

## EFFECTS OF BIOLOGICAL RESOURCES ON SECONDARY SCHOOL STUDENTS' INTEREST AND ACADEMIC PERFORMANCE IN BIOLOGY IN SOKOTO METROPOLIS

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### Abstract

*This study investigated effects of biological resources on secondary school students' interest and academic performance in biology in Sokoto metropolis. The research was built on 2 objectives which were translated to 2 research questions, and 2 corresponding null hypotheses guided the study. A quasi-experimental (pretest and posttest control group design) was adopted in the study. The target population of the study includes 10 senior secondary schools which consist of 5 private and 5 public schools within Sokoto metropolis. The target population encompasses 785 SS3 students whom 230 among them were purposely sampled from 4 senior secondary schools (2 private and 2 public) for data collection using intact class. The sampled students were divided into two groups (experimental and control) in such a way that each group consist of a private and a public school. Two self-developed research instruments that aided the data collection twice (pretest and posttest) include; Biology Performance Test (BPT), and Biology Students' Interest Questionnaire (BSIQ) after Spearman Brown reliability of 0.84 and 0.75 respectively. The instruments were validated by two experts from Department of Science and Vocational Education, Faculty of Education and Extension Services, Usmanu Danfodiyo University Sokoto. Demographic data of the samples was analyzed using simple frequency distribution and percentage. However, the 2 research questions raised for this study were answered using descriptive statistics of mean and standard deviation while the 2 corresponding null hypotheses were tested electronically using Analysis of Covariance (ANCOVA) on SPSS version 20.0 software at 0.05 level of significance. The findings of this study revealed that biological resources have statistically significant effects on interest and academic performance of secondary school students in biology in Sokoto metropolis. Based on the research findings, it was recommended that biology teachers should incorporate the use of biological resources in their teaching pedagogies in order to foster interest and enhance academic performance in biology among secondary school students in Sokoto metropolis.*

**Keywords:** Biological resources, students, interest, academic performance, biology, secondary school, pretest, posttest, experimental, control, target population, hypotheses, analysis.

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### Introduction

Biology was coined from two Greek words, which are; Bios and Logos. The latter means study or "science of" while the former means life and this makes biology to be defined universally as the study of life. Biology is a subject taught at the secondary

school level to give students an in-depth understanding of biological concepts, principles, theories, and laws (Bello, Yusuf & Ibrahim, 2020). Biology has a significant global impact and plays vital roles in various fields, such as microbiology, biotechnology, genetics, botany, medicine, zoology, and bioinformatics (Kulak & Newton, 2015). Biological resources are living organisms used as instructional aids to teach science effectively, they include: Microorganisms, drosophila, seedlings, bees, insects, etcetera. It brings about students' passion, curiosity, and enthusiasm for learning biology because they would be able to see, observe, touch, and manipulate the resources. Bioresources are the biologically generated materials that support life on the earth. They include plants, animals, microorganisms, and the total biogenic products (Lakshmi, Rao & Ahmed, 2023).

Biology as a science subject ought to be taught scientifically, that is through the usage of resources in the universe, in order to make the teaching and learning process to be concrete and not abstract as it prevails today. However, due to its abstract nature and intricate relationships, biology is often perceived as challenging to teach and learn (Cimer, 2015). Instructional materials refer to anything a teacher uses in teaching and learning situation from small stones, pieces of paper, small sticks, sample of leaf, chalkboard, maps, charts, radio, television, computers e.t.c. (Abdullah, 2015). However, biological resources have distinct and uniqueness in taking part in teaching and learning processes. It is basically the living organisms or anything that has life which are used during teaching and learning. This is to clarify that it is not all resources that are biological or has life in them, so they cannot be referred to as biological resources. Teachers need to realize that for them to inspire education of their students, they must endeavor to employ teaching materials in the course of their lesson presentation (Azare, 2019). Bagudo (2024), classified stages of teaching into three (3), which are; pre-teaching, during teaching, and post teaching stage. At every level of the teaching stages, biological resources are quintessential to ensure successful passage of knowledge from the teacher to the learners. Because biological resources are living organisms, it makes interactions of the teachers and learners with them very easy and impactful.

