



**NIGERIAN ONLINE JOURNAL OF  
EDUCATIONAL SCIENCES  
AND TECHNOLOGY (NOJEST)**

<http://nojest.unilag.edu.ng>

**NIGERIAN ONLINE JOURNAL  
OF  
EDUCATIONAL SCIENCES  
AND TECHNOLOGY**

**EFFECTIVENESS OF CHEMISTRY TEACHING  
AND LEARNING IN SENIOR SECONDARY  
SCHOOLS IN LAGOS STATE**

**Okunuga, R. O.**

Department of Science and Technology Education  
University of Lagos, Lagos State, Nigeria.  
rokunuga@unilag.edu.ng

**To cite this article:**

Okunuga, R. O. (2021). Effectiveness of chemistry teaching and learning in senior secondary schools in Lagos State. *Nigerian Online Journal of Educational Sciences and Technology (NOJEST)*, 3 (1), 93-103

This article may be used for research, teaching, and private study purposes.

Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is expressly forbidden.

Authors alone are responsible for the contents of their articles. The journal owns the copyright of the articles.

The publisher shall not be liable for any loss, actions, claims, proceedings, demand, or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of the research material.



## EFFECTIVENESS OF CHEMISTRY TEACHING AND LEARNING IN SENIOR SECONDARY SCHOOLS IN LAGOS STATE

OKUNUGA, Racheal. O.

---

### Abstract

---

#### Article Info

#### Article History

Received: 19  
July 2021

Accepted: 14  
November 2021

#### Keywords

Keywords: [teaching,  
learning, quality, guided  
discovery method]

*The effectiveness of chemistry teaching and learning in Lagos state secondary school was the focus of this study. The descriptive survey research design was adopted with five research questions and two hypotheses raised. 98 chemistry teachers and 294 chemistry students in Lagos State Education Districts I and IV were sampled using simple random sampling technique. Questionnaire with a reliability coefficient of 0.82 was designed to collect the data for the study. Data analysis was carried out using descriptive statistics of frequency, percentages and mean. Pearson Product Moment Correlation (PPMC) was used to test the hypotheses at the significance level of 0.05. The results showed that chemistry instructional materials are adequately available in Lagos state schools; chemistry students perceived their teachers to be of good qualities with respect to their personality and relationships. However, majority of the teachers still use lecture method of teaching instead of the recommended guided discovery method. Also, the findings indicate that teaching and learning of chemistry in most schools sampled are limited with challenges of inadequate laboratory equipment, lack of modern chemistry textbook, poor funding of chemistry projects and lack of incentives for chemistry teachers. It is recommended among others that government should ensure adequate provision of facilities for all government secondary schools in the state while teachers should adopt modern instructional materials and teaching methods.*

---

### Introduction

The 21<sup>st</sup> century is shaped by the development of science and technology which are essential to global sustainable development. Some countries in the world are termed ‘developed nations’ due to the technological progress and growth they have made. For Nigeria to achieve accelerated advancement and to keep pace with the developed countries in the world in this 21<sup>st</sup> century, it has become a necessity for the citizens to be more interested in science and a need for effective science teaching in all the levels of education in the country (Obomanu, 2010).

Chemistry is one of the science disciplines that contribute to technological progress. It is the branch of science dealing with understanding of natural phenomenon in a practical and experimental form. Chemistry plays a fundamental role in all aspects of national and economic advancement. To the individual and a country, the importance of chemistry is unquestionable. It has been able to contribute to improving life immensely with the use of chemical products such as drugs and medicines in the health sectors, cosmetics and paints for maintenance and beautification, and fertilizers for agricultural purposes. Also, a good knowledge of chemistry is a prerequisite for adequate learning of the science and technology related courses in the universities and

