
**ADEQUACY OF SCIENCE-BASED TEACHERS AND STUDENTS’
ACADEMIC PERFORMANCE IN SCIENCE SUBJECTS IN
SECONDARY SCHOOLS IN YAKURR LOCAL GOVERNMENT AREA
OF CROSS RIVER STATE, NIGERIA**

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ABSTRACT

This study investigated the adequacy of science-based teachers and its influence on students’ academic performance in science subjects in Secondary Schools in Yakurr Local Government Area of Cross River State, Nigeria. Guided by two research questions and corresponding hypotheses, a descriptive research design was adopted. A sample of 435 science students was drawn from Public Secondary Schools using cluster and simple random sampling techniques. Two instruments - Adequacy of Science-Based Teachers’ Questionnaire (ASBTQ) and Science Achievement Test (SAT) - were used for data collection. Data were analyzed using mean, standard deviation, and Analysis of Variance (ANOVA). Results revealed a significant influence of teachers’ competence in the use of instructional materials and teachers’ adequate knowledge of subject matter on students’ academic performance in science subjects. It was concluded that teacher adequacy - in terms of subject mastery and pedagogical competence - is vital for improving science achievement among students. The study recommended that the Ministry of Education should ensure the provision of adequate instructional materials, continuous teacher training, and regular supervision to enhance science teaching and learning outcomes in Secondary Schools.

KEYWORDS: Teacher adequacy, subject matter knowledge, instructional materials, science education, academic performance, and teachers’ competence.

INTRODUCTION

Science education remains a vital instrument for technological development and national progress, as it equips learners with the skills and knowledge required to understand and manipulate their environment. In Nigeria, the quality of science education has become a matter of growing concern due to the persistent decline in students' academic performance in science subjects such as Physics, Chemistry, and Biology (Aina & Ayodele, 2021; Eze & Olatunji, 2021). The competence and adequacy of science-based teachers play a decisive role in determining students' success in these subjects. According to Adesoji and Olatunbosun (2020), students' mastery of scientific concepts largely depends on the teacher's ability to communicate ideas effectively, integrate practical activities, and apply appropriate pedagogical strategies. This implies that the adequacy of science teachers - both in quality and quantity - is indispensable to the achievement of national goals in science education.

Teacher adequacy extends beyond the numerical availability of staff to include their qualification, professional experience, subject-matter competence, and use of instructional materials. In many Nigerian Secondary Schools, particularly in rural areas such as Yakurr Local Government Area of Cross River State, the problem is not only a shortage of science teachers but also insufficient mastery of subject content among those available (Etim & Udo, 2024). Studies have shown that teachers who possess adequate subject knowledge and pedagogical skills are more effective in facilitating students' learning and retention of scientific concepts (Ogunniyi & Adeyemi, 2020; Mensah, 2019). Conversely, inadequate teacher preparation often leads to poor lesson delivery, reduced learner engagement, and low academic achievement (Arowolo & Hassan, 2022).

Empirical findings across Nigeria and other developing Countries consistently reveal a positive correlation between teacher adequacy and students' academic performance in science subjects. For instance, Nwosu and Uzoechi (2021) found that the adequacy of qualified science teachers significantly predicted students' performance in West African Senior School Certificate Examinations. Similarly, Eze and Okoro (2020) demonstrated that students taught by well-trained and adequately resourced teachers performed significantly better in Physics and Chemistry than those taught by underqualified instructors. Furthermore, Oladejo (2021) emphasized that even where instructional materials are available, the teacher's knowledge of how to apply them effectively is crucial to improving learning outcomes. These findings collectively underscore the multidimensional nature of teacher adequacy, which involves professional qualification, mastery of content, access to instructional materials, and teaching experience. According to Obaji (2001) instructional materials cannot only be made available

but adequately too, since without adequate instructional materials, educational objectives cannot be achieved.

Abidoye and Adekunle (2021) examined science students on instructional materials in Ilorin West, Kwara State, Nigeria, using a sample of 120 students and a questionnaire relating to instructional materials; they found that students taught with science instructional materials performed significantly better than those without. This supports the notion that, in contexts like the Yakurr Local Government Area of Cross River State, the degree to which science-based teachers are competent in using instructional materials is likely to relate to students' achievement.