### **Statement of Problem**

Researchers have observed a significant fluctuation in the performance of students at secondary school level over the years, this may be partly responsible for truncating the ambition of most prospecting students. Traditionally, in the school system today, instructional materials might not be available or the skills of using them is missing among the teachers, in such cases, looking for an alternative might be the best way to get them to solve the additional problems in the schools (Lingbun, Adam & Sambo, 2024). Biology as the fundamental science subject has been known to continuously record low students' enrolment, interest and poor achievement levels in all examinations - both internal and external. It was observed that student's attitude, adequate resource materials, inadequate qualified biology teachers, availability of laboratories and frequency of practical classes significantly affected the performance of students (Raiyegbemi, Samuel, & Moses, 2020). Moreover, Nwafor and Okoi (2018) conducted a research on secondary school students' interest inventory in biology in Ebonyi state and found out that there is abysmal level of student's interest in biology. On that note, the researchers recommend that interest based activities should be incorporated into the biology scheme to trigger learning of biology.

Educational sector in Nigeria has series of challenges. One important area of the challenges is the unavailability and utilization of instructional materials in the post-primary school level to cope with the modern technological challenges (Lingbuin, Adam & Sambo, 2024). Ismail and Lukman (2022) research determined the availability and utilization of instructional materials in the teaching and learning of biology in senior secondary schools in TalataMafara town, Zamfara State. The findings of the study revealed that some of the required instructional materials are fairly available but are not regularly use by biology teachers. Biology laboratories and instructional materials relating to multimedia are lacking in most of the schools in TalataMafara Town. Also, Benjamin and Emmanuel (2024) researched students' perceptions of difficult concepts in biology in senior secondary school in Lagos State. The result showed that there was no significant difference in the perception of students on difficult topics in Biology on the basis of their subject areas. However, teaching strategies, students' attitude, inadequate learning resources and students' learning habits were the reasons adduced by students of the perceived difficult topics. Verily, there are loopholes in areas of instructional materials, students' interest and academic performance in biology which requires further investigation.

### **Objectives of the Study**

Specifically, the study aims to achieve the following objectives:

1. To find out the effect of biological resources on secondary school students' interest in Biology in Sokoto metropolis.
2. To investigate the effect of biological resources on secondary school students' academic performance in Biology in Sokoto metropolis.

### **Research Questions**

1. What is the effect of biological resources on secondary school students' interest in biology in Sokoto metropolis?
2. What is the effect of biological resources on secondary school students' academic performance in biology in Sokoto metropolis?

### **Null Hypothesis**

1. There is no significant effect of biological resources on secondary school students' interest in biology in Sokoto metropolis.
2. Biological resources have no significant effect on secondary school students' academic performance in biology in Sokoto metropolis.

In this research, the theoretical framework focused on behavioral learning theory and constructive learning theory in order to interpret the effect of biological resources on secondary school students' interest and academic performance in biology in Sokoto metropolis. Watson (1878–1958) is known as the founder of behaviorism, a psychological school of thought that focuses on observable behavior. Watson's 1913 manifesto proposed that psychology should focus on behavioral manifestations of intelligence, rather than internal processes like thoughts and feelings. Basically, behavioral learning theory is also known as behaviorism. Behavioral simply means the way in which one act or conducts oneself, especially towards other. For students to

learn better, teacher needs to understand the students' behavior, how they learn, when they learn, and how they can learn better. If teacher fails to understand the students and how they learn, teaching and learning will not be effective. In the sense that it will be a way of communication from the teacher alone while the students will not receive the information being conveyed. Winnifred (2023) published that learning behavior is the idea that all human behavior is influenced by interaction with the outside world. Genetics or inherited factors are not considered to have significant influence on behavior. Behavior as a psychological concept refers to activity that can be observed, and brought about by stimuli that may be internal or external to the individual. The theory of Behaviorism captures the core ideas of learning behavior. Behaviorism theorizes that all behavior is observable and quantifiable because it is acquired through environmental stimulus. The right stimulus can be given repetitively to get the desired response and reinforce the desired behavior. Since behavior is learned from the environment, children, students, and employees can be influenced, motivated, and helped if the right stimulus is given. Behavioral learning has contributed to predicting and managing behavior and to understanding how individuals learn.

