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Research

Provision and Utilization of Laboratory Facilities and Students' Academic Achievement in Chemistry in Public Secondary Schools in Ogun State, Nigeria

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Abstract: Students' academic achievement in chemistry in external examinations had shown a downward trend over the years. The poor achievement in chemistry had not been limited to provision of laboratory facilities alone but also the utilization of such facilities. This study investigated the contribution of provision and utilization of laboratory facilities to students' academic achievement in chemistry in public secondary schools in Ogun State. Three research question were raised and two hypotheses formulated and tested at .05 level of significance. The study adopted a descriptive research design of survey type, involving 30 chemistry teachers and 300 chemistry students, selected through multi- stage sampling technique from a population of 102 chemistry teachers and 5,923 SS 2 chemistry students in 79 public secondary schools in Ogun-Central Senatorial District, Ogun State, Nigeria. Laboratory Facilities Provision Rating Scale (LFPRS), Laboratory Facilities Utilization Rating Scale (LFURS) and Chemistry Achievement Test (CAT) with reliability coefficients of .82, .78 and .85 respectively were used to collect data. Data were analysed using descriptive statistics of frequency counts, percentage, mean and standard deviation and inferential statistics of Multiple Linear Regression. Findings revealed that the level of provision and utilization of laboratory facilities and students' academic achievement in chemistry were low. There was a significant joint contribution of provision and utilization of laboratory facilities to students' academic achievement in chemistry ($F(2, 27) = 43.767$, $p < .05$). There was a significant relative influence of provision ($\beta = .398$, $t = 2.629$, $p = .014$, $p < .05$) and utilization ($\beta = .526$, $t = 3.471$, $p = .002$, $p < .05$) of laboratory facilities on students' academic achievement in chemistry. Based on the findings, appropriate recommendations were made..

Keywords: Provision, Utilization, Laboratory facilities, Students' Academic Achievement

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Introduction

Academic achievement is an indispensable indicator of students' success at the various levels of education. At the secondary school level, academic achievement is a critical issue not only because it lays the foundation for higher levels of education but also serves as an indicator to measure the level of adequacy and the frequency of utilization of laboratory facilities. Academic achievement refers to the level of knowledge demonstrated by learners after receiving instructions from teachers over a period of time in a specific subject, as measured by their scores. Asiyai (2023) defined students' academic achievement as the scores obtained by students in standardized teacher-made tests or public examination. According to Kenni (2020), the academic achievement of students in chemistry has remained unsatisfactory in recent years despite substantial financial investment in laboratory facilities. Mayra and David (2018) reported that the high failure rate in high school chemistry in Ecuador has contributed to increased attrition from science related careers particularly engineering and medicine indicating that the declining students' achievement in chemistry is a global issue rather than a solely African challenge.

Obikesie et al.(2023), defined chemistry as a discipline in science, technology, engineering and mathematics (STEM) that investigates the properties, compositions and structures of matter as well as the transformation matter undergoes and the consequences of those transformation on human welfare and environment. Chemistry is one of the basic science subjects required for studying medical sciences, engineering and technology, pure and applied sciences and other science related courses in tertiary institutions. According to Muhammad and Ubendu (2021), laboratory contains the resources, equipment and apparatus required for science teaching, ranging from basic consumable to comprehensive facilities needed for effective chemistry instruction and learning. Provision of laboratory facilities in the opinion of Oyelowo (2023), is the level to which laboratory facilities are available or accessible for teaching and learning. Ofeimu and Asemhokhai (2022) affirmed that utilization of laboratory facilities involves using available or accessible tools, equipment and appliances to make the teaching and learning process easier, more engaging and more rewarding. Kumar and Ramnath (2018) as well as Ezano and Ugwu (2024), asserted that the teaching process is effective and less strenuous for teachers and students when laboratory facilities are sufficiently available and frequently utilized.

Chandana (2018) examined the availability of chemistry laboratory facilities and its utilization in the higher secondary schools of Guwahati City, Assam, India. No sampling

techniques was employed because only 10 out of the 19 schools had science stream. Data were collected using questionnaire and science laboratory inventory checklist. Frequency count and percentage were used for data analysis. Findings revealed that the proportion of schools with inadequate laboratory facilities exceeded those with adequate laboratory facilities. Juanico et al. (2023) investigated science teachers' experiences in implementing laboratory work and activities amid insufficient laboratory equipment or apparatus. The study involved 12 science teachers selected from schools in the Philippines and thematic analysis was employed to generate themes from transcript of in-depth interviews with the teachers. Findings indicated that science teachers encountered significant challenges in implementing science laboratory works and activities due to the scarcity of laboratory equipment or apparatus.

