

TEACHER CHARACTERISTICS AS CORRELATES OF STUDENT'S ACADEMIC ACHIEVEMENT IN SENIOR SECONDARY SCHOOL CHEMISTRY IN KOGI STATE, NIGERIA

BY

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Abstract

This study looked at the relationship between Kogi State pupils' academic success in chemistry and the characteristics of their professors. The study is guided by four distinct objectives, four research questions, and four null hypotheses. The study was designed using a correlational survey approach. 1504 SS2 chemistry students and 122 chemistry teachers from 254 public secondary schools in Kogi State made up the study's population. Using a multi-stage sampling approach, the study's sample consisted of 315 chemistry SCII students and 93 chemistry teachers from 24 coeducational secondary schools. The Chemistry Achievement Test (CAT) and the Teacher Characteristics Questionnaire (TCQ) were the devices utilized to collect the data. Two professionals in the field of educational measurement and assessment validated the tools. Additionally, Prince Abubakar Audu University in Anyigba, Kogi State, Nigeria, has a science education expert. The TCQ and CAT had reliability values of 0.86 and 0.85, respectively, for the devices. Crunbach Alpha for the TCQ and KR20 for the CAT were used to analyze data from a trial test that included 20 chemistry students and 10 chemistry teachers. The respondents received the instruments in their educational institutions. To address study questions, the Pearson product moment correlation coefficient (PPMC) was employed. The hypotheses were tested using regression analysis. The analysis's findings demonstrated that both the teaching style and the teachers' qualifications strongly predicted the academic success of their students in chemistry. Based on the findings, the study recommended among others that teachers should engage students-centered teaching methods for curriculum delivery and government should prioritize those with educational background/qualifications during teacher's recruitments for effective teaching and learning of chemistry in senior secondary schools.

Keywords: Chemistry, academic achievements, teachers' characteristics

Introduction

A body of information, a method of thinking used to understand nature, and endeavors pertaining to the natural world are all commonly referred to as science. According to Aniodoh (2018), science is a collection of knowledge derived from methodical, systematic procedures built upon heuristic observation and experimentation. An important part of human

society is science. It has an impact on political, social, technological, cultural, and even religious activities. Since human engagement with science is inescapable, the importance and worth of science in the current world cannot be overstated (Ekpo,2016). Nigeria is a developing country where there is a growing need for qualified labor with a science background. The first step in achieving this is to acquire and apply science courses at the secondary school level, including chemistry, integrated science, biology, and physics. According to scientific research, the current form of instruction in many secondary schools in Nigeria is based on face-to-face classroom instruction using traditional teaching methods. The majority of teachers use a didactic style of instruction and do not encourage pupils to participate in active learning, as recommended by science. Only chemistry is covered in these listed scientific courses offered in secondary schools in Nigeria.

In Nigeria, chemistry is one of the subjects taught in senior secondary schools. Chemistry is a science discipline that studies the make-up and characteristics of natural materials. It is essential to science and technology, needed by all, and involved in all human endeavors (Abubakar & Eze, 2020). Additionally, chemistry is a topic that many senior secondary school students choose first because they feel it to be more engaging and connected to nature. According to the Federal Ministry of Education's curriculum document (FME, 2004), the overall goals of the chemistry curriculum are to cultivate a passion for the subject, arrange fundamental theoretical and practical knowledge and skills, foster an interest in science, technology, and mathematics, develop a reasonable level of competence that will foster entrepreneurial skills, apply skills to meet the needs of the community by generating wealth and employment, and take advantage of the many career opportunities in chemistry to be well-prepared for further study in the subject. The performance of students in the WAEC and NECO senior secondary certificate examination, which determines whether students can offer chemistry courses like medicine, nursing, pharmacy, forestry, and fisheries among others in the university and other tertiary institutions, is the only way to know if these general objectives of the chemistry curriculum are being achieved, especially the basic concepts and principles of chemistry as preparation for further studies.

Any culture that wants to live a useful life must understand chemistry. It is at the center of producing the resources required for any country's socioeconomic, scientific, and technological growth, including those related to industry, housing, transportation, agriculture, and medical. Chemical products, including medicines, cosmetics, paints, soaps, and fertilizer, among others, give life greater meaning. Since chemistry encompasses a wide range of disciplines, as previously mentioned, its significance for the growth of the national economy cannot be overstated.