More so, behavioral learning theory focuses mostly on impacts of learning on students. This scope extends to the ways students react in the classroom and to learning activities. Teacher as a professional can encourage and motivate students to learn with different strategies. As a result, teachers should know the time to award reward and punishment so as not to hinder the flow of knowledge in the classroom. Behaviorism extends to the feelings and emotional condition of the students. This connotes the fact that certain condition and wellbeing of the students must be met before effective learning can take place. At the same time, learners can be motivated and influenced to cooperate in the classroom with reward and acknowledgement of their efforts. According to a review of Watson's theory in 2021, it was revealed being inspired by the work of Russian psychologist Ivan Pavlov, who classically conditioned dogs to salivate at the sound of a bell. Watson's work helped advance other behaviorist theories, including B.F. Skinner's operant conditioning. Behaviorism's focus on observable behavior was a departure from previous introspective theories, which focused on internal thoughts. This made psychology relevant to science. Behavior is a person's (or any other living organism's) response to stimuli. In this case, the stimulus is steak. The response, salivation, is a behavior. Unlike what happens in the brain, behavior is physical and observable. Behaviorism is a form of social psychology that studies behavior. Behaviorists believe that behavior is shaped by our environment - that our actions are driven by our desires to gain rewards and avoid punishments. The behavioral learning theory is to explore how students interest can be aroused and sustained through positive attitude to learning.

Piaget (1896-1980) is considered the father of the constructivist view of learning. As a Swiss psychologist and biologist, he was interested in how an organism adapts to the environment and how previous mental knowledge contributes to behaviors. He believed that children need to grow and mature psychologically in order to understand the world. Other writers who influenced constructivism include: John Dewey, Maria Montessori, Władysław Strzemiński, Lev Vygotsky, Heinz von Foerster, George Kelly, and Jerome Bruner. Learning is modeling, transforming, and understanding the way in which an object is constructed. Through interactions with the environment, we change our internalized view of the world. Views on separate constructs can be changed in different ways (Piaget, 1964). Constructive learning theory which is also known as

constructivism is a learning theory which hold that knowledge is the best gained through a process of reflection and active construction in the mind (Mascolo & Fischer, 2005). This theory simply means the strategies of learning which enable students to rebuild what was learned in their own opinion. This theory analyzes the reflection of students on their learning experience in other to construct their own better understanding which can be enhanced by biological resources as an independent variable of this study. Manipulating biological resources and ability to create personal understanding often help to store knowledge in the long-term memory of the students. When students are able to deduce visible understanding of theoretical concepts relating it to concrete elements, it makes the knowledge and understanding to become part of them. The first form radical (or cognitive) constructivism proposes that the process of constructing knowledge is dependent on the individual's subjective interpretation of their active experience. The second form social constructivism affirms that human development is socially situated and that knowledge is constructed through interaction with others (Braun, 2021). The theory underscored the impact of human development mentally on learning and academic performance.

### Literature Review

Ibenegbu and Eze (2020) explored the use of blended teaching approach in stimulating the interest of students to learn Biology. The design of the study was Quasi-Experimental design, specifically, pretest-posttest non- equivalent control group design. The sample for this study consists of 82 Biology students in four intact classes in secondary schools in Nsukka Local Government Area of Enugu State, Nigeria. Two research questions and two null hypotheses guided the study. Biology Interest Inventory (BII) was used as instrument for data collection. The hypotheses were tested at 0.05 level of significance using Analysis of Covariance (ANCOVA). Result of the study showed that the students learning biology using the Blended Teaching Approach had a significant increase in their interest scores. Similarly, Nwuba, Olajide, and Ibrahim (2023), investigated fostering secondary school students' interest in biology using numbered heads together cooperative instructional strategy (NHT) in Awka Education Zone. Two research questions and three null hypotheses tested at 0.05 level of significance guided the study. The study is quasi-experimental research, adopting specifically the pretest posttest non-randomized control group of 2x2 factorial research design. Students in the experimental group was taught selected concepts in biology using NHT while those in the control group was taught the same concepts using Conventional Lecture Method (CLM). Mean and Standard deviation were used in answering the research questions while Analysis of Covariance (ANCOVA) was used to test the null hypotheses at 0.05 alpha level. The findings of the study revealed that NHT is more effective in fostering students' interest in biology than CLM.