Asefa et al. (2023) assessed the availability of chemistry laboratories, the extent of applying the laboratory resources utilization in teaching chemistry and the challenges encountered in using chemistry laboratory for teaching and learning. The study was conducted at Adet and Debremewii secondary schools, Amhara Region, Ethiopia. Respondents comprised all chemistry teachers, one departmental head, one chemistry laboratory technician and 20 students from grade nine (9) and ten (10). Questionnaire, rating scale, interview and observation checklist were used to collect data for the study. The data collected were analysed using frequencies and percentages. The findings revealed that laboratories facilities were isolated and the available laboratory facilities were inadequate. Twahirwa and Twizeyimana (2020) studied the effect of practical work on academic achievement in physics among learners at selected secondary schools in Rwanda. The results revealed that practical work using laboratory facilities was more effective in improving students' achievement.

Ezeano and Ugwu (2024) examined the effect of laboratory teaching method on senior secondary students' academic achievement in inorganic chemistry, specifically acid–base titration in Enugu Education Zone of Enugu State, Nigeria. The study adopted a pre-test, post-test, non-controlled group quasi–experimental design. The population comprised 1,407 senior secondary two (SS 2) chemistry students from 20 public co–educational schools in the zone. Mean and standard deviation were used to answer the research questions, while Analysis of Covariance (ANCOVA) was employed to test the null hypothesis at .05 level of significance. Findings revealed that laboratory teaching had more positive significantg effect on chemistry students' achievement. Usman (2021) investigated

the effect of availability and utilization of laboratory facilities on students' academic achievement in chemistry. A descriptive survey research design was adopted. The sample comprised 14 science teachers and 310 secondary school students drawn from seven selected schools from Sokoto Local Government Area in Sokoto State. Findings revealed inadequate chemistry laboratory equipment in the secondary schools surveyed. The researcher noted that out of the 15 schools involved in the study, only four had adequate laboratory equipment for practical work. This was attributed the special support the four schools received from the Ministry of Basic and Secondary Education and Ministry of Science and Technology as they were the only designated science secondary schools under the ministries.

Statement of the Problem

The dwindling level of students' academic achievement in chemistry in recent years raises a concern among the stakeholders in education. The Chief Examiner's report of the West African Senior School Certificate Examination (WASSCE) consistently highlighted poor academic achievement in chemistry, with declining mean scores over the years: 54.0 in 2020; 49.0 in 2021, 45.0 in 2022 and 34.0 in 2023. The trends in students' academic achievement in chemistry have sparked concern among parents, teachers and other stakeholders in education, prompting questions about whether availability and utilization of laboratory facilities being parts of the underlying factors contributing to this outcome. The downward trend in students' academic achievement in chemistry underscores a significant knowledge gap that this study aimed to address. Therefore this study investigated the contribution of provision and utilization laboratory facilities to students' academic achievement in chemistry in public secondary schools in Ogun State, Nigeria

Objectives of the Study

The main objective of this study was to investigate provision and utilization of laboratory facilities and students' academic achievement in chemistry in public secondary schools in Ogun State, Nigeria. Specifically, this study:

1. assessed the level of provision of laboratory facilities in public secondary schools in Ogun State.
2. investigated the extent of utilization of laboratory facilities by chemistry teachers in public secondary schools in Ogun State.
3. examined the level of students' academic achievement in chemistry in .public secondary schools in Ogun State.

4. investigated the joint contribution of provision and utilization of laboratory facilities to students' academic achievement in chemistry in public secondary schools in Ogun State.

5. assessed the relative influence of provision and utilizations of laboratory facilities on students' academic achievement in chemistry in public secondary schools in Ogun State.

Research Questions

This study answered the following research questions:

1. what is the level of provision of laboratory facilities in public secondary schools in Ogun State?

2. to what extent do teachers utilize laboratory facilities in public secondary schools in Ogun State?

