**AVAILABILITY OF WELL-EQUIPPED, FREQUENCY OF USE AND STUDENT PARTICIPATION IN BASIC SCIENCE LABORATORY ACTIVITIES IN GURARA LOCAL GOVERNMENT AREA OF NIGER STATE, NIGERIA**

**Abstract**

Science has been considered as the bedrock upon which the modern day technological breakthrough is built and to achieve this, the inculcations of the scientific principles demands the initiation of a child right from the early stage of life. All scientific research and experiments are done in the laboratory. Laboratory is seen as a room equipped for scientific research. Many secondary schools are not measuring up to standard of the required resources in the laboratory, thus this study which is concerned with the survey of science laboratories on Basic science students’ performance in Gurara local government area, Niger state tends to find out the availability, frequency of use and student participation of the use of laboratory resources. The study adopted a descriptive survey research method which used questionnaire as instrument for data collection. Three specific objectives and three research questions were raised to help the study. Literatures were reviewed under conceptual frame work, theoretical work and empirical studies. The population of the study comprised of Basic Science JSS II students in Nigeria and the target population comprised of all the Basic science student in the secondary schools in Gurara local government. The study used the sample size of a total of 343 respondents through use of the Slovenes formula (1978). A structured questionnaire was used for data collection is divided into three (3) sections and comprised of 18 items. The instrument was validated by four experts and trial tested for reliability. Data were analyzed using Mean score, Standard deviation and Ranking. The result of the findings indicated that there are laboratories in selected secondary schools in Gurara, though not well-equipped with modern laboratory resources. The study also revealed that the teachers do not frequently use the laboratory facilities available for Basic science. The students are always allow to use the laboratory for practical in basic science. Recommendations made include among others that the available laboratories should be equipped with Modern electronic laboratory resources through the parents’ teachers association (PTA) and need to ensure that both teachers and students of basic science in junior secondary schools in Gurara and suggestions were made for further studies on Factors for limited usage of laboratory in teaching the basic science and Teachers’ perception on laboratory equipment use in basic science.

## Introduction

Basic science was formally known as integrated science but due to some curriculum reforms by the Nigerian Educational Research and Development Council, which allows learners appreciate the fundamental unity of science led to the change of its name (NERDC, 2008). Basic Science is integration of all science subject that deal with the study of living things and non-living things. Basic Science is taught at the primary and JSS level which provide initial theoretical and practical frameworks which are prerequisites for future study in core science subjects. The emphasis on teaching and learning of Basic Science through the use of science laboratories is on ensuring that teachers not only teach the processes of science but also enable sensory learners to learn scientific concepts. By this, the “hands” and “minds” of leaners must be on scientific activities such that learners will be able to learn actively and thereby participate in knowledge construction and do well in their academic performance.

Academic achievement or academic performance is the extent to which a student, teacher or institution has attained their short or long-term educational goals. Completion of educational benchmarks such as secondary school diplomas and bachelor's degrees represent academic achievement. Academic performance refers to the assessment of a student's learning achievement and is used to predict future learning outcomes based on historical student behavior data. It is an important indicator of the quality of the teaching-learning process and the appropriation of knowledge. Factors such as students' home education background and their interactions with virtual learning environments can influence academic performance. Various methods, including data mining techniques and machine learning algorithms, have been used to predict and analyze academic performance. These methods have shown high accuracy in predicting academic success and identifying patterns of resource usage that lead to good academic performance. The concept of performance in the school environment has evolved to be affected by many factors in the school such as the availability of teaching and learning facilities.

The availability of well-equipped basic science laboratory facilities in teaching has been investigated in several studies. Science laboratory is a workplace for the conduct of scientific research. The well-equipped laboratory is a distinctive feature in science teaching and learning. The extent of adequacy of laboratory facilities for science teaching depends on the population of students in a particular school. A science lab offers various opportunities for students to think creatively, develop techniques, and explore their interests. Therefore, a science lab is essential for students to learn and explain scientific facts and theories. Additionally, many teachers do not utilize the few available facilities due to reasons such as lack of adequate laboratory facilities and practical manuals. Similarly, a study by Abidoye and Adedeji (2022), revealed that laboratory resources are not available for teaching basic science in junior secondary schools, and students rarely use laboratory facilities in their instruction.

