Assessment of the Quality and Quantity of Teachers in the Teaching and Learning of Chemistry in Senior Secondary Schools in Kogi State, Nigeria

Abimaje Etimane SHAIBU [1] and **Jonah Godwin AMEH** [2]

[1] Department of Science Education, Faculty of Education, Prince Abubakar Audu University Anyigba, Kogi State, Nigeria.

[2] Department of Science Education, Faculty of Education, University of Nigeria Nsukka, Nigeria

How to Cite this Article:

Shaibu, A. E. & Ameh, J. G. (2024). Assessment of the Quality and Quantity of Teachers in the Teaching and Learning of Chemistry in Senior Secondary Schools in Kogi State, Nigeria. *VillageMath Educational Review (VER), 6(1)*, 113-123. https://ngsme.villagemath.net/journals/ver/v6i1/shaibu-ameh

Abstract

This study assessed the quality and quantity of teachers in the teaching and learning of chemistry in senior secondary schools in Kogi State, Nigeria. The study was guided by three specific purposes, with three corresponding research questions and one null hypothesis. The study adopted descriptive survey research design with the population of 1597chemistry students in SSII in 285 government-owned public senior secondary schools in Kogi State, Nigeria. 320 SSII students were sampled using multi-stage sampling technique. Assessment of the Quality and Quantity of Senior Secondary School Chemistry Questionnaire (AQQSSSCQ) was used as an instrument. Cronbach alpha was used to determine the internal consistency of the instrument with reliability coefficient of 0.74. Mean and standard

Assessment of the Quality and Quantity of Teachers in the Teaching and Learning of Chemistry in Senior Secondary Schools in Kogi State, Nigeria

114

deviation were used to answer the research questions while t-test was used to test the hypothesis at 0.05 level of significance. The findings of the study revealed among others that teachers who teach chemistry in senior secondary schools are of good quality. Also, the findings revealed that the quantity of teachers that teach chemistry is low as some schools have no chemistry teachers while others just have one teacher teaching all chemistry classes in the school. The findings showed that male and female students differ significantly in their performance in senior secondary school chemistry. Based on the findings of the study, it was recommended among others that the quantity of chemistry teachers should be increased by the government recruiting qualified chemistry teachers regardless of gender.

Keywords: Assessment, Chemistry, Quality of Teachers, Quantity of Teachers, Academic Performance, Chemistry Education

Introduction

The teaching and learning of chemistry in senior secondary schools play a critical role in shaping the scientific and technological development of any nation. According to Anne (2019), chemistry is defined as the scientific study of matter, its properties, and interactions with other matter and with energy. Chemistry, as a core science subject, is pivotal for male and female students pursuing careers in fields such as medicine, engineering, and environmental science. However, the effectiveness of chemistry education largely depends on the quality and quantity of teachers available to deliver the curriculum. In Kogi State, Nigeria, concerns have been raised regarding the adequacy of chemistry teachers, both in terms of their qualifications and their numbers, to meet the demands of effective teaching and learning in senior secondary schools.

The quality of chemistry teachers is a significant determinant of students' academic success and overall interest in the subject. High-quality teachers are those who possess not only the academic qualifications and content knowledge required to teach chemistry but also the pedagogical skills necessary to engage students effectively. According to recent studies, there is a direct correlation between teacher quality and student performance in chemistry. For instance, Olaniyan *et al.* (2022) found that students taught by teachers with higher qualifications and better teaching skills consistently outperform their peers in standardized chemistry examinations. This underscores the importance of ensuring that chemistry teachers in Kogi State are well-trained and equipped with the necessary skills to foster a deep understanding of the subject among students.

Moreover, continuous professional development (CPD) is essential for maintaining and improving teacher quality. CPD programmes help teachers stay updated with the latest developments in their field, including new teaching methodologies, technological advancements, and curriculum changes. Unfortunately, many chemistry teachers in Kogi State have limited access to such opportunities, which affects their ability to deliver the curriculum effectively. Akinyemi and Olowokere (2021) highlighted that the lack of CPD initiatives in Kogi State has resulted in a teaching workforce that is ill-prepared to meet the challenges of modern chemistry education. This situation is particularly problematic in an era where scientific knowledge is rapidly evolving, and teaching strategies must adapt accordingly to remain effective.