3. what is the level of students' academic achievement in chemistry in public secondary schools in Ogun State?

Hypotheses

The following null hypotheses were tested in this study:

Ho_1: There is no significant joint contribution of provision and utilization of laboratory facilities to students' academic achievements in chemistry in public secondary schools in Ogun State.

Ho_2: There is no significant relative contribution of provision and utilization of laboratory facilities on students' academic achievements in chemistry in public secondary schools in Ogun State.

Methodology

The study adopted the descriptive research design of the survey type. The target population of this study comprised 102 chemistry teachers and 5,923 Senior School 2 (SS2) chemistry students in 79 public senior secondary schools in Ogun-Central Senatorial District, Nigeria. The sample size of this study consisted of 300 Senior School 2 (SS 2) chemistry student and 30 chemistry teachers in Ogun-Central Senatorial District using a multi-stage sampling approach. The sample size of 300 chemistry students and 30 chemistry teachers was determine using Taro Yamane's statistical formula.

At the first stage, the six Local Government Areas in Ogun-Central Senatorial District were stratified into three zones: (Abeokuta South/Odeda, Abeokuta North/Obafemi-Owode and Ifo/ Ewekoro), after which simple random sampling, was used

for selecting three Local Government Areas which were: Abeokuta South, Obafemi-Owode and Ifo, comprising one Local Government Area from each zone. At the second stage, ten (10) public secondary schools were selected through simple random sampling from each of the selected Local Government Areas. Thereafter, at the third stage, purposive sampling technique was used to select one chemistry teacher in a school with only one chemistry teacher while simple random sampling technique was used to select one chemistry teacher in a school with two or more chemistry teachers. At the fourth stage, ten (10) Senior Secondary School 2 (SS2) chemistry students were selected using simple random sampling from each of the selected schools.

Three research instruments tagged Laboratory Facilities Provision Rating Scale (LFPRS), Laboratory Facilities Utilization Rating Scale (LFURS) and Chemistry Achievement Test (CAT) were used to collect data. The LFPRS constructed by the researcher captured the level of provision and availability of 30 individual items in chemistry laboratory. The response was based on a four (4)-point rating scale designated as; Not Available (NA) =1, Available but Obsolete (AO) =2, Available but Not Adequate (AN) =3 and Available and Adequate (AA) =4. The respondents were the chemistry teachers. The LFURS captured the frequency of utilization of 30 individual items in chemistry laboratory that were responded to by the chemistry teachers on a four (4)-point frequency rating scale, designated as Never Utilized NU=1, Rarely Utilized RU=2, Occasionally Utilized OU =3, Frequently Utilized FU=4 The Chemistry Achievement Test (CAT) contained thirty (30) standardized multiple choice test items on provision and utilization of chemistry laboratory facilities, adapted from past chemistry questions of the West African Senior School Certificate Examination (WASSCE). The chemistry achievement test scored out of 30, was a administered to 300 SS 2 students from 30 public secondary schools, with 10 students per school in Ogun-Central Senatorial District, Ogun State, Nigeria.. The mean achievement score for each school was calculated by averaging the total score of the 10 students. Teacher's responses were matched with the corresponding school mean achievement score.

The instruments were validated by two experts in the Department of Educational Management and one expert in the Department of Chemical Sciences, Tai Solarin University of Education. Ijebu-Ode, Nigeria. A test-reset method was used to determine the reliability of all the instruments. A reliability test was conducted by using Pearson Product Moment Correlation (PPMC) for LFPRS and LFURS. The coefficient of stability index obtained were .82 for Laboratory Facility Provision Rating Scale (LFPRS) and .78

for Laboratory Facility Utilization Rating Scale (LFURS). The reliability coefficient for the Chemistry Achievement Test using Kuda Richardson R-20 was .80. The research questions were answered using descriptive statistics of frequency counts, percentages, mean and standard deviation scores. The data obtained for the hypotheses were analysed using Multiple Linear Regression Analysis. The formulated hypotheses were tested at .05 level of significance.

Results, Interpretation and Discussion of Findings

Research Question One:

What is the level of provision of laboratory facilities in public secondary schools in Ogun State?

Table 1: Mean indicating the level of provision of laboratory facilities in public secondary schools in Ogun State.