The extent to which students engage in basic science laboratory activities varied across the studies. Laboratories provide students with diverse opportunities to acquire knowledge and experiment, which plays a pivotal role in fostering the continuous intellectual growth of students’ at all academic levels. Science labs afford students the necessary time, space, and resources to explore and experiment. Failure to properly utilize science laboratory materials leads to resource wastage, diminished effectiveness of the laboratory, and reduced academic achievement. However, a separate study conducted by Adair and Swinton (2012) found no association between laboratory usage and student learning outcomes. Overall, the availability and utilization of laboratory activities in basic science education exhibited variations across different contexts and settings. Consequently, if laboratories are accessible and utilized by both students and teachers, students will consistently exhibit interest in participating in laboratory experiments either independently or under the guidance of their teachers.

The active involvement of students in practical experiments and tasks within a laboratory setting, commonly known as hands-on participation in laboratory activities, is crucial. This approach entails direct engagement of students with materials, equipment, and procedures to acquire practical skills and hands-on experience. Its objective is to enhance learning outcomes by providing students with opportunities to apply theoretical knowledge, develop critical thinking and problem-solving abilities, and foster a deeper understanding of scientific concepts. Hands-on activities encompass various aspects such as designing and conducting experiments, utilizing laboratory techniques and instruments, analyzing data, and interpreting results. Research conducted by Kaneza, Nkurunziza, and Twagilimana (2023) has demonstrated that hands-on experiences in the laboratory positively impact learning outcomes, student engagement, and interest in the subject matter. When appropriately designed and guided by qualified educators, hands-on experiences significantly enhance learning at all levels of science education. During hands-on chemistry activities, students directly and safely explore chemical properties and reactions while utilizing laboratory apparatus and instruments.

The primary objective of any educational institution is to deliver high-quality education and ensure that students reach their full potential. It is the responsibility of school administrators to ensure sufficient provision and effective and efficient utilization of educational resources in order to achieve the objectives of their institution.

## STATEMENT OF PROBLEM

Science concepts are better taught as processes but not as bodies of knowledge (NPE, 2013). This type of teachings can only take place when students are allowed and encouraged to take active participation in the learning process. Hence hands-on learning in the laboratory becomes the best method of learning and has been found to stimulate student’s interest, may lead to better understanding and retention which may result to improved academic achievement of students. But most junior secondary schools in Gurara L.G.A do not have well equipped science laboratories which might be the reason Basic Science students under perform in Basic Education Certificate Examinations.

The rise and fall in the percentage of students who had distinction in Basic science from 2020 until 2023 fell between 0.35% and 33.70% which eventually dropped below 1% in 2023 across the Gurara Local Government (Niger State Ministry of Education, 2023). Though more than 50% of the students passed at credit level in each year, the trend was declining right from 2021 up to 2023. The percentage of students that pass Basic Science at credit level was at 50%; and that of failure was at 49.21% (Niger State Ministry of Education, 2023).

If this trend of failure is not reversed, the implication is that most students will not be encouraged to study science related subjects in senior secondary schools and this will result to low percentage of students that will gain admission to read science and technology related courses in higher institution. Since science and technology is the bedrock of society, the society will suffer from shortage of manpower and technological advancements. In lieu of the above, this study set to investigates the impact of laboratories in junior secondary schools on students’ performance in Basic science in Gurara Local Government Area of Niger State

## OBJECTIVE OF THE STUDY.

The research aim to investigate the availability of well-equipped, frequency of use and student participation in basic science laboratory activities; with the following specific objectives:

1. To determine the impact of the presence of a well-equipped science laboratories on academic performance of Basic Science Students.
2. To determine the impact of students regularity in science laboratories on academic performance of Basic Science Students.
3. To determine the impact of laboratory hands-on learning on academic performance of Basic Science Students.

**Methodology**

The study adopted a descriptive survey research method which used questionnaire as instrument for data collection. Three specific objectives were raised to help the study. Literatures were reviewed under conceptual frame work, theoretical work and empirical studies. The population of the study comprised of Basic Science JSS II students in Nigeria and the target population comprised of all the 8229 Basic science student in the secondary schools in Gurara local government. The study used the sample size of a total of 343 respondents through use of the Slovenes formula (1978). A structured questionnaire was used for data collection is divided into three (3) sections and comprised of 18 items. The instrument was validated by four experts from Basic science, statistics, test and measurement and trial tested for reliability index at 0.88. Data were analyzed using Mean score, Standard deviation and Ranking

**RESULT AND DISCUSSION**

**Response Rate**

The three objectives of the study were to determine the impact of laboratories in junior secondary schools on students’ performance in Basic science in Gurara Local Government Area of Niger State; The relationship between well-equipped science laboratories on academic performance of Basic Science Students, the relationship between students’ regularity in science laboratories on academic performance of Basic Science Students and the relationship between laboratory hands-on learning and academic performance of Basic Science Students. The response rate from the Junior Secondary School Students in Gurara Local Government Area, Niger State are presented in Table 1.

