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Class Size and Availability of Laboratory Facility on Students' Performance in Chemistry in Selected Private Secondary Schools in Ethiope West, Delta State

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Abstract. This study focuses on the effect of class size and the availability of laboratory facilities on students' academic performance in Chemistry in selected private secondary schools in Ethiope West Local Government Area of Delta State. The study adopted a survey research design. The population of the study is 970 which consisted of teachers and students in selected private secondary schools in Ethiope West Local Government Area, Delta State. From this population, a sample size of 175 respondents was randomly selected to participate in the study. The research instrument used for data collection was a structured questionnaire designed by the researcher. The instrument was subjected to face and content validation by experts in educational research to ensure its appropriateness and relevance to the study objectives. The reliability of the instrument was established using a reliability testing method to ensure consistency which gave a co-efficient value of 0.68 indicated that the research instrument was relatively reliable in the responses obtained. Data for the study were collected through the administration of the questionnaire to the selected respondents. Mean, Pearson Product Moment Correlation coefficient(r) and coefficient of determination (r2) were to answer the research questions and hypotheses were tested using t-test and Pearson Product Moment Correlation coefficient(r) at 0.05 level of significance. The findings of the study revealed that smaller class sizes increase teacher–student interaction, encourage active participation among students, and promote more effective learning activities in the classroom, thereby improving students' academic performance in Chemistry.

keywords: Class Size, Laboratory Facility, Students' Performance, Chemistry, Secondary Schools.

I Introduction

Education is widely recognized as the cornerstone of national development, serving as a crucial mechanism for equipping individuals with the knowledge, skills, and values necessary to contribute meaningfully to society (Abah et al., 2025). Across the world, the quality of education determines not only personal success but also the economic, social, and technological advancement of nations. Within the spectrum of educational subjects, science education occupies a particularly important role (Odimgbe et al.,

2025). Science subjects such as Physics, Biology, and Chemistry are essential for developing critical thinking, problem-solving skills, and analytical abilities among students (Ugboma et al., 2024). These subjects provide learners with a deeper understanding of natural phenomena and prepare them for careers in science, technology, engineering, and medicine (STEM), areas that are vital for national growth and global competitiveness (Festus-Amadi et al., 2021; Oladosu et al., 2026). Among science subjects, Chemistry holds a unique position.

Chemistry bridges the gap between theoretical knowledge and practical application, helping students understand the composition, structure, and changes of matter. Mastery of Chemistry requires not only cognitive engagement but also hands-on experience, which allows students to apply theoretical concepts through experimentation (Abah et al., 2025). The performance of students in Chemistry is thus a critical indicator of the effectiveness of science education in secondary schools (Abeokuta et al., 2025). Yet, despite its importance, student performance in Chemistry has been a persistent concern in many educational systems, particularly in developing regions, where educational resources and infrastructure may be inadequate. Student performance is influenced by a complex interplay of factors, including teaching methods, availability of learning resources, teacher competence, school environment, and student motivation (Odimgbe, 2023). Among these, two factors—class size and the availability of laboratory facilities—have consistently emerged as key determinants of academic achievement in science subjects. Class size refers to the number of students in a single classroom or learning session (Yohanna et al., 2025). Research has shown that smaller class sizes often facilitate better interaction between teachers and students, allow for individualized attention, and enable teachers to address students' specific learning needs (Odimgbe, 2025). Conversely, larger class sizes can limit student engagement, reduce opportunities for practical demonstrations, and negatively affect the overall quality of learning. Similarly, the availability and adequacy of laboratory facilities are crucial for effective science education (Ogwuche & Obruche, 2020; Umudi et al., 2025).

Laboratories provide students with an environment where they can observe, experiment, and analyze scientific phenomena firsthand (Julius et al., 2026). The hands-on experience gained in the laboratory enhances understanding, stimulates curiosity, and

reinforces theoretical knowledge. Without access to well-equipped laboratories, students may struggle to comprehend complex chemical concepts, leading to poor academic performance (Umudi et al., 2026). Unfortunately, in many schools, especially in developing regions, laboratory facilities are often inadequate, outdated, or poorly maintained, posing significant challenges to effective science teaching and learning (Erienu et al., 2022; Obruche et al., 2025).

In Nigeria, the importance of private secondary schools in complementing public education cannot be overstated (Itodo et al., 2021). Private schools often promise better resources, improved teaching methods, and enhanced student outcomes (Ekpo et al., 2023). However, even within private institutions, there exists variation in educational quality due to differences in resource allocation, class management, and infrastructural development (Umudi et al., 2025). In Delta State, and specifically in the Etoppe West area, private secondary schools have witnessed significant growth in enrollment (Oladosu et al., 2026). Despite this growth, challenges such as large class sizes and limited laboratory facilities persist, potentially affecting the academic performance of students in critical subjects like Chemistry. Several studies have highlighted that optimal learning in science subjects requires a balance between theoretical instruction and practical experimentation.

