Exploring the Effectiveness of Two Tiers System of Instruction on Students' Academic Performance in Basic Science

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ABSTRACT

This study explored the impact of learner-instructor-interaction and conventional lecture methods on students' academic performance in basic science in junior secondary schools in Lagos State Education District V, Nigeria. A non-randomized pre-test, post-test, non-equivalent quasi-experimental research design in two intact classes which comprised of 117 students with 50 in experimental group and 67 in control group from two randomly selected junior secondary schools in Amuwo-Odofin zone of the district was used. While students in the control group completed course assignments individually, students in the treatment group completed the assignments in small groups which enable effective students-instructor-interaction. Students' Academic Performance Test (PAPT) and Students' Attitude Questionnaire (SAQ) which were validated by two experts in science education with reliability of 0.79 and 0.87 were used for data collection. Analysis of Covariate (ANCOVA) was used to analyze the null hypotheses at 0.05 level of significant. The results of the study revealed that learner-instructor has a statistically significant effect on students' academic performances [$F(1,115)=14.16$; $p<0.05$; $\eta^2=0.54$]. Students working collaboratively achieved significantly higher than those working individually. Finding also shows that student-instructor fostered a statistically significant positive attitude among learners [$F(1,115)=0.58$; $p<0.05$; $\eta^2=0.41$]. Further finding revealed no statistically significant effect of learner-instructor interaction on students' academic performance and attitude based on school type. According to the study's findings, it is advised, among other things, that learners should be taught utilizing the three-tier system of instruction in order to improve their knowledge in terms of students' learning results. The study concluded that learner-instructor-interaction had an impact on students' academic performances to retention. These shows that students 'academic performance is improved through learner-instructor interaction. This study recommends among others that, students should be taught through learner-instructor interaction in order to promote academic performance.

Key words: academic performance, basic science, school types, two-tier-system.

INTRODUCTION

Academic performance is the desired consequence for a child's academic achievement and attitude. It describes what a student can accomplish, how they can accomplish it, and the performance criteria they must be able to reach. The achievement of the goal can be assessed by examining the students' academic performance and attitude, as well as what is observed prior to the start of the learning activities and what is anticipated once all learning activities have been completed. Academic performance can be summed up as the extent to which a student meets his or her educational objectives, gains the knowledge, skills, and aptitudes required to succeed in school, and maximizes college possibilities while keeping an academic focus. The three criteria for a successful school experience that were most frequently mentioned were academic performance, goal achievement, and skill development. Academic performance is a gauge of a

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student's learning style and academic performance (Ricarda et al., 2017). Performance on standardized tests by students, teachers, and schools gauges how well an institution's educational strategy is working. Exams and other forms of continuing evaluation are the most popular ways to keep track of academic progress. Standardized examinations, performance evaluations, and portfolio evaluations are frequently used to gauge students' academic performance, which is defined as what they have learnt (Benedict, 2010).

According to Fareo (2013), a student's academic success is the desirable shift in behavior that occurs as a result of effective and efficient teaching and learning. This approach is widely used to assess whether educational goals and objectives, particularly those pertaining to the instruction of reading and writing, have been reached. Adeyemi and Adeyemi's (2014) findings, which claimed that students' poor academic performance is mostly caused by their gloomy attitude toward exams, confirm this. The word "attitude" refers to a person's ongoing assessments of various circumstances and objects. A person's attitude is also their own unique manner of thinking, behaving, and acting. As a result of learning experiences, attitudes form; if the experience is favorable, a positive attitude forms; if the experience is negative, a negative attitude forms (Orunaboka, 2011). People's actual behavior is greatly influenced by how they feel. Researchers in management, psychology, and sociology examine how attitudes develop and how they affect and determine later behavior. Negative emotions and "attitude" are all collective terms for dislikes, biases, and prejudices. One's attitude can be viewed as a set of convictions that shape their viewpoint emotionally. People's points of view can be changed by both their personal experiences and the knowledge they learn from others, and both positive and bad attitudes can be taught. One's mood nearly never remains constant from day to day.