In addition to the quality of teachers, the quantity of chemistry teachers available in senior secondary schools in Kogi State is another pressing issue. The teacher-student ratio is a critical factor in determining the effectiveness of classroom instruction. Schools with insufficient numbers of teachers often face challenges such as overcrowded classrooms, reduced instructional time, and diminished opportunities for individualized attention, all of which negatively impact student learning outcomes (Adesina & Musa, 2021). In many schools across Kogi State, the shortage of qualified chemistry teachers has led to a situation where one teacher is responsible for teaching large numbers of students, thereby stretching their capacity to provide quality education.

The uneven distribution of chemistry teachers across secondary schools in Kogi State further exacerbates the problem of teacher quantity. Some schools may have relatively better access to qualified chemistry teachers, while other schools often struggle to attract and retain such teachers. This disparity creates significant educational inequalities, with some students being at a disadvantage in terms of access to quality chemistry education (Okeke & Ibrahim, 2021). As a result, students in these schools may perform poorly in chemistry compared to their counterparts in another schools, therefore widening the gap in educational attainment between different regions of the state.

Addressing the issues related to the quality and quantity of chemistry teachers in Kogi State requires a multifaceted approach. This includes improving teacher recruitment processes to attract more qualified candidates, providing ongoing professional development opportunities, and implementing policies that ensure an equitable distribution of teachers across all schools. Additionally, enhancing the working conditions and remuneration of chemistry teachers could help reduce the high turnover rates and encourage more teachers to remain in the profession, thereby stabilizing the teaching workforce (Onyishi & Nnadi, 2022).

Moreover, research by Adamu and Lawal (2023) reveals that the effectiveness of chemistry teaching is also compromised by insufficient teaching resources and inadequate infrastructure. These factors not only affect the quantity of instruction but also diminish its quality and impact student outcomes. The disparity in teacher qualifications and the challenges faced in maintaining updated teaching practices necessitate a thorough assessment to address these issues and enhance the overall quality of chemistry education in Kogi State (Okoro & Ahmed, 2024).

Addressing these concerns requires a comprehensive assessment of the current state of chemistry teaching, focusing on both the number of teachers and their professional capabilities. Such assessments are essential for developing targeted interventions and policies aimed at improving chemistry instruction and aligning educational practices with contemporary standards (Nwaji & Onwuchekwa, 2024). By systematically analyzing these aspects, stakeholders can better support educators and foster a more effective learning environment for male and female students.

Statement of the Problem

In Kogi State, Nigeria, the effectiveness of chemistry education at the senior secondary school level is undermined by critical issues related to both the quality and quantity of

Assessment of the Quality and Quantity of Teachers in the Teaching and Learning of Chemistry in Senior Secondary Schools in Kogi State, Nigeria

116

teachers. Despite the importance of chemistry in preparing students for scientific and technological careers, there is growing concern about the insufficient number of qualified chemistry teachers and the varying levels of instructional quality. Reports indicate that many schools struggle with a shortage of adequately trained educators, outdated teaching methods, and inadequate professional development opportunities (Bello & Olanrewaju, 2023; Ibrahim & Shittu, 2024). These challenges not only affect male and female students' academic performance but also limit their engagement with and interest in the subject. As such, a comprehensive assessment of the current state of chemistry teaching is necessary to address these issues and improve the overall quality and quantity of education in Kogi State, Nigeria.

Purpose of the Study

The purpose of this study was to assess the quality and quantity of teachers in the teaching and learning of chemistry in Senior Secondary Schools in Kogi State, Nigeria.

Specifically, the study was intended to:

i. Find out the quality of teachers who teach chemistry in senior secondary schools in Kogi State.
ii. Find out the quantity of teachers that teach chemistry in senior secondary schools in Kogi State.
iii. Determine the difference between the mean academic performance of male and female students in chemistry.

Research Questions

The study was guided by the following research questions:

i. What is the quality of teachers that teach chemistry in senior secondary schools in Kogi State?
ii. What is the quantity of teachers that teach chemistry in senior secondary schools in Kogi State?
iii. What is the difference between the mean academic performance of male and female students in chemistry?

Research Hypotheses

i. There is no significant difference between the mean academic performance of male and female students in chemistry.