Large class sizes can hinder this balance by making it difficult for teachers to conduct experiments effectively or provide individual guidance. Similarly, the absence or inadequacy of functional laboratory facilities can limit students' exposure to practical activities, reducing their ability to apply theoretical knowledge in real-life contexts. While these issues have been examined in general terms, there is limited empirical research that specifically investigates the combined effects of class size and laboratory availability on students' performance in Chemistry within the context of private secondary schools in Etoppe West, Delta State. Addressing these gaps is crucial because student performance in Chemistry not only reflects the effectiveness of teaching and learning practices but also determines students' future opportunities in STEM-related fields. By investigating the effects of class size and laboratory facilities, this study aims to provide valuable insights into the factors that enhance or impede students' learning outcomes in Chemistry. The findings of this research could guide school administrators, policy-

makers, and educators in designing interventions that optimize class sizes, improve laboratory infrastructure, and ultimately enhance academic performance (Okpanachi et al., 2025). Therefore, this study specifically seeks to examine the effect of class size and the availability of laboratory facilities on student performance in Chemistry in selected private secondary schools in Etoppe West, Delta State. By focusing on these two critical variables, the study aims to identify practical solutions to improve science education outcomes, ensuring that students acquire the knowledge, skills, and competencies necessary for academic success and future professional endeavors.

II. Statement of the Problem

Following the pattern of the country's educational system, notably in Delta State, population growth without a proportional rise in facilities in our schools has created a major challenge that has jeopardised the essence of learning. This situation got so severe that over 100 pupils were crammed into a classroom with insufficient infrastructure; as a result, many students received their courses while standing. Overcrowding in classrooms has been identified as one of the primary causes of deteriorating educational standards in Nigeria, particularly at the elementary and secondary levels (Obruche et al., 2018). There has been debate over the relative effects of class size and students' academic performance. The empirical question of whether class size has a negative or beneficial influence on students' academic achievement remains unresolved. Against this context, this study aims to provide a critical assessment of the link between class size and students' academic achievement, with a focus on certain chosen secondary schools in Ethiope West LGA, Delta state.

III. Purpose of the study

The main aim of the study is to examine the effect of class size and availability of laboratory facility of student performance in chemistry clases in some selected private secondary schools in Mosogar. Specific Objective: The specific objectives of this study are:

- To investigate if there is any significant relationship between class size and students’ academic performance in chemistry.

- To determine the effect of laboratory facility on students' academic achievement in chemistry.
- To find out if small class size have effect on students' academic performance in chemistry.

IV. Research Questions

In an attempt to come up with relevant findings in this study, the following questions were raised to guide and give focus to the study:

- Is there relationship between class size and students' academic performance in chemistry in private secondary schools in Ethiope West local Government Area Delta State?
- Does availability of laboratory have an effect on student academic achievement in chemistry in Ethiope West local Government Area Delta State?
- What is the difference in the mean scores of male and female students in large and small chemistry classes in private senior secondary schools in Ethiope West local Government Area Delta State?

V. Research Hypotheses

The research tested the following hypotheses at 0.05 level of significance:
Ho1: There is no significant relationship between class size and students' academic performance in chemistry.
Ho2: There is no significant relationship between availability of laboratory facility and students' academic performance in chemistry.

VI. Methodology

This section is concerned with the procedures which will be adopted in this study. They include: Research Design, Population of the study, sample and sampling techniques, Instrument of Data Collection, Validity of the instrument, Method of data collection and Method of Data analysis.

Research Design

Research designs are perceived to be an overall strategy adopted by the researcher whereby different components of the study are integrated in a logical manner to effectively address a research problem. In this study, the researcher employed the survey research design. This is due to the nature of the study whereby the opinion and views of people are sampled. According to Obruche et al.(2019), Survey research can use quantitative research strategies (e.g., using questionnaires with numerically rated items), qualitative research strategies (e.g., using open ended questions), or both strategies (i.e. mixed methods). As it is often used to describe and explore human behaviour, surveys are therefore frequently used in social and psychological research.

Population of the Study

This study was carried out to examine the effect of class size and availability of laboratory facility of student performance in chemistry in Ethiope West, LGA, Delta State. Hence, the population of this study comprises of estimated of 970 students of some selected private secondary schools in Ethiope West, LGA, Delta State.