Items	Response (%)							Remarks
	NA	AO	AN	AA	Mean	S.D	Rank	
Chemistry Laboratory	0.0	63.3	10.0	26.7	2.63	.890	4th	High Extent
Preparatory Room	66.7	23.3	0.0	10.0	1.53	.937	25th	Low Extent
Weigh balance/scale	53.3	16.7	10.0	20.0	1.97	1.217	16th	Low Extent
Marker board/chalk board	0.0	63.3	6.7	30.0	2.67	.922	3rd	High Extent
Overhead projector	100.0	0.0	0.0	0.0	1.00	.000	30th	Low Extent
Test tube	0.0	53.3	6.7	40.0	2.87	.973	2nd	High Extent
Beaker	0.0	46.7	13.3	40.0	2.93	.944	1st	High Extent
Conical flask	10.0	56.7	6.7	26.6	2.50	1.009	9th	High Extent
Burette	10.0	56.7	6.6	26.7	2.50	1.009	9th	High Extent
Pipette	3.3	63.3	6.7	26.7	2.57	.935	7th	High Extent
Funnel	10.0	43.3	20.0	26.7	2.63	.999	4th	High Extent
Wash bottle	6.7	36.7	53.3	3.3	2.53	.681	8th	High Extent
Source of heat	26.7	50.0	23.3	0.0	1.97	.178	16th	Low Extent
Spatula	23.3	33.3	23.3	20.1	2.40	1.070	11th	High Extent
Retort stand	13.3	30.0	36.7	20.0	2.63	.964	4th	High Extent
Crucible	66.7	20.0	10.0	3.30	1.50	.820	26th	Low Extent
Evaporating dish	76.7	16.7	3.3	3.30	1.33	.711	28th	Low Extent
Mortar and pestle	26.7	50.0	23.3	0.0	1.97	.718	16th	Low Extent
Acids	83.3	20.1	23.3	23.3	2.37	1,189	12th	High Extent
Alkalis	10.0	56.7	33.3	0.0	2.23	.626	13th	High Extent
Salts	3.3	93.4	3.3	0.0	2.00	.263	15th	Low Extent
Precipitating Agents	70,0	20.0	3.3	6.7	1.37	.860	27th	Low Extent
Organic Compounds	16.7	83.3	0.0	0.0	1.83	.379	20th	Low Extent
Indicators	60.0	23.3	16.7	0.0	1.57	.774	24th	Low Extent

Filter Papers	36.7	13.3	50.0	0.0	2.13	.937	14th	High Extent
Entry and exit door	16.7	76.6	0.0	6.7	1.97	.669	16th	Low Extent
Laboratory coat	46.7	43.3	10.0	0.0	1.63	.669	22nd	Low Extent
Fire extinguisher	40.0	50.0	10.0	0.0	1.70	.651	23rd	Low Extent
Chart on safety rules	66.7	20.0	13.3	0.0	1.60	1.037	29th	Low Extent
Fume cupboard	90.0	0.0	10.0	0.0	1.20	.610	30th	Low Extent

Source: Researcher's field survey (2025)

N (number of respondents) = 30; NA= Not Available, AO= Available but Obsolete, AN= Available but Inadequate, AA= Available and Adequate; %= Percentage, S.D= Standard deviation of responses, mean < 2.06 is Low Extent while mean > 2.06 is High Extent

Table 1 presents a comprehensive insight of provision of laboratory facilities in public secondary schools in Ogun State. The results revealed a concerning trend with most of the basic laboratory facilities scoring low on availability and adequacy. The results indicated that: 34.0% of the facilities were not available at all, 40.0% were available but obsolete, 14.0% were available but inadequate while only 12.0% were available and adequate. Only 14(46%) out of 30 basic and essential facilities met the availability of laboratory facilities bench mean score of 2.06, availability level of 51.5% and standard deviation of .646. Laboratory facilities made of glass ranked highest among the seven groups or categories with mean score of 2.67, standard deviation of .974 and 66.8% level of availability. The second ranked category group of items was plastic apparatus (mean =2.58, SD = .840 and 64.6% availability). Metal apparatus (mean = 2.33, SD = .917, level of availability = 58.3%) ranked third. General laboratory facilities (mean = 1.96, SD = .793, level of availability = 49%) ranked fourth. The levels of availability and adequacy of the fifth, sixth and seventh ranked categories of items were to a very low extent. Included in this category were chemicals and consumables (mean = 1.94, SD = .629, level of availability = 48.6%), safety equipment (mean = 1.72, SD = .723, level of availability = 40.5%) and ceramic apparatus (mean = 1.60, SD = .750, level of availability = 40.0%) respectively. Overhead projector (mean = 1.00, SD = .00 and 25% level of availability) and fume cupboard (mean = 1.20, SD = .610, level of availability = 30. 0%) were not available at all in all the selected schools.

