International Journal of Research in Engineering, Science and Management
Volume 8, Issue 7, July 2025
https://www.ijresm.com | ISSN (Online): 2581-5792

Adequacy of Human and Material Resources for Teaching Chemistry in Senior Secondary Schools in Aguata Education Zone of Anambra State

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***Abstract*: This study investigated on the adequacy of resources for teaching chemistry in Aguata Education Zone, Anambra State. The study adopted a descriptive survey design. The population of the study comprised 33 chemistry teachers from 48 public secondary schools in the zone, and all the chemistry laboratory equipment. A sample size of 15 chemistry teachers was used. Three research questions guided the study. Two instruments were used for data collection, these are (checklist and questionnaire); checklist on adequacy of chemistry teachers and laboratory attendants, and questionnaire on adequacy of material resources. The internal consistency reliability index for questionnaire instruments for adequacy of material resources was determined to be 0.94 using Cronbach alpha. The data collected on checklist was analyzed using frequency and percentages. While the data collected on questionnaire instruments was analyzed using mean and standard deviation. The findings show that laboratory adequacy is low in extent. The findings also revealed that chemistry teachers and material resources for teaching and learning of chemistry in senior secondary schools in Aguata Zone of Anambra State are adequate. Based on the findings, the study recommends among others that government should ensure that qualified laboratory attendants are employed in each school to assist the chemistry teachers and students during teaching.**

***Keywords*: Adequacy, Chemistry, Human Resources, Material Resources, Senior Secondary, Teaching.**

1. Introduction

Chemistry as one of the science related carriers subject require effective teaching and learning, however, the adequacy of human and material resources play an important role in determining the quality of education received. This study determines the adequacy of resources for teaching chemistry in senior secondary schools within the Aguata Education Zone of Anambra State, Nigeria.

Resources in chemistry are those elements needed for teaching chemistry in secondary schools. It involves the academic and non-academic staff, structures like the classroom, laboratories, equipment and administrative block. According to Olaitan and Ali (2010), resources covered all the human and material elements adopted for teaching for the purpose of impacting knowledge to the learner in an ongoing lesson. Human resources are the people who make up the workforce of an organization. Alabi (2014) stated that human resources include chemistry teachers, and laboratory attendants. According to Taber (2012), a qualified chemistry teacher is one who has undergone the pedagogical training in education and is capable of transferring it to students. Equally, laboratory attendants play a vital role in the learning activities. They are the key player in a laboratory setting. Kelly (2018) defined a laboratory attendant as a person that provides written and verbal reports about testing procedures and results, also manages the maintenance of equipment and stocking of necessary supplies. Chemistry teachers and laboratory attendants play a major role in the implementation of objectives in chemistry.

Material resources in chemistry are school facilities like laboratory, laboratory equipment, and materials, chemistry textbooks, etc. which facilitate effective teaching and learning of the subject in schools. According to Usman (2016), material resources are resources that can easily be seen and observed in any institution. They are resources which can facilitate school activities and processes and which directly or indirectly contribute to the achievement of goals. Material resources facilitate effective teaching and learning in school. They enable chemistry teachers and students to perform their work effectively especially in the laboratory (Ige, 2013). Material resources for chemistry teaching include instructional materials in terms of consumable and non-consumables like periodicals, text books, journals, supplementary books, equipment and chemicals, and other referenced materials (Nwosu, 2017). Resources are needed because they are lay up of knowledge that provide the important underpinning for national development. Students' performance is seriously affected when there is paucity in resources for teaching chemistry. Usman (2016) stated that teaching aids are various equipment and materials applied in teaching and learning by teachers to stimulate self-activity on the part of the students. To this end, the search for means of enhancing chemistry teaching and learning in secondary schools has been the major concern of science teachers/educators at all levels of education system. This is because, chemistry students still face the challenges of poor performance and decline in interest in chemistry and these challenges have been of great concern to both parents and teachers. It was observed that poor performance of students in