In a relatively similar study, Okeke (1998) asserted that instructional materials when insufficiently available hinders the progress of teaching and learning because of the key roles they play imparting knowledge. According to him Schools would not succeed in teaching and learning without adequate instructional resources. Momoh (2010) conducted a research on "effect of instructional resources on students' performance in West African Senior School Certificate Examination (WASSCE) in Kwara State". The study reveals that materials resources have a significant effect on students' achievement in each of the subjects.

Oladejo (2021) examined the influence of standardized and improvised instructional materials on Secondary School students' achievement in Physics in Oyo State, Nigeria. The study involved three co-educational Secondary Schools and used a pretest - posttest quasi-experimental design. Data were collected through Physics Achievement Tests (PAT) and classroom observation checklists (COC). The findings revealed that both standardized and improvised instructional materials significantly improved students' achievement compared to the control group, although improvised materials were more effective in Schools with limited resources. The strength of this study lies in its rigorous quasi-experimental approach and practical focus on improvised materials, though its limitation is the small sample size which restricts generalization. This study is relevant to the present research in Yakurr as it underscores that teachers' competence in utilizing available or locally improvised materials can enhance science performance, especially in resource-scarce environments.

Ogunniyi and Adeyemi (2020) conducted a study titled Teachers' mastery of subject matter and students' academic achievement in Physics in Osun State, Nigeria. The study sought to determine how teachers' depth of knowledge in Physics influenced students' learning outcomes. Using a correlational design, data were gathered from a sample of 250 Physics teachers and 600 Senior Secondary students across ten Schools. Instruments used included a Teacher Knowledge Assessment Test (TKAT) and a Students' Physics Achievement Test

(SPAT). Findings revealed a strong positive correlation between teachers' mastery of subject matter and students' academic achievement, indicating that teachers with deeper understanding of Physics concepts produced better-performing students. A major strength of the study is its large sample and dual assessment of both teacher and student variables, while its limitation lies in relying primarily on test-based data without classroom observation. The study relates directly to the present research in Yakurr as it establishes that teacher competence in subject content remains a powerful determinant of science achievement.

Shulman (1986) distinguishes between four broad kinds of knowledge that an effective teacher should possess: general pedagogical knowledge; content knowledge; pedagogical content knowledge; and curricular knowledge. Pedagogical knowledge is generally obtained formally through pre- and in-service training and informally through trial- and –error in their own classrooms and through observing their peers.

Similarly, Eze and Olatunji (2021) examined the relationship between teachers' content knowledge and students' academic performance in Chemistry in Enugu State, Nigeria. A total of 12 Public Secondary Schools participated, comprising 48 Chemistry teachers and 480 students. Data were collected through a Chemistry Teacher Competency Scale (CTCS) and a Students' Chemistry Achievement Test (SCAT). Results showed that teachers with higher content knowledge produced significantly better student outcomes, especially in complex topics such as stoichiometry and chemical bonding. The strength of this research lies in its subject-specific focus and statistical rigor using regression analysis. Its weakness, however, is the omission of classroom process variables such as teaching strategies. This study aligns with the Yakurr context by highlighting the need for science teachers not only to have access to instructional resources but also to possess deep conceptual understanding to guide effective use of such resources.

Arowolo and Hassan (2022) carried out a study titled Teachers' knowledge of Integrated Science content and its effect on students' performance in Lagos State Secondary Schools. The population comprised 320 Integrated Science teachers, from which 100 were sampled, along with 500 students. Instruments used were a Teacher Knowledge Questionnaire (TKQ) and a Basic Science Performance Test (BSPT). Findings revealed that students taught by teachers with adequate knowledge of integrated science scored higher in performance tests compared to those taught by teachers with lower subject mastery. The strength of this study is its broad coverage across Schools and its focus on integrated science, which cuts across multiple disciplines. However, its limitation is that it did not assess how teachers' pedagogical knowledge complemented their subject knowledge. This study's implication for

Yakurr is that continuous professional development and retraining are vital to sustain teachers' content mastery, which ultimately enhances students' achievement.

