JCARM
Journal of Contemporary Academic Research and Methodologies

An Online Peer Reviewed / Refereed Journal
Volume 1 | Issue 3 | April 2026
Website: www.journal.jcarm.in

Research

# The Availability and Use of Chemistry Science Learning Resources amongst Students in Kuje, Abuja, Nigeria

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**Abstract**: The accessibility and utilization of chemistry learning resources amongst 200 students in 4 randomly selected secondary schools in Kuje, Abuja. A well-structured descriptive survey utilizing a comprehensive questionnaire was used and was statistically analyzed (at $P< 0.05$). The results showed that in 3 of the schools, resources were available and utilized. However, STEM-involving activities rated very low in all four schools. There is a positive association with no significant difference between the availability and use of chemistry learning resources, but a non-significant negative association between schools with and without adequate learning resources. Important recommendation for teachers, instructors, related institutions and government authorities on making intentional efforts on the availability and use of STEM and other science-related resources is essential as this would boost and develop practical scientific, social and leadership skills.

**Keywords**: Learning resources, science, availability, Laboratory, STEM

## INTRODUCTION

Chemistry is a science subject that studies the nature, properties and uses of matter. It is thus a science that requires lots of hands-on activities like experimentations, excursions and other Science, Technology, Engineering and Mathematics (STEM) activities (Ehirim, et. al, 2020, Emrah and Hilal, 2022). Beyond these, researches have shown that Chemistry also requires critical thinking and other analytic activities as well. All these learning activities are only achievable with the maximum utilization of available learning resources (Sec. STEM Education, 2023).

## LITERATURE REVIEW

The demand for learners to engage and manipulate their senses through experimentation and other activities that make use of available resources to attain stated


https://doi.org/10.5281/zenodo.20061269

scientific objectives is a major component of learner-oriented science education. This entails the learners' complete engagement in an active process of knowledge building with their hands and minds (Ausubel, 1963 in Ram, 2021). Interactions with both non-human and human learning materials are also necessary for these. As a result, it is not only necessary but also vital that these resources be made available.

Further observations about how innovative teaching approaches utilizing technology and improvisation increase teachers' efficacy were made by Nachias (2000), Owo (2009), and Nwagbo and Ugwuanyi (2015). Chemistry and other allied fields have reportedly performed poorly (Sintema, 2020). This has something to do with the level of availability and utilization of learning resources (Nweze, 2021). Although several innovative resources for teaching and processes are being provided or improvised in addition to the old ones, they are yet insufficient to support the much needed teaching and learning processes in the class (Akani, 2016).

Abubakar (2014) has linked inadequate scientific student performance to one of the following:

1. The use of inexperienced teachers in the classroom;
2. The absence of labs in schools.
3. Insufficient educational materials or
4. Insufficient expertise in utilizing educational materials during instruction, among other issues.

A study conducted in 2020 by Ehirim et al. on the availability and use of instructional materials in the teaching and learning of chemistry at senior secondary schools in the Imo the state's Owerri Municipal Council Area demonstrated that while a large number of instructional materials were available, they were not being used to their full potential. When accessible, chemistry teachers fail to correctly innovate instructional tools to teach and study the subject effectively.

The practical activity method of teaching and learning has yielded more results in the development students' processing skills with respect to science, which could ultimately enhance students' performance. This was found in another analysis by Nwagbo and Uzoma (2019) on the influence of practical activities on secondary school students' acquisition of process skills in the Abuja, Nigeria Municipal Council.

Numerous other studies on the impact of laboratory equipment have discovered a strong correlation between students' enthusiasm in learning chemistry and their use of these

resources (Negi, 2018 as reported by Sec. STEM Education, 2023). The report further added that there is no meaningful relationship between students' academic achievement in chemistry and their use of science laboratory resources.

There needs to be more information on the availability and use of learning resources in Kuje Town, Abuja, and much less information about secondary schools in Abuja. In order to gather information on the availability and use of these resources by the students for efficient teaching and learning, it is necessary to examine the chemistry classroom practices of Kuje Town's chemistry students.

**Research Questions:**

1. How much do the teaching resources for the chemistry curriculum delivery exist?
2. How much are the teaching resources used in the delivery of the chemistry instruction?

**Research Hypotheses**

The following null hypotheses were tested in this study:

1. There is no significant difference between the availability and the utilization of chemistry instructional resources amongst students of chemistry science
2. The mean percentage values of the utilization of chemistry instructional resources between schools with and without adequate instructional resources in chemistry science is not significantly different.

**Purpose of the study**

To determine:

i. What obtainable extent is learning resources for chemistry curriculum delivery available.
ii. The extent of Utilization of learning resources for chemistry curriculum delivery

**RESEARCH METHODOLOGY**

**Research Design**

A survey with a descriptive approach was used for this research. (Akande, 2019).

**Study Research Population**

This research work was conducted in public Senior Secondary schools offering Chemistry Science in Kuje town, Kuje local government Area, Federal Capital Territory, Nigeria. There are only four public senior science secondary schools in Kuje town with chemistry science students.

**Techniques for Sampling**

The respondence is made up of the four public colleges from which senior secondary schools students offering chemistry were randomly selected in an average stratum of 50 students per school; giving sample size of 200 students.

**Instrumentation**

The research tool employed in this study comprised of a well-structured questionnaire. The questionnaire was divided into thre0e sections.

Section A consists of availability and extent to which human resources are utilized to learning chemistry science as well the availability utilization of improvisation; section B considered the availability and extent to which environmental factors are utilized to learning chemistry science while section C consists of chemistry laboratory facilities/equipment inventory and extent of usage respectively with the purpose to obtain information on the availability of instructional resources for chemistry teaching and learning chemistry in the aforementioned schools.

**Validity of the Instruments**

Akande (2019) suggested that instruments should be given to expert to review the items and also make comments. It makes sure not only the surface value of the instrument but also its content validity. Thus, the instrument was taken to other science educational experts, for vetting and criticisms after which the instruments were considered good enough for use.

**Data Collection Procedure**

The researcher prepared a visit schedule which indicated the number of days the researcher visited each sampled school. The researchers had earlier sought for permission from the principals of the selected schools before personally handing over the instrument to the students with the help of science teachers. Allowance for enough time and privacy was allocated to the students to input the respective data after which the forms were collected after six hours (closing period) by the researcher. The researcher with permission went to each laboratory, observed and collected necessary information on the available facilities at the various laboratories. This enabled the researcher to obtain first-hand information on the materials available in all the laboratories.