The percentage of higher education institutions offering learner-instructor interactions climbed from 34.5 in 2002 to 62.4 in 2011, according to the most recent Sloan Survey conducted in 2013. Similar to this, throughout the same time period, the number of students registered for learner-instructor interactions increased from 1.6 million to 6.7 million. Over 32% of students were reported to have signed up for at least one learner-instructor-interaction during the fall 2011 semester (Allen & Seaman, 2013). Even though interest in learner-instructor connections has grown quickly throughout the world, dropout rates and the percentage of students who are unsatisfied with these interactions have also risen. Poor academic performances are a major issue for teachers and parents since they lead to higher dropout and dissatisfaction rates among students (Carr, 2020).

Ibe and Abonyi (2019) have pointed out that the overemphasis on subject-matter mastery, theory, and excessive examination consciousness against practical orientation toward science-based disciplines is a severe aberration on the quality of science in Nigeria. According to them, this contributed to the failure of the science education program in emerging nations, namely Nigeria. Additionally, Fakomogbon (2018) demonstrated that Nigerian students' attitudes toward basic science are negative. There is an increase in the percentage of students who failed Basic science in Junior Secondary School Certification examination from 2019 to 2022 in Nigeria (Mohammed, 2023).

Table1: JSCE Quality of Performance in Basic Science and Basic Technology (2019-2022)

Exam Subject	2019			2020			2021			2022		
Basic Science	%	%	%	%	%	%	%	%	%	%	%	%
	A1-A3	Credit	Pass	A1-A3	Credit	Pass	A1-A3	Credit	Pass	A1-A3	Credit	Pass
	1.1	47.6	50.2	0.8	45.1	53.5	2.7	42	51.8	0.4	42.7	56.7

From the analysis shown in Table 1, it is evident that less than 50% of the candidates that sat for the examination passed at credit level and above within the years under investigation (Mohammed, 2023). It's probable that the reason for the students' persistently low performance is due to the use of conventional

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methods, insufficient teaching resources, educators who are not so competent to teach the subject etc. Despite its evident drawbacks, the lecture approach is still widely used in Nigeria (Ajiboye, 2017; Ogunmade & Saibu, 2017). Because most classroom instruction is lecture-based, it is clear that most educators do not take into account the interests, needs, and learning preferences of the students. If teaching strategies may be focused on learner-instructor interaction, students' performance in fundamental science will improve. If learner-instructor interaction is used during teaching-learning enterprise, all of these issues can be minimized, if not completely eliminated.

One of the main causes of feelings of isolation in online learning settings, along with course-related and instructor-related concerns, is the level of interaction – both between learners and the instructor as well as among the learners themselves (Chang & Smith, 2018). They further claimed that interactions between students and teachers take place in a variety of ways and across a variety of communication channels (for example, through introduction a bulletin board, the creation of participant profiles, feedback, office hours). The instructor engages with students both individually and collectively; throughout the course, the instructor engages with the entire class frequently (at least once per week) (for example, through a course announcement, generalized feedback on activities or assignments).

According to research by Huger (2022), students' learning results are positively impacted by learner-instructor interaction. Also, Dunee (2022) found that learner-instructor-interaction had a substantial impact on students' performance in literacy. The study examined the effectiveness of learner-instructor interaction on students' academic performance in literacy. Elvis (2019) found that learner-instructor-interaction does not significantly affect students' academic performances. Unlike public schools, which are controlled by the federal, state, or municipal governments in Nigeria, private schools are run by people, organizations, or companies. Finding a private school with characteristics that are essential to them should be a parent's primary goal. More so than parents of children attending public schools, parents of children attending private schools have a financial stake in the educational options their children receive (Olatoye & Agbatogun, 2019). It is necessary to look more closely at the connection between educational factors and student accomplishment.

According to Opokua (2015) and Oginni et al. (2013) the type of school has an impact on students' teaching and learning, and consequently, on their academic performances as a whole. This impact is comparable to that of the educational resources provided to the school. As a result, the type of school affects what is taught, how it is taught, and what resources are accessible. Oginni et al. (2020) claimed that when students lack access to sufficient educational resources, both their academic performances and mental wellbeing suffer. When a teacher and their students get along well, the students prioritize their education. It was determined that better academic quality could be attained through efficient management. A different study by Bedi and Garg (2009) asserted that students who attended private secondary schools received a pay premium of no more than 75% over those who attended public schools. Another study by Guio (2020) shown that student-instructor interaction improves academic performances in public schools more than it does for students in private institutions. In this study, the researcher aims to ascertain how well the three-tier system (learner-instructor-interaction) affects students' academic performances in Lagos State.