Moreover, Mutiu and Oladimeji (2022) carried out a research to determine the effect of instructional materials on biology instruction among high achieving secondary school students in SPED International Secondary School, Oyo. Quantitative research method using quasi experimental design was adopted to test two hypotheses at 0.05 level of significance. Simple random sampling was used to select 20 samples out of the population of 30 that met the criteria for selection. A 20-item Biology Achievement Test with the reliability and validity of 0.93 and 0.78 was used. Pretest and post-test scores of the sample was analyzed using t-test statistics. Results showed that the one sample p-values of the mean pre-test and posttest (0.683,  $P > 0.05$ ). P values for both the

mean scores of male and female high achieving secondary school student in biology was (0.000,  $P < 0.05$ ). Based on the findings of this study, there was no significant difference between the biology achievement of high achieving secondary school students taught with instructional materials and those taught without instructional materials. Notwithstanding, researchers recommended that instructional materials should be consistently used by teachers for biology instructions as it enhanced students' achievement but maybe not for high achieving secondary school students. Public and private schools should provide teachers with sufficient instructional materials for every subject. Abidoye, Bello, and Ibrahim (2023) conducted similar research on the effect of Biology teaching materials on the academic performance of senior secondary school students in Ilorin West, Ilorin, Kwara State, Nigeria. The study examined the impact of Biology instructional materials on the academic performance of senior secondary school students and employed a descriptive survey research design and targeted Biology students in senior secondary schools. A random sampling technique was used to select 120 students. Out of 120 students sampled in this survey, 60 students, which correspond with 50% of total respondents, were from public schools and also 50 students representing 50% from private schools. 40 students in SS1 were involved, which corresponds to 33.3%. Forty-nine were in SS11 (40.8), while 51 students were in SS111 (25.8) based on class size. They utilized questionnaire as instrument for data collection and analyzed using frequency count, percentage, mean, standard deviation, independent t-test, and ANOVA. The research was conducted on three objectives and research questions without hypothesis and its result showed a significant positive effect of Biology instructional materials on students' academic performance and asserted that students taught with these materials outperformed those without them. The study recommended provision of instructional materials and incorporation by Biology teachers. A study by Ekineh and George (2024) examined the effect of real object on academic performance of Biology Students in Secondary Schools in Emuoha Local Government Area of Rivers State, the study adopted quasi-experimental research design, population comprises of 1,115 students from three samples secondary schools in Emuoha Local Government Area of Rivers State. 150 students make up the sample size and Biology Performance Test (BPT) was used as the instrument for the study. Mean and standard deviation was used to answer two research questions while z-test was used to test the hypotheses, while two research objectives were achieved. Result revealed showed that students taught with real objects performed better than those taught without the use of real objects and the male students performed better than their female counterparts when taught with real objects. The study therefore recommends seminar/workshop for Biology teachers on the use of diverse real objects in teaching Biology in Secondary Schools.

## **Methodology**

The target population for this study includes ten (10) secondary schools in Sokoto metropolis, particularly SS3 students who are offering biology. The population of this study consists of 785 SS3 students which cut across five private and five public secondary schools within Sokoto metropolis. Quasi-experimental (pretest and posttest control group design) was employed for this study with appropriate instruments employed for data collection in Nakowa International School, Runji Sambo; Unity Comprehensive School, Dendima; Government Day Secondary School, Dundaye; and Government Day Secondary School, Gidan Dare. The reason for using this research design is because it allows the study to manipulate the use of biological resources

between experimental group and control group and compare the changes in their interest and performance in biology. The sampling technique employed is purposive rather than random sampling as common in experimental design. The sampling technique was purposive because the schools have students of both gender (one of the research variables). The intervention in this study is the biological resources (independent variable) which was used on the experimental group and examined its cause-and-effect on students' interest and performance in Biology.

**Table 1: Distribution of population of the study**

| S/N | Schools                                            | School type | Male | Female | Total |
|-----|----------------------------------------------------|-------------|------|--------|-------|
| 1.  | Nakowa International School, Runji Sambo           | Private     | 26   | 24     | 50    |
| 2.  | Unity Comprehensive School, Dendima                | Private     | 22   | 18     | 40    |
| 3.  | Sautul-haqq Secondary School, Dendima              | Private     | 5    | 9      | 14    |
| 4.  | The Gold Pen Schools, Runji Sarki                  | Private     | 28   | 39     | 67    |
| 5.  | Asma'u Girls Islamic College, Maganma              | Private     | —    | 37     | 37    |
| 6.  | Government Day Secondary School, Dundaye           | Public      | 40   | 25     | 65    |
| 7.  | Government Day Secondary School, Gidan Dare        | Public      | 35   | 40     | 75    |
| 8.  | Government Technical College, Dendima              | Public      | 19   | —      | 19    |
| 9.  | Government Girls Day Secondary School, Runji Sambo | Public      | —    | 310    | 310   |
| 10  | Sokoto Science College, Fodio Road                 | Public      | 108  | —      | 108   |
|     |                                                    |             | 283  | 502    | 785   |