**Analyzing Generated Data**

The researcher used percentage frequency graphs and plots to answer research questions one (1) and two (2) and two to classify the schools into two (2) categories, that is, inadequate (above 50% non-availability score), and adequate (50% and above in

availability score), in order to determine schools with inadequate and adequate instructional resources. The degree of utilization of learning resources was also determined using percentage frequency charts.

While the hypotheses which stated that:

i. The availability and the utilization of chemistry instructional resources amongst students of chemistry science is not significantly different

ii. The utilization of chemistry instructional resources between schools with and without adequate instructional resources in chemistry science is not significantly different.

Mean, Standard deviation, Correlation values was determined from Paired T- test statistical tools were used to analyze the two (2) hypotheses (by using SPSS 2010 version).

**RESULTS AND ANALYSIS**

**Bio data**

**Gender**

The graph (Figure 4.1) showed that the highest school with female participation is school 3 with 100% (an all-girls school), and that of boys is school 4 with 51% participation. Generally, more girls participated in the random selection which suggests an increased girl-child interest in learning sciences as reported by UNESCO (2017). Nja. (2018) , and Adegun et al, (2015) reported in significant differences in academic performance based on gender between male and female science students.

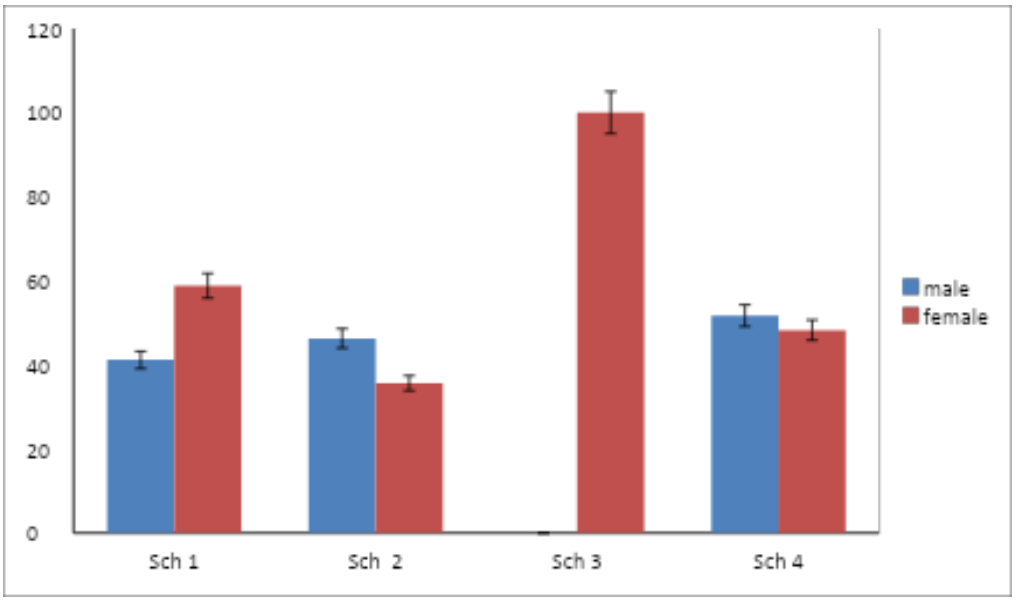


*Figure 1: Gender distribution*

**Class**

Majority of the participants (Figure 2) are members of SS2 because SS3 are mainly already engaged in their various SSCE exams. This is similar to the work of Usman(2016) who also used SS2 in his research.

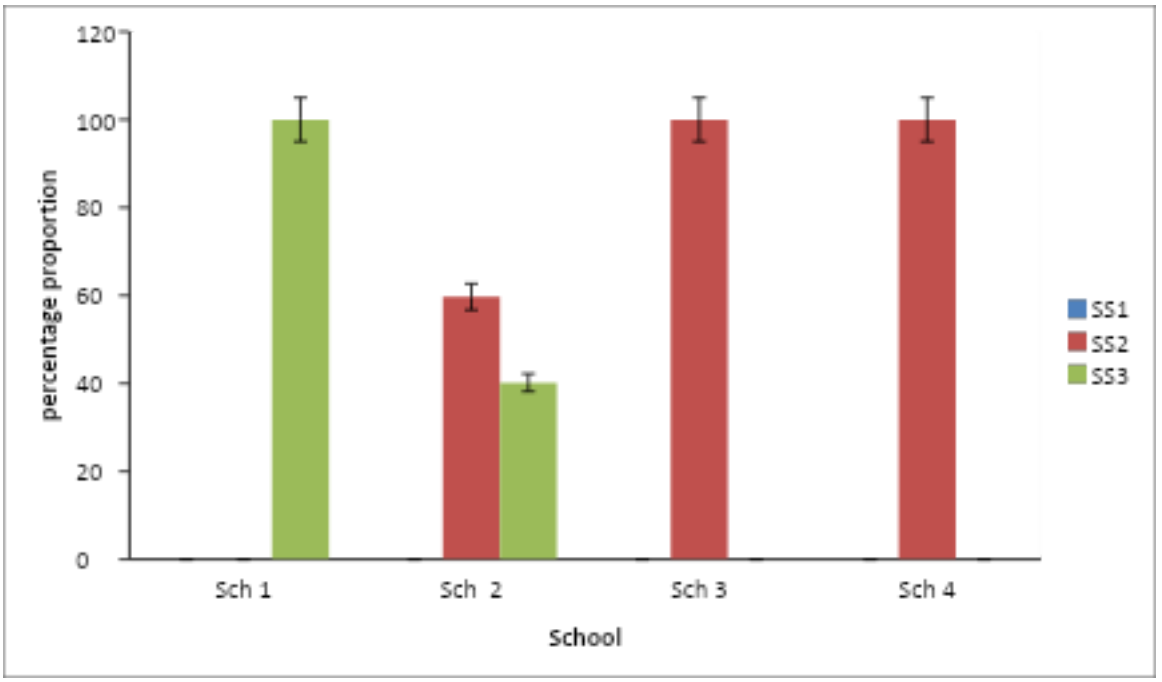


*Figure 2: Class distribution of students.*

**Research Question 1**

"To what extent are the instructional resources available for chemistry curriculum delivery?"