Research Question Two:

To what extent do teachers utilize laboratory facilities in public secondary schools in Ogun State?

Table 2: Mean indicating the extent of utilization of laboratory facilities by teachers in Ogun State public secondary schools.

ITEMS	Response (%)				Mean	SD	Rank	Remarks
	NU	RU	OU	FU				
General Laboratory Facilities								
Chemistry Laboratory	6.7	30.0	26.7	36.6	2.93	.980	4th	High Extent
Preparatory Room	70.0	6.6	16.7	6,7	1.60	1.003	24th	Low Extent
Weigh balance/scale	53.3	13.3	20.0	13.4	1.93	1.143	19th	Low Extent
Marker board/chalk board	3.3	26.7	23.3	46.7	3.13	.937	2nd	High Extent
Overhead projector	100.0	0.0	0.0	0.0	1.00	.000	30th	Low Extent
Apparatus Made of Glass								
Test tube	3.3	26.7	23.3	46.7	3.13	.937	2nd	High Extent
Beaker	3.3	23.3	16.7	56.7	3.27	.944	1st	High Extent
Conical flask	13.3	26.7	13.3	46.7	2.93	1.143	4th	High Extent
Burette	23.3	23.3	10.0	43.4	2.73	1.258	8th	High Extent
Pipette	20.0	26.7	6.6	46.7	2.80	1.243	7th	High Extent
Plastic Apparatus								
Funnel	13.3	30.0	13.4	43.3	2.87	1.137	6th	High Extent
Wash bottle	20.0	23.3	36.7	20.0	2.57	1.040	10th	High Extent
Metal Apparatus								
Source of heat	33.3	40.0	20.0	6.7	2.00	.910	16th	Low Extent
Spatula	30.0	13.3	30.0	26.7	2.53	1.196	11th	High Extent
Retort sand	23.3	23.4	30.0	23.3	2.53	1.106	11th	High Extent
Ceramics Apparatus								
Crucible	70.0	16.7	10.0	3.3	1.47	.819	26th	Low Extent
Evaporating dish	76.7	16.7	3.3	3.3	1.33	.711	28th	Low Extent
Mortar and pestle	36.7	43.3	20.0	0.0	1.83	.747	21st	Low Extent
Chemicals and Consumables								
Acids	36.7	16.7	20.0	26.6	2.37	1.245	14th	High Extent
Alkalis	26,7	10.0	36.6	26.7	2.63	1.159	9th	High Extent
Salts	13.3	46.7	23.3	16.7	2.43	.935	13th	High Extent
Precipitating Agents	63.3	20.0	6.7	10.0	1.63	.999	23rd	Low Extent
Organic Compounds	26.7	53.3	20.0	0.0	1.93	.691	19th	Low Extent
Indicators	56.4	16.6	20.7	6.3	1.77	1.006	22nd	Low Extent
Filter Papers	36.7	16.7	36.6	10.0	2.20	1.064	15th	High Extent
Safety Equipment								
Entry and exit door	26.7	56.6	10.0	6.7	1.97	.809	17th	Low Extent
Laboratory coat	46.7	26.6	10.0	16.7	1.97	1.129	17th	Low Extent
Fire extinguisher	66.7	20.0	13.3	0.0	1.47	.730	26th	Low Extent
Chart on safety rules	63.3	23.3	6.7	6.7	1.57	.898	25th	Low Extent
Fume cupboard	90.0	10.0	0.0	0.0	1.20	.610	29th	Low Extent

Source: Researcher's Field View (2025)

N (number of respondents) = 30; NU= Not Utilize, RU = Rarely Utilized, OU= Occasionally Utilized, FU= Frequently Utilized; %= Percentage, S.D= Standard deviation of responses, mean < 2.19 is Low Extent while mean > 2.19 is High Extent