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chemistry has been so high in many Nigerian public schools in the recent years. Also, in spite of the strong stress on effective science learning by Federal Republic of Nigeria, available data from West African Examination Council (WAEC) Chief Examiner's report indicated that students performed poorly in chemistry from 2016-2019. The mean scores of 2016, 2017, 2018 and 2019 out of 50 are 25.0, 26.0, 24.0 and 27.0 respectively. The WAEC Chief Examiner's report emphasized that inadequate laboratory practices, has been some of the factors that contributed to students' poor performance in chemistry. Also, research studies carried out in the area of adequacy of chemistry resources such as Neji, Ukwetang and Nja (2014) in their study reported that majority of human resources (chemistry teachers and laboratories attendants) for teaching and learning of chemistry were grossly inadequate. Alabi (2014) reported that there are gross inadequacies of human resources in teaching of chemistry. Moreso, Shamsudeen (2015) stated that there are no sufficient laboratory supporting staff. Adegoke and Mefun (2016), Bello (2015) also shows that very many of these available resources are not adequate. Also, studies such as Arokoyu and Ugonwa (2012) have shown that there is inadequate supply of material resources and this prompted the researcher to investigate the adequacy of resources in teaching and learning of chemistry in secondary schools. If the resources required for teaching chemistry are adequate in Nigerian schools, it leads to an increase in knowledge and quality of life of students (Umunadi, 2011). Therefore, chemistry teachers, laboratory attendants and material resources need to be adequately provided for effective teaching and learning of chemistry.

Adequacy of chemistry resources is the quantity of the available resources sufficient for teaching chemistry. Morrison (2017) sees adequacy of resources as the sufficiency of the quantity of the available resources for teaching chemistry. The sufficiency of the quantity of resources facilitates and provides meaningful learning experience to the learner. Neji, Ukwetang, & Nja (2014) stated that teaching and learning experience center on the extent of adequacy of resources and teachers' effectiveness in the use of laboratory facilities. Educators have proved that all teaching can be greatly improved by the use of adequate resources because, they help in making learning experiences memorable if adequately utilized, hence, the need for this study.

2. Statement of the Problem

It was observed that poor performance of students in chemistry has been so high in many Nigerian public schools in the recent years. Also, in spite of the strong stress on effective science learning by Federal Republic of Nigeria, it was reported that students performed poorly as a result of inadequate laboratory practices, some other causes of poor performance of students in examinations which include inadequate supply of material resources may constitute a hindrance to effective teaching and learning. Therefore, the problem put in question is; what is the adquacy of human and material resources for teaching chemistry in Aguata education zone of Anambra state?

3. Purpose of the Study

The general purpose of this study was to determine the adequacyof resources for teaching chemistry in senior secondary schools in Aguata Education Zone of Anambra State. Specifically, the study seeks to ascertain the:

i. Adequacy of chemistry teachers for teaching chemistry.
ii. Adequacy of laboratory attendants for teaching chemistry
iii. Adequacy of material resources for teaching chemistry.

4. Research Questions

The following research questions guided this study;

i. What is the level of adequacy of chemistry teachers for teaching chemistry?
ii. What is the level of adequacy of laboratory attendants for teaching chemistry?
iii. To what extent are material resources used for teaching chemistry in secondary schools in Aguata Education Zone of Anambra State adequate?

5. Methods

Research methods used in this study was briefly discussed under the following headings.

6. Design of the Study

The study adopted a descriptive survey research design. For this study descriptive survey was appropriate because the researcher was interested in collecting data on adequacy of resources for teaching chemistry in senior secondary school and describing the facts gathered in a systematic manner.

7. Population of the Study

In this study, the population comprised 33 chemistry teachers from the 48 public secondary schools in the zone, zero (0) laboratory attendants, and chemistry laboratories equipment. The chemistry laboratories equipment was uncountable and so the total number was not mentioned by the researcher

8. Sample

In the study, the sample consists 15 chemistry teachers from schools that have both chemistry teachers and students. Simple random sampling technique (use of balloting without replacement) was used to select five schools each from the three local governments."