**Availability of Human Resources**

The chart for the utilization of human resources indicated that school 3 had the highest rating (94%) for the availability of a motivated professional teaching staff whereas, school 4 (81%) was highest for the rating for the availability of other chemistry science related professionals and School 1 is lowest for both motivated professional chemistry science teacher (65%) and related professions (18%) , Etuiobon and Benson (2014) supported the increase in qualified teachers and significant influence of teacher qualification and experience in the quality of chemistry education process.

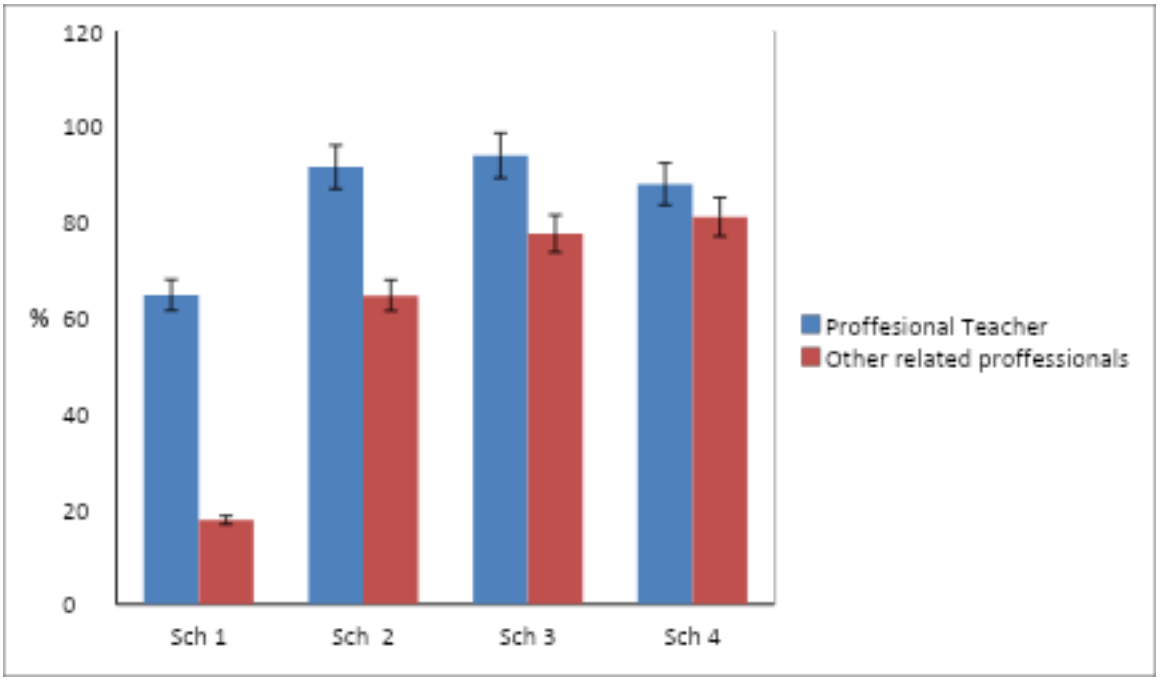


*Figure 3: Availability of Human Resources*

**Availability of Resources for Improvisation**

The availability of resources for improvisation (Figure 4) is an indication that school 3 scored highest (96%, as chemicals or 90% as apparatus) where as school one rated the least for both(18% each, respectively) as other schools come in between. Nweze (2021) explained that the lack of knowledge to improvise by teachers constitutes a major factor for achievements in learning.

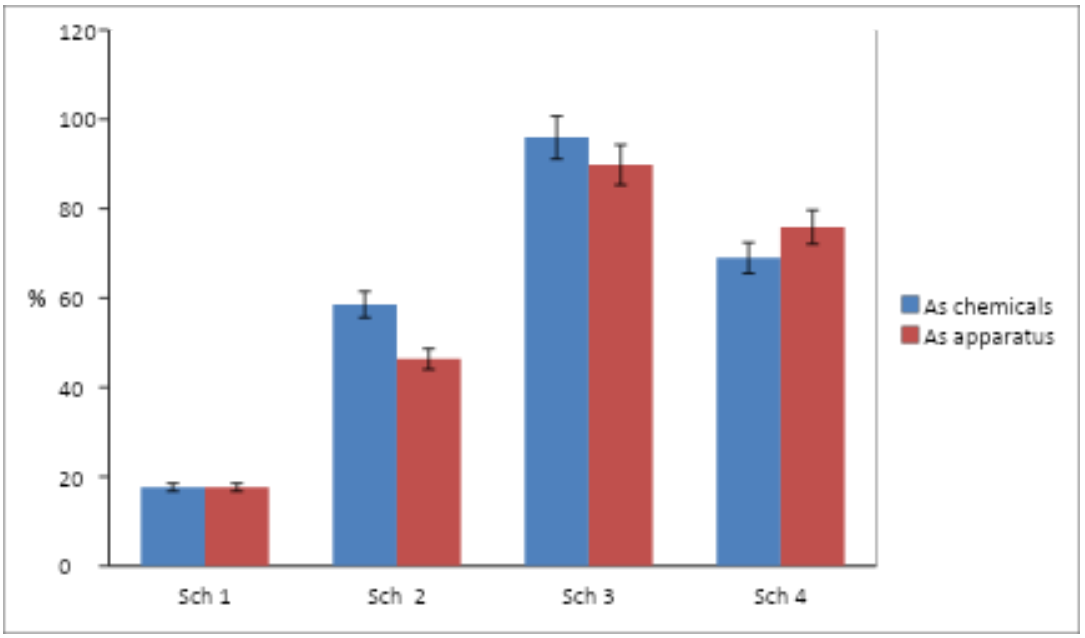


*Figure 4: Availability of Resources for Improvisation*

**Availability of Learning Environment**

The Figure 5 represents the rating score for Learning Environment by the various schools. the rating for equipped and functional library of School 4 (81%) stands as the highest amongst the other factors while conducive classroom is highest with school 3 (71%) and functional ICT environment is highest with school 4 (74%). School 1 has less than 50% rates in all the parameters. This is similar to the report of Appolinus et al (2020), Achimugu (2017) and Fatoba and Abidakun (2019 ) that most resources are available for learning except for utilization. In all the availability of science activities like STEM, students' excursion environment for its activity rated the lowest in all schools with the highest being only 38% in School 4. The Essence of conducive learning environment and Science activities like STEM, student's excursion cannot be overemphasized (Emrah and Hilal, 2022). Amongst others things, it stimulates learners' interest, enables a better understanding and application of the achieved objectives in various areas of practical life and scientific thinking.