other higher institutions of learning thereby providing various career opportunities for graduates of chemistry in the health and agricultural sectors as well as chemical-based industries (Okunuga and Ajeyalemi, 2018). However, with all these importance and relevance of chemistry, the performance of students in West Africa Examination Council conducted Senior Secondary Certificate Examinations (SSCE) have been reported to be persistently poor. Research studies have also shown that students' academic performance in the three basic science subjects have been very poor with little or no appreciable improvement over the years (Jegade, 2010; Oloyede, 2010). This has led to the calls for reforms and innovations to be geared towards improving science education in Nigeria (Omorogbe and Ewansiha, 2013). It is believed that innovative practices in science teaching can help to enhance students' academic achievement in the science subjects. In accordance with this view, Ajaja (2013) noted that the strategy used for science teaching and learning in our secondary schools is one of the factors that has contributed to students' low interest in science, hence, there is a need to look for alternative teaching strategies that would interest students and improve their performance.

To achieve these, science teachers must convert science teaching into a process that has the potential to generate interest in the students and motivate them to stay back in the science discipline (Okunuga, (2011), David, (2018)). Innovative teaching strategies like mastery learning instructional strategy and computer assisted instructions were found to have enhanced learning of science subjects among secondary school students. The achievements of students were significantly improved even when such strategies were used to teach difficult topics such as mole concept in chemistry (Lamidi, Oyelekan & Olorundare (2015); Gambari, Yusuf & Thomas (2015).

Various studies conducted by researchers identified the problem as the lack of resources for equipment and materials for practical activities, inability to cover the syllabus, teachers not adequately qualified to teach the science subjects effectively, teachers' workload, experience, and willingness to teach. Others include general lack of teaching skills and ineffective teaching style and technique of the subject matter (Olanrewaju, (2014), Ajeyalemi and Okunuga, (2013), Okunuga, (2018). Hence, it is necessary to examine what is to be taught in science, how to teach it and the available resources for effective learning to take place. Effective teaching is achieved when students the learning outcomes and objectives have been achieved, rather than allowing students to simply repeat scientific concepts (Omoifo, 2012). Effective learning takes place when students learn how to learn, develop conceptual understanding and ability to think. This implies that effective teaching and learning would help change the ways students explain the everyday world around using scientific concepts, as well as the ways of thinking about their personal lives.

Nigeria Federal and State governments have put much effort into the teaching and learning of the sciences in the various levels of school and especially in the secondary schools. Positive incentives such as prioritization of scientific courses in the giving of grants and scholarships to students and giving of awards and in-service training for teachers, building and construction of science equipment production centres, inclusion of science allowances into teachers' remunerations and the establishment of universities and colleges of technology. The Lagos State government introduced EKO Project, which became effective on November 2009. The project objectives include (i) to improve secondary school effectiveness through school development grants (ii) provide quality-enhancing incentives grant to schools; (iii) strengthening teachers' professional development (Roshan, Lomme, Hima & Santibanez (2016). The project experienced exceptional performance in the senior secondary school examinations in the sciences and other major subjects.

A teacher's experience can also help teachers with coping and adapting to changes in educational programmes, thereby fostering effectiveness in science teaching. The years of experience of a teacher is seen by Akinsolu (2010) as a measure of the quality of the teacher and therefore becomes essential in enhancing students' academic performance. According to Khurshid and Zahur (2013), teachers with more professional qualifications are more conscious about innovative teaching methods than teachers with lower professional qualifications. This implies that teachers with more professional qualifications tend to deliver effective science teaching.

