



## Impact of Chemistry Practical Activities on Secondary School Students' Academic Performance and Achievements in Bauchi Metropolis, Nigeria

Suleiman Kazeem, Jibrin Adamu Gagdi, Sadiya Ibrahim Muhammad, Auwal Rabiu,  
Department of Science Education,  
Faculty of Technology Education,  
Abubakar Tafawa Balewa University, Bauchi.

### ABSTRACT

Academic performance and achievement are the major determinants of students' academic success in any academic institutions including secondary schools in Bauchi State, Nigeria. In chemistry practical, secondary school students are expected to perform optimally and achieve extensively yet many students perform below expectations in Bauchi Metropolis. Therefore, this paper examined the impact of practical activities in chemistry laboratory on students' academic performance and achievements among SS III Chemistry students in public senior secondary schools in Bauchi Metropolis. Two objectives and questions were raised to guide the study. The sample of the study comprises of 30 male and 30 female Chemistry students in two (2) selected schools in Bauchi Metropolis. Structured questionnaire consisted of 10 questionnaire items each based on the two research questions raised in the study while mean score of 2.5 and above is accepted, any response with a mean score below 2.5 is rejected. The study revealed that practical activities in chemistry significantly improves the learners' academic performance and promotes students' academic achievement in the subject in the study area. The study recommended that the practical periods on the time-table of students should be increased, large crowd of students should be discouraged during chemistry practical in the laboratory and teachers should make the subject interesting to learners during practical chemistry classes.

### ARTICLE INFO

#### Article History

Received: December, 2022

Received in revised form: February, 2023

Accepted: March, 2023

Published online: June, 2023

### KEYWORDS

Chemistry, Practical, Secondary Schools,  
Bauchi.

### INTRODUCTION

The knowledge of science has been proven beyond reasonable doubt as the major catalyst for both industrial and technological advancements leading to better living conditions in the contemporary societies. The ease of doing things and accessibility to what is several miles away is incomparable to any time before now. This is achieved as a result of advancement in scientific knowledge globally hence, the need for continuous improvement in scientific understanding aspiring nations. As a result, Bajon (2015) refer to science as a special type of discipline with peculiar characteristics, prominent among which include continuous knowledge seeking. Chinwe and Emendu (2016) posited that science is both a process and a product, which are both acquired through effective planned

subject such as Chemistry. In Nigeria however, Chemistry subject, as spelt out in National Policy on Education (2014) is a compulsory subject for all secondary schools in science classes. In order to achieve the aims of Chemistry in this 21<sup>st</sup> century at the secondary school level in Nigeria, laboratory activities must be systematic and detailed.

Chemistry is one of the major branches of science that deals with scientific understanding of structure, structural changes and composition of matter (Udogu, Ewendu & Nnambdi, 2017). According to Ilya, Babayo, Hassan & Agbonika (2016) chemistry is a science of nature that deals with the properties of non-living substance, whose properties ranges from the preparation and changes they undergo when such substances are subjected to adverse condition of high temperature and

Corresponding author: Suleiman Kazeem

✉ [kazeemsuleiman013@gmail.com](mailto:kazeemsuleiman013@gmail.com)

Department of Science Education, Abubakar Tafawa Balewa University, Bauchi.

© 2023. Faculty of Tech. Education, ATBU Bauchi. All rights reserved



pressure. Dantani (2011), posited that chemistry has various unique features but also shares many features with other science subjects such as physics and chemistry. The philosophy of chemistry describes the nature of the subject. For example, how different classification schemes helps to explain qualitative aspects of matter, how different class concepts such as acid, salt and element, are used as a means of representation, how some concepts play very specific roles in Chemistry explanations, like chemical composition molecular structure and bonding and how electrons in particular orbital are employed in "level specific explanation". Therefore, Iliya et al (2016) stated that promoting scientific understanding of Chemistry (meaningful Chemistry learning), requires an increased focus on secondary school level students' higher order thinking skills that is applying, analyzing evaluating and creating or synthesizing. This could be achieved when Chemistry lessons are practiced in an equipped laboratory that would subsequently improve learners' academic performance and overall achievement in the subject.