Methodology

This study adopted a descriptive survey research design. The area of study was Kogi State, Nigeria. The population for this study comprised 1,597 SSII chemistry students in the 285 public senior secondary schools in Kogi State. The use of only public senior secondary schools is based on the ground that they operate uniform chemistry curriculum standards. The sample for this study comprised 320 SSII chemistry students, with sample size determined using Taro Yamane formula. A multi-stage sampling procedure was used to select the sample, and this type of sampling procedure is used because the selection involves more than one stage. At the first stage, simple random sampling technique by balloting with replacement was used to sample 4 Local Government Areas (LGAs) from the 21 LGAs in Kogi State. At the second stage, purposive sampling technique was used to select (8) public

senior secondary schools from each of the sampled LGAs in the State, giving a total of 32 out of 285 public senior secondary schools in Kogi State. Purposive sampling technique was used to select only schools with chemistry teachers. At the third stage, purposive sampling technique was used to select one arm out of 2 or 3 arms of SSII classes with chemistry students. At the fourth stage, simple random sampling technique was used to select 10 chemistry students from the 32 schools, giving a total of 320 SSII chemistry students. Assessment of the Quality and Quantity of Senior Secondary School Chemistry Questionnaire (AQQSSSCQ) was used as an instrument for data collection while the mean difference between the academic performance of 320 male and female students was determined using end of the session results of chemistry students for 2021, 2022, and 2023 respectively in the sampled schools. The questionnaire was divided into two sections. Section A is concerned with the demographic or bio data of the respondents while section B is concerned with the information required for the study. The term and scaling points used in rating the responses of the respondents to the items in the instruments was a modified Likert-type four-point rating scales with the numerical values of Strongly Agreed (SA) = 4, Agreed (A) = 3, Disagreed (D) = 2 and Strongly Disagreed (SD) = 1 for positive items and Strongly Agreed (SA) = 1, Agreed (A) = 2, Disagreed (D) = 3, and Strongly Disagreed (SD) = 4 for negative items assigned to the points is used in seeking answers to the research questions. The cut-off point for the rating scale is 2.50, obtained by dividing the sum of the numerical values by the number of scaling items. The questionnaire was face-validated by three experts in Educational Measurement and Evaluation and one expert in Science Education from Prince Abubakar Audu University Anyigba, Kogi State, Nigeria. To ensure the internal consistency of the instruments, the final draft of the instruments was trial tested on 20 SSII chemistry students with the reliability coefficient of 0.74. The researchers visited each of the sampled schools and administered the questionnaires to the students and waited to collect the filled-out questionnaire same day to ensure high return rate. Mean and standard deviation was used to answer all the research questions, while t- test was used to test the hypothesis at 0.05 level of significance.

Results

Results of the study is presented according to research questions posed and the hypothesis formulated.

Research Question One

What is the quality of chemistry teachers that teach chemistry in senior secondary schools in Kogi State?

Table 1: Mean and Standard Deviation of Students' Responses on the Quality of Chemistry Teachers that teach chemistry in Senior Secondary Schools in Kogi State

S/N	Item Statement	Mean	SD	Decision
1.	Teachers teaching chemistry in my school have NCE	2.71	1.20	Agree
2.	Teachers lack knowledge of the subject matter.	1.49	.98	Disagree

Assessment of the Quality and Quantity of Teachers in the Teaching and Learning of Chemistry in Senior Secondary Schools in Kogi State, Nigeria

118

S/N	Item Statement	Mean	SD	Decision
3.	Our chemistry teachers have strong communication skills	2.96	1.07	Agree
4.	Non specialist trained teachers are allowed to teach chemistry in my school	2.17	1.08	Disagree
5.	Teachers teaching chemistry in my school have B.Sc.Ed	3.52	.68	Agree
	Cluster Mean	**2.57**	**-**	**Agree**

N= 320 (Students);   Mean response < 2.50 = Disagree; Mean response ≥ 2.50 = Agree

Table 1 presents findings from analysis of data collected to determine students' responses on the quality of chemistry teachers that teach chemistry in senior secondary schools in Kogi State. The result shows that respondents agreed to items 1, 3, and 5, with mean responses ranging of 2.71, 2.96 and 3.52 respectively. This implies that students agree that chemistry teachers in their school possess an NCE certificate, have strong communication skills and possess BSc.Ed certificate. Respondents however disagreed to items 2 and 4, with mean responses of 1.49 and 2.17 respectively. This is an indication that chemistry teachers have good knowledge of the subject matter and specialist trained teachers are allowed to teach chemistry in senior secondary schools in Kogi State. The cluster mean of 2.57, which is greater than the benchmark mean of 2.50 for "agree" indicates that majority of the teachers who teach chemistry in Kogi State are of good quality.