Further, the methods and materials that are used in teaching and learning are very important and this is more with chemistry being an experimental science. Effective teaching and learning can only take place if there are instructional materials to aid the teacher in the lesson delivery and there are adequate chemicals, apparatus, and equipment to carry out practical activities. The instructional materials can provide information that will cause desired behavioral changes in students. They include a variety of devices and materials, ranging from software to hardware, that are used for teaching and learning. It is however noted in Nigerian schools that most of these resources are not available or not adequately available. It has been further observed that there are instances where these materials are available but are under-used or not used at all by the teachers due to several factors such as the time required to make use of them during teaching. Learning of chemistry, with its abstract nature can be more effective and maximized if the environment has adequate resources instead of a classroom that is bear with little or no stimulation for learning. In the same vein, quality and effective teaching of chemistry depends largely on adequate provision and proper utilization of instructional resources (Ezeudu, Nkokelonye, & Ezeudu (2013), Okunuga (2018)). A practical-based approach to chemistry is the key to a breakthrough in science and technology advancement and it is against this backdrop that this study seeks to assess teaching of Chemistry in Lagos State Secondary Schools.

The contemporary situation of science education in Nigeria is a concern, not only to the educational sector but the society in general. The WAEC chief examiners reports on students' achievement in chemistry in May/June 2015 and May/June 2016 showed that the performance of candidates was generally poor as it was in previous years. There is the need to examine the cause of this recurring poor performance despite some of the interventions put in place by the government and educational stakeholders. To solve these lingering problems therefore requires a true understanding of what is presently happening in the teaching and learning of chemistry in Lagos State secondary schools. It is necessary to check the factors that limit the standard of chemistry teaching and learning.

### **Objective of the Study**

The main purpose of this study is to assess the quality and effectiveness of chemistry teaching in Lagos State secondary schools, The specific objectives are to,

1. examine instructional materials available for the teaching of chemistry.
2. assess the quality of chemistry teachers in terms of their qualification, method of teaching, personality, and other teacher-related factors.
3. identify the methods frequently used in teaching chemistry.
4. assess students' attitudes towards learning chemistry.
5. find out major challenges to effective teaching and learning of chemistry.

### **Research Questions**

The study made attempts to provide answers to the following:

1. To what extent are instructional materials available for the teaching of chemistry?
2. What are the qualities of teachers teaching chemistry?
3. What are the methods frequently used in teaching chemistry?
4. What are science students' attitudes towards learning chemistry?
5. Identify the major challenges to effective teaching and learning of chemistry

### **Hypotheses**

**H0<sub>1</sub>:** There is no significant relationship between qualities of chemistry teachers and their performance in classroom delivery

**H0<sub>2</sub>:** There is no significant relationship between teaching methods used by chemistry teachers and performance in delivery.

### **Methodology**

A descriptive survey research design was adopted in carrying out the study. The study population comprised all chemistry teachers and students in Lagos State secondary school. The sample of the study includes all chemistry teachers and students in Education Districts (Districts I and IV) of Lagos State. The participants

were selected using simple random sampling technique. Education District I consist of three zones namely, Alimosho, Agege and Ifako-Ijaiye with a total of fifty-one (51) senior secondary schools while Surulere, Apapa and Lagos Mainland zones make up Education District IV with a total of forty-seven (47) senior secondary schools. Simple random sampling was used to select three (3) Chemistry students and one Chemistry teacher from each school. Hence, study sample size is 392 participants comprising 294 chemistry students and 98 chemistry teachers. The students are all Senior Secondary School year 2 and between 15 -18 years of age.

Two Questionnaires were used as the data collecting instruments. One was used to elicit relevant information from the teachers while the other was used for the students. The relevant items (availability of instructional materials, teacher's qualification, teaching methods frequently used, students' attitude, and challenges faced) that sought answer to research questions raised by the researcher.

The reliability of the research instrument was ascertained by administering it to ten (10) teachers and fifteen (15) students who were not part of the main study but possess the exact characteristics of the samples. Cronbach Alpha reliability test of 0.82 was obtained which is considered good for the study. The questionnaires for the study were administered to the selected respondents (teachers and students) by the researcher with permission from their principals.

The teachers that took part in the study consist of 40 (40.8%) male and 58 (59.2%) female. 28 (28.6%) have HND/B.Sc. degree, 20 (20.4%) have B.Ed. degree, 43 (43.9%) have master's in education degree (with a bachelor's degree) while 7 (7.1%) have other qualifications not specified.