9. Instrumentation

Checklist and questionnaire were used for data collection. Checklist was used to determine the adequacy of human resources using SSII students, while questionnaire was used to determine the extent of adequacy of material resources for teaching chemistry. Checklist was most suitable for checking the adequacy of human resources for the problem under investigation and it contains items that measured exactly what

the researcher was looking for or items that generated the appropriate data for solving the problem under study. The checklist used teacher/student's ratio and laboratory attendant/school ratio using frequency and percentage ratio. The questionnaire instrument was developed by the researcher and was used for chemistry teachers. The questionnaire instruments had two sections, A and B. Section A inquired about general information of the respondents. While section B consisted of items which sought information on the adequacy of resources for teaching chemistry in Aguata education of Anambra state. The instruments used were validated by three experts from the Department of Science Education, University of Nigeria, Nsukka (UNN). The reliability of the questionnaire instrument was estimated using Cronbach alpha (α) to test for the internal consistency of the instrument for multiple response items. The reliability of adequacy of material resources questionnaire was determined to be 0.94.

10. Analysis of Data

Frequency and percentages were used to answer research question 1 and 2 on adequacy of human resources to determine teachers/students' ratio and laboratory attendants/school ratio. That is, the number of chemistry teachers teaching senior secondary II students and the laboratory attendants available. The bench mark for the adequacy of teachers/students' ratio was 2.5% and above, while 2.49% and below was inadequate. While the bench mark for laboratory attendants/school ratio is 100%, any value below 100% was inadequate. Mean and standard deviation was used to answer research question three table 3 on adequacy of material resources. The limit of numbers for decision was taken as follows; on adequacy of material resources, the decision was taken as, very adequate (VA) = 4.00 - 3.50, Adequate (A) = 3.49 - 2.50, Inadequate (NA) = 2.49 - 1.50, Grossly inadequate (GI) = 1.49 and below. Any item with a mean value of 4.00 - 3.50 was regarded as very adequate, any item with a mean value of 3.49 - 2.50 was regarded as adequate, any item ranging from 2.49 - 1.50 was regarded as inadequate, and any item with 1.49 and below was regarded as grossly inadequate.

11. Results

The result of the analysis of the data for this study is presented in tables of this chapter based on the research questions that guided this study."

A. Research Question One

What is the level of adequacy of chemistry teachers for teaching chemistry?

Results from table 1, shows that teachers were adequate in 12 schools and inadequate in three (3) schools. The overall percentage of 8.4 which is above the expected frequency of 2.5% indicates that chemistry teachers are highly adequate for teaching chemistry in secondary schools in Aguata zone of Anambra State.

B. Research Question Two

What is the level of adequacy of laboratory attendants for teaching chemistry?

Table 2 above shows the frequency and percentage of chemistry laboratory attendants` adequacy. The result in the table shows that all the schools recorded 0% in terms of the percentage ratio of laboratory attendant to schools. This is below the expected percentage of 100%. This means that laboratory attendants are highly inadequate for teaching chemistry in secondary schools of Aguata zone of Anambra State.

C. Research Question Three

To what extent are the material resources used for teaching chemistry in secondary schools in Aguata Zone of Anambra State adequate?