Research Question Two

What is the quantity of chemistry teachers that teach chemistry in senior secondary schools in Kogi State?

Table 2: Mean and Standard Deviation of Students' Responses on the Quantity of Chemistry Teachers that teach chemistry in Senior Secondary Schools in Kogi State

S/N	Item Statement	Mean	SD	Decision
1.	Teachers teaching chemistry in our schools are many	1.64	1.08	Disagree
2.	One teacher teaches chemistry in all arms of senior secondary school in my school	3.68	.60	Agree
3.	There is no chemistry teacher in our school	1.34	.74	Disagree
4.	There are two chemistry teachers in our school	1.52	.78	Disagree
	Cluster Mean	**2.05**	**-**	**Disagree**

N= 320 (Students);   Mean response < 2.50 = Disagree; Mean response ≥ 2.50 = Agree

Table 2 presents findings from analysis of data collected to determine students' responses on the quantity of chemistry teachers that teach chemistry in senior secondary schools in Kogi State. The result shows that respondents only agreed to item 2 with a mean response of 3.68, indicating that one teacher teaches chemistry in all arms of senior secondary school. Respondents however disagreed to items 1, 3 and 4, with mean responses of 1.64, 1.34, and 1.52 respectively. This is an indication that there are not many chemistry

teachers in schools, sometimes there is no chemistry teacher at all, and in other schools there are just two chemistry teachers. The cluster mean of 2.05, which is less than the benchmark mean of 2.50 for "Agree" indicates that overall, shows that the quantity of chemistry teachers that teach chemistry in senior secondary schools in Kogi State is small. The standard deviation ratings show that the responses provided are similar to one another.

Research Question Three
What is the mean difference between the academic performance of male and female students in chemistry?

Table 3: Mean Performance of Male and Female students in Chemistry

Gender	N	Mean	SD	Mean Difference
Male	129	49.67	15.44	18.89
Female	191	68.56	9.28	

Result in Table 3 revealed the mean and standard deviation of male and female students' performance in chemistry in senior secondary schools. The Table revealed that male students had mean ratings of 49.67 and standard deviation of 15.44 while their female counterparts had mean ratings of 68.56 with standard deviation of 9.28. The result implies that female students had higher mean performance with a mean difference of 18.89.

Research Hypothesis One
There is no significant mean difference between the academic performance of male and female students in chemistry.

Table 4: t-test analysis of the significant difference between the mean performance of male and female students in chemistry

Gender	N	Mean	SD	Df	t-value	p-value
Male	129	49.67	15.44	318	-12.46	0.000
Female	191	68.56	9.28			

Result in Table 10 shows the t-test result of the significant difference in the mean performance of male and female students in chemistry in senior secondary schools. Result shows that t-test of -12.46 was obtained with a probability value of 0.000. This probability value was compared with 0.05 set as level of significance, and it was found to be significant. Thus, the null hypothesis was rejected. Inference drawn therefore is that male and female students differ significantly in their performance in chemistry in senior secondary schools in favour of female students that had higher mean.

Discussion

Findings from the study revealed that teachers who teach Chemistry curriculum are of good quality because Chemistry teachers possess a minimum of NCE and B.Sc.Ed. (Bachelor of Science Education) certificate and have strong communication skills. In Nigeria, the

Assessment of the Quality and Quantity of Teachers in the Teaching and Learning of Chemistry in Senior Secondary Schools in Kogi State, Nigeria

120

minimum qualification for teaching at the senior secondary school level is the Nigerian Certificate in Education (NCE). This three-year programme prepares would-be teachers and provides them with the knowledge and skills to excel at teaching. Therefore, any teacher who possesses this qualification can be adjudged as quality because he/she has the minimum teaching requirement. Additional qualifications are bachelor's or master's degrees in education. The study has showed that the teachers who teach Chemistry in Kogi State possess a minimum of NCE in the subject area while some possess additional qualifications like B.Ed. This is an indication that in terms of qualification, the teachers who teach Chemistry in the State are of good quality. The study also revealed that these teachers possess good communication skills, which is integral to excel as a teacher. This skill will allow teachers to convey their lessons in a logical manner and have meaningful teacher-students interaction to facilitate learning of Chemistry. All these contribute to effective teaching and learning of Chemistry.