Despite the recognized importance of teacher adequacy in science education, several challenges persist in many Nigerian Secondary Schools. Rural areas such as Yakurr often face acute shortages of qualified teachers, inadequate laboratory facilities, and limited professional development opportunities (Edet, Akpan, & Thomas, 2023). This inadequacy not only undermines the quality of science instruction but also widens the achievement gap between students in urban and rural Schools. Consequently, understanding how the adequacy of science-based teachers influences students' academic performance is vital for addressing disparities in science education and achieving the goals of the Nigerian National Policy on Education (Federal Republic of Nigeria, 2013).

Therefore, the present study investigates the adequacy of science-based teachers and students' academic performance in science subjects in Secondary Schools in Yakurr Local Government Area of Cross River State, Nigeria. It aims to determine whether science teachers in Yakurr possess the requisite qualifications, subject-matter competence, and pedagogical skills necessary for effective teaching. The study also seeks to examine how these factors collectively influence students' academic outcomes in science subjects. By focusing on a rural educational context, this study provides empirical evidence that can guide policymakers, School administrators, and teacher education programs in improving teacher adequacy and enhancing science learning outcomes in Nigeria.

Purpose of the study: The general purpose of the study is to determine the adequacy of science based teachers' and students' academic performance in science subjects in Yakurr Local Government Area of Cross River State, Nigeria. The specific objectives are:

1. To determine the adequacy of teachers' competence in the use of instructional materials on students' academic performance in science subjects.
2. To ascertain the adequacy of teachers' adequate knowledge of subject matter on students' academic performance in science subjects.

Research questions: The following questions are posed to give direction to the study:

1. Does the adequacy of teachers' competence in the use of instructional materials influence students' academic performance in science subjects?
2. Does the adequacy of teachers' knowledge of subject matter influence students' academic performance in science subjects?

Statement of hypotheses: The following hypotheses were formulated to guide the study:

1. There is no significant influence of teachers' adequate competence in the use of instructional materials and students' academic performance in science subjects.
2. Teachers' adequate knowledge of subject matter does not significantly influence students' academic performance in science subjects.

METHODOLOGY

The research design adopted for this study is the descriptive design. The descriptive research design was adopted because it helped in evaluating the influences of the adequacy of science based teachers' and students' academic performance in science subjects. The population of this consists of science students in Public Secondary Schools in Yakurr Local Government Area Education Authority (YLGEA, 2025), there are seventeenth Public Secondary Schools in the local government. Cluster and simple random sampling technique were adopted. The cluster sampling enabled the researcher to draw samples from science students in the Public Secondary Schools clustered in Yakurr Local Government Area. The simple random sampling was then adopted in selecting students to assess the adequacy of science based teachers' and students' academic performance. The sample size for this study consists of 435 science students in Public Secondary Schools in the Local Government Area. Two instruments were used for data collection: Adequacy Science Based Teachers' Questionnaire (ASBTQ) and Science Achievement Test (SAT). The instrument were divided into two parts: part A was designed to measure the demographic characteristics of respondents while part B measured the sub-variables of the independent variables. 4 - point Likert scale was used for the design. The scale contains information such as Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). Validity of a research instrument refers to the extent to which an instrument measures what it is designed to measure. The instruments were validated both face validity and content validity. The instruments were constructed by the researcher and validated by Senior lecturers in Chemistry Education, the Supervisors and other experts in Measurement and Evaluation at the University of Cross River State, Calabar.

Test-retest was adopted to test the reliability of the instrument. Fifteen copies of the questionnaire were administered to fifteen science students in government Secondary School Adun in Obubra Local Government Area, Cross River that was not part of the School selected for the study. After two weeks, the same instruments were administered again to the same students who participated in the first test. The data collected were analyzed using spearman rank correction co-efficient analysis (ρ) and obtained a reliability indices ranging

from 0.89 to 0.92, indicating a high degree of correlation of both scores. The instrument was therefore highly reliable and suitable for the collection of data for the study.

RESULTS

General description of research variables: The variables include: teachers' competence in the use of instructional materials and teachers' adequate knowledge of subject matter and the dependent variable which is students' academic performance in science subjects. The mean scores and standard deviations of the variables are presented in Table 1. The number of respondents used for the study is 435.