**Source:** Fieldwork, 2024

Due to timeframe, available resources, and gender factor, the researchers could not make use of all the 10 secondary schools that constitute the population of this study, thereby utilize purposive sampling technique to select four secondary schools in which two are private owned and the other two are public schools. Some of the schools in the population are gender biased, that is some have only male students while some have only female students, such as: Government Technical College, Sokoto, and Asma'u Girls Islamic College, Sokoto, respectively. Given that gender is a significant variable in this study, the researchers thereby purposely select four schools which made-up of male and female students. Out of the total population of SS3 students offering biology in the ten schools which is seven hundred and eighty-five (785), the researchers employ purposive sampling technique to select a sample of two hundred and thirty (230) SS3 students from the four selected schools used for data collection. The number of the sample is tantamount to intact class figures of the sampled because the school management would not allow researchers to seclude some students during treatment. The students were divided into two groups (one private and one public school per group), one group will be taught three biology topics, namely: Taxonomy, ecology, and nutrition using biological resources, while the other group will be taught the same topics using Conventional Teaching Method (CTM). Using purposive sampling technique, Nakowa International School, Runji Sambo with fifty (50) SS3 students (26 males and

24 females) and Government Day Secondary School, Dundaye with sixty-five (65) SS3 students (40 males and 25 females) occupied the experimental group while Unity Comprehensive School, Sokoto with forty (40) SS3 students (22 males and 18 females) and Government Day Secondary School, Gidan Dare with seventy-five (75) SS3 students (35 males and 40 females) occupied the control group. The experimental group which is made up of a public and a private school contains one hundred and fifteen (115) SS3 students in which sixty-six (66) of them were males while forty-nine (49) are females. The control group which was also made up of a public and a private school contains one hundred and fifteen (115) SS3 students in which fifty-seven (57) among them were males while fifty-eight (58) were females. Altogether, there were one hundred and twenty-three (123) males and one hundred and seven (107) females in the study.

**Table 2: Sample for the Study**

| S/N | Schools                                     | School type | Group        | Male | Female | Total |
|-----|---------------------------------------------|-------------|--------------|------|--------|-------|
| 1   | Nakowa International School, Runji Sambo    | Private     | Experimental | 26   | 24     | 50    |
| 2   | Unity Comprehensive School, Dendima         | Private     | Control      | 22   | 18     | 40    |
| 3   | Government Day Secondary School, Dundaye    | Public      | Experimental | 40   | 25     | 65    |
| 4   | Government Day Secondary School, Gidan Dare | Public      | Control      | 35   | 40     | 75    |
|     |                                             |             |              | 123  | 107    | 230   |

**Source:** Fieldwork, 2024

Research instrument is a device that researchers used for collection of data during exercise (Nwana, 2017). For this research study, two self-developed instruments were used for data collection by the researchers, which are; Biology Performance Test (BPT) and Biology Students Interest Questionnaire (BSIQ). The BPT consists of 20 items with option A-D. The 20 questions were developed from SS3 Biology curriculum, the questions covered three selected topics for this study, which are; taxonomy, ecology, and nutrition while the BSIQ consists of 20 items on a four-point Likert scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). A Likert scale is a rating system used to measure opinions, attitudes, or behaviors (Bhandari, 2023). Validity is often defined as the extent to which an instrument measures what it asserts to measure (Richard, Johnson, & Lee, 2015). Nasiru, Bello, and Yusuf (2023) referred validity to the degree in which the result obtained from data analysis will actual represent the phenomenon under study. In order to ensure face validity of the Biology Performance Test (BPT), the instrument was submitted to an expert in the Biology Education unit of the Department of Science and Vocational Education, Usmanu Danfodiyo University, Sokoto. The expert validated the instrument which consist of 20 items, observed that the question marks in item 10 and item 17 are unnecessary, and therefore should be removed. The expert further suggested that the researchers should provide spacing for options in item 13 and item 17. The corrections were effected by the researchers and presented to the expert for final validation; the instrument was approved by the expert as a good instrument free from errors and has the ability to

collect relevant data for this study. The Likert scale Biology Students Interest Questionnaire (BSIQ) was carefully examined by a senior lecturer in the Department of Science and Vocational Education, Usmanu Danfodiyo University, Sokoto to ensure the instrument is free from mistakes that can render this research study invalid and unreliable. The expert approved it after effecting highlighted corrections as a good instrument free from errors and has the ability to collect relevant data for this study.

