

# **Impediments to the Teaching of Chemistry as an Experimental Science in Secondary School in Oju Local Government Area, Benue State, Nigeria**

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## **ABSTRACT**

*This study investigates the implements to the teaching of chemistry as an experimental science in secondary schools in Oju Local Government Area of Benue State. The aim is to highlight the appropriate approach that should be adopted in the teaching of the course in secondary schools. Purposive sampling method was used to sample the nine chemistry teachers from five secondary schools in the study area. Three research questions were stated and answered. The instrument used for data collection was the chemistry teachers' experimental science questionnaire; simple percentage and itemization were used to analyse the data collected for the study. From this analysis, it was found that lack of professional qualification by chemistry teachers as well as lack of chemistry equipment/instruments affected to a very high extent the teaching of chemistry as an experimental science. The study recommended among others that government and other stakeholders in the education sub-sector should provide functional chemistry laboratory for meaningful practical activities.*

**Keywords:** *Chemistry, Experimental Science, Secondary Schools, implements*

## **INTRODUCTION**

Man turned to science in his efforts to understand the mysteries of the universe. He relies on science, especially chemistry, in areas such as communication, transport, medicine and various other ways (Otor, 2010). One major problem, however, is how the knowledge of science is being imparted to students in secondary schools to enhance learning. This is because the theoretical approach to science teaching has been found to be inadequate (Ikeobi, 2010; Agogo and Otor, 2013). There is therefore the need to replace this method with experimental approach for better performance. Experimental methods enable both the chemistry teachers and the students to verify many theories, laws and principles of chemistry in the laboratory. A survey of the achievements of students in some subjects in senior secondary schools (particularly chemistry) in Nigeria over the years reveals a discernible decline in students' performance (Ojerinde, 2000 cited in Ogbeba, 2010, Ogom, 2000 and Fatokun, 2012). The poor performance in chemistry by the students is attributed to the problem of non-availability of necessary facilities for practical work (Agaun, 2000, Ezenwa, 1993 and Fatokun, 2012); inadequate exposure to laboratory work (Achumugu,

2012) as well as shortage of qualified chemistry teachers (Fatokun, 2012) and absence of equipment/materials for science teaching (Agogo, 2009). There is therefore the need to teach chemistry with full students' involvement, as Ikeobi (2010) opines that chemistry is an experimental science which relies primarily on the relationship between theory and experiment. As the students experience the study of chemistry, they acquire desirable practical skills when they observe, handle materials/chemicals, prepare chemicals/reagents and such other activities (Ikeobi, 2010). According to Ezechukwu (2005), chemistry is what creates an enabling chemical infrastructure that delivers food, medicine and material world, while Agogo and Otor (2013) see it as an experimental science that is activity-based. They further state that Chemistry students are expected to:

- i. Observe things in and outside the class
- ii. Report objectively from investigations
- iii. Prepare various chemicals for practicals
- iv. Handle instruments and equipment during practical activities
- v. Weigh by using weighing balances to ascertain quantity (substances/chemicals) to be used in an experiment
- v. Measure accurately things/items to ensure right quantity for use, among other functions.

The implication of this is that chemistry knowledge is abstract in nature, which Agogo (2009) says it requires that teachers engage in meaningful and realistic practical activities. This would ensure better understanding of its various concepts. The method of instruction therefore requires the provision of learning experiences that would enable the students interact with the learning materials. This would provide motivation for better performance by the students (Agogo and Iji, 2010).

One major impediment of teaching chemistry as an experimental science is the absence of functional chemistry laboratories in most secondary schools in Nigeria. Ogom (2000) identifies absence of functional laboratories as a factor in students' poor performance in secondary school chemistry. Ikeobi (2010) however stresses that the teaching of chemistry as an experimental science enables the correct application of laboratory skills as well as proper handling of equipment in a chemistry class. In the same way, Mailumo, Agogo and Kpagh (2007) posit that modern chemistry teaching emphasises that it should be taught practically with full students' participation. Practical chemistry is therefore used to reinforce what is learned in the theory class, so it encourages the spirit of experimentation (Achimugu, 2012), and helps learners acquire the skill of observation, organization and proper reporting (Ode, 2012; Ezechukwu, 2005). In preparing for chemistry practicals, certain points should be taken into consideration to ensure that learning takes place:

- i. There should be laboratory rules that both teachers and students must adhere to.
- ii. Safety precautions should be adhered to,
- iii. Students should be assigned definite work areas with needed materials.
- iv. Students should keep their work areas clean and neat to avoid laboratory accidents (dispose all wastes properly)
- v. Unused reagents must not be returned to the bottles.