Table 1 Summaries of means and standard deviations of the effective variables and achievement in science subjects.

Variable	N	X	Std Dev.
Teachers' competence	435	20.03	3.81
Knowledge of subject matter	435	20.13	3.32
Academic performance	435	27.90	4.73

Source: Fieldwork, 2025

Table 1, showed that teachers' competence in the use of instructional materials has a mean score of 20.03 with a standard deviation of 3.81 while knowledge of subject matter has a mean score of 20.13 and a standard deviation of 3.32, and academic achievement in science subjects has a mean score of 27.90 and a standard deviation of 4.73.

Hypothesis one: There is no significant influence of teachers' adequate competence in the use of instructional materials and academic performance in science subjects.

One-way Analysis of Variance (ANOVA) was used to test the hypothesis at 0.05 level of significance. The result of the analysis is presented in table 3.

Table 2 Mean and standard deviation values of the influence of teachers' competence in the use of instructional materials and academic performance in science subjects.

Variable	N	X	Std. Dev.
Adequate competence	89	21.86	4.26
Moderate competence	178	18.37	3.77
Not adequate	168	20.10	2.88
Total	435	21.03	3.82

Source: Fieldwork, 2025

The result in table 2 above shows that the mean score of teachers with adequate competence in the use of instructional materials ($x = 21.86$) is greater than the mean scores of other

groups. This implies that teachers with adequate competence in the use of instructional materials influence higher performance in students than those with moderate and not moderate competence as shown in the mean values. When these mean differences was tested using one-way analysis of variance as shown in table 3, the result showed that ($F = 32.813^*$, $P < .05$). This implies that the null hypothesis is rejected.

Table 3 One-way analysis of variance (ANOVA) of the influence of teachers' competence in the use of instructional materials and academic performance in science subjects.

Source of variation	Sum of square	Df	Mean square	F	Sig.
Between	837.37	2	418.68	32.81*	.003
Within	5512.18	432	12.76		
Total	6349.55	434			

Source: *Fieldwork (2025)*

Post hoc analysis was further carried out and the result is presented in table 4 below. The result in table 4 shows that ($t = 3.03$, $P < .05$) those in the adequate and moderately adequate group is significant. This implies that teachers with these characteristics of competence influence students' academic performance in science subjects.

Table 4 Result of Fishers' least significant difference (LSD) multiple comparison on influence of teachers' competence on academic achievement in science subjects.

Sub-variable	Variable	1	2	3
		(n = 89)	(n = 178)	(n = 168)
Teacher competence	Adequate	21.15 ^a	2.79	.012
	Moderate adequate	3.03c *	18.36	- .53
	Not adequate	1.17	1.54	21.03
	MSwithin = 12.76			

1 = group along the principal diagonal

2 = means differences above the principal diagonal

3 = critical t-values below the principals diagonals

Source: *Fieldwork (2025)*

Hypothesis two: Teachers' adequate knowledge of subject matter does not significantly influence students' achievement in science subjects.

Table 5 Mean and standard deviation values of the influence of teachers' adequate knowledge of subject and academic achievement in science subjects.

Variable	N	X	Std. Dev.
Adequate competence	161	21.02	4.09
Moderate competence	180	21.15	3.32
Not adequate	194	17.90	3.34
Total	435	21.03	3.82

Source: Fieldwork (2025)

The result of table 5 shows that the mean value of teachers with adequate knowledge in the subject matter ($X = 21.02$) and those in the moderate level of knowledge ($X = 21.15$) is greater than the means of those in not knowledgeable group. This implies that teachers' with and moderate level of knowledge of subject matter influence higher performance in students than those with low level of knowledge of subject matter as shown in their mean values. When these mean differences were tested using one-way analysis of variance as shown in table 6 the result showed that ($F = 24.16^*$, $P < .05$). This implies that the null hypothesis is rejected.

Table 6 One-way analysis of variance (ANOVA) of the influence of teachers' adequate knowledge of subject matter and academic achievement in science subjects.