In terms of teaching experience, 30(30.2%) of the respondents have 0 to 5 years, 37 (38.2%) have 6 to 10 years, 10 (10.1%) have 11 to 15 years, 9 (9.3%) have 16 to 20 years while 12 (12.2%) have 21 years and above teaching experience.

## **Data Analysis and Results**

The research questions were answered using frequencies and percentages while the hypotheses were tested with the use of Pearson Product Moment Correlation.

### **Results**

#### **Research Question One**

To answer the research question: to what extent are instructional materials available for the teaching of chemistry, the teachers were presented with a checklist of some common apparatus and chemical reagents used in the teaching and learning of chemistry. They were to check the availability and adequacy of the materials listed. The respondents were also asked to list the charts available in the laboratory. The results are presented using frequency and percentages in Table 1.

**Table 1:**  
Teachers Response to Availability of Instructional Materials for Teaching Chemistry

S/N.	Items	Available and Adequate	Available but not Adequate/Functioning	Not available
<b>Apparatus</b>				
1.	Reagent Bottle	98 (100)	0 (0.0)	0 (0.0)
2.	Bunsen Burners	91 (92.9)	7 (7.1)	0 (0.0)
3.	Weighing balance	79 (80.6)	7 (7.1)	12 (12.2)
4.	Beakers	91 (92.9)	7 (7.1)	0 (0.0)
5.	Burettes	98 (100)	0 (0.0)	0 (0.0)
6.	Evaporating Dishes	91 (92.9)	7 (7.1)	0 (0.0)
7.	Conical flasks	91 (92.9)	7 (7.1)	0 (0.0)
8.	Funnels	98 (100)	0 (0.0)	0 (0.0)
9.	Mortar and pestle	78 (79.6)	7 (7.1)	13 (13.3)
10.	Pipettes	91 (92.9)	0 (0.0)	7 (7.1)
11.	Retort stand and clamps	98 (100)	0 (0.0)	0 (0.0)
12.	Measuring cylinders	98 (100)	0 (0.0)	0 (0.0)
<b>Chemical Reagents</b>				
1.	Calcium chloride	91 (92.2)	0 (0.0)	7 (7.1)
2.	Fehling's solution	91 (92.2)	0 (0.0)	7 (7.1)
3.	Silver protonitrates	70 (71.4)	7 (7.1)	21 (21.4)
4.	Hydrochloric acid (dilute & concentrated)	84 (85.7)	0 (0.0)	14 (14.3)
5.	Tetraoxosulphate (vi) acid (dilute & concentrated)	98 (100)	0 (0.0)	0 (0.0)
6.	Ethanoic acid (dilute)	84 (85.7)	0 (0.0)	14 (14.3)
7.	Dilute ammonia acid	91 (92.9)	0 (0.0)	7 (7.1)
8.	Potassium hydroxide	92 (93.9)	0 (0.0)	6 (6.1)
9.	Hydrogen peroxide	85 (86.7)	0 (0.0)	13 (13.3)
10.	Methyl orange indicator	84 (85.7)	0 (0.0)	14 (14.3)
11.	Sodium carbonate	98 (100)	0 (0.0)	0 (0.0)
12.	Phenolphthalein indicator	98 (100)	0 (0.0)	0 (0.0)
13.	Litmus Paper	91 (92.2)	0 (0.0)	7 (7.1)

Table 1 shows the availability of instructional materials needed in the teaching of chemistry. It can be observed that apparatus for practical activities are available and adequate in almost the schools sampled. The above findings reveal that instructional materials used in teaching chemistry in Lagos State secondary schools are available and functioning in almost of the categories (Apparatus, and Chemical Reagents).

### Research Question Two

What are the qualities of teachers teaching chemistry?

The analysis of students' response to items raised on the qualities of teachers teaching chemistry using mean and standard deviation are presented in Table 2.