Table 2 presents the extent of utilization of laboratory facilities by chemistry teachers in public secondary schools in Ogun State. The findings showed that: 38.5% of the

laboratory facilities were never utilized at all, 24.2% were rarely utilized and 17.4% were occasionally utilized while only 19.9% were frequently utilized. The results also indicated that laboratory facilities were not utilized to high extent as only 15 (50.0%) out of the 30 laboratory facilities met the laboratory facilities utilization mean of 2.19, level of utilization of 54.8% and standard deviation of .668. Glass apparatus had the highest rank among the seven categories of items (mean = 2.97, SD = 1.105, level of utilization = 74.3%). Apparatus made of plastic (mean =2.72, SD = 1.089, level of utilization = 68.0%) had the second highest mean score among the seven categories of items. Apparatus made of metal (mean = 2.35, SD = 1.071, level of utilization = 58.9%) ranked third with two metallic apparatus (spatula and retort stand) having the same mean of 2.35, standard deviation of 1.196 and level of utilization of 58.9%. The combination of metallic apparatus: Bunsen burner, wire gauze and tripod stand that formed source of heat had mean of 2.00, standard deviation of 910 and level of utilization of 50.0%. Chemicals and consumables (mean = 2.14, SD = 1.010, level of utilization = 53.5%) ranked fourth. The fifth ranked items were the general laboratory facilities (mean = 2.12, SD = .813, level of utilization = 53.0%). Safety equipment (mean = 1.64, SD = .835, level of availability = 40.8%) ranked sixth while apparatus made of ceramic (mean = 1.44, SD = .759, level of availability = 38.6%) ranked seventh. Overhead projector (mean = 1.00, SD = .000, level of availability = 25%) and fume cupboard (mean = 1.20, SD = .610, level of availability = 30. 0%) were not utilized at all in all the selected schools.

Research Question Three:

What is the level of students' academic achievement in chemistry in public secondary schools in Ogun State?

Table 3: Descriptive Statistics of Chemistry Achievement Test of Public Secondary Schools in Ogun State

School	Mean Score	Percentage (%)	Rank	Remarks
1	12	40.0	20th	Low Extent
2	10	33.3	26th	Low Extent
3	23	76.7	5th	High Extent
4	11	36.7	23rd	Low Extent
5	14	46.7	15th	Low Extent
6	13	43.3	18th	Low Extent
7	9	30.0	28th	Low Extent
8	25	83.3	3rd	High Extent
9	19	63.3	9th	High Extent

10	18	60.0	10th	High Extent
11	13	43.3	18th	Low Extent
12	24	80.0	4th	High Extent
13	12	40.0	20th	Low Extent
14	14	46.7	15th	Low Extent
15	9	30.0	28th	Low Extent
16	17	56.7	12th	High Extent
17	20	66.7	8th	High Extent
18	8	26.7	30th	Low Extent
19	26	86.7	2nd	High Extent
20	16	53.3	12th	High Extent
21	11	36.7	23rd	Low Extent
22	22	73.3	6th	High Extent
23	12	40.0	20th	Low Extent
24	17	56.7	12th	High Extent
25	10	33.3	26th	Low Extent
26	11	36.7	23rd	Low Extent
27	14	46.7	15th	Low Extent
28	18	60.0	10th	High Extent
29	21	70.0	7th	High Extent
30	27	90.0	1st	High Extent

Source: Researcher's Field Survey (2025)

Grand Mean = 15.9(53.0%)

Mean score < 2.19 is low extent, Mean score > 2.19 is high extent

Table 3 presents a comprehensive overview of the chemistry achievement test on provision and utilization of laboratory facilities across the selected schools in Ogun-Central Senatorial District, Ogun State. The achievement test comprised thirty (30) standardized multiple choice test items on provision and utilization of chemistry laboratory facilities, adapted from past chemistry questions of the West African Senior School Certificate Examination (WASSCE). Out of the 30 schools, only 14 (46.7%) had students who passed the achievement test, meeting the bench mean score 15.9(53.0%). The first three top ranked schools demonstrated relatively higher mean scores of 27.0, 26.0 and 25.0 corresponding to percentage levels of 90.0%, 86.7% and 83.3% respectively. In contrast, the bottom three lowest ranked schools scored lower mean scores of 9.0, 8.0 and 8.0 equivalent to percentage levels of 30.0%, 26.7% and 26.7% respectively.