Statement of the Problem

Numerous studies conducted over the past ten years have supported the need for better academic performances for students, particularly in terms of their academic performance and attitude toward science in elementary schools. Lagos State's literacy rate is 49.3%, according to the report from the 2021–and 2022 Common Entrance Examination. Additionally, it was reported that 36.47% of students who took the exam succeeded while 63.53% of students who took the common admission exams failed. Claims have been made that current records of learning results have substantially decreased since teachers' practices do not allow for students' active participation; this may be caused by a variety of circumstances, such as teachers' ineffective

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course management and the use of antiquated teaching methods. Learner-instructor-interaction may be one of the measures that might promote students' active engagement in the classroom.

Over a billion youngsters are estimated to be illiterate worldwide. According to Nigeria's Universal Basic Education Commission, regardless of sex or kind of school, 56.3% of primary school students are illiterate, making the country's total number of illiterates above 50 million. It was said that many students in Nigerian secondary schools, both public and private, continue to perform poorly. If Nigerian children's future is concerned, this situation warrants serious concern. Therefore, it is uncertain if education involving learner-instructor-interaction would improve learners' academic performances. This is the study's main focus.

Null Hypotheses

$H0_1$: There is no statistically significant effectiveness of learner-instructor-interaction on academic performance of students.

$H0_2$: There is no statistically significant effectiveness of learner-instructor-interaction on attitude of students.

$H0_3$: There is no statistically significant effectiveness of learner-instructor-interaction on academic performance of students based on school type.

$H0_4$: There is no statistically significant effectiveness of learner-instructor-interaction on attitude of students based on school type.

METHODOLOGY

The study population comprised of all students in junior secondary in Lagos State education District V and simple random sampling technique was used to select two junior secondary schools from the area Amuwo-Odofin zone of the district. A non-randomized pre-test, post-test non-equivalent quasi-experimental research design in two intact classes which comprised of 117 students with 50 in experimental group and 67 in control group was used. Due to the understanding of the administrative limitations that surround getting clearance from the state ministry of education to randomly assign students to groups for this study, an intact class from each group was used. Hence, the quasi-experimental design.

Two instruments were used in the study. Students' Academic Performance Test (PAPT) and Students' Attitude Questionnaire (SAQ). The PAPT had two sections, A and B. Section A contained demographic data while section B contained 25 multiple choice on the concept of man and energy drawn from BECE past examination questions 2017-2022. Each item of the multiple choices had three distracters and one key. The SAQ also contained two sections, A and B. Section A contained demographic data while section B contained 10 items on students' attitude towards basic science drawn on 4-Likert Scale of SA, A, D and SD point rating scale of 4, 3, 2 and 1. These instruments were validated by two experts in science education and reliably tested to yield coefficients of 0.79 and 0.87 respectively.

The students were pretested before the administration of the treatment. The pre-test was used as a covariate to adjust for the subjects' initial differences. This was done to determine whether the achievement and ability levels of the two groups were comparable prior to receiving the treatment. Teacher's Instructional Guide on learner-instructor-interaction (TIGLII) was used to teach the treatment group while and Teacher's Instructional Guide on Lecture Method (TIGLM) was used to teach the students in the control group. While students in the control group completed course assignments individually, students in the treatment group completed the assignments in small groups while interacting with their teacher.

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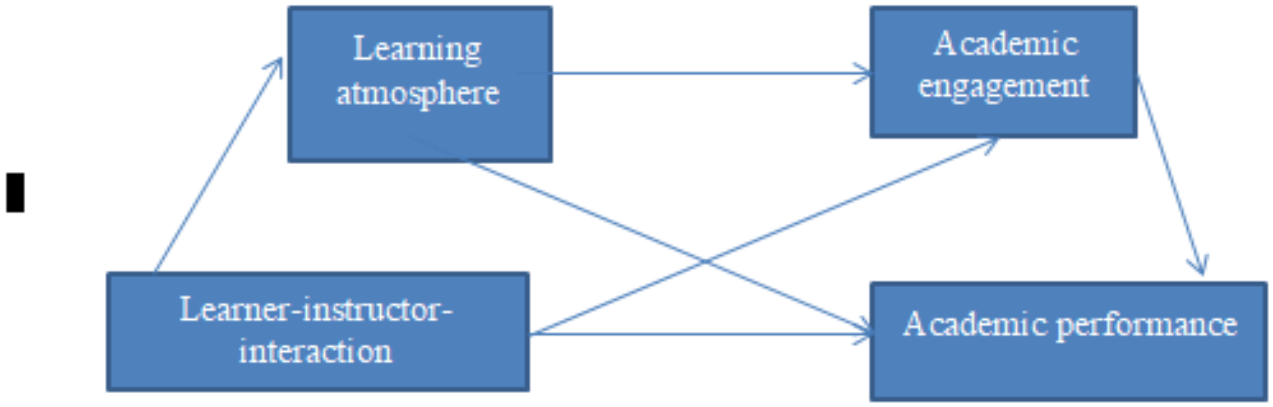