Table: 1: *Response Rate*

|  |  |  |  |
| --- | --- | --- | --- |
| **Name of the Schools** | Total Shared | Total Returned | Percent |
| Government sec. school Lambbata | 54 | 51 | 94.4% |
| Government sec. school Gawu | 109 | 103 | 94.5% |
| Govt sec school Izom | 97 | 95 | 98% |
| Gov’t sec. sch. Dikko | 34 | 31 | 91.2% |
| Govt sec sch. Tufa | 49 | 44 | 89.8% |
| **Total** | **343** | **324** | **94.5**% |

Table 1 showed the response rate of the respondents. The following are the responses: Government secondary school Kafin Koro 54 questionnaires were distributed, 51 (94.4%) response rate. Government secondary school Paiko 109 questionnaires were distributed, 103 (94.5%) response rate. Government secondary school Kwakuti 97 questionnaires were distributed, response rate, 95 (98%) response rate. Governemnt secondary school Tugan Mallam 34 questionnaires were distributed, 31 (91.2%) response rate and Government secondary school Jere 49 questionnaires were distributed, 44 (89.8%) response rate. The study targeted a sample population of 343 respondents who were students from the schools of Gurara Local Government. The research achieved a response rate of 94.5 percent from the questionnaires that were administered and distributed to the selected respondents of the study. Therefore with this response rate, there is high confidence that the responses received on the study are reliable. Story and Tait (2019) suggests that a response rate of 50% is adequate when quantitative data is manually collected.

**Demographic traits of respondents**

This was based on the gender of respondents, age and class. This was intended to attain a detailed understanding of the respondent‘s key characteristics influences the result of the study. The general information has an implication on the study variables. The different demographic characteristics are analyzed and presented in table 2 below;

Table 2 Demography of respondent

|  |  |  |  |
| --- | --- | --- | --- |
| Categories |  | Frequency | Percentages |
| Gender | Male | 223 | 68.8 |
|  | Female | 101 | 31.2 |
|  | Total | 324 | 100.00 |
| Age | Below 10 years | 23 | 7.1 |
|  | 11 – 12 | 49 | 15.1 |
|  | 13 – 14 | 166 | 51.2 |
|  | 15 – 16 | 67 | 20.7 |
|  | 16 above | 19 | 5.9 |
|  | Total | 324 | 100.00 |
|  |  |  |  |
| Class | JSS II | 324 | 100.00 |

The study findings on the gender of the respondents reveal that majority of the respondents were male with 223 representing 68.8% of the respondents, the females were 101 representing 31.2 % of the respondents. The results reveal that though the male dominated the study both genders provided the data, it further imply that data was collected from respondents across the gender which may not have any influence on the outcome of the study. However, the findings can‘t be doubted on gander grounds.

The results on the age of respondents reveal that majority respondents were below 10 years 23 with 7.1 % of the respondents, 11-12 age bracket with 49 representing 15.1% of the respondents, 13-14 had 166 representing 51.2 % of the respondents, 15 - 16 had 67 representing 20.7% of the respondents and those above 16+ years were 19 representing 5.9% of the respondents. The results reveal that many respondents are children hence a proper understanding on the study.

In terms of the class which the respondent belong, all the 324 (100.0%) of the respondents represented by the students class JSS II.

Objective One: Determine the relationship between well-equipped science laboratories on academic performance of Basic Science Students in Gurara Local Government Area, Niger state.

To determine the relationship between well-equipped science laboratories on academic performance of Basic Science Students in Gurara Local Government Area, Niger state. Several items were considered. The views of the librarians were sought on the items concerning the objective. The decision was based on a benchmark of 3.00. Their responses are presented in mean and standard deviation in Table.2.