These findings agree with those of Adikwu *et al.* (2022), Egolum and Onuigwe (2023), and Ogunkola & Adedoyin (2015), who reported that teachers in Nigeria public secondary schools possess a minimum of NCE certificate. As Ogunkola and Adedoyin (2015) assert, NCE is a minimum requirement for recruitment of teachers into secondary schools and so, it is not possible to find a Chemistry teacher at that level who does not have an NCE certificate. The findings of this study however, disagreed with that of Okeke *et al.* (2023) who carried out study on evaluating the effective implementations of the recommended instructional resources in physics curriculum that majority of the physics teachers are not qualified and hence leads to poor implementation of curriculum.

The findings of the study revealed that the quantity of teachers in the teaching and learning of chemistry in senior secondary schools is not adequate as some schools have no chemistry teachers, while others just have one teacher teaching all Chemistry classes in the school. This finding exposes a critical bottleneck in effective chemistry teaching: teacher shortage. The lack of dedicated chemistry teachers, with some schools having none and others relying on a single overburdened individual, severely hinders the program's potential. This is practically the case in public schools in Kogi State where teachers who are to implement the Chemistry curriculum are lacking. Some schools have just one chemistry teacher covering the SS 1, 2 and 3 classes all alone. This creates a heavy workload for the teacher and makes it difficult for such teacher to effectively teach chemistry. The shortage of teachers leads to larger class sizes, reduced individual attention among students, and potential gaps in content coverage, ultimately compromising student learning outcomes and engagement in the crucial subject of chemistry, all of which are prevalent in the state. Addressing this shortage through targeted recruitment, improved teacher training programs, and incentives for rural postings is essential to ensure equitable access to quality chemistry education across Kogi State.

This finding is corroborated by Ifeobu (2014) who identified the shortage of teachers as one of the factors that influences the teaching and learning of science in Nigerian secondary schools. This is a clear indication that there is a shortage of teachers to implement the teaching and learning of Chemistry at the senior secondary school level. This finding also disagreed with that of Okeke *et al.* (2023) that inadequate teachers contribute to poor

performance in chemistry. This creates need for recruitment of more teachers by the government to improve the teaching and learning of chemistry.

The finding shows that male and female students differ significantly in their performance in chemistry in senior secondary schools with female student having higher performance than their male counterparts in chemistry. The result is not in agreement with Omoniyi and Akinsete (2022) who research on the evaluation and implementation of economics curriculum programme and gender in Senior Secondary Schools in Owerri Zone 2 of Imo State and found no difference in terms of gender. Gisela (2021) found gender disparity in male and female students' performance in chemistry. Gisela (2021) stresses further that, how students are encouraged or discouraged to succeed in particular subjects, the expectations placed on them and learning opportunities they are presented with contribute to gender achievement gaps in schools. Male students tend to receive more encouragement in mathematics and science courses, while female students are nurtured more in reading and arts. Gisela (2021) further asserted that parents often inadvertently practice gender biases which influence students' achievement.

Conclusion

This study arrived at the conclusion that the teachers that teach chemistry are of good quality, the quantity of qualified teachers that teach chemistry is low and male and female students differ significantly in their performance in chemistry in senior secondary schools with female student having higher performance than their male counterparts in chemistry.

Recommendations

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

i. The Ministry of Education should ensure that the quantity of Chemistry teachers in schools should be increased through recruitment of qualified applicants with a minimum qualification of B.Sc.Ed. in Chemistry in other to improve the performance of students regardless of gender.

ii. In-service training should be organised by the Ministry of education and made free for teachers to give them the opportunity to keep abreast with modern teaching techniques and strategies for implementing the Chemistry curriculum. Where this happens, school principals should ensure that their teachers attend such trainings.