The literature shows that students perform poorly in chemistry despite the subject's popularity and significance for the development of the country (Nwankwo and Okigbo, 2021). The WAEC Chief Examiners' report also showed that candidates' performance in chemistry paper 2 as of 2018 (mean score of 29 with standard deviation of 13.78) was lower than that of candidates in 2017 (mean score of 47 with standard deviation of 13.78). Furthermore, it was said that applicants' performance in chemistry paper 3 as of 2018 (mean score of 24 with a standard deviation of 9.95) was inferior to that of candidates in 2017 (mean score of 26 with a standard deviation of 8). These evaluations of the results show that students' performance in chemistry has decreased for those years. On the other hand, the West Africa Examination

Council (WAEC) 2019 results for chemistry showed a 43.02% failure rate; in 2020, the same percentage was 42.61%; in 2021, the failure rate was 33%; and the most recent WAEC results, from 2022, indicated that only 38.68% of students passed chemistry (WAEC, 2022). These results corroborated the findings of Uchegbu et al.'s (2015) study, which found that relatively few students perform well on the Secondary School Certificates Examinations (both WAEC and NECO) in the subject of chemistry.

According to Hanson (2010), academic achievement is the quantity of knowledge that students learn as a result of being exposed to and participating in curriculum content. Additionally, academic accomplishment is defined as how students' learning outcomes relate to a curriculum's predetermined purpose (Stinebrickner & Stinebrickner, 2019). Thus, a student's academic accomplishment is determined by their level of academic competence. Academic accomplishment is "academic achievement which includes curricular and co-curricular achievement of the students," according to Mehta (2016). It displays the pupils' learning objectives. Consequently, it is impossible to overstate the significance of students' academic success. First, the degree to which an individual has attained their educational goals determines their academic achievement. Students experience both periods of academic success and failure during their academic careers, and this needs to be evaluated in order to encourage growth and leverage educational advancement. Success in educational institutions is determined by students' academic performance in certain areas, and teachers carry out this assessment.

A teacher is someone who shares knowledge with others, provides care when necessary, and has the qualities of kindness, love, and patience (Dasco, 2020). A teacher is a person who has been professionally trained, recognized, and employed to support learning both within and outside of the classroom in order to accomplish predefined goal(s).

Most academics and researchers concur that school characteristics, such as teacher administration, have a greater impact on academic attainment than other variables (Patrick, 2019). There is no denying the teachers' crucial role in education. Teachers have a significant impact on their students' classroom practices, particularly at the senior secondary school level. In order to have an impact on students' academic achievement, a teacher must possess and utilize particular qualities. A teacher must be effective in order for students to draw the connection between what they learn in school and how it applies to solving problems in real life. The general conclusion that the empirical data to date does not find a substantial role for teachers in the determining of academic achievement is the result of a lack of agreement on the significance of certain teacher aspects. This study looked at the qualities of teachers in Kogi State, Nigeria, as a key component of students' academic success in senior secondary school chemistry.

The phrase "teacher's characteristics" refers to a teacher's qualifications for the knowledge required to investigate various approaches, address learning challenges, and establish the supportive atmosphere required to make a topic easier to understand (Shittu and Oanite, 2020). It might be called attributes that come from their academic or professional records or that can be assessed through examinations. According to Ali (2020), there is a statistically significant correlation between the academic accomplishment of students and the characteristics of their teachers. According to Adeyemo (2018), classroom teaching and

learning are influenced by the characteristics of the teachers. According to Olaloye (2019), there is a correlation between the attributes of teachers and the academic achievement of their students. The teaching style and the teacher's credentials are the teachers' attributes for the purposes of this review.

The term "teaching methods" describes recurring educational procedures that can be used by multiple teachers and are relevant to a variety of topic areas. It is a series of interactions between educators and learners that are meant to be left to the accomplishment of predetermined learning goals. A chemistry teacher needs to be able to apply a variety of science teaching methodologies where they are most useful and applicable in order to give instruction effectively (Omwirhiren & Ibrahim, 2016). Udu (2018) asserts that choosing the right instructional delivery strategy promotes effective teaching practices and supports student learning. Because of this, chemistry teachers ought to place less emphasis on the traditional, teacher-centered "chalk talk" methods of instruction. For controlled reading and math study sessions, this method pairs up high achievers with low achievers or those with similar accomplishments (Rohrbeek, 2018). Isah (2020) looked at how teaching strategies affected secondary school pupils' academic achievement. The study's conclusions showed that most teachers' pedagogical choices have a significant impact on their pupils' academic achievement.

