D. Dissertation, University of Jos, Plateau State.
- Dawal, B.S., & Jantur, P.M. (2019). An assessment of the use of activity-based instructional strategy in teaching basic science for global economic growth in Jos-East, Plateau State, Nigeria. *International Journal of Educational Studies*, 2 (1), 94-105.

- Engwa, A.G, (2014). Science and technology in Africa: the key elements and measures for sustainable development. *Global Journal of Science Frontier Research: G Bio-Tech & Genetics*, 14 (2), 17-28
- Musa, J.H., Achor, E.E., & Ellah, B.O. (2021). Fostering achievement and retention in Basic Science using simulation and demonstration strategies. *Journal of Research Instruction*. 1 (2), 95 108
- Nwankwo, G.U., & Okoli, J.N. (2019). Effect of activity-based instruction on secondary school students' achievement in Basic Science. *International Journal of Innovative Research and Advanced Studies (IJIRAS)*, 6 (8), 19-23.
- Ogunjiofor, C.N, (2020). Effects of explicit instruction on students' achievement and attitudetowards basic science. *Nigerian Online Journal of Educational Sciences and Technology (NOJEST)*, 1(2), 19-34
- Stoet, G., & Geary, D.C. (2018). Sex differences in science and math achievement are not what you think. *Psychological Science*, 29 (5), 850-864.
- Sunday, C.T. (2021). Basic science curriculum and development in Nigeria: Post covid-19 challenges and prospects. *Unizik Journal of Educational Research and Policy Studies*, 7, 1-15
- Workman, J., & Heyder, A. (2020) Gender achievement gaps: the role of social costs to trying hard in high school. *Social Psychology of Education*, 23(6):1407–1427, Retrieved October 2 from <https://doi.org/10.1007/>