Table 3 shows the mean and standard deviation on the extent of adequacy of material resources used for teaching chemistry. From the table, the result shows that items, 8 and 17 are very adequate while items 3, 4, 5, 6, 7, 9,10,11, 12, 13, 14, 15, 16, 18, 19, 20, 22, 23, 24, 25, 26, 28, 31, 32, 33, 36 and 37 are adequate, but items 1, 2, 21, 27, 29, 30, 34 and 35 are

Table 1
Frequency and percentage ratio of chemistry teachers' adequacy

S.No.	Name of School	Freq. of teachers	No. of students	Ratio	%	Expected ratio (%)	Decision
L.G.A.	A						
1		1	74	1:74	1.4%	1:40 (2.5%)	I
2		1	5	1:5	20%	1:40 (2.5%)	A
3		1	44	1:44	2.3%	1:40 (2.5%)	I
4		1	20	1:20	5%	1:40 (2.5%)	A
5		1	14	1:14	7.1%	1:40 (2.5%)	A
L.G.A.	B						
6		1	17	1:17	5.9%	1:40 (2.5%)	A
7		1	6	1:6	16.7%	1:40 (2.5%)	A
8		1	6	1:6	16.7%	1:40 (2.5%)	A
9		1	15	1:15	6.7%	1:40 (2.5%)	A
10		1	20	1:20	5%	1:40 (2.5%)	A
L.G.A.	C						
11		1	122	1:122	0.8%	1:40 (2.5%)	I
12		1	15	1:15	6.7%	1:40 (2.5%)	A
13		1	23	1:23	4.3%	1:40 (2.5%)	A
14		1	15	1:15	6.7%	1:40 (2.5%)	A
15		1	5	1:5	20%	1:40 (2.5%)	A
Overall Percentage					**8.4%**		**A**

Key: Adequate (A), Inadequate (I)

Table 2
Frequency and percentage ratio of chemistry laboratory attendants` adequacy

S.No.	Name of School	Freq. of attendants	No. of students	Ratio	%	Expected ratio (%)	Decision
L.G.A.	A						
1		0	74	0:74	0%	1:1 (100%)	I
2		0	5	0:5	0%	1:1 (100%)	I
3		0	44	0:44	0%	1:1 (100%)	I
4		0	20	0:20	0%	1:1 (100%)	I
5		0	14	0:14	0%	1:1 (100%)	I
L.G.A.	B						
6		0	17	0:17	0%	1:1 (100%)	I
7		0	6	0:6	0%	1:1 (100%)	I
8		0	6	0:6	0%	1:1 (100%)	I
9		0	15	0:15	0%	1:1 (100%)	I
10		0	20	0:20	0%	1:1 (100%)	I
L.G.A.	C						
11		0	122	0:122	0%	1:1 (100%)	I
12		0	15	0:15	0%	1:1 (100%)	I
13		0	23	0:23	0%	1:1 (100%)	I
14		0	15	0:15	0%	1:1 (100%)	I
15		0	5	0:5	0%	1:1 (100%)	I
Overall Percentage					**0%**		**I**

Key: Adequate (A), Inadequate (I)

Table 3
Mean and standard deviation on the extent of adequacy of material resources used for teaching chemistry

S.No.	Item Statement	N	Mean	Std. Dev.	Decision
1	Source of water	15	2.44	1.04	I
2	Power supply	15	1.78	.81	I
3	Chemistry laboratory	15	3.28	.75	A
4	Teacher preparatory office	15	2.94	.87	A
5	Retort stand	15	3.22	.88	A
6	Reagents	15	3.06	.64	A
7	Reagents bottles	15	3.44	.62	A
8	Pipette	15	3.50	.62	VA
9	Burettes	15	3.33	.77	A
10	Tables	15	3.22	.73	A
11	Stool	15	3.28	.90	A
12	Test-tube and test-tube holder	15	3.44	.70	A
13	Test-tube rack	15	3.33	.69	A
14	Measuring cylinder	15	3.11	.76	A
15	Clamp	15	2.89	.96	A
16	Funnels	15	3.11	1.02	A
17	Beakers	15	3.61	.50	VA
18	Separation techniques	15	2.61	1.04	A
19	Thermometer	15	2.89	.96	A
20	Crucibles	15	2.67	1.03	A
21	Heater	15	2.17	.99	I
22	Wash bottles	15	2.89	.83	A
23	Watch glass	15	3.00	.49	A
24	Weighing balances	15	2.78	.94	A
25	Volumetric flask	15	2.67	.84	A
26	Measuring spoons	15	2.67	.77	A
27	Measuring cups	15	2.28	.83	I
28	Rulers	15	2.56	.92	A
29	Melting point apparatus	15	2.33	.77	I
30	Evaporating dishes	15	2.39	.92	I
31	Graduated cylinders	15	2.61	.85	A
32	Bottles and jars with tight-fitting lids	15	2.56	.62	A
33	Mortar and pestles	15	2.67	.84	A
34	Computers	15	1.78	1.00	I
35	Overhead projector	15	1.61	.85	I
36	Litmus paper (red and blue)	15	3.17	.86	A
37	Periodical charts	15	3.06	.80	A
Overall Mean			**2.82**	**0.82**	**A**