Table 2: **BASIC SCIENCE LABORATORIES IN THE SELECTED SCHOOLS**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S/No.** | **SECTION B: AVAILABITY OF BASIC SCIENCE LABORATORIES IN THE SELECTED SCHOOLS** | **MEAN** | **Std** | **Interpretation** | **Rank** |
|  | We have a Biology laboratory in my school | 2.892 | 1.009 | High | 1 |
|  | We have a Chemistry laboratory in my school | 2.888 | .998 | High | 2 |
|  | We have a Physics laboratory in my school | 2.746 | 1.039 | High | 3 |
|  | The Biology laboratory in my school do not have enough equipment | 2.743 | 1.118 | High | 4 |
|  | The Chemistry laboratory in my school do not have enough equipment | 2.685 | 1.156 | High | 5 |
|  | The Physics laboratory in my school do not have enough equipment | 2.665 | 1.169 | High | 6 |
|  | **Average Mean** | **2.701** | **1.077** | **High** |  |
| **S/No.** | **SECTION C: STUDENTS’ REGULARITY IN SCIENCE LABORATORIES IN THE SELECTED SCHOOLS** | **MEAN** | **Std** | **Interpretation** | **Rank** |
|  | We normally go to Biology laboratory each time we have basic science | 2.509 | 1.042 | Low | 1 |
|  | We normally go to Physics laboratory each time we have basic science | 2.404 | 1.087 | Low | 2 |
|  | We normally go to Chemistry laboratory each time we have basic science | 2.336 | 1.079 | Low | 3 |
|  | Our Basic science teachers do not always take us to the laboratories during lessons | 2.299 | .960 | Low | 4 |
|  | Our basic science teachers do not always carry out practical in the laboratories | 2.213 | 1.085 | Low | 5 |
|  | Our basic science teacher does not always allow us to carry out practical by ourselves in the lab during lesson | 2.061 | .980 | Low | 6 |
|  | **Average Mean** | **2.301** | **1.038** | **Low** |  |
| **S/No.** | **SECTION D: LABORATORY HANDS-ON LEARNING IN THE SELECTED SCHOOLS** | **MEAN** | **Std** | **Interpretation** | **Rank** |
|  | Our Basic science teacher always allow us to carry out experiment in the laboratories | 2.509 | 1.054 | Low | 1 |
|  | Our Basic Science teacher always carry out the practical by himself | 2.500 | 1.077 | Low | 2 |
|  | Our Basic science teacher always tell us what to do in the laboratory | 2.481 | 1.059 | Low | 3 |
|  | Our Basic science teacher always allow us to carry out experiment in the laboratories | 2.351 | 1.090 | Low | 4 |
|  | Our Basic Science teacher always carry out the practical by himself | 2.290 | 1.050 | Low | 5 |
|  | Our Basic science teacher always tell us what to do in the laboratory | 1.768 | .900 | Low | 6 |
|  | **Average Mean** | **2.321** | **1.036** | **Low** |  |
|  | **Overall Mean** | **2.441** | **1.050** | **Low** |  |

Key: Std: Standard Deviation

Results in table 2 revealed that the presence of well-equipped basic science laboratory in Gurara Local Government Area was generally rated as low and this was indicated by the overall mean of 2.441, SD=1.050 and this critically implies that the basic science laboratory usage in the schools in Gurara are low, this signal to the low level of usage of basic science laboratory used on academic performance of Basic Science Students in Gurara Local Government Area especially in leaning the Basic science subjects.

Results on the availability of basic science laboratory and academic performance of Basic Science Students reveal that the basic science laboratory were available to a high level, these is accompanied by the mean responses of 2.701 interpreted as high. These study findings are supported by the various results as presented in the assessment provided here under

The Basic Science students are having a Biology laboratory in their school with the mean of 2.892, SD=1.009 interpreted as high ranked as 1st meaning that the results have imply that the biology laboratory is available for practical. Furthermore concerning the aspect of the availability of a chemistry laboratory in their school, the mean response was 2.888, SD=.998 interpreted as high ranked as 2nd meaning that there is the presence of a chemistry laboratory in the respondents schools.

In relation to the aspect of the availability of a physics laboratory in their school, the mean response was 2.746, SD=1.039 interpreted as high ranked as 3rd meaning that there is the presence of a chemistry laboratory in the respondents schools.

The available physics laboratory in the respondents’ school do not have enough equipment according to the mean of 2.743, SD=1.118 interpreted as high meaning that the biology laboratory do not have enough equipment for practical, these was ranked as 4th.The available Chemistry laboratory in the respondents school do not have enough equipment according to the mean of 2.685, SD=1.156 interpreted as high ranked as 5th meaning that the state of the equipment in chemistry lab is limited.