Academic performance and academic achievement are two different concepts used to mean the same thing in most cases by several academic writers. Meanwhile, academic performance according to Jayanthi, Balakrishnan, Lim Siok Ching, Abdul Latiff and Nasirudeen (2014), is usually seen in relation to students' performance in examination, which could be internal or external examination. Also, students' academic performance usually describes the outcome of students' accomplishment in each subject or course through Grade Point Average (GPA). On the other hand, academic achievement is the extent to which a learner, teacher or institution has achieved the overall educational aims and objectives throughout a course of training (Bakon, Zappe, Messner & Lee 2011). More so, Amadi and Paul (2017) conceptualized academic achievement as a standardized test score, grades and overall academic ability and performance outcome of learners within their program in school. It can be described as a mark of success for both students and the teacher at the completion of the program of studies. Therefore, it could be said that

academic achievement of students includes the entire outcome of students' academic and non-academic activities designed in the school curriculum including examination results depicting academic performance. Therefore, academic performance and achievement of students in chemistry practical are paramount in determination of overall students' learning outcomes in chemistry subject at secondary school level, which is usually influenced by the quality of practical involvement of the learners during teaching learning process.

### LITERATURE REVIEW

In reference to previous studies, Moeed (2015) reported the findings of Toplis (2012) on students' views about teaching and learning through practical work in the science laboratory. It was discovered that students become more scientific conscious through the employment of scientific processes in the laboratory. The findings further depict that student's level of aversion towards transmission of knowledge from the teacher, rote learning and recall of facts without active laboratory practical in science classes, which Chemistry is inclusive. This is in line with the submission of Igwe (2017) that Chemistry practical is very paramount to promote and instill the idea of human and material development thorough practices among learners from school. Similarly, Moeed (2015) submitted that practical work in a laboratory setting is considered to be a preferred learning environment for school science. In the same vein, Akani (2015) studied the roles of the laboratory on students' academic achievement in chemistry in secondary schools in Ebonyi State of Nigeria. 240 students were sampled from ten secondary schools, in the three Education Zones in Ebonyi State. The results showed that the use of the laboratory helps to develop scientific attitudes in the students towards the learning of chemistry.

In a recent study in Uganda, Julius (2017) investigated the effect of laboratory exposure on students' academic achievement in practically based subjects in secondary schools in Wakiso District. It was discovered that several secondary schools have no proper laboratories but science rooms to cover up for laboratory during science teaching and learning. Meanwhile, these science rooms lack

Corresponding author: Suleiman Kazeem

✉ [kazeemsuleiman013@gmail.com](mailto:kazeemsuleiman013@gmail.com)

Department of Science Education, Abubakar Tafawa Balewa University, Bauchi.

© 2023. Faculty of Tech. Education, ATBU Bauchi. All rights reserved



fume thereby preventing students from learning practical on topic related to poisons gas. More so, the science rooms' lack accidents' precautions and prevention equipment. This makes safety of teachers and students in such room uncertain during science practical sessions in case of any accidents. Nevertheless, there were few laboratory equipment, apparatus, chemicals and specimens but not sufficient enough forcing teachers to improvise laboratory learning materials in order to cover the topics stated out in the school syllabus (Julius, 2017). Such practices have been reported in most Nigeria schools to the extent that some science teachers have to neglect practical aspects of the subjects (Usman & Sabo, 2018), consequently having negative effects on the performance of Chemistry students in practical activities. This study therefore aimed to determine the impact of practical activities in Chemistry laboratory on secondary school students' academic performance and achievements in Bauchi Metropolis.

#### STATEMENT OF THE PROBLEM

The continuous poor performance of senior secondary school students in Chemistry has become a great concern for the entire education stakeholders. This inability of students to perform effectively in Chemistry examinations could not be divorced from the failure of several senior secondary schools in the country to provide adequate laboratory learning environment for practical sessions in the subject. Akani (2015) reported that teaching Chemistry theoretically lead to inability of Chemistry students to; develop scientific attitude, solve scientific related

problem since they lack such skills, ask scientific probing questions, unable to acquire scientific research inquisitiveness and thereby perform poorly in internal and external Chemistry examinations. Hence, this study impact of chemistry practical activities on secondary school students' academic performance and achievement in Bauchi Metropolis, Nigeria.

#### Objectives of the Study

This study aims to determine the:

1. Impact of practical activities on secondary school students' academic performance in Bauchi Metropolis.
2. Impact of practical activities on secondary school students' academic achievement in Bauchi Metropolis.

#### Research Questions

The following research questions guided the study:

1. What is the impact of practical activities on secondary school students' academic performance in Bauchi Metropolis?
2. What is the impact of practical activities on secondary school students' academic achievement in Bauchi Metropolis?