The fundamental training that an educator must complete in order to practice in the teaching profession is known as their teacher qualification. A teacher with greater qualifications could utilize instructional strategies and resources more effectively than one with less training (Solomon 2020). Etibon (2021) looks into the credentials and experience of teachers as factors that affect the quality of chemistry instruction in Nigeria's Akwa Ibom State. The outcome demonstrates that teacher qualifications had a major impact on the caliber of chemistry instruction. Additionally, Machingambi (2021) looked at how teachers' credentials affected students' performance in A-level science at a particular secondary school in the Mutare district of Zimbabwe's Manicalance Province. He also agreed that hiring qualified teachers is essential in any educational system.

Numerous advantages have been reported in the literature for instructors and students during in-class instruction. Since it promotes student inclusion and enhances the classroom environment, the social consequences of outstanding teachers' traits are also beneficial (Malone et al., 2019). Certain discoveries have led to a decline in student achievement, particularly in secondary education. This can be ascribed to various aspects of teachers, including their credentials, their classroom experience, and their consistency. Therefore, immediate action is required to improve the situation if pupils are performing poorly in Chemistry. In order to ascertain this, the study's use of teachers' attributes as a predictor of students' academic success in chemistry is required.

Statement of the Problem

Chemistry is essential to the physical sciences, permeates almost every facet of life, and is essential to the survival of humans. Chemistry has been seen as a challenging subject even though it is a fundamental science with enormous benefits for students, society, and the national economy. In addition, the degree and rate of chemical failure among students raise serious concerns about chemistry education, student performance in the subject generally, and the school, society, and country at large. The appalling performance in chemistry and

other related sciences documented in the NECO/WAEC Annual report for 2018–2021 (WAEC, 2018–2021) exacerbates these circumstances even further. Poor teachers' characteristics were identified by Ukor & Neji (2018) as a major contributing cause to the large failure of pupils in chemistry on both the WAEC and NECO tests, however many other factors may also be at play. The low chemistry achievement of pupils can be attributed to a number of teacher qualities, including a shortage of experienced and trained educators. Therefore, it is necessary to conduct an empirical investigation to determine the correlation between the attributes of teachers and the academic performance of pupils in senior secondary school chemistry. Thus, the issue posed by this study is: What is the connection between the qualities of teachers and the academic success of their students in the subject of chemistry?

Purpose of the Study

The main purpose of the study was to find out how teachers' characteristics correlates with students' achievement in senior secondary school chemistry in Kogi state. Specifically, the study sought to:

1. Finding the relationship between teachers teaching methods and students' academic achievement in chemistry in Kogi State.
2. Investigate the relationship between teachers' qualification and students' academic achievement in chemistry in Kogi State.

Research Questions

The following research questions guided this study:

1. What is the relationship between teachers' teaching method and students' academic achievement in chemistry in Kogi State?
2. What is the relationship between teachers' qualification and students' academic achievement in chemistry in Kogi State?

Hypotheses

The study was guided by two hypotheses tested at 0.05 alpha level.

HO₁: There is no significant relationship between teachers teaching methods and students' academic achievement in chemistry

HO₂: There is no significant relationship between teachers' qualification and students' academic achievement in chemistry

Methodology

The study was designed using a correlational survey approach. At the time of the study, 1504 senior secondary school II (SS 2) chemistry students from 254 public secondary schools in Kogi State and 122 chemistry teachers made up the study's population. Ninety-three (93) chemistry teachers and three hundred and fifteen (315) SSII chemistry students made up the study's sample, which was drawn via a multistage sampling technique from twenty-four coeducational secondary schools. The Teachers' Characteristics Questionnaire (TCQ), a

structured questionnaire, and the Chemistry Achievement Test (CAT) were the tools utilized to gather data. At Prince Abubakar Audu University in Anyigba, Kogi State, Nigeria, two experts in educational measurement and evaluation and one specialist in science education approved the instruments. The TCQ and CAT had reliability values of 0.86 and 0.85, respectively, for the devices. This was ascertained by use Cronbach's Alpha (for the TCQ) and KR20 (for the CAT) to analyze data from a pilot test that included ten chemistry teachers and ten pupils. The respondents received the instruments at their classrooms, and the data was analyzed using regression analysis and Pearson Product Moment Correlation (PPMC) to test the null hypothesis at the 0.05 level of significance.

Results

Research question One To what extent do teachers' teaching methods correlate with students' academic achievement in Chemistry in Kogi State?