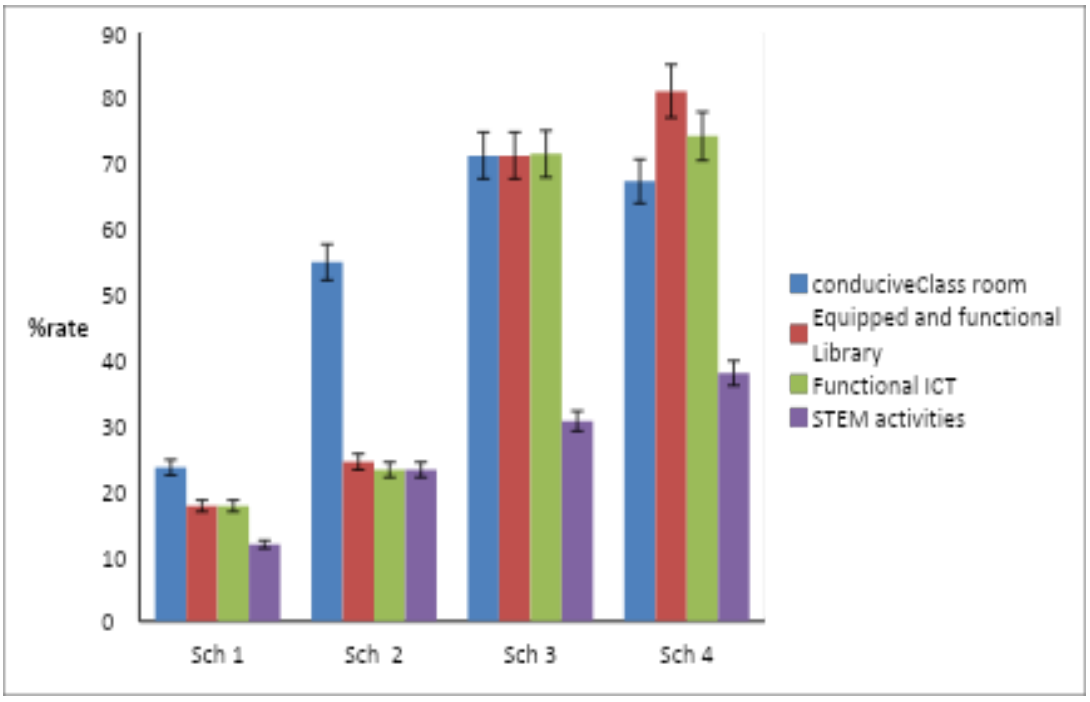


*Figure 5: Availability of Learning Environment*

**Availability: Equipment and Reagents in Chemistry Laboratory**

The Availability of laboratory Equipment and Reagents (Figure 6) showed that they is more than 60% score for the laboratory equipment and reagents in all the schools except for school 1 that had a lower than 50% rates by the students. This is comparable to the work

of Tekalign (2016) that showed that more schools have available chemical laboratory equipment than those that do not.

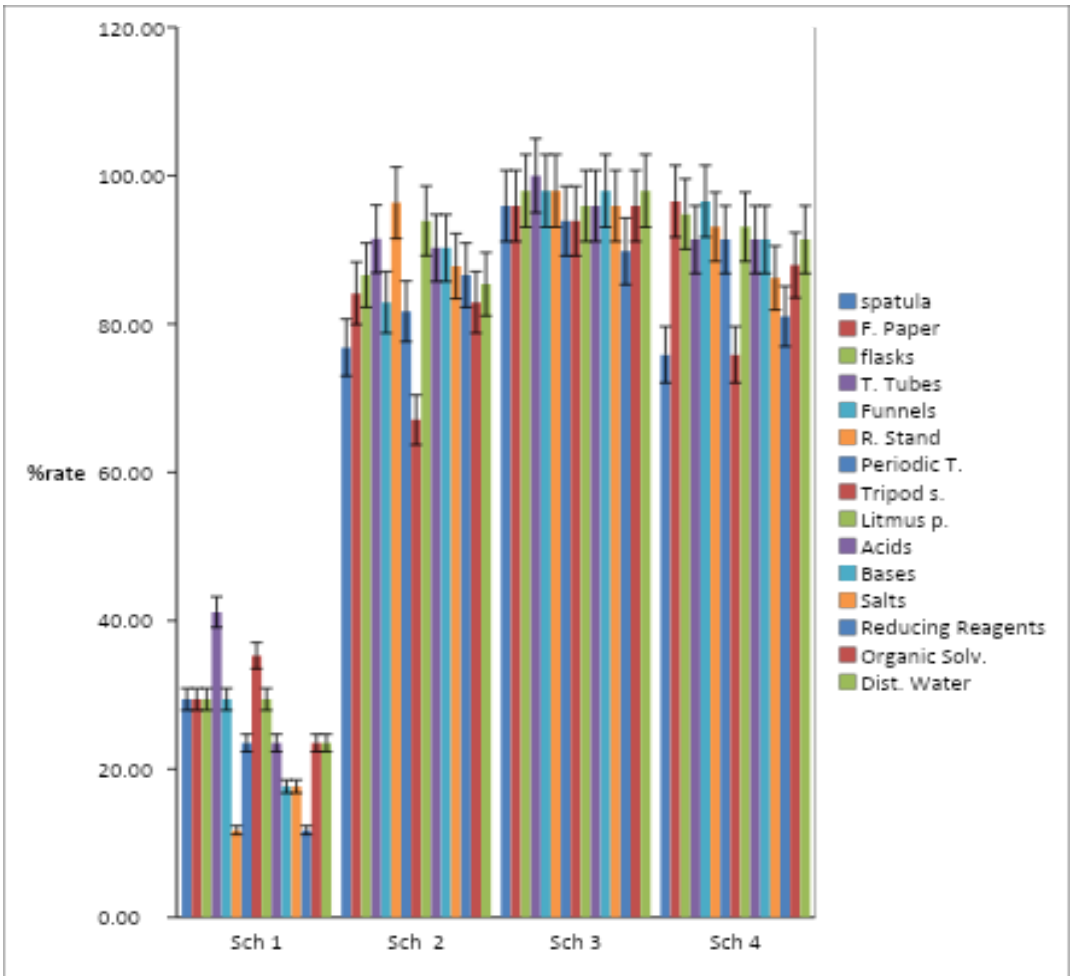


*Figure 6: Availability of Laboratory Equipment and Reagents*

**Research Question 2**

At what degree are the instructional resources utilized for chemistry curriculum delivery?