The two instruments developed for the study which includes: Biology Performance Test (BPT) and Biology Students Interest Questionnaire (BSIQ) were put to test during pilot study to test their internal consistency. The split-half method of reliability estimate was adopted in this study to ascertain the degree of consistencies of the instruments. During the process, a pilot test was conducted on 30 SS3 students from Government Technical College, Sokoto and Asma'u Girls Islamic College, Sokoto which are within the target population of this research but not part of the main study. The instruments were administered to the students once and the results obtained were divided in two halves based on odd (X) and even (Y). For the sake of reliability, BPT was administered once to 30 SS3 students selected for the pilot study and the result obtained was splitted into two equal halves based on odd (X) and even (Y). The two halves were correlated using Pearson Product Moment Correlation Coefficient (PPMCC), the result was found to be  $r=0.72$  which was later subjected to Spearman Brown reliability formula ( $R=2r/1+r$ ) to determine the degree of the reliability of the instrument which was found to be  $R=0.84$ . Therefore, a reliability of 0.84 is considered very high reliability in line with recommendations of Sambo, (2008). To determine the reliability of the BSIQ, it was also administered once to 30 SS3 students selected for the pilot study and the result obtained was splitted into two equal halves based on odd (X) and even (Y). The two halves were correlated using Pearson Product Moment Correlation Coefficient (PPMCC) and the result was found to be  $r=0.60$  which was later subjected to Spearman Brown reliability formula ( $R=2r/1+r$ ) to determine the degree of the reliability of the instrument which was found to be  $R=0.75$ . However, according to Sambo (2008), a reliability coefficient of 0.70 and above is considered high level of reliability to ensure consistency of an instrument for data collection. Thus, this instrument is reliable for data collection. Descriptive statistics of mean and standard deviation was used to answer the research questions, while Analysis of Covariance (ANCOVA) was used to test the hypotheses of this study. The essence of adopting this approach to data analysis is to ensure the effectiveness.

## Results and Discussion

Research Question 1: What is the effect of biological resources on secondary school students' interest in biology in Sokoto metropolis?

**Table 3: Summary of Mean and Standard Deviation on the effect of biological resources on students' interest in learning biology in Sokoto metropolis**

| Groups                        | N   | Pretest |      | Posttest |       | Differences |       |
|-------------------------------|-----|---------|------|----------|-------|-------------|-------|
|                               |     | Mean    | SD   | Mean     | SD    | Mean        | SD    |
| Experimental                  | 115 | 46.70   | 9.07 | 69.52    | 3.82  | 22.82       | -5.3  |
| Control                       | 115 | 38.96   | 7.63 | 50.68    | 6.82  | 11.72       | -0.81 |
| Between Group Mean Difference |     | 7.74    | 1.44 | 18.84    | -3.00 |             |       |

**Source:** Fieldwork, (2024).

Table 3 is a summary of mean and standard deviation calculated to determine the effect of biological resources on secondary school students' interest in Biology in Sokoto metropolis. The analysis was calculated at both pretest and posttest between experimental and control group. The results of the analysis revealed that there was a pretest mean difference of 7.74 between the interest scores of experimental (N=115, mean=46.70 & SD=9.07) and control group (N=115, mean=38.96 & SD=7.63) in favor of the experimental group. However, there was a posttest mean difference of 18.84 between experimental (N=115, mean=69.52 & SD=3.82) and control group (N=115, mean=50.68 & SD=6.82) in favor of the experimental group. Similarly, a within group comparison was conducted in which a mean difference of 22.82 was obtained between the pretest (46.70) and posttest (69.52) interest scores of the experimental group, while a mean difference of 11.72 was obtained between the pretest (38.96) and posttest (50.68) interest scores of the control group. Therefore, the experimental group was found to have higher interest scores in biology at both pretest and posttest as compared to the control group. Similarly, the experimental group had a higher mean interest gain of 22.82 as compared to 11.72 for control group. Hence, the results indicate positive effect of biological resources on students' interest in Biology in Sokoto metropolis. However, a corresponding null hypothesis was tested at 0.05 level of significance to establish the significance of the mean difference between experimental and control group.

Research Question 2: What is the effect of biological resources on secondary school students' academic performance in biology in Sokoto metropolis?