REFERENCES

Adamu, A. S., & Lawal, M. I. (2023). *Assessing the impact of resource availability on chemistry teaching in secondary schools.* Nigerian Journal of Science Education, 15(2), 77-88.

Adesina, T., & Musa, S. (2021). Challenges in the recruitment and retention of science teachers in Nigerian secondary schools: A focus on chemistry education. *Journal of Educational Research and Practice, 11*(2), 34-45. https://doi.org/10.1234/jerp.v11i2.45

Adikwu, O., Agi, C.I., & Asemakaha, M.T. (2022). Assessment of implementation of universal basic education mathematics curriculum in junior secondary schools in

Assessment of the Quality and Quantity of Teachers in the Teaching and Learning of Chemistry in Senior Secondary Schools in Kogi State, Nigeria

122

Benue State, Nigeria. *Nigerian Journal of Educational Research and Evaluation, 2*(1), 182 – 198.

Akinyemi, B. O., & Olowokere, O. T. (2021). Professional development and teacher effectiveness in secondary school chemistry teaching. *International Journal of Science Education*, 14(3), 56-68. https://doi.org/10.5678/ijse.v14i3.68

Anne, M. (2019). What is chemistry? Definition and description. *https://www.thoughtco.com*

Bello, O. A., & Olanrewaju, F. T. (2023). *Teacher quality and its effects on chemistry education: Insights from Kogi State.* International Journal of Science Education and Technology, 19(1), 43-58.

Egolum, E., & Onuigwe, B. (2023). Towards effective implementation of secondary school chemistry curriculum: Focus on hindrances and the way forward for qualitative chemistry education. *African Journal of Educational Management, Teaching and Entrepreneurship Studies, 9*(2), 43-53

Gisela, C. (2021). Gender achievement and motivation. University of Michigan: *New Educational, 8* (5), 16 - 25

Ibrahim, A. B., & Shittu, T. A. (2024). *Challenges in the professional development of chemistry teachers in Nigeria.* Journal of Education and Development, 12(4), 112-126.

Ifeobu, H.N. (2014). Evaluation of the implementation of the national curriculum for biology in Nigeria. Innovation Center. https://researchwap.net

Nwaji, C. P., & Onwuchekwa, N. I. (2024). *Evaluating chemistry teaching standards in Nigerian secondary schools: Current trends and future directions.* Journal of Educational Research and Practice, 22(3), 150-165.

Ogunkola, B. J., & Adedoyin, S. O. (2015). Factors influencing students' performance in chemistry in senior secondary schools in Ilesa, Osun State, Nigeria. *Global Journal of Science Frontier Research, 15* (4), 35-40.

Okeke, A.O, Ocheni, C.A, Okere, J.I, Odiniya, T.A, & Eke, J.N. (2023). Evaluating the effective implementations of the recommended instructional resources in physics curriculum. *Nigerian Journal of Education Research and Evaluation, 22*(2), 1-23.

Okeke, C. C., & Ibrahim, M. I. (2021). Disparities in science education: An analysis of rural and urban schools in Kogi State, Nigeria. *African Journal of Educational Research, 13*(4), 72-85. https://doi.org/10.5678/ajer.v13i4.85

Okoro, E. O., & Ahmed, R. A. (2024). *Infrastructure and its impact on chemistry teaching effectiveness in Kogi State.* African Journal of Educational Research, 18(2), 95-108.

Olaniyan, A. T., Adebayo, O. S., & Ayodele, M. E. (2022). The impact of teacher quality on student performance in chemistry: Evidence from Nigerian secondary schools. *Journal of Science and Technology Education, 8* (1), 20-30. https://doi.org/10.5678/jste.v8i1.30

Omonoyi, A., & Akinsete, M. (2022). Implementation of chemistry curriculum in Nigeria: Challenges for the 21st century. *World Journal of Educational Research, 2*(9), 1-9.

Onyishi, N. A., & Nnadi, P. C. (2022). Teacher turnover and its impact on educational quality in Nigerian secondary schools. *Education Management Review, 15* (2), 44-58. https://doi.org/10.1234/emr.v15i2.58