Table 1

Pearson's Product Moment Correlation Analysis of the Predictive Power of Teachers' Teaching Methods on Students' Academic Achievement in chemistry

Variable	\bar{x}	SD	N	r	R ²
Teachers' Methods of teaching	20.38	2.136	93	0.66	0.44
Students' Academic Achievement	70.32	7.064			

R² = coefficient of determination

The study's findings, which are displayed in Table 1, demonstrate the correlation coefficient between the instructional strategies used by teachers and the academic success of their pupils in Chemistry in Kogi State, Nigeria. The results indicate that there was a 0.66 correlation coefficient between the academic achievement of students in Chemistry and the teaching strategies used by the teachers. This indicates that there was a correlation between students' academic success in Chemistry and the teaching strategies used by the teachers. With a correlation coefficient of 0.66, the predictive value, or coefficient of determination, is equal to 0.44. The coefficient of determination (0.44) indicates that the instructional strategies used by teachers in Chemistry account for 44% of the academic achievement of pupils in the subject. This suggests that up to 44% of students' academic success in Chemistry can be predicted by the ways in which professors teach the subject. This is an indication that 56% of students' academic achievement in Chemistry is predicted by other factors than teachers' teaching methods.

Research question Two: To what extent does teachers' qualification correlate with students' academic achievement in Chemistry in Kogi State?

Table 3

Pearson’s Product Moment Correlation Analysis of the Predictive Power of Teachers’ qualification on Students’ Academic Achievement in chemistry

Variable	\bar{x}	SD	N	r	R ²
Qualification	16.86	2.470	93	0.56	0.31
Students’ Academic Achievement	70.32	7.064			

R² = coefficient of determination

The correlation coefficient between teachers' qualifications and students' academic achievement in Chemistry in Kogi State, Nigeria, is displayed in Table 3 as a result of the study. The findings indicate that there was a 0.56 correlation coefficient between the academic achievement of students in Chemistry and the qualifications of their teachers. This indicates that there was a correlation between students' academic success in Chemistry and the qualifications of the professors. The correlation coefficient of 0.56 is correlated with a coefficient of determination (predictive value) of 0.31. The coefficient of determination (0.31) indicates that teachers' Chemistry qualifications predict 31% of students' academic progress in Chemistry. This suggests that up to 31% of students' academic success in Chemistry can be predicted by the qualifications of their lecturers. This is an indication that 69% of students’ academic achievement in Chemistry is predicted by other factors order than teachers’ qualifications.

Hypothesis One: There is no significant relationship between teachers teaching methods and students’ academic achievement in Chemistry.

Table 2

Regression Analysis of Teachers’ Teaching Methods and Students’ Academic Achievement in Chemistry

Model	Sum of Squares	Df	Mean Square	F	Sig.	Dec.
Regression	1.963	1	1.963	0.039	0.00	S
1 Residual	4588.359	92	50.422			
Total	4590.323	93				

$\alpha = 0.05$, S = Significant

The regression analysis of the impact of instructors' instructional strategies on students' academic performance in Chemistry in Kogi State, Nigeria, is displayed in Table 2. The outcome demonstrates that an exact probability value of 0.00 was related with an F-ratio of

0.039. When the hypothesis was tested, this precise probability value of 0.00 was determined to be less than the 0.05 level of significance, and the result was deemed significant. The conclusion reached is that, in Kogi State, Nigeria, teachers' teaching methods significantly predict students' academic achievement in Chemistry. This rejection of the null hypothesis, which claimed that there is no significant relationship between teachers' teaching methods and students' academic achievement in Chemistry, follows. This also implies that teachers' teaching methods is a significant predictor of students' academic achievement in Chemistry.

Hypothesis Two: There is no significant relationship between teachers' qualification and students' academic achievement in Chemistry

Table 4

Regression Analysis of Teachers' Qualification and Students' Academic Achievement in Chemistry

Model		Sum of Squares	Df	Mean Square	F	Sig.	Dec.
1	Regression	82.990	1	82.990	1.676	0.00	S
	Residual	4507.333	92	49.531			
	Total	4590.323	93				

$\alpha = 0.05$, S = Significant

Table 4 presents the findings of a regression study examining the influence of instructors' qualifications on the academic achievement of Chemistry students in Kogi State, Nigeria. The outcome demonstrates that an exact probability value of 0.00 was related with an F-ratio of 1.676. When the hypothesis was tested, this precise probability value of 0.00 was determined to be less than the 0.05 level of significance, and the result was deemed significant. The conclusion reached is that, in Kogi State, Nigeria, teachers' qualifications significantly predict students' academic achievement in Chemistry, rejecting the null hypothesis, which claimed that there is no significant relationship between teachers' qualifications and students' academic achievement in Chemistry. This suggests that a strong predictor of pupils' academic performance is the qualifications of teachers.