**The Utility of Resources from Man**

The Figure 7 indicates the utilization of Human Resources as indicated by the chemistry science students in the various schools. All the schools had more than 50% for the utilization of a professional teacher and other related professionals whereas school 1 showed only 12 % responses for utilization of other professionals. The significant correlation that relates quality of the teacher and the resultant accomplishment made by the student in the achieved performance of students who achieved a set objective by Akparobore (2018), also indicates a higher level of utilization. However, Udo and Edet,

(2012) showed a contrasting result that indicated that available human resources are not equally dispersed for proper utilization.

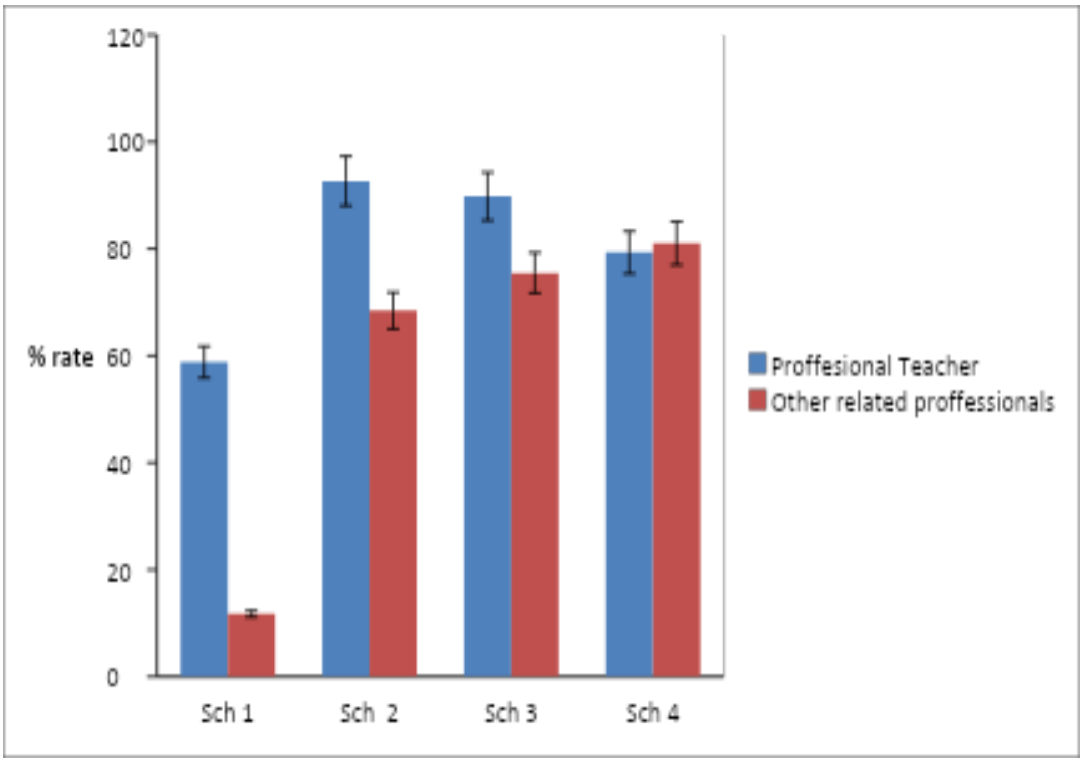


*Figure 7: Utilization of Human Resources*

**Utilization of Resources for Improvisation**

The utilization of resources for improvisation as shown in Figure 8 shows that available resources are being utilized for improvising the process of learning. This trend is highest in school 3 (96 and 90 % respectively for utilization of resources as chemicals and apparatus respectively). The only exception again is school 1 that had previously also indicated a low availability of resources for improvisation. This is similar to part of the work of John (2016) that showed that materials are being improvised. According to the author however, 76% pointed out that most of the teaching resources were commercially based and 24% are locally made by the teachers.