Hypothesis One:

There is no significance joint contribution of provision and utilization of laboratory facilities to students' academic achievement in chemistry in public secondary schools in Ogun State.

Table 4: Regression Model Summary Indicating the Joint contribution of Provision and Utilization of Laboratory Facilities to Students' Academic Achievement in Ogun State Public Secondary Schools

R	R Square	Adjusted R Square	Std. Error of the Estimate
.874	.764	.747	2.799

ANOVA[a]

Model	Sum of Squares	Df	Mean Square	F	Sig.	Remark
Regressior	685.899	2	342.956	43.767	.000[b]	Sig.
Residual	211.587	27	7.836			
Total	897.486	29				

a. Dependent Variable: Students' Academic Achievement (Mean Score of Achievement Test)

b. Predictors: (Constant), Provision of Laboratory Facilities, Utilization of Laboratory Facilities.

Table 4 presents the results of a multiple regression analysis, examining the joint contribution of provision and utilization of laboratory facilities to students' academic achievement in chemistry in public secondary schools in Ogun State. The ANOVA result from the regression analysis showed that the F-statistic ($F_{(2, 27)}$) = 43.767, p = .000, p < .05) indicated a statistically significant of the joint contribution of predictors (Provision and utilization of laboratory facilities) to the outcome (students' academic achievement in chemistry). The p value is less than .05, consequently the null hypothesis was rejected, revealing that there is a significant prediction of students' academic achievement in chemistry (R = .874; R^2 = .764; R^2adjusted = .747; p < .05). The adjusted R square of .747 suggested that approximately 74.7% of the variance in students' academic achievement in chemistry was explained by the joint contribution of the predictors (provision and utilization of laboratory facilities).

Hypothesis Two:

There is no significant relative influence of provision and utilization of laboratory facilities on students' academic achievements in chemistry in public secondary schools in Ogun State.

Table 5: Regression Model Summary Indicating the relative contribution of Provision and Utilization of Laboratory Facilities to Students' Academic Achievement in chemistry in Ogun State Public Secondary Schools.

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	] Std. Error		Beta		
(Constant)	.799	1.853		.431	.000
Provision of laboratory facilities	3.427	1.304	.398	2.629	.014
Utilization of laboratory facilities	4.382	1.260	.526	3.477	.002

Dependent Variable: Students' Academic Achievement

Table 5 presents the results of a multiple regression analysis assessing the relative contribution of provision and utilization of laboratory facilities to students' academic achievements in chemistry in public secondary schools in Ogun State. The standard beta coefficients, t and p values indicated that each of the predictors, provision of laboratory facilities ($\beta = .398$, $t = 2.629$, $p = .014$, $p < .05$) and utilization of laboratory facilities ($\beta = .526$, $t = 3.471$, $p = .002$, $p < .05$) has a significant positive contribution to students' academic achievements in chemistry. Notably, utilization of laboratory facilities ($\beta = .526$) has a stronger contribution to students' academic achievements in chemistry compared to provision of laboratory facilities ($\beta = .398$).

Discussion of Findings

The findings of research question one revealed a concerning state of laboratory facilities as most of the basic facilities were either not available, obsolete or inadequate in most of the public secondary schools Ogun State. The findings align with the previous researches of Asefa et al. (2023), Olajide *et al.* (2017, Chandana (2018), Ekanem and Obodom (2019) and Nweze *et al*. (2024) who observed that laboratory facilities in secondary schools were not adequate as a lot of the schools lacked chemicals and other essential facilities. When the necessary facilities are not available or obsolete or inadequate, chemistry students will not learn the subject properly and this will negatively affect students' academic achievement. However, the findings contradict David (2018) who reported that majority of the chemistry laboratory facilities were available above 50% in secondary schools.