Figure 1: Learner-Instructor -instruction and academic performance at a glance

Implementation of learner-instructor-interaction in classroom

Step 1: Lesson contains activities where the instructor receives students' feedback to determine if there is a need to adapt the direction of the lesson.

Step 2: Lesson as multiple opportunities for interaction between the instructor, individual students, small student groups, and the whole class.

Step 3: Teacher capitalizes on the diversity of students' experiences to generate alternative solutions to problems and to explore students' ideas within the context of the lesson.

Step 4: Teacher includes sufficient time to have meaningful discussions around students' activities and arrive at fully realized responses.

Data Analysis and Results

Analysis of Covariate (ANCOVA) was used to analyze the research hypotheses at 0.05 level of significant.

$H0_1$: There is no statistically significant effectiveness of learner-instructor-interaction on academic performance of students.

Table 2: ANCOVA showing the effectiveness of learner-instructor-interaction on academic performance of students

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	208.049	5	29.721	4.142	.001	.403
Intercept	478.866	1	478.866	66.729	.000	.608
Pretest	6.036	1	6.036	.841	.364	.019
Learner-instructor-interaction	101.627	1	101.627	14.162	.001	.548
Error	308.579	115	7.176			
Total	21359.000	117				
Corrected Total	516.627	117				

a. R Squared = .403 (Adjusted R Squared = .305)

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Table 2 shows statistically significant effectiveness of learner-instructor-interaction on academic performance of students in junior secondary schools [$F(1,115)=14.16$; $p<0.05$; $\eta^2=0.54$]. The effect size as revealed by partial eta squared is 54.8%. Therefore, null hypothesis 1 is rejected because the significant value is less than 0.05.

$H0_2$: There is no statistically significant effectiveness of learner-instructor-interaction on attitude of students.

Table 3: ANCOVA showing the effectiveness of learner-instructor-interaction on attitude of students

Corrected Model	350.222	5	50.032	1.148	.352	.157
Intercept	4547.360	1	4547.360	104.359	.000	.708
Pre-Attitude	87.254	1	87.254	2.002	.164	.014
Attitude	25.216	1	25.216	.579	.041	.043
Error	1873.699	115	43.574			
Total	127831.000	117				
Corrected Total	2223.922	117				

a. R Squared = .157 (Adjusted R Squared = .020)

Table 3 reveals statistically significant effectiveness of learner-instructor-interaction on attitude of students in junior secondary schools [$F(1,115)=0.58$; $p<0.05$; $\eta^2=0.43$]. The effect size is 4.3% which is significant. Therefore, hypothesis 2 is rejected because the significant value is greater than 0.05.

$H0_3$: There is no statistically significant effectiveness of learner-instructor-interaction on academic performance of students based on school type.

Table 4: ANCOVA showing the effectiveness of learner-instructor-interaction on academic performance of students based on school types

Corrected Model	208.049	5	29.721	4.142	.001	.403
Intercept	478.866	1	478.866	66.729	.000	.608
Pretest	6.036	1	6.036	.841	.364	.019
School type	3.526	1	3.526	.491	.487	.011
Error	308.579	115	7.176			
Total	21359.000	117				
Corrected Total	516.627	117				

a. R Squared = .403 (Adjusted R Squared = .305)

Table 4 shows no significant effectiveness of learner-instructor-interaction on academic performance of students in junior secondary schools based on school types [$F(1,115)=0.49$; $p>0.05$; $\eta^2 = 0.01$]. Therefore hypothesis 3 is not rejected because the significant value is greater than 0.05. This implies that school type

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had no significant effectiveness of learner-instructor-interaction on academic performance of students in junior secondary schools.