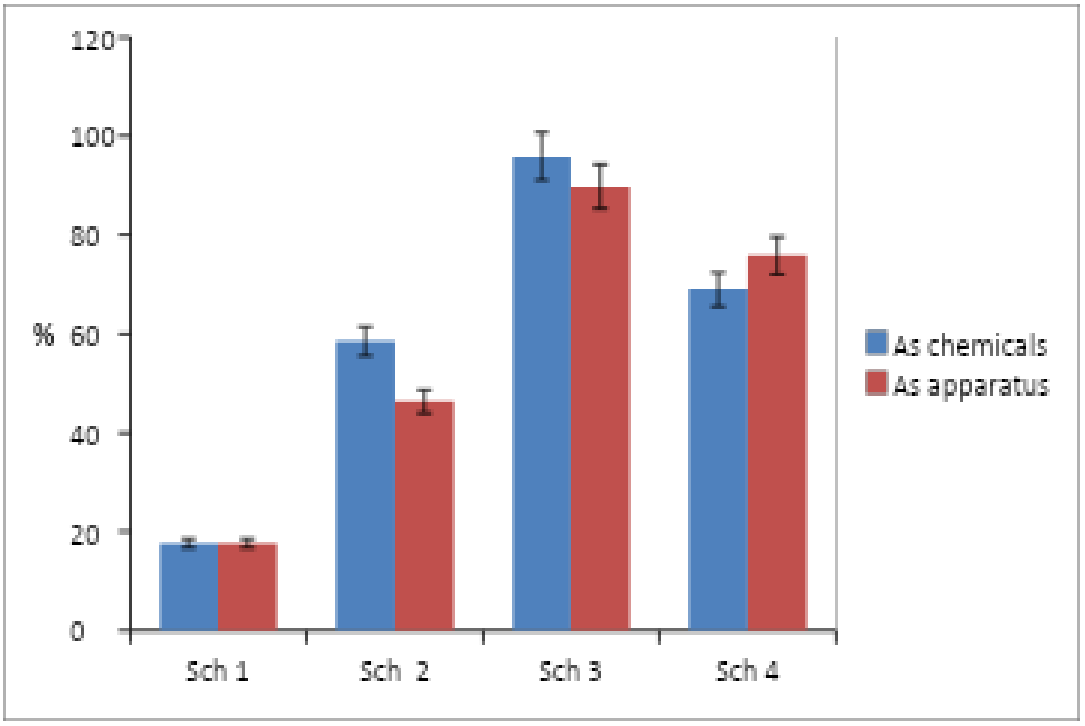


*Figure 8: Utilization of Resources for Improvisation*

**Utilization of Learning Environment**

School 4 with 81% has the highest rate for the utilization of available equipped and conducive library and also highest for utilization of functional ICT facilities but utilization of science activities like STEM, student's excursion facilities or activities has below 50% score in the responses of all schools. More so schools 1 and 2 had additional below 50 % in all the three parameters used for assessing the utilization of a conducive learning environment. This is a pointer to the fact that the availability of resources is one thing and the utilization of the available resources is a different step further as indicated by school 2. Moreover, Nja and Ideba (2018) conducted a research and recommended that recommended that learning is not affected by school environmental type and so teachers should employ innovation or improvisation and resourcefulness of even home materials in teaching.

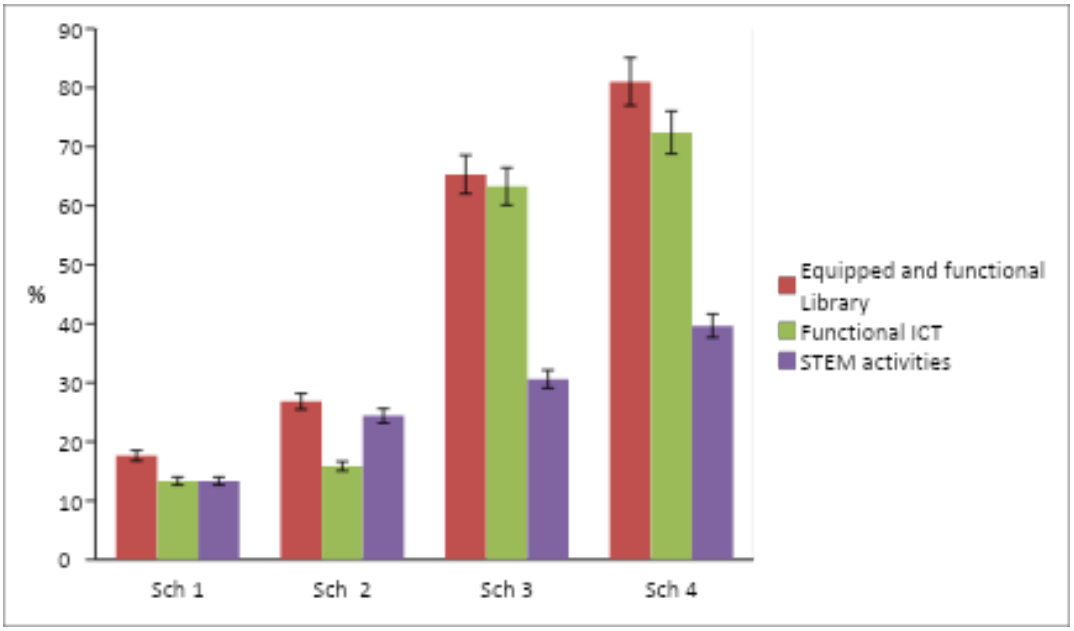


*Figure 9: Utilization of learning environment*

**Utilization of Chemistry Laboratory Equipment and Reagents**

Only school 1 showed that laboratory resources were not utilized since all the score are below 50 % (Figure 10), all the other schools had values that showed the resources were being utilized. Achimugu (2017), reported that even though these resources were available, they were inadequately utilized, she puts further that, the audio visuals were unavailable and so not utuilized in teaching and learning Chemistry.

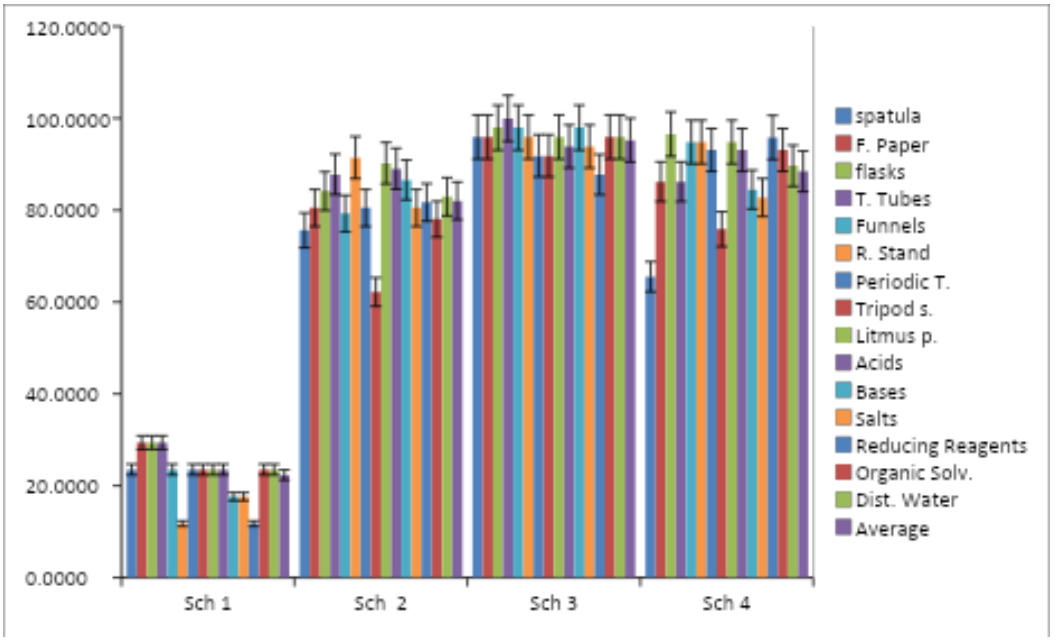


*Figure 10: The Use of Chemistry Laboratory Resources*

**Research Hypothesis 1**

Ho: There is no significant difference between the availability utilization of chemistry instructional resources amongst students of chemistry science.