Table 2:  
Qualities of Teachers Teaching Chemistry

S/N.	Items	Mean	SD	Remark
1.	My chemistry teacher starts a class explaining how students can apply the contents to real life situation	3.26	0.83	Agreed
2.	My chemistry teacher uses interesting and up to date examples	3.59	0.61	Agreed
3.	My chemistry teacher considers the anxiety students may feel when carrying out class activities	3.04	0.87	Agreed
4.	My chemistry teacher asks what we know about a new topic	3.33	0.83	Agreed
5.	My chemistry teacher talks to students in a soft and informational tone	3.34	0.69	Agreed
6.	My chemistry teacher assigns class activities based on the level of assimilation of the individual student	3.25	0.75	Agreed
7.	My chemistry teacher spends time on activities and explanations before the class	3.31	0.78	Agreed
Grand mean		3.30		

Given the benchmark of 2.50, the grand mean of 3.30 is higher implying that the chemistry teachers in the schools sampled have high quality and a significant impact on the students.

### Research Question Three

What are the methods frequently used in teaching chemistry?

Table 3 shows the teachers' response on methods frequently used in teaching chemistry in the schools sampled. Mean and standard deviation were used in presenting the result.

**Table 3:**

### Method Used in Teaching Chemistry

S/N.	Items	Mean	Std. Dev	Remark
1.	Guided discovery method	2.87	0.96	Agreed
2.	Lecture method	3.32	0.98	Agreed
3.	Discussion method	3.02	0.88	Agreed
4.	Demonstration method	3.00	0.63	Agreed
5.	Expository method	2.79	0.97	Agreed
6.	Field trip/excursion method	1.92	1.10	Disagreed
7.	Concept mapping	2.06	1.06	Disagreed
<b>Grand Mean</b>		<b>2.69</b>		

Using the mean value 2.50 as a benchmark for a favorable response, Table 3 reveals that lecture method with the mean value of 3.32 is mostly used by chemistry teachers in the schools sampled. This is followed by discussion method with a mean value of 3.02, Demonstration method (3.00), Guided discovery method (2.87), Expository method (2.79) followed in descending order of their frequent use by chemistry teachers. Concept mapping method with a mean value of 2.06 and Field trip/Excursion method with mean value of 1.92 fell under the benchmark of 2.50 showing the two methods are not commonly used by teachers in teaching chemistry.

**Research Question Four**

What are science students' attitudes towards learning chemistry?

Table 4 indicates teachers' opinion on science students' attitude towards learning chemistry. Mean and standard deviation were used in presenting the result.

**Table 4:**

Students' Attitude towards Learning of Chemistry

S/N.	Items	Mean	Std. Dev	Remark
1.	Students see chemistry as a difficult subject	2.11	1.02	Disagreed
2.	Many students do not like chemistry because they feel it is a boring subject	2.40	0.87	Disagreed
3.	Students participate in science courses so that others may think that they are smart and knowledgeable	2.52	0.86	Agreed
4.	Many students think that learning science is important because it stimulate their thinking	2.82	0.97	Agreed
5.	Some students see chemistry as an interesting subject	3.30	0.68	Agreed
<b>Grand Mean</b>		<b>2.63</b>		

Using mean value of 2.50 as a benchmark for a favorable response, Table 4 shows teachers did not agree that students perceive chemistry as a difficult subject and that many students do not like chemistry because they feel it is a boring subject with the mean value 2.11 and 2.40 respectively. On the contrary, the teachers agreed that students participate in science courses so that others may think that they are smart and knowledgeable; also, that many students think that learning of science generally stimulates thinking and that some students see chemistry as an interesting subject with the mean value 2.52, 2.82 and 3.30 and respectively.

This finding therefore reveals that chemistry students in Lagos state schools have positive attitudes towards learning chemistry.

**Research Question Five**

Identify the major challenges to effective teaching and learning of chemistry

Table 5 shows participants' answers to questions raised on major challenges militating against effective teaching and learning of chemistry. The result was presented using mean and standard deviation.