Discussions of the Findings/Results

Teachers' teaching methods correlate with students' academic achievement in Chemistry in Kogi State

The study's conclusion reveals that teachers' instructional strategies predict 44% of students' academic success in chemistry. Additionally, the results showed that in Kogi State, Nigeria, students' academic achievement in Chemistry is significantly ($p < 0.05$) predicted by the teaching methods used by their professors. This suggests that students' academic success in Chemistry is significantly predicted by the teaching strategies used by their teachers. This supports the findings of Isa et al. (2020), who discovered that a significant impact is made on

students' academic performance by the majority of teachers' pedagogical approaches. The results also corroborate those of Okwuduba and Okigbo (2018), who examined the impact of instructional strategies on Nigerian students' academic achievement in chemistry and discovered a substantial correlation between teachers' strategies and found that there was a significant relationship. In his research, Onwirihien et al. (2016) contended that there is no discernible variation in the academic achievement of male and female students who get demonstrative instruction in chemistry between the methods used by their lecturers. According to Aniodoli et al. (2018), in order to foster comprehension and raise academic accomplishment, creative student-centered instructional approaches must be adopted. The findings show that students' academic success in chemistry was significantly impacted by the instructional strategies used by their teachers. The conclusion might have been reached because the teacher enhances learning through the use of instructional methods. That teachers should switch from teacher-centered to student-centered methods of instruction, and that the more a teacher uses a student-centered approach, the more likely it is that children will do better academically.

Teachers' qualification correlates with students' academic achievement in Chemistry in Kogi State

According to the study's findings, teachers' qualifications account for 31% of students' academic success in chemistry. The results also showed that, in Kogi State, Nigeria, students' academic achievement in chemistry is significantly predicted by the qualifications of their teachers. This suggests that chemistry students' academic success is predicted by the teaching credentials of the lecturers. This is consistent with the findings of Etiubon et al. (2021), who discovered that the credentials and experience of teachers had a major impact on the caliber of chemistry instruction. The results are likewise consistent with those of Machingambi, (2021) et al., who discovered that a teacher's credentials have a significant impact on pupils' academic achievement. This finding suggests that students' academic success in chemistry is significantly influenced by the qualifications of their teachers. This result conflicts with that of Ajayi, Onibeju, and Olutayo (2020); Kosqei (2011), who found no evidence of a substantial correlation between the academic achievement of biology students and the qualifications of their professors. A teacher's qualifications show what kind of training they have had before beginning their career as teachers. The study may have been conducted because more experienced educators are thought to be better equipped to focus on the most suitable methods of teaching specific subjects to pupils with varying backgrounds, aptitudes, and levels of prior knowledge. Therefore, it is necessary and recommended to integrate teachers' qualifications to make learning meaningful in order to improve students' academic performance.

Conclusion

The study's conclusions led to the following deduction. This study has shown that academic achievement of students is significantly predicted by teacher-related characteristics, such as teaching style and certification. According to the study's findings, teachers' instructional strategies can predict 44% of students' academic success in chemistry. The study's conclusion indicates that 31% of students' academic accomplishment in Chemistry is predicted by instructors' qualifications, and that teachers' teaching strategies significantly ($p < 0.05$) predict

students' academic achievement in Chemistry. The study's conclusion demonstrates that students' academic success in Chemistry is significantly predicted by the qualifications of their teachers.

Recommendations

Based on the findings, the following recommendations were made.

1. Teachers should adopt engaging student-centered teaching methods in teaching the subject as this will make learning of Chemistry more exciting for students and potentially improve their academic achievement in the subject.
2. The Ministry of Education should consider qualification of applicants into teaching positions before recruiting them. A minimum of NCE in the teaching subject being applied for should be the benchmark. Where higher qualifications are required, priority should be given to graduates of the field of education, like B.Ed, M.Ed, and P.h.D in Education. This is because these graduates have acquired the pedagogical knowledge to teach the content for which they are being recruited, unlike their counterparts who did not go through Faculties of Educations.
3. Chemistry teachers in collaboration with the school should organize training program for the students in order to engage them with the necessary skills to enhance their academic achievements.

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