**Paired Sample Statistics to Test Hypothesis 1**

The tables 4.3, 4.4 and 4.5 showed that there tcal is less than critical t, hence Ho is accepted (at both 0.5 and 0.1 levels of significance). This is similar to the findings of Njelita and Emendu (2015). More so the correlation that connects the availability and the utilization of chemistry instructional resources amongst students of chemistry science in the conducted research, is positive.

Generally, apart from science activities like STEM, student's excursion, etc as shown from the Table 1 the mean value and standard error of mean percentage for availability of learning resources for chemistry in all the schools collectively, showed that there are adequate instructional resources for chemistry science education(67.53±3.125). Similarly, the table 2 also indicated the study also revealed that the available instructional resources are adequately utilized (65.8 ±3.14). The availability of laboratory resources has also been confirmed by David (2018). With respect to utilization Neji (2019) reported an effective utilization of resources by chemistry science students, whilst Bukoye (2019) from her results found out that although the resources are utilized, they are not done appropriately.

*Table 1: Variable 1(Availability of Learning Resources)*

| | **Variable 1 (Availability of Learning Resources)** |
|---|---|
| N | 95 |
| Mean | 67.53 |
| Std Deviation | 30.46 |
| Std. Err Mean | 3.125 |

*Table 2: Variable 2 (The use of learning resources)*

| **Variable 2** | |
|---|---|
| N | 95 |
| Mean | 65.8 |
| Std Deviation | 30.61 |
| Std. Err Mean | 3.14 |

*Table 3 Paired Sample correlation for Accessibility and the Use of Learning Resources*

| | |
|---|---|
| Df | 93 |
| Correlation | 0.219 |

*Table 4: Paired Sample Test for Availability of Learning Resources*

| | |
|---|---|
| **Mean** | 1.732 |
| **Std Deviation** | 38.156 |
| **Std. Err Mean** | 3.915 |
| **Df** | 94 |
| **T** | 0.442 |
| **Cohen's d** | 0. 045 |

**Table5: Critical t for Accessibility and the Use of Learning Resources**

| **Critical t** | At 0.05 significance level | At 0.01 significance level |
|---|---|---|
| One tailed | 1.661 | 2.367 |
| Two tailed | 1.986 | 2.629 |

**Research Hypotheses 2**

$Ho_2$: The difference in the mean percentage values of the utilization of chemistry instructional resources between schools with and without adequate instructional resources in Chemistry Science is not significant.

**Paired sample Statistics for Research Hypotheses 2**

The tables 8, 9 and 10 showed that there tcal is less than critical t, hence there is a negative correlation between schools with and without adequate instructional resources in chemistry science in the conducted research. Hence $Ho_2$ is rejected (at both 0.5 and 0.1 levels of significance). Abubakar (2014) noticed a significant difference between schools with adequate and inadequate resources and rejected the null hypothesis generated.

*Table 6: Variable 1: Utilization in school with low available resources*

| Variable 1: Utilization in school with low available resources | |
|---|---|
| N | 20 |
| Mean | 24.2 |
| Std Deviation | 13.967 |
| Std. Err Mean | 3.121 |

*Table 7: Variable 2 Utilization of means for schools with available resources*

| Variable 2 Utilization of means for schools with available resources | |
|---|---|
| N | 20 |
| Mean | 78.95 |
| Std Deviation | 16.488 |
| Std. Err Mean | 3.687 |

*Table 8: Paired Sample correlation Utilization of Learning Resources*

| | |
|---|---|
| Df | 18 |
| Correlation | -0.051 |

*Table 9: Paired sample Test Utilization of Learning Resources*

| | |
|---|---|
| Mean | -54.75 |
| Std Deviation | 22.133 |
| Std. Err Mean | 4.949 |
| Df | 19 |
| T | -11.063 |
| Cohen's d | -2.474 |

*Table 10 Critical t for Utilization of Learning Resources*

| Critical t | At 0.05 significance level | At 0.01 significance level |
|---|---|---|
| One tailed | 1.729 | 2.539 |
| Two tailed | 2.093 | 2.861 |

## SUMMARY, CONCLUSION AND RECOMMENDATIONS

### Summary

The primary issue on which the study focused was to quantitatively asses the availability and utilization of chemistry science learning resources amongst chemistry students in Kuje Town, Abuja, Nigeria.

### Conclusions

From this study, it can be concluded that: -

1. The Schools(Senior Secondary) Kuje Town have adequate chemistry science learning resources.
2. The resources are utilized in learning chemistry by the students and the is more room for improvement.
3. Science activities like STEM, Students Excursion activities and facilities are inadequate or and underutilized.

### Implications of the Study

Implications of these findings include the following:

i. Adequacy of instructional resources will make students to be able to obtain the required scientific skills and attitudes expected of them. This may result in students having positive attitudes toward science. This could suggest the resent net increasing trend in student's performance in chemistry SSCE as seen in the work of Kenni (2020).

ii. Adequacy learning resources make practical lesson engaging and saves time.

iii. High availability of resources causes high performance students chemistry science performance.

iv. Lack of the technical know-how and the ability of utilizing learning resources can make learning more difficult.

No school has a 100% adequacy of all needed resources hence improvisation is essential where some is lacking is very critical to learning chemistry

v. Absence of science activities like STEM, students' excursion activities could contribute to lower achievements in learning sciences and chemistry in particular.

### Study Limitations

i. The research was conducted using only senior secondary students in Kuje Town, Abuja.

ii. The study covers only four senior secondary schools (no private) due to the time factor, financial constraint and rejection from private school owners in the district.

iii. The scope of generalization used in this work, is limited to the population used in this research.

iv. Students achievement test was not conducted.

**5.6 Recommendations**

With the above background, the following are recommended: -

1. The Ministry of Education officials, school owners and relevant personnel should encourage the continued availability of chemistry learning resources.
2. The Ministry of Education officials, school owners and relevant personnel should encourage the appropriate utilization of chemistry learning resources.
3. The Ministry of Education should make it compulsory to all the proprietors of the private schools to provide enable room for researchers to assess their facilities for the general good of improving learning of abstract sciences like chemistry,
4. The Ministry of Education should mandate all the proprietors of making available sufficient resources to their schools for the successful conduct of practical, or else refuse registration of schools refused to comply.
5. Continued maintenance of utilized resources is encouraged
6. Teachers should be encouraged to commit themselves to be effective in the use of teaching and learning resources and improvisation of student oriented instructional delivery.

**Conflict of Interest**

Authors declare that they are no conflicts of interest.