**Table 5:**

Challenges against effective teaching and learning of chemistry

S/N	Items	Mean	SD	Remark
1.	Inadequate laboratory equipments hinders the effective teaching and learning of chemistry	3.09	0.92	Agreed
2.	Lack of constant power supply affects the effective teaching and learning of chemistry	2.36	1.03	Disagreed
3.	Lack of modern chemistry textbooks in school library results in dearth of innovations and ideas	3.34	0.70	Agreed
4.	Poor funding of chemistry project in schools disallow growth of innovation and ideas	3.40	0.73	Agreed
5.	Lack of incentives reduce efficiency of chemistry teachers and effective teaching of the subject	3.17	0.66	Agreed
<b>Grand Mean</b>		<b>3.07</b>		



Table 5 reveals that respondents agreed that poor funding (3.40), Lack of modern chemistry textbooks (3.34), Lack of incentives (3.17), Inadequate laboratory equipments (3.09), are some of the challenges that hinder effective teaching and learning of chemistry. However, they disagreed that lack of constant power supply affects teaching of chemistry, with the mean response of 2.36.

This shows that the teaching and learning of chemistry in most schools sampled, are limited with challenges of inadequate laboratory equipment, lack of modern chemistry textbook, poor funding of chemistry projects, and lack of incentives for chemistry teachers.

### Testing of Hypotheses

#### Hypothesis 1

There is no significant relationship between qualities of chemistry teachers and their performance in delivery. Pearson Product Moment Correlation was used to test this hypothesis; the result is presented in Table 6.

**Table 6:**

Relationship between qualities of chemistry teachers and their performance in delivery

Variables	Mean	SD	df	R	P-value	Decision
Chemistry Teachers Qualities	14.42	4.67	292	0.44	.02	Rejected
Performance in Delivery	15.59	2.69				

$P < 0.05$

From Table 6, it can be observed that the calculated  $r$  value of 0.44 is significant, since it is more than the critical value of 0.113, given 292 degrees of freedom, at 0.05 level of significance. This means there is a significant relationship between qualities of chemistry teachers and performance in delivery. Consequently, the null hypothesis is rejected

#### Hypothesis 2

There is no significant relationship between teaching methods used by chemistry teachers and performance in delivery. Pearson Product Moment Correlation was used to test this hypothesis, the result of the analysis is presented in Table 7.

Table 7:

Relationship between teaching methods used by chemistry teachers and their performance in delivery

Variables	Mean	SD	N	df	r	P-value	Decision
Teachers Teaching Methods	16.33	3.44	294	292	0.36	0.03	Rejected
Teachers' Performance in Delivery	15.59	2.69					

$P < 0.05$

From Table 7, it can be observed that the calculated  $r$  value of 0.36 is significant since it is more than the critical value of 0.113 given 292 degrees of freedom at 0.05 level of significance. This means there is a significant relationship between teaching methods used by chemistry teachers and performance in delivery. Consequently, the null hypothesis is rejected.

### Discussion of Findings

Participants' responses to the extent to which instructional materials are available for teaching chemistry revealed that instructional materials are available for the teaching and learning of chemistry in Lagos State secondary schools. However, the availability of chemical reagents can be an issue of concern because they can expire and become unusable for practical activities. Availability of instructional materials will generally enhance effective teaching and learning provided they are made use of effectively and appropriately. This finding is in line with Roshan, Lomme, Hima, & Santibanez (2016) that links performance of students to the provision of adequate facilities. Schools which are well equipped are likely to have good records of achievement and attract more students.