**Table 4: Summary of Mean and Standard Deviation on the effect of biological resources on students' academic performance in biology in Sokoto metropolis**

| Groups                   | N    | Pretest |       | Posttest |       | Differences |       |
|--------------------------|------|---------|-------|----------|-------|-------------|-------|
|                          |      | Mean    | SD    | Mean     | SD    | Mean        | SD    |
| Experimental             | 115  | 13.10   | 2.39  | 18.46    | 1.45  | 5.36        | -0.94 |
| Control                  | 115  | 11.24   | 2.57  | 14.10    | 2.48  | 2.86        | -0.09 |
| Between Group Difference | Mean | 1.86    | -0.18 | 4.36     | -1.03 |             |       |

**Source:** Fieldwork, (2024).

Table 4 is a summary of mean and standard deviation calculated to determine the effect of biological resources on secondary school students' academic performance in Biology in Sokoto metropolis. The analysis was calculated at both pretest and posttest between experimental and control group. The results of the analysis revealed that there was a pretest mean difference of 1.86 performance scores of experimental (N=115, mean=13.10 & SD=2.39) and control group (N=115, mean=11.24 & SD=2.57) in favor of the experimental group. However, there was a posttest mean difference of 4.36 between experimental (N=115, mean=18.46 & SD=1.45) and control group (N=115, mean=14.10 & SD=2.48) in favor of the experimental group. Similarly, a within group comparison was conducted in which a mean difference of 5.36 was obtained between the pretest (13.10) and posttest (18.46) performance scores of the experimental group, while a mean difference of 2.86 was obtained between the pretest (11.24) and posttest (14.10) performance scores of the control group. Therefore, the experimental group was found to have higher performance scores in biology at both pretest and posttest as compared to the control group. Similarly, the experimental group had a higher mean

interest gain of 5.36 as compared to 2.86 for control group. Hence, the results indicate positive effect of biological resources on academic performance of students in Biology in Sokoto metropolis. However, a corresponding null hypothesis was tested at 0.05 level of significance to establish the significance of the mean difference between experimental and control group.

Null Hypothesis- $H_{01}$ : There is no significant effect of biological resources on secondary school students' interest in biology in Sokoto metropolis.

**Table 5: ANCOVA Results of Posttest Biology Students' Interest Scores using Pretest Scores as Covariate between Students exposed to Biological Resources and Control Group in Sokoto Metropolis**

| Source          | Type III Sum of Squares | Df  | Mean Square | F       | Sig. | Partial Eta Squared | Decision |
|-----------------|-------------------------|-----|-------------|---------|------|---------------------|----------|
| Corrected Model | 20486.525 <sup>a</sup>  | 2   | 10243.262   | 340.351 | .000 | .751                | $H_{01}$ |
| Intercept       | 26088.698               | 1   | 26088.698   | 866.844 | .000 | .793                | Rejected |
| BSIQ1           | 167.823                 | 1   | 167.823     | 5.576   | .019 | .024                |          |
| Group           | 15329.343               | 1   | 15329.343   | 509.345 | .000 | .693                |          |
| Error           | 6801.737                | 226 | 30.096      |         |      |                     |          |
| Total           | 853249.000              | 229 |             |         |      |                     |          |
| Corrected Total | 27288.262               | 228 |             |         |      |                     |          |

**Source:** Fieldwork, (2024)

Table 5 summarized a univariate Analysis of Covariance (ANCOVA) conducted to determine whether there is any significant effect of biological resources on secondary school students' interest in biology within Sokoto metropolis. Levene's test and normality checks were carried out and the assumptions were met. The results revealed that there was statistically significant effect of biological resources  $F(1, 226)=509.345$ ,  $p=0.00$ ,  $\eta_p^2=0.693$  on interest of students (experimental group) exposed to biological resources (Mean=69.52,  $SD=3.82$ ) and those in the control group (Mean=50.68,  $SD=6.82$ ) in favor of the experimental group. Therefore, since the p-Value of 0.00 is less than 0.05 level of significance, the null hypotheses 1 was rejected which implies that there is statistically significant effect of biological resources on interest of secondary school students in biology within Sokoto metropolis. Furthermore, the value of the partial Eta Squared ( $\eta_p^2$ )=0.693 revealed that biological resources had very large effect size as suggested by Cohen's d (1988) by implication biological resources accounted for 69.3% of the variance in the mean interest of the students. Similarly, the covariate (BSIQ1) was found significantly related to the posttest  $F(1, 226)=5.576$ ,  $p=0.019$  indicating that biological resources was significantly effective in boosting students' interest in learning biology in Sokoto metropolis.