**Ethical Clearance**

Although they are no ethical issues related with this work, due request of consent and its approval was obtained from the heads of the secondary schools as well as the responding students as indicated in the questionnaire making them willing volunteer their responses.

**Authors Contribution**

Every aspect of the work had substantial contribution from both authors, except for final arrangement and proposal of research topic that was contributed by the first author.

**Acknowledgement**

This is to acknowledge the kind efforts of the principal, academic administrators and teachers of the various schools used for this study. To keep to the terms of confidentiality, we can not afford to mention the names of the officers nor their schools but we are grateful that they help to contribute to knowledge. Thanks be to God.

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**Appendix**

**Questionnaire on Quantitative Assessment of the accessibility and Use of Chemistry Science Learning Resources amongst Chemistry Students in Kuje Town, Abuja, Nigeria**

My name is Ehoche Edache Elijah, a PGDE student of College of Education, Zuba. I am carrying out a study on the above named topic to assess how available and how utilized, learning resources are used for learning amongst Chemistry science students. The questionnaire is strictly for research only. ***Each answerss will be treated confidentially. Avoid indicating your name or school the document. so your responses will NEVER be traced back to you as a person. Kindly bring back the completely filled form. Thanks***

Kindly **Circle** one most appropriate option to the best of your knowledge

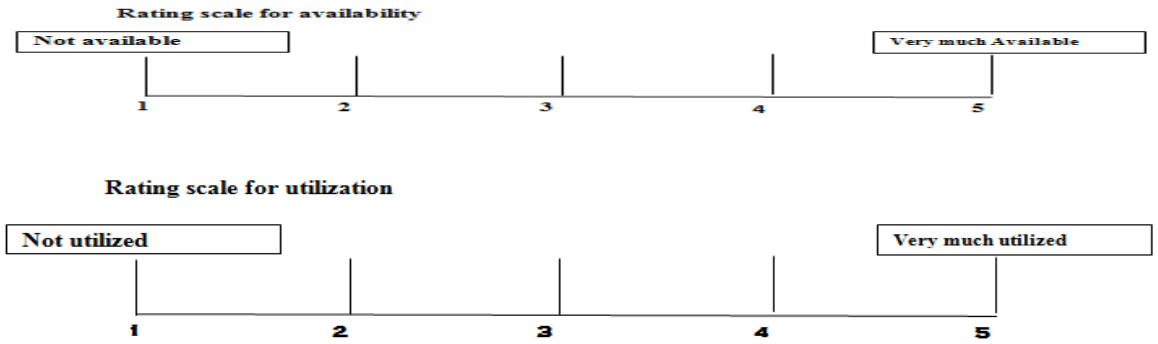
**Part 1: Bio Data**

Gender: Male Female

Class: SS1 SS2 SS3

**Part 11: Learning resources**

Kindly rate by a circle, how available and then how utilized or used (if available), are the following learning resources in your learning of chemistry science. Indicate by cycling the most appropriate corresponding number **using the scale below to rate your values each separately**, for the availability and utility. Scale of 1 lowest and 5 is the maximum rate in each case.




**Section $A_1$**

**1. Availability and utility of Human Resources**

| S/N | Human Resources | To what extent is the following Human Resources AVAILABLE to support your learning chemistry(1, 2, 3, 4,5) | To what extent is the following Human Resources UTILIZED to support your learning chemistry (1, 2, 3, 4,5) |
|---|---|---|---|
| 1. | Professional and motivated chemistry teacher | | |
| 2. | Other related professionals (e..g science laboratory | | |

| | | | |
|---|---|---|---|
| | technologists, medical professionals, etc) | | |

**Section $A_2$**
**Availability and utilization of improvisation materials**

| S/N | Local materials for improvisation | To what extent are local materials for improvisation AVAILABLE to support your learning chemistry (1, 2, 3, 4,5) | To what extent are local materials for improvisation UTILIZED to support your learning chemistry (1, 2, 3, 4,5) |
|---|---|---|---|
| 1. | Wood charcoal, chalk, vinegar, soured /un-soured fruit juice, common salt, water sources, chemistry related kitchen and laundry items etc as crude examples to identify substances, to experiment simple reactions, etc | | |
| 2. | Wood, plastic, bones, papers, sticks, metals, charts containers , kitchen and laundry wares, etc to construct models, crude apparatus to show simple reactions, etc | | |

**Section B**
**Availability and utility of environmental factors**

| S/N | Environmental factors | To what extent is the following environmental factor AVAILABLE to support your learning chemistry (1, 2, 3, 4,5) | To what extent is the following environmental factor UTILIZED to support your learning chemistry (1, 2, 3, 4,5) |
|---|---|---|---|
| 1. | Conducive class room | | |
| 2. | Well equipped library | | |
| 3. | Functional ICT facilities e.g. Internet, videos, etc | | |
| 4 | Other Science Activities e.g Excursions, STEM, etc | | |

**Section C**
**Availability and utility of Laboratory Equipment and reagents**

| SN | Laboratory Equipment and reagents | To what extent is the following Laboratory Equipment and reagents AVAILABLE to support your learning chemistry (1, 2, 3, 4,5) | To what extent is the following Laboratory Equipment and reagents UTILIZED to support your learning chemistry (1, 2, 3, 4,5) |
|---|---|---|---|
| 1. | Spatula | | |
| 2. | Filter paper | | |
| 3. | Flasks (conical, flat, bottom ) | | |
| 4. | Test tubes and Boiling tubes with racks, Bunsen burner/stove | | |
| 5. | Funnel (glass/rubber), Beakers , Wash bottles , Reagent bottles, etc | | |
| 6. | Retort stand, Burette and pipettes | | |
| 7 | Standard periodic table, mathematical set | | |
| 8. | Tripod stand and wire gauze | | |
| 10. | Litmus paper , indicators (e.g Methyl Orange, etc) | | |
| 11 | Dilute acids (e.g HCL, $H_2SO_4$ ,etc ) | | |
| 12. | Dilute base/alkali (e.g KOH, NaOH, $Ca(OH)_2$ etc) | | |
| 13. | Salts e.g $AgNO_3$, $FeCl_3$, etc | | |
| 14. | Reduction reagents e.g $KMnO_4$, KI, etc | | |
| 15. | Organic solvents e.g Methanol , Ethanol, Aqueous ammonia etc | | |
| 16 | Distilled water | | |