- vi. Results of all experiments should be reported accurately and promptly.
- vii. Title and objectives of each practical should be written on the report book.
- viii. Concise account of experimental procedures should be written.
- ix. All observations should be written clearly on the notebook.
- x. All calculations of yields and concentrations should be properly done from data generated.

Adeyegbe (1971) as cited in Achimugu (2012) traces the poor performance of students in practical chemistry to teachers' inability to take the candidates through practical sessions in the laboratory. Thus, this study takes a look at the impediments of teaching chemistry as an experimental science in secondary schools in Oju local government area of Benue State. The primary aim is to uncover the appropriate approach that should be adopted in teaching chemistry in secondary schools. The following research questions are raised to guide the study.

1. To what extent does lack of professional qualification of chemistry teachers affect the teaching of chemistry as an experimental science?
2. To what extent does lack of chemistry equipment/instruments in the laboratory affect the teaching of chemistry as an experimental science?
3. What constitutes impediments to the teaching of chemistry as an experimental science?

## **METHOD**

This study employs survey design with a population of chemistry teachers in the five secondary schools that offer chemistry at the West African Examination Council (WAEC) level in Oju local government area of Benue State. Nine Chemistry teachers were the participants of the study. This also formed the sample size for the study which was purposively sampled. The instrument for data collection was the Chemistry Teachers Experimental Science Questionnaire (CETESQ). The questionnaire was validated by lecturers from Benue State University, Makurdi, in Science education Unit and Test and Measurement. Data generated were analysed using simple percentage and itemization.

## **RESULTS AND DISCUSSION**

Table 1 shows that 55.6% of the respondents are NCE (Chemistry) holders, 22.2% have Bachelor's Degree with chemistry as major subject, 11.1% holds a Masters Degree and a degree outside chemistry as major teaching subject respectively. This means that NCE holders that are expected to teach only at the junior secondary school level, are made to teach chemistry and other science subjects at the senior level. This is a probably the reason that chemistry may not be taught as an experimental science. This is because this category of teachers may not be well equipped intellectually to handle the chemistry practical classes effectively.

Table 2 shows that 77.8% of the respondents said that professional qualification of chemistry teachers affect their teaching of the subject as an experimental science to very high extent, 22.2% said it is to a high extent while no teacher sees it to a low or no extent. This means that chemistry teachers' qualification is a factor in the teaching of the subject as an experimental science. According to Fatokun (2012), shortage of qualified chemistry teachers affect the performance of students in the subject at the secondary school level because of how they teach the subject. An unqualified chemistry teacher is likely to dwell more on theoretical knowledge than the practical aspects, thereby making the students to lose the practical investigative experience. From table 3, 55.6% of the respondents say that lack of chemistry equipment/instruments affect the teaching of the subject as an experimental science to a very high extent, 33.3% say it is to a high extent while 11.1% say it is only to a low extent. The respondents itemised their responses as to what constitutes the impediments to the teaching of chemistry as an experimental science as follows:

- i. Lack of functional chemistry laboratory (containing vital equipment/instruments and chemicals for meaningful practical activities.
- ii. Lack of professionally qualified chemistry teachers
- iii. Poor funding policy by proprietors of schools (government, private or community)
- iv. Poor conditions of service for chemistry teachers that make them to engage in strike actions or work to rule actions.
- v. Very few chemistry practical periods on the school time table.
- vi. Overcrowded chemistry practical class, making practical almost impossible, leading to laboratory accidents.
- vii. Poor maintenance culture by many schools that soon destroy/break their chemistry equipment/instruments or such other materials.
- viii. Corruption, making people to buy fake instruments/equipment that do not function well in the laboratory, thus wrong results are obtained during practicals.
- ix. Many students are not serious with their chemistry (science) class, as they avoid practical classes and vital topics/concepts.
- x. Too many public holidays that interrupts normal classes.
- xi. Many of the chemicals and materials in use are obsolete and out of use, leading to teachers' frustration as poor results are usually obtained.
- xii. African cultural practices tend to antagonise some scientific principles, so some students fear to violate cultural laws, so they skip practicals.
- xiii. Many chemistry students have phobia for the subject, especially practical aspects of the subject; so they tend to avoid practical chemistry sessions.