Key: Very adequate (VA), Adequate (A), Inadequate (I)

inadequate. The overall mean of 2.82 shows that the resources used for teaching chemistry are adequate. This means that material resources for teaching chemistry are moderately adequate. The overall standard deviation of 0.82 implies a high variation in the responses of the teachers with respect to adequacy of material resources used for teaching chemistry.

12. Discussions

A. Adequacy of Chemistry Teachers

From the result presented in table 1, it was observed that the number of chemistry students in most of the schools are to a

high extent lower than the stipulated number of student mapped out by the National Policy on Education in Federal Republic of Nigeria (FRN, 2013:15) to be the minimum standard of teacher/students ratio which is 1:40. This shows that students of Aguata Education Zone are not turning up in Chemistry as a science subject considering the total number of SS II students offering Art and Commercial subject in Aguata Education Zone, irrespective of the strong stress on effective science learning by the NPE.

B. Adequacy of Laboratory Attendant for Teaching of Chemistry

From the result in Table 2, it was observed that none of the sampled schools had laboratory attendant. More so, considering the total schools in Aguata Education Zone, it was observed that none of the schools had laboratory attendant. In line with this finding, Alabi (2014) reported that there are gross inadequacies of human resources in teaching of chemistry. Moreso, Shamsudeen (2015) agreed with these findings that there are no sufficient laboratory supporting staff.

C. Adequacy of Material Resources for Teaching Chemistry

The result in table 3 showed the extent of adequacy of material resources used for teaching chemistry. A mean value of 2.82 obtained showed that material resources for teaching chemistry are adequate. In most of the schools visited during the administration of the research instruments, the researcher observed that the number of chemistry students were very low beyond the standard class size which is 40 and the chemistry teachers of the schools visited considered the adequacy of their material resources using the population of chemistry students in their schools. This is in line with the statement of Neji, Ukwetang and Nja (2014) that the extent of adequacy of laboratory facilities for chemistry teaching depends on the population of students in a particular school. However, this finding is consistent with the findings of Oduh, Agboola and Ironua (2020) that most of the instructional materials were adequate.

13. Conclusion

For a favorable learning environment to be created for students, chemistry teachers, laboratory attendants and facilities should be adequately provided which will in turn, enhance functional learning thereby, improving the performance of students in chemistry.

14. Recommendations

Based on the findings of this study, the following recommendations were made:

i. "Government should recruit chemistry teachers to the schools that have no chemistry teachers. Government should also ensure that only qualified and competent chemistry teachers are employed for teaching chemistry.
ii. Government in collaboration with principal of schools should organize seminars and workshop to sensitize teachers to improve on how to make the use of adequate resources interesting to students during teaching in order to yield good performance in the academic life of students.
iii. Government should ensure that qualified laboratory attendants are employed in each school to assist the chemistry teachers and students during teaching.

Government in collaboration with parent teachers' association (PTA) members should help in procuring some of the equipment and material that are lacking in schools such as source of water supply, power supply, computers, overhead projector, melting point apparatus, evaporating dishes, and heater.

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