Table 1: Names of school and number of Respondent

S/N	Names of School	Number of Respondent
1	Royal Faith Standard International School, Mosogar	20
2	Destiny Child International School, Mosogar	20
3	Fortune Academy Mosogar	19
4	Our ladies of Nigeria Secondary school, Oghara	19
5	Destiny Child International Academy Oghara	20
6	Supreme God Academy Ogharefe	19
7	Merit Academy Jesse	19
8	Blazers International School Jesse	19
9	Jesse International School Jesse	20
Total		**175**

Sample Size Selection Technique and Procedure

According to Umudi et al. (2025), sampling techniques are procedures adopted to systematically select the chosen sample in a specified away under controls. This research work adopted the convenience sampling technique in selecting the respondents from the total population. In this study, the researcher adopted the convenient sampling

method to determine the sample size. Out of the entire students of some selected private secondary schools in Ethiope West, LGA, Delta State. The researcher conveniently selected 175 respondents (as shown in table 1) as sample size for this study. According to Ekpo et al. (2025), a sample of convenience is the terminology used to describe a sample in which elements have been selected from the target population on the basis of their accessibility or convenience to the researcher.

Instrument for Data Collection

The research instrument used in this study is the questionnaire. A survey containing series of questions were administered to the enrolled participants. The questionnaire was divided into two sections, the first section enquired about the responses demographic or personal data while the second sections were in line with the study objectives, aimed at providing answers to the research questions. Participants were required to respond by placing a tick at the appropriate column. The questionnaire was personally administered by the researcher.

Validity of the Study

Validity referred here is the degree or extent to which an instrument actually measures what is intended to measure. An instrument is valid to the extent that is tailored to achieve the research objectives. The researcher constructed the questionnaire for the study and submitted to the project supervisor who used his intellectual knowledge to critically, analytically and logically examine the instruments relevance of the contents and statements and then made the instrument valid for the study.

Reliability of the Study

The reliability of the research instrument was determined. The test – retest method was used. In this method twenty five (25) of the instruments were administered to a set of respondents who were not part of the sample. Result obtained was subjected to the Pearson Correlation Coefficient. A co-efficient value of 0.68 indicated that the research instrument was relatively reliable. According to Umanah et al. (2025) the range of a reasonable reliability is between 0.67 and 0.87.

Method of Data Collection

Two methods of data collection which are primary source. The primary sources was the use of questionnaires, data were personally collected by the researcher by visiting the

selected government approved senior secondary schools. A total of 175 copies of questionnaire were administered to the teachers and collected same day of administration to ensure proper 100% return rate

Method of Data Analysis

Data were analyzed using the simple percentage in order to facilitate the interpretation of the data collected. The simple percentage calculation is carried out as;

$$\text{Percentage Response \%} = \frac{\text{Number of response}}{\text{Total Number of respondents}} \text{ x } 100$$

VI. Results and Discussion

This section presents the analysis of data derived through the questionnaire and key informant interview administered on the respondents in the study area. The analysis and interpretation were derived from the findings of the study. The data analysis depicts the simple frequency and percentage of the respondents as well as interpretation of the information gathered. A total of one hundred and seventy five (175) questionnaires were administered to respondents which only one hundred and twenty nine (129) were returned and one hundred (100) were validated. This was due to irregular, incomplete and inappropriate responses to some questionnaire. For this study a total of 100 was validated for the analysis.

Data Presentation

The table below shows the summary of the survey. A sample of 175 was calculated for this study. A total of 129 responses were received while 100 were validated. For this study a total of 100 were used for the analysis.

Table 2: Distribution of Questionnaire

Questionnaire	Frequency	Percentage
Sample size	175	100
Received	129	72.5
Validated	100	62.5

Source: Field Survey, 2025

Table 3: Demographic data of respondents

Demographic information	Frequency	percent
Gender		
Male	67	67%
Female	33	33%
Age		
15-20	50	50%
21-30	16	16%
31-40	27	27%
41-50	07	07%
51+	00	00%
Position		
Student	50	50%
Teacher	50	50%

Source: Field Survey, 2025

Answering Research Questions

Question 1: is there any significant relationship between class size and students academic performance in Chemistry in Ethiope West Local Government Area Delta State?

Table 4: Respondent on question 1

Options	Frequency	Percentage
Yes	60	60
No	19	19
Undecided	21	21
Total	**100**	**100**

Source: Field Survey, 2025

From the responses obtained as expressed in the table above, 60 respondents constituting 60% said yes. 19 respondents constituting 19% said no. While the remain 21 respondents constituting 21% were undecided.

Question 2: Does availability of laboratory facility have an effect on students academic achievement in Chemistry in Ethiope West Local Government Area Delta State?