This means that absence of chemistry equipment/instruments affect the teaching of the subject in the laboratory as there may be no materials or instruments to work with. The teacher is therefore forced to base his teaching majorly on theory. Ikeobi (2010) sees chemistry teaching as relating to balancing of theoretical knowledge with the practical, however when the essential chemistry equipment are lacking, the teachers resort to alternative to practical, which is not good for chemistry learning. Mailumo, Agogo and

Kpagh (2007) posit that chemistry is best taught and learned when the teacher has functional equipment and instruments to use in the laboratory. This has therefore stressed the importance of chemistry equipment, instruments or materials in the practical teaching of the subject, where all the students are meaningfully involved. On the issue of what constitutes the major impediments to the teaching of chemistry as an experimental science, the respondents itemised these factors. They include lack of professionally qualified chemistry teachers, poor conditions of service of chemistry teachers as well as absence of functional chemistry laboratories in most secondary schools in Nigeria, among others. According to Achimugu (2012), the current trends in chemistry education which places emphasis on inquiry (practical activity) to teaching and learning makes it a must for chemistry teachers to integrate the theoretical aspect of the subject with practical works in the laboratory. This means that all schools offering chemistry should have functional laboratories, qualified chemistry teachers as well as properly remunerated chemistry teachers. Achimugu (2012) therefore concluded that the teaching of chemistry using practical works in the laboratory should be a rule rather than an option to chemistry teachers. This means that chemistry is best taught and learned when it is done as an experimental science.

**Table 1:** Chemistry teachers' qualification

<b>Qualification</b>	<b>Frequency</b>	<b>%</b>
NCE (Chemistry major)	5	55.6
B.Ed (B.Sc. (Edu.) Chemistry	2	22.2
M.Ed/M.Sc (Sc. Edu)	1	11.1
Other qualification	1	11.1
<b>Total</b>	<b>9</b>	<b>100</b>

*Source:* Survey, 2013

**Table 2:** Extent that lack of professional qualification affect chemistry teaching as an experimental science

<b>Schools</b>	<b>VHE</b>	<b>HE</b>	<b>LE</b>	<b>NE</b>
A	2	-	-	-
B	2	-	-	-
C	1	1	-	-
D	1	1	-	-
E	1	-	-	-
<b>Total</b>	<b>7</b>	<b>2</b>	<b>0</b>	<b>0</b>
<b>%</b>	<b>77.8</b>	<b>22.2</b>	<b>-</b>	<b>-</b>

*Source:* Survey, 2013

**Table 3:** Extent that lack of chemistry equipment in the laboratory affect the teaching of the subject as an experimental science

	<b>VHE</b>	<b>HE</b>	<b>LE</b>	<b>NE</b>
Respondents	5	3	1	-
%	55.6	33.3	11.1	0

*Source:* Survey, 2013

**Note:**

VHE	-	Very High Extent	HE	-	High Extent
LE	-	Low Extent	NE	-	No Extent (it has no effect at all).

## CONCLUSION AND RECOMMENDATIONS

Chemistry is central to many science and science-related courses and technology. The teaching of the subject therefore involves hands-on and minds-on activities for better understanding. This calls for the teaching of the subject as an experimental science. It also means employing professionally qualified teachers in schools with functional laboratories where the students are meaningfully engaged in experimental studies and exploration of the theoretical knowledge. Based on the findings, the following recommendations are made:

1. Government and other stakeholders in the education sector should provide functional chemistry laboratory for meaningful practical activities in schools in Benue State in general and Oju LGA in particular.
2. The school authorities and indeed the proprietors should ensure that professionally qualified chemistry teachers are employed in the study area to teach the subject for better students' performance, especially in practical aspects.
3. The school authority should increase the practical lessons for meaningful laboratory works and for wider contents coverage, as most schools have very few hours for practical activities in chemistry.

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