#### METHODOLOGY

The population of this study comprises the entire SS III Chemistry students in public senior secondary schools in Bauchi Metropolis. However, the sample of the study was made up of 30 male and 30 female Chemistry students in two (2) selected schools in Bauchi Metropolis. The following Table 1 depicted the details of the sample of the study:

**Table 1:** Sample of the Study

S/No	School Type	School type	Gender		Total
			Male	Female	
1.	Government Day Secondary School, Fed/Low Cost, Bauchi	Co-education	15	15	30
2.	Government College Secondary School, Sa'adu Zungur, Bauchi	Co-education	15	15	30
<b>Total</b>			<b>30</b>	<b>60</b>	<b>60</b>

Structured questionnaire developed by the researcher was used in collecting data from the respondents. In order to ensure face

and content validity of the instrument that to be used for the study, two senior research experts at the Department of Science Education,

Corresponding author: Suleiman Kazeem

✉ [kazeemsuleiman013@gmail.com](mailto:kazeemsuleiman013@gmail.com)

Department of Science Education, Abubakar Tafawa Balewa University, Bauchi.

© 2023. Faculty of Tech. Education, ATBU Bauchi. All rights reserved



Abubakar Tafawa Balewa University, Bauchi vetted the instrument. The instrument was restructured as suggested by the experts before distribution to the respondents. The questionnaire was divided into two sections: "A" and "B". Section "A" comprises of personal data of the respondents such as age, gender, class, etc. Section "B" and "C" consisted of 10 questionnaire items each based on the two research questions raised in the study. Adjusted 4 Likert rating scale of Strongly Agree (SA), Agree (A), strongly disagree (SD) and Disagree (D) were used with nominal value of 4, 3, 2 and 1 respectively. The researcher administered the questionnaire to the selected 60 Chemistry students in the four schools.

The data obtained were analyzed and interpreted using arithmetic mean and standard deviation. The numeric values assigned to the different scaling items used are as follows; SA = 4, A = 3, D = 2 and SD = 1. Therefore, the mean for these values was determined by  $x = 4 + 3 + 2 + 1 = 10/4 = 2.5$ . This formed the decision rule and the cut-off-point mean of 2.50. That means any response that has a mean score of 2.5 and above is accepted while any response with a mean score below 2.5 is rejected.

### RESULTS

The results of this study are presented in tables and according to the research questions they addressed.

**Table1:** Impact of practical activities on secondary school students' academic performance in Bauchi Metropolis.

S/N	Options: Practical activities in Chemistry laboratory influence my academic performance in the following ways:	SA (4)	A (3)	D (2)	SD (1)	$\bar{X}$
1.	It increases my ability to compete favourably among my peers in Chemistry	31 (124)	18 (54)	06 (12)	5 (5)	3.25
2.	It captures and retains my attention throughout the lesson period.	24 (96)	13 (39)	17 (34)	6 (6)	2.92
3.	It enhances me to promptly complete my Chemistry assignments.	30 (120)	26 (78)	04 (8)	0 (0)	3.43
4.	I can transfer knowledge of a topic to solve another related problem in Chemistry.	28 (112)	23 (46)	07 (14)	2 (2)	2.90
5.	It encourages me to personally go beyond class or laboratory discussions and lessons in Chemistry.	16 (64)	21 (63)	10 (20)	13 (13)	2.67
6.	It encourages me to form personal notes in Chemistry during and after the class or lab activities.	44 (176)	12 (36)	01 (2)	3 (3)	3.62
7.	Colleagues disturbances is minimal hence improves my Chemistry understanding during laboratory activities.	35 (140)	25 (75)	0 (0)	0 (0)	3.58
8.	Timely chemistry laboratory practical greatly improves my understanding of the subject.	23 (92)	29 (87)	05 (10)	3 (3)	3.20
9.	Practical chemistry in the lab enhances my Chemistry textbook reading and understanding ability.	25 (100)	13 (39)	10 (20)	12 (12)	2.85
10.	Chemistry Lab practical improves my general understanding of chemical concepts.	23 (92)	21 (63)	09 (18)	7 (7)	2.90
<b>Grand Mean</b>						<b>3.13</b>

**Decision Rule:** Mean  $\geq 2.50$  = Accepted; Mean  $< 2.50$  = Rejected

Table 1 revealed that students in the secondary schools agreed that practical activities in Chemistry laboratory greatly

improves their academic performance in Chemistry in Bauchi Metropolis with the grand mean of 3.13, which is greater than 2.50

Corresponding author: Suleiman Kazeem

✉ [kazeemsuleiman013@gmail.com](mailto:kazeemsuleiman013@gmail.com)

Department of Science Education, Abubakar Tafawa Balewa University, Bauchi.