Source of variation	Sum of square	Df	Mean square	F	Sig.
Between	650.36	2	325.28	24.16*	.000
Within	5698.98	432	13.19		
Total	6349.52	434			

Source: Fieldwork (2025)

Post hoc analysis was further carried out and the result is presented in table 7 below. The result in table 7 shows that the critical t-values for the three groups are all significant. This implies that teachers with adequate knowledge of subject matter influence students' achievement in science subjects.

Table 7 Result of Fishers' least significant difference (LSD) multiple comparison on influence of teachers' knowledge of subject matter on academic achievement in science subjects.

Sub-variable	Variable	1 (n = 161)	2 (n = 180)	3 (n = 94)
Teacher competence	Adequate	21.02 ^a	- 1.25	2.12
	Moderate adequate	3.01*	21.15	3.25
	Not adequate	2.68*	3.16*	17.90
	MS _{within} = 12.76			

- 1 = group along the principal diagonal
- 2 = means differences above the principal diagonal
- 3 = critical t-values below the principals diagonals

Source: Fieldwork (2025)

DISCUSSION OF FINDINGS

1. Teachers' adequate competence in the use of instructional materials and academic achievement in science subject.

The result suggests that teachers' adequate competence in the use of instructional materials influences students' academic achievement in science subjects. This portrays that students' academic performance in science subjects is achieved when science teachers make good use of laboratories, use the science workbook in delivering lessons, allow students carryout experiments in the laboratory and use of appropriate teaching aids in lesson delivery.

The result of this study is in line with Obaji (2001) who was of the view that instructional materials cannot only be made available but adequately too, since without adequate instrumental materials, educational objectives cannot be achieved. Also, Okeke (1998) also asserted that instructional materials when insufficiently available hinders the progress of teaching and learning because of the key roles the play in imparting knowledge.

In support of this findings, reseach work carried out by Momoh (2010) on "effect of instructional materials on students' performance in West African Senior School Certificate Examination in Kwara State, Nigeria". The study revealed that "instructional materials have a significant effect of students' academic achievement in science subjects.

2. Teachers' adequate knowledge of subject matter and students' academic achievement in science subject.

The result of the analysis was significant. Therefore, the null hypothesis was rejected and the alternative accepted. The result implies that teachers with adequate knowledge of subject matter influence students' academic achievement in science subject.

This shows that students' academic performance in science subjects is achieved when teachers: can make students understand what they teach; have a firm grip of the subject they teach; use relevant examples on the topics they teach and know the definition of key concepts.

This findings is in line with Shulman (1987) who asserts that teaching necessarily begins with a teacher understanding what is to be learned and how it is to be taught. The transformation

of a teachers' knowledge of a subject into pedagogical content knowledge occurs by taking what he or she understands and making it ready for effective instruction.

This findings is in line with a study carried out by Olaleye (2013) on "teachers' characteristics as predictor of academic performance of students' in Secondary Schools in Osun State, Nigeria. The result revealed a significant relationship between students' perception of teachers' subject knowledge, work attitude of teachers, teaching skills of teachers and students' academic performance. Thus, if teachers' mastered the subject matter well, students' will like them and there will be a good student performance in subjects offered.

CONCLUSION

Based on the result of the findings, it was concluded that teachers' competence in the use of instructional materials, teachers' adequate knowledge of subject matter influence students' academic achievement in science subjects.

It is therefore necessary for the Ministry of Education in Cross River State to ensure that teachers make use of instructional materials and science equipment in Schools in Yakurr Local Government Area to enhance the effective teaching of science subjects. Hence, students' success in science subjects depends significantly on adequacy of science based teachers that results in improved students' academic achievement.

RECOMMENDATIONS

Based on results of the findings, it was recommended that:

1. Government should provide facilities in Schools such as: good laboratory and instructional materials as it will go a long way to enhance students' academic achievement.
2. There should be regular training for teachers in the use of instructional materials in order to attain students' academic performance in science subjects.

Suggestions for further research

The following areas have been suggested for further research:

1. The scope of this study should be widened to cover both private and federal Secondary Schools in Yakurr Local Government Area of Cross River State.
2. A study of this kind should be carried out by future researchers in another Local Government Area of Cross River State.

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