Research question two which investigated the extent of utilization of laboratory facilities by chemistry teachers highlighted that many of the facilities were not utilized and those that were used were employed to a very low extent. These findings are consistent with the outcomes of Neji and Nuoha (2015), Etiubon (2018), Carlos and Abad (2019) and Darejaw and Asefa (2023) who discovered that laboratory facilities were not adequately utilized by chemistry teachers for teaching chemistry in secondary schools. The implication of the finding highlights the need for chemistry teachers to receive professional training on improvisation and effective use of laboratory facilities. Regular monitoring, supervision and inspection of the teachers by school administrators can also ensure that teachers conduct practical activities using the available laboratory facilities.

Research question three examined the level of students' academic achievement in chemistry in public secondary schools in Ogun State and the finding revealed that students' academic achievement was low. The finding agrees with the findings of Mayra and David (2018), Ibe *et al*. (2021), Kenni (2020) who observed that there was a decline in the students' achievement in chemistry in the public examinations. The low achievement in chemistry can be attributed to the inadequate provision and utilization of laboratory and this has a lot of implications. For example, the poor achievement in chemistry at the secondary school level, according to Mayra and David (2018) has resulted in poor enrolment in science subjects and high dropout rate in science related professions especially in the area of engineering and medicine. However the current finding contradicts Nweze and Uzochukwu (2019) who identified multiple factors affecting students' academic achievement such as student characteristics, societal context, government policy, language challenges and variables related to examination, curriculum, test book and home environment rather than being solely attributed to inadequate and underutilized of laboratory facilities.

From the results of the tested hypothesis, hypothesis one was rejected indicating that there is a significant joint contribution of provision and utilization of laboratory facilities to students' academic achievement in chemistry in public secondary schools in Ogun State. The findings showed that provision and utilization jointly contributed to a large variance of 74.6% in students' academic achievement. The above finding aligns with Waigera et al. (2020), Ofeimu and Asemhokai (2022) and Issah *et al*. (2023) who asserted that availability and utilization of laboratory facilities at school enhance students' academic achievement. However, the finding does not reflect the outcome of the study of Oyelowo

(2019) who concluded that students' attitude to the subject rather than availability and utilization of laboratory facilities was responsible for the poor academic achievement of students. Hypothesis two was also rejected and this indicated a significant relative contribution of provision and utilization of laboratory facilities to students' academic achievements in chemistry in public secondary schools in Ogun State. The finding further suggested that utilization of laboratory facilities was a more critical factor, had higher probability and greater contribution to students' academic achievement when compared with provision of laboratory facilities. The finding is in consonance with the study of Chandana (2018) and Usman (2021) who observed that utilization has a greater influence on student academic achievement than availability of laboratory facilities. The finding does not agree with the outcome of Kumar and Ramnath (2018) who investigated the availability and utilization of chemistry laboratory resources in higher secondary schools and found that most of the schools selected had adequate laboratory facilities.

Conclusion

This study concluded that provision and utilization of laboratory facilities are critical determinants of students' academic achievement in chemistry in Public secondary schools in Ogun State. While provision of laboratory facilities equips students with the opportunity to engage in hands-on learning experiences, utilization of laboratory facilities enhances the development of scientific knowledge that will ultimately affect students' career prospect. Given the persistent low achievement in chemistry in Nigeria, provision of adequate laboratory facilities and effective utilization of such facilities are viable strategies of improving students' academic achievement in chemistry. Therefore, stakeholders should prioritize providing adequate laboratory facilities and train teachers to utilize them effectively.

Recommendations

Based on the findings of this study. It is recommended that:

1. The government and stakeholders in education should provide adequate laboratory facilities in public secondary schools in Ogun State to enhance teaching and learning.
2. School administrators should support science teachers' professional growth by providing regular opportunities for training, workshops, seminars, conferences and development opportunities. This will enable teachers to exchange ideas, update their knowledge and enhance their skills in improvisation and effective utilization

laboratory facilities as well as integrating 21st century learning skills and technology.

3. Regular monitoring, supervision and inspection of teachers by school principals and administrators should be implemented to ensure that teachers conduct practical activities effectively using laboratory facilities thereby enhancing students' academic achievement.
4. Based on the significant joint contribution of provision and utilization of laboratory facilities to students' academic achievement, stakeholders should priorities investments in both facilities provision and teacher training.
5. Sequel to the relative contribution of provision and utilization of laboratory facilities to students' academic achievement, school administrators should prioritize effective allocation maintenance of laboratory facilities, and provide incentive to teachers who produce students' with outstanding academic achievements using these facilities.

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