Students' responses on the qualities of teachers teaching chemistry indicate that the teachers are of high quality in using updated and interesting examples, classroom management, classroom interaction, classroom activities, lesson

explanation, laboratory, and practical teaching, and listening to students' opinion and questions with mean score greater than 2.50. This implies that there are quality teachers teaching chemistry in majority of the school. The findings agreed with the view of that if teachers take the time to build relationships, they can motivate their students to learn and perform better. However, Kosgei et al (2013) study on teacher characteristics and students' academic achievement in schools in Nandi south district, Kenya revealed that teachers' experience does not influence students' academic achievement. Yewande, Okunuga & Ojo (2012) opined that teacher's experience is strongest during the first few years of teaching, after which there is marginal diminishing returns. This study so far has revealed that experienced teachers have a richer background of experience to draw from and can contribute ideas to the course of teaching and learning. Another finding revealed that lecture method is the most used method though other methods such as discussion, demonstration, inquiry, guided discovery and expository are used to teach chemistry while field trip/excursion method and concept mapping are hardly used. The instructional method used for teaching and learning have significant effect on effective implementation of school curriculum, Ajaja, (2013) noted that the teacher's methodology is a sufficient factor in facilitating the implementation of the intended aims and expressed objectives of a given educational programme. Chemistry is an experimental science and the recommended method of teaching in the curriculum is the guided discovery method which gives opportunity to learners to carry out various activities that can enhance learning. Also, teachers need to use different teaching methods in their subject delivery. Thus, effective teaching strategies are significant to a successful teacher's delivery of instruction. Though there are adequate instructional materials, the method of teaching used by the teacher affects the performance of the students. This could be a result of the recurring poor performance of chemistry students in WAEC examinations.

The students agreed that learning chemistry is important, and that chemistry is an interesting subject. However, majority of the students study chemistry because of the course they would want to study in the higher institution and the need to pass chemistry with a good grade as a requirement for entry into tertiary institution (Okunuga, 2011). On major challenges militating against effective teaching and learning of chemistry, participants' responses revealed that lack of constant power supply, lack of modern chemistry textbooks and poor funding of chemistry hinder effective teaching and learning.

### Conclusion

The impact of good teachers' characteristics on teaching and learning of chemistry and teachers job delivery is of great importance. Teachers teaching styles, participation and experience are crucial factors that influence teachers' job delivery. It has been revealed that there are instructional materials available for the teaching and learning of chemistry in Lagos State schools. There is a significant relationship between qualities of chemistry teachers and their performance in delivery.

### Recommendations

A chemistry laboratory appears to be highly expensive to build and equipped. Most of the apparatus are glassware; fragile and not durable. The chemical reagents are consumables and as such get depleted with use. They also bear expiry dates so they cannot be bought in large quantities if there is no need for them to be used. It is recommended that schools should use virtual lab to teach chemical activities to compliment the use of actual chemical reagents which are expensive, not readily available and are time bound in terms of expiry date.

Also, the Government can have chemical storage in each Education District, where schools can go to collect the small quantities needed for their practical activities. This will prevent wastage and reduce cost.

### References

- Abdulwahab N., Oyelekan, O. S., & Olorundare, A. S. (2016). Effects of Cooperative Instructional Strategy on Senior School Students' Achievement in Electrochemistry. *Eruasian Journal of Physics and Chemistry Education*, 8(2), 37- 48
- Ajaja, O. P. (2013). Which strategy best suits biology teaching? Lecturing, concept mapping, cooperative learning or learning cycle? *Electronic Journal of Science Education*, 17(1), 1-37.
- Akinsolu, A.O. (2010). Teachers and students' academic performance in Nigeria Secondary Schools: Implications for planning. Florida. *Journal of Educational Administration and Policy*, 3, 86-103.
- David, A. U. (2018). Innovative practices in science education: a Panacea for improving secondary school Students' academic achievement in Science Subjects in Nigeria. *Global Journal of Educational Research* 17, 23-30.