© 2023. Faculty of Tech. Education, ATBU Bauchi. All rights reserved

decision mean. This table further shows that greater number of students with 3.62 mean testified they could be able to form personal notes as a result of practical lessons. Similarly, students agreed with mean score of 3.58 absolute silence in the Chemistry laboratory

usually improves their understanding of the subject. Equally, it was also agreed with mean score of 3.25 that laboratory activities encourage favourable academic competition among students, hence improving their performance in Chemistry.

**Table 2:** Impact of practical activities laboratory on secondary school students' academic achievement in Bauchi Metropolis.

S/N	Options: <i>Practical activities in Chemistry laboratory influence my academic achievement in the following ways:</i>	SA (4)	A (3)	D (2)	SD (1)	$\bar{X}$
1.	It promotes my science process skills of observation, classifying, prediction, measuring and data recoding.	21 (84)	28 (84)	06 (12)	03 (3)	3.05
2.	It enhances my ability to understand scientific methods of problem solving in Chemistry.	21 (84)	18 (54)	08 (16)	13 (13)	2.78
3.	It helps in my scientific attitude development such as objectivity, honesty, inquisitiveness, persistence and impartiality.	29 (116)	16 (48)	08 (16)	07 (7)	3.12
4.	It arouses my interest and curiosity in Chemistry subject.	23 (92)	14 (42)	14 (28)	09 (9)	2.85
5.	It strengthens Chemistry theory I have learnt in the classroom.	15 (60)	21 (63)	17 (34)	07 (7)	2.73
6.	It helps my manipulative skills and ability in preparing practical reports.	34 (136)	12 (36)	08 (16)	06 (6)	3.23
7.	It improves my Chemistry concept understanding better than when taught theoretically.	25 (100)	19 (57)	12 (24)	4 (4)	3.08
8.	It upholds my activeness throughout the class to learn concretely than memorization of concepts and idea.	22 (88)	21 (63)	14 (28)	03 (3)	3.03
9.	It lays a solid ground for my future application of basic and applied research in chemistry.	27 (108)	22 (66)	03 (6)	08 (8)	3.13
10.	It helps me to prove chemistry laws and theories in textbooks.	19 (76)	29 (87)	10 (20)	02 (2)	3.08
<b>Grand Mean</b>						<b>3.08</b>

**Decision Rule:** Mean > 2.50 = Accepted; Mean < 2.50 = Rejected

Table 2 indicates that practical activities in Chemistry laboratory significantly impact secondary school students' academic achievement in Bauchi Metropolis. This finding was supported with 3.08 grand mean greater than the 2.50 decision mean. Greater number of the Chemistry students agreed with mean of 3.23 that practical activities in Chemistry help in development of manipulative skills, which is highly useful in preparing practical reports. More so, Chemistry students also agreed with the mean of 3.13 that laboratory practical activities lay solid foundation for future application of basic and applied research in

Chemistry. Also, students agreed with mean score of 3.12 that laboratory practical activities help in development of scientific attitude such as objectivity, honesty, inquisitiveness, persistence and impartiality hence, leading to greater achievement in Chemistry subject.

#### DISCUSSION OF FINDINGS

The findings of this study showed that practical activities in Chemistry laboratory significantly impact students' academic performance in Chemistry in Bauchi Metropolis with the grand mean of 3.13, which is greater than 2.50 decision mean. This finding is in line





with the finding of Udogu, Umendu and Nnamdi (2015) that laboratory practical activities among Chemistry helps to familiarize students with abstract concepts in chemistry, induce their scientific attitude and as well help in maintaining their interest thereby improving their academic performance in the subject.

The finding of this study also revealed that practical activities in Chemistry laboratory shows significant impact on students' academic achievement in Chemistry in Bauchi Metropolis with the grand mean of 3.08, which is greater than 2.50 decision mean. This finding however corroborates with the finding of Akani (2015) who discovered that laboratory teaching of Chemistry subject has positive implication on the academic achievement of students in secondary school students in Ebonyi State of Nigeria as it helps in the development of scientific skills for problem solving among the learners in the subject.