Table 5: Respondent on question 2

Options	**Frequency**	**Percentage**
Yes	56	56
No	21	21
Undecided	23	23
Total	**100**	**100**

Source: Field Survey, 2025

From the responses obtained as expressed in the table above, 56 respondents constituting 56% said yes. 21 respondents constituting 21% said no. While the remain 23 respondents constituting 23% were undecided.

Research Question 3: What is the difference in the mean scores of male and female students in large and small chemistry classes in private senior secondary schools in Ethiope West Delta State?

Table 6: Mean Responses on the mean scores of female students in large and small classes

S/N	**ITEM STATEMENT**	**SA 4**	**A 3**	**D 2**	**SD 1**	**X**	**S.D**	**REMARK**
1	Large class size promotes learning outcome of female students	00	23	57	120	1.7	2.59	Rejected
2	Small class size increase male and female student concentration on class task	40	130	20	10	3.1	2.42	Accepted
3	Large class size helps in male and female student contribution in class group projects	00	10	53	137	1.65	2.62	Rejected
4	Small class size encourages male andfemale students' classroom participation and learning activities	100	60	15	25	3.3	2.49	Accepted

In table 6, item 1 with mean response of 1.7 rejected that Large class size promotes learning outcome of female students. Item 2 with mean response of 3.1 accepted that Small class size increase female student concentration on class task. Item 3 with mean response of 1.65 also rejected that Large class size helps in female student contribution in class group projects. Item 4 with mean response of 3.3 accepted that Small class size encourages female students' classroom participation and learning activities which leads to high academic performance. Comparing the responses in the item 1 & 3 which rejected the options with the mean value at 1.7 and 1.65 and the responses in item 2 & 4 which accepted the options with the mean values at 3.1 & 3.3, This indicates that there is a difference in the mean scores of female students in large and small classes.

Test of Hypotheses

Ho1: There is no significant relationship between class size and students' academic performance in chemistry

Table 7: Summary of Linear Regression Analysis of the Relationship Between relationship between class size and students' academic performance in chemistry

Model 1	R = 0.830	R^2 = 0.936	Adj.R^2 = 0.687	Std. Error estimation = 0.307	Durbin-Watson = 1.679
	Sum of Square	Df	Mean Square	F	Sig.
Regression	6089.246	1	6089.246	328.315	.000[b]
Residual	2744.947	99	18.547		
Total	8834.193	100			
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	-11.417	2.936		-3.888	.000
Class size	.887	.016	.830	18.119	.000

The table 7 shows that class size have significant influence on academic performance of student in chemistry at (β = 0.887, R2 = 0.936, P = .000). Furthermore, result reveals that class size has 94% decisive influence on academic performance of student in chemistry. The P value of 0.000 is less than significant level of 0.05. The result shows that there is a significant positive relationship between class size and academic performance of student in chemistry. Therefore H01 is rejected.

Ho2: There is no significant relationship between availability of laboratory facility and students' academic performance in chemistry

Table 8: Summary of Linear Regression Analysis of the Relationship Between availability of laboratory facility and students' academic performance in chemistry

Model 2	R = 0.831	R^2 = 0.952	Adj.R^2 = 0.688	Std. Error estimation = 0.308	Durbin-Watson = 1.688
	Sum of Square	Df	Mean Square	F	Sig.
Regression	6089.247	1	6089.247	328.316	.000[b]
Residual	2744.948	99	18.547		
Total	8834.194	100			

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	-11.418	2.943		-3.999	.000
Availability of laboratory facility	.896	.017	.830	18.120	.000

Source: Author's Data Analysis, 2025

The table 8 shows that availability of laboratory facility has significant influence on academic performance in chemistry at (β = 0.896, R2 = 0.952, P = .000). Furthermore, result reveals that availability of laboratory facility has 95% decisive influence on student performance in chemistry. The P value of 0.000 is less than significant level of 0.05. The result shows that there is significant relationship between availability of laboratory facility and students' academic performance in chemistry. Therefore H02 is rejected.

VII. Conclusion

This in-depth study analyzed the relationship between class size and academic performance within. The findings of this study provide educational leaders with data regarding class size and academic achievement, resulting in the continuation of class size reduction. The study also reveals that: Smaller classes result in increased teacher-student contact. Students in smaller classes show more appreciation for one another and more desire to participate in classroom activities. In smaller classes, more learning activities

take place. Smaller classes foster greater interaction among students, helping them understand one another and increasing their desire to assist one another. Smaller classes allow for potential disciplinary problems to be identified and resolved more quickly. Smaller classes result in higher teacher morale and reduced stress. Less retention, fewer referrals to special education, and fewer dropouts are the ultimate rewards of class-size reduction.

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