- Ezeudu F. O, Nkokeonye C. U., Ezeudu S. A., (2013). Science Education and the challenges Facing its Integration into the 21<sup>st</sup> Century School System in a globalised World: A Case of Igbo Nation. *US-China Education Review B*, 3(3), 172-182.
- Gambari, A. I., Yusuf, M. O., & Thomas, D. A. (2015). Effects of computer assisted STAD, LTM and ICI cooperative learning strategies on Nigerian secondary school students' achievement, gender and motivation in Physics. *The Malaysian Online Journal of Educational Sciences*, 3(4), 11-26.
- Jegade , S. A., (2010). Nigerian Student's Perception of Technical Words in the Senior Secondary School Chemistry Curriculum. *Pakistan Journal of Social Sciences*, 7, 109 – 111.
- Khurshid, F., & Zahur, B. (2013). Comparison of teachers' awareness and utilisation of innovative teaching strategies in private and public sector secondary schools. *Elixir Psychology* 45, 12242-12245.
- Kosgei, A., Mise, J. K., Odera, O., & Ayugi, M. E., (2013). Influence of teacher characteristics on students' academic achievement among secondary schools. *Journal of Education and Practice* 4(3), 76-82. ISSN: 2222-1735
- Lamidi, B. T., Oyelekan, O. S., & Olorundare, A. S. (2015): Effects of mastery learning instructional strategy on Senior School students' achievement in the mole concept. *Electronic Journal of Science Education*, 9(5), 1-20.
- Obomanu, J.B. & Akporehwe N.J. (2010). The effective of using manipulative materials and lecture method in Teaching Senior Secondary Schools Biology in Bayelsa State. *Trends in Educational Studies Journal*, (1&2), 231-244.
- Okunuga, R. O., Ajeyalemi, D. (2018). Relationship between knowledge and skills in the Nigerian undergraduate chemistry curriculum and graduate employability in chemical-based industries. *Industry and Higher Education*. Sage Publications, 22 (3), 183-191. UK.
- Okunuga, R. O. (2011). Science Education in Nigeria: School Chemistry Curriculum and its Impact on Discovery Learning. In Ayo Alani & Soji Oni (Eds.), *Trends and Issues in Education in Nigeria. (A book of Readings in Memory of Prof. Mrs. E. O. O. Busari)* (pp 523-535). Lagos, Nigeria: Triumph-Providential Publishers.
- Olaleye, F. O., (2011). Teachers characteristics as predictor of academic performance of secondary school students in Osun state, Nigeria. *European Journal of Educational Studies* 3(3), 505-511
- Oloyede, O. I. (2010). Enhanced mastery learning strategy on the achievement and self concept in senior secondary school chemistry. *Humanity and Social Sciences Journal*, 5(1), 19-24.
- Omoifo, C.N. (2012). *Dance of the limits, reversing the trends in science education in Nigeria*, Inaugural lecture, University of Benin, Benin City.
- Omorogbe, E., & Ewansiha, J. C. (2013). The Challenge of Effective Science Teaching in Nigerian Secondary Schools. *Academic Journal of Interdisciplinary Studies*, 2(7), 181. DOI: [10.5901/ajis.2013.v2n7p181](https://doi.org/10.5901/ajis.2013.v2n7p181)
- Roshan S, Lomme R, Hima H. & Santibanez C (2016). The Lagos EKO Secondary Education Sector: Tailoring International Best Practices to Improve Educational Outcomes at the Stale Level. World Bank Working Paper. Retrieved June 22<sup>nd</sup> 2021 from <https://www.researchgate.net/publication/307509761>
- West African Examination Council (WAEC), (2014). *Chief Examiners Report*. Lagos
- West African Examination Council (WAEC), (2015). *Chief Examiners Report*. Lagos
- Yewande, R. O., Okunuga, R. O., Ojo, O. T., (2012). Effect of School and Student Characteristics Variables on Secondary School Chemistry Students' Self-Concept. *Lagos Educational Review. A Journal of Studies in Education* 13, 61-89. Lagos.

---

### Author Information

---

#### Rachael O. Okunuga

Department of Science and Technology  
Education, Faculty of Education,  
University of Lagos

---