#### RECOMMENDATIONS

The following recommendations are made:

1. Since practical activities increases academic retention leading to better academic performance through practical in the laboratory then, the practical periods on the time-table of students should be increased.
2. Since laboratory practical activities reduces level of peer disturbances to enhance students' academic performance then, large crowd of students should be discouraged during chemistry practical in the laboratory.
3. Chemistry teachers should make the subject interesting to learners during practical chemistry classes to continually improving students' academic achievement in the subject.

#### REFERENCES

Akani, O. (2015). Laboratory Teaching: Implication on Students' Achievement in Chemistry in Secondary Schools in Ebonyi State of Nigeria. *Journal of Education and Practice* 6, No.30. [www.iiste.org](http://www.iiste.org) ISSN 2222-1735 (Paper) ISSN 2222-288X (Online).

- Amadi, G. and Paul, A. K. (2017). Influence of Student-Teacher Communication on Students' Academic Achievement for Effective Teaching and Learning. *American Journal of Educational Research*. 5(10), 1102-1107. DOI: 10.12691/education-5-10-12.
- Bajon, R. H. (2015). Effect of Mode of Laboratory Work on Senior Secondary School Students. Unpublished Thesis, Faculty of Education, University of Nigeria, Usukka.
- Bakon, J. W., Zappe, N., Messner, S., and Lee, P. (2011). *The blended learning: Using web course management tools to become guide on the side paper presentation at the 11<sup>th</sup> international conference on college technology and learning.*
- Chinwe, B. N. and Emendu, N. B. (2016). The effects of practical Activities on Chemistry student's science process skill Acquisition: *International Journal of Topical Issues*, 1, 153 – 165.
- Dantani, S. S. (2011). Effect of Computer Assisted Concept Mapping and Digital Video Instructions on Students Achievement in Chemistry. Phd Thesis University of Nsukka, Nigeria.
- Igwe, O. I. (2017). Extent of Safety Measures in Chemistry Laboratories in Secondary Schools in Nigeria. *JSAR Journal of Life and Applied Sciences* 2, Issue 2, 58-69 <http://www.mdcjournals.org/ijasar-jlas...html> (IJSAR-JLAS) ISSN: 2408-7610.
- Iliya, M., Babayo, K. M., Hassan, N. Agbonika, O.R (2016); Impact of demonstration method on students' Academic Performance in Chemical Kinetics concept of Senior Secondary School unpublished undergraduate project ATBU Bauchi.
- Jayanthi, S. V., Balakrishnan, S., Lim Siok Ching, A., Abdul Latiff, N. A. and Nasirudeen, A.M.A. (2014). Factors Contributing to Academic Performance of Students in a Tertiary Institution in Singapore. *American Journal of Educational*

Corresponding author: Suleiman Kazeem

✉ [kazeemsuleiman013@gmail.com](mailto:kazeemsuleiman013@gmail.com)

Department of Science Education, Abubakar Tafawa Balewa University, Bauchi.

© 2023. Faculty of Tech. Education, ATBU Bauchi. All rights reserved



- Research*, 2, 9, 752-758.  
<http://pubs.sciepub.com/education/2/9/8>.
- Julius, K. (2017). The effect of laboratory exposure on students' academic achievement in practically based subjects in secondary schools in Wakiso District. Unpublished B.Sc Dissertation College of Education, Open and Long-Distance, Kampala International University.
- Moeed, A. (2015). *Science Laboratory Learning Environment, and Learning*. Chapter 2 in *Science Investigation: Student Views about Learning, Motivation and Assessment*. *Springer Briefs in Education*, DOI 10.1007/978-981-287-384-2\_2.
- National Policy on Education (2014), Federal Government of Nigeria (Revised), Abuja, Nigeria: Nigeria Education Development Council (NERDC) ijese.2016.288a.
- Toplis, R. (2012). Students' views about secondary school science lessons: The role of practical work. *Research in Science Education*, 42, 531–549. doi:10.1007/s11165-011-9209-6.
- Udogu, M. E., Ewendu, N. B., and Nnamdi, B. (2017). Impact of Practical Activities in Chemistry Laboratory Exercise in Senior Secondary School in Nigeria. International Digital Organization for Scientific Research ISSN: 2579-0781 *IDOSR Journal of Experimental Sciences* 2(3) 59-67.
- Usman, I. S. and Sabo, M. (2018). Impact of Laboratory Practical Skills on Students' Achievement in Physics in College of Education Azare, Bauchi Metropolis, Nigeria. *KIU Journal of Humanities*. Kampala International University ISSN: 2415-0843; 3(2): 205–210.