Finally it was established that the available science laboratories in the respondent schools do not have enough equipment. The mean responses were 2.665, SD=1.169 interpreted as high ranked as 6th meaning that the state of equipment in physic laboratory is appalling

**Objective Two: Determine the impact of students regularity use of science laboratories on academic performance of Basic Science Students in Gurara Local Government Area, Niger state**

Concerning students regularity use of Laboratory (practical equipment) in learning Basic science, the mean responses reveal that the regular usage of laboratory for basic science is Low. This is supported by the students response they normally go to Biology laboratory each time they have basic science with the mean of 2.509, SD=1.042 ranked as 1st interpreted as Low. The students responded that they normally go to Physics laboratory each time they have basic science was low with the mean of 2.404, SD=1.087 ranked as 2nd. While the students response to normally go to chemistry laboratory each time they have basic science was ranked as 3rd with the mean of 2.336, SD=1.079 interpreted as low ranked as 3rd meaning that the state of they normally go to are low

Furthermore the basic science teachers do not always take the students to the laboratories during lessons according to the mean of 2.299, SD=.960 interpreted as low ranked as 4th while the student response to basic science teachers do not always carry out practical in the laboratories with 2.213, SD=1.085 ranked as 5th and interpreted as 4th while the students response to basic science teacher does not always allow us to carry out practical by ourselves in the lab during lesson the mean was 2.061, SD=.980 interpreted as Low ranked as 6th

**Objective Three: Determine the impact of students hands-on-learning of science laboratories on academic performance of Basic Science Students in Gurara Local Government Area, Niger state**

The study results regarding the Basic science teacher always allows the students to carry out experiment in the laboratories presented the mean of 2.509, SD=1.054 interpreted as low ranked 1st meaning that the teacher allow student carry out experiment low. It was also established that Basic Science teacher always carry out the practical by himself with the mean of 2.500, SD=1.077 interpreted as low and ranked as 2nd while the Basic science teacher always tells the students what to do in the laboratory was ranked as 3rd with the mean of 2.481, SD=1.059 interpreted as Low

The Basic science teacher always allow us to carry out experiment in the laboratories had the mean of 2.351, ranked as 4th interpreted as low. While students response to Basic Science teacher always carry out the practical by himself was ranked as 5th with the mean of 2.290, SD=1.050 interpreted as Low

The students are always told what to do in the laboratory by the Basic science teacher was finally low with the mean of 1.768, SD=.900 interpreted as Low ranked as 5th based on the prevalence and performance.

**Discussion of Findings**

Research question one sought to assess the relationship between well-equipped science laboratories on academic performance of Basic Science Students in Gurara L.G.A. The finding revealed that there is availability of basic science laboratories (Biology, chemistry and physics) to a high level in the selected schools, though the available laboratories in the respondents’ school do not have enough equipment and that there is a significant relationship between Well-equipped science laboratory and academic performance of Basic Science Students in Gurara LGA. The result collaborate the findings of Abidoye *et’al* (2022). The finding shows the influence of Basic science laboratory on the performance of students in Upper Basic Schools in Kwara State, Nigeria was significantly. The findings of Ogunkunle and Akinsola, (2020) result also showed that simulated laboratory (SL) and enriched laboratory guide material (ELGM) experiments, affected the achievement in basic science of male and female students with different future career interests in science.

The students regularly use Biology, chemistry and physics laboratory for basic science is Low. The basic science teachers do not always take the students to the laboratories during lessons. Therefore the result shows there is a significant relationship between students regularity in science laboratories on academic performance of Basic Science Students in Gurara L.G.A.Niger state. The findings were supported by Adair and Swinton (2012). The study find that lab attendance benefits the student in overall exam performance also Matz, et’al., (2012) They found that concurrent enrollment in the lecture and laboratory positively impacts (1) the odds of retention in the lecture by 2.2 times on average and (2) final lecture grades by up to 0.19 grade points on a 4.0 scale for the lowest‐scoring students according to university‐level mathematics and chemistry placement exam scores.

The Basic science teacher always allows the students to carry out experiment in the laboratories. The Basic Science teacher always carry out the practical by himself low and always tells the students what to do in the laboratory as Low, the teacher always allow students to carry out experiment in the laboratories teacher always carry out the practical by himself and the students are always told what to do in the laboratory by the Basic science teacher and that there is a significant relationship between laboratory hands-on learning and academic performance of Basic Science Students in Gurara L.G.A. The findings were supported by Lawson et’al., (2020). The author’s result showed that hand-on laboratory session provided an opportunity for students to revisit concepts initially presented in the traditional classroom setting and to actively engage in applying these concepts to case-based scenarios. The improved educational outcomes will benefit students’ in future standardized exams as they’ll as in their professional practice also the finding supported Kaneza et’al., (2023). The results indicate that providing laboratory experiments through a student hands-on experiment SHE or a teacher-based demonstration experiment TBDE approaches significantly improved students’ academic performance of solutions and titration.

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