$H0_4$: There is no statistically significant effectiveness of learner-instructor-interaction on attitude of students based on school type.

Table 5: ANCOVA Showing the significant effectiveness of learner-instructor-interaction on attitude of students based on school types

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	350.222	5	50.032	1.148	.352	.157
Intercept	4547.360	1	4547.360	104.359	.000	.708
Pre-Attitude	87.254	1	87.254	2.002	.164	.044
School type	1.017	1	1.017	.023	.879	.001
Error	1873.699	115	43.574			
Total	127831.000	117				
Corrected Total	2223.922	117				

a. R Squared = .157 (Adjusted R Squared = .020)

Table 5 depicts no significant effectiveness of learner-instructor-interaction on attitude of students in junior secondary schools based on school types [$F(1,115)=0.23$; $p>0.05$; $\eta^2 = 0.001$]. Therefore hypothesis 4 is not rejected because the significant value is greater than 0.05. This implies that school type had no significant effectiveness of learner-instructor-interaction on attitude of students in junior secondary schools.

DISCUSSION OF FINDINGS

According to the study's findings, learner-instructor-interaction significantly improves students' academic performance in junior secondary schools. This suggests that the learner-instructor-interaction two-tiered method of instruction has a beneficial effect on students' academic performances. The application of this training can enhance students' academic achievement. This finding is consistent with research by Huger (2022), and Oginni and Saibu (2019) which showed that student academic performances are positively impacted by learner-instructor interaction.

Additionally, a study by Dunee (2022) examining the impact of learner-instructor-interaction on students' academic achievement in literacy revealed that this interaction has a significant impact on students' performance. This conclusion showed that the two-tier structure has a good impact on academic performances. However, the study by Miracle (2019) found that learner-instructor-interaction has no bearing on students' academic performances. According to Elvis (2019), learner-instructor-interaction does not significantly affect students' academic performances. The results of Hai-Long et al (2022) indicate that teacher–student interaction not only directly affects students' learning effects but also influences students' learning effects through the mediating effect of the psychological atmosphere and learning engagement.

Another outcome of this study indicated that learner-instructor-interaction is significantly effective in influencing students' attitudes in junior secondary schools. This result demonstrated that students' attitudes on the usage of learner-instructor interaction were favorable. This result confirms the findings of Fugos (2019), who found that students in the Kiatum district have a favorable attitude toward the three-tier system

of instruction. More so, study has found that spiritual communication and the exchange of ideas between teachers and students are needed to foster harmonious development for both parties so as to achieve better teaching results (Pennings et al., 2018). Therefore, teacher–student interaction is a reflection of the relationship between teachers and students, and as such teachers and students must communicate emotionally to form spiritual interactions and build a new type of interactive teacher–student relationship (Hai-Long et al., 2022).

Additionally, the study demonstrated that school type had no appreciable influence on students' academic performance in junior secondary. This research suggests that students in both public and private institutions do similarly or equally well academically when employing learner-instructor interaction as a teaching strategy. This research contradicts Guio (2020) shown that student-instructor interaction improves academic performances in public schools more than it does for students in private institutions. According to Bedi and Garg (2000), students who attended private secondary schools received a pay premium of no more than 75% over those who attended public schools. The results of a final study showed that there was no significant impact of school type on student attitudes in junior secondary schools. This suggests that there was no discernible difference between students in public and private institutions in their attitudes toward the usage of learner-instructor interaction. This finding is consistent with Ulam (2018), who demonstrated that students in both public and private schools had favorable attitudes toward the three-tier method of instruction.

CONCLUSION AND RECOMMENDATIONS

It is evident from the study that student-instructor interaction can promote learning and foster a positive attitude among students based on school types. This study therefore came to the conclusion that the three-tier structure of classroom instruction is beneficial in improving academic performances. Based on the findings of the study, the study recommends that:

1. Learners should be taught using the three-tier system of instruction to bring about a great understanding and improvement in academic performance of learners
2. Schools should regularly train and educate teachers on the appropriate instruction to use in teaching learners while exploring the efficacy of the learner-instructor-interaction system.
3. Both public and private schools should be advised to employ the use of three tier system of instruction in the classrooms for effective teaching and appreciable learning outcomes.

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