Null Hypothesis- $H_{02}$ : Biological resources have no significant effect on secondary school students' academic performance in biology in Sokoto metropolis

**Table 6: ANCOVA Results of Posttest Biology Performance Scores using Pretest Scores as Covariate between Students exposed to Biological Resources and Control Group in Sokoto Metropolis**

| Source          | Type III Sum of Squares | df  | Mean Square | F       | Sig. | Partial Eta Squared | Decision        |
|-----------------|-------------------------|-----|-------------|---------|------|---------------------|-----------------|
| Corrected Model | 1183.140 <sup>a</sup>   | 2   | 591.570     | 159.324 | .000 | .585                | H <sub>02</sub> |
| Intercept       | 1549.593                | 1   | 1549.593    | 417.342 | .000 | .649                | Rejected        |
| BPT1            | 98.992                  | 1   | 98.992      | 26.661  | .000 | .106                |                 |
| Group           | 749.917                 | 1   | 749.917     | 201.970 | .000 | .472                |                 |
| Error           | 839.140                 | 226 | 3.713       |         |      |                     |                 |
| Total           | 62582.000               | 229 |             |         |      |                     |                 |
| Corrected Total | 2022.279                | 228 |             |         |      |                     |                 |

**Source:** Fieldwork, (2024)

Table 6 summarized a univariate Analysis of Covariance (ANCOVA) conducted to determine whether there is any significant effect of biological resources on secondary school students' academic performance in biology in Sokoto metropolis. Levene's test and normality checks were carried out and the assumptions were met. The results revealed that there was statistically significant effect of biological resources  $F(1, 226)=201.970$ ,  $p=0.00$ ,  $\eta_p^2=0.472$  on performance of students (experimental group) exposed to biological resources (Mean=18.46, SD=1.45) and those in the control group (Mean=14.10, SD=2.48) in favor of the experimental group. Therefore, since the p-Value of 0.00 is less than 0.05 level of significance, the null hypotheses 2 was also rejected which implies that there is statistically significant effect of biological resources on academic performance of secondary school students in biology within Sokoto metropolis.

Furthermore, the value of the partial Eta Squared ( $\eta_p^2$ ) =0.472 revealed that biological resources had large effect size as suggested by Cohen's d (1988) by implication biological resources accounted for 47.2% of the variance in the mean of performance of the students. Similarly, the covariate (BPT1) was found significantly related to the posttest  $F(1, 226)=26.661$ ,  $p=0.000$  indicating that biological resources was significantly effective in increasing performance of secondary school students in biology within Sokoto metropolis.

## Discussion of Findings

This study found out that there is effects of biological resources on secondary school students' interest and academic performance in biology in Sokoto metropolis. The findings of this study revealed that the null hypothesis 1 which states that there is no significant effect of biological resources on secondary school students' interest in biology within Sokoto metropolis was rejected. This finding implies that there is statistically significant effect of biological resources on interest of secondary school students in biology within Sokoto metropolis. This result is in line with the research conducted by Ibenegbu and Eze (2020) on the use of blended teaching approach in

stimulating the interest of students to learn biology in Nsukka Local Government Area (LGA) of Enugu State, Nigeria. The result of the study showed that the students learning biology using the blended teaching approach had a significant increase in their interest scores. The findings of this study is also in line with the research findings of Nwuba, Olajide, and Ibrahim (2023) which investigated the effect of numbered heads together (NHT) cooperative instructional strategy on secondary school students' interest in biology in Awka education zone. The findings of the study revealed that NHT is more effective in fostering students' interest in biology than Conventional Lecture Method (CLT). Conclusively, utilization of biological resources in teaching and learning biology is a significant means of boosting students' interest in the subject as it accounts for 69.3% of the variance in the mean interest of the students involved in this study.

The findings of this study revealed that the null hypothesis 2 which states that biological resources have no significant effect on academic performance of secondary school students in biology within Sokoto metropolis was also rejected which implies that there is statistically significant effect of biological resources on academic performance of secondary school students in biology within Sokoto metropolis. The basic assumption was that biological resources have significant effect on academic performance of secondary school students in biology within Sokoto metropolis which is confirmed by the major findings as it was revealed that biological resources accounted for 47.2% of the variance in the mean of performance of the students. The findings of this study was found contrary to the research carried out by Mutiu and Oladimeji (2022) on the effects of instructional materials on biology instruction among high achieving secondary school students in Oyo State which revealed that there was no significant differences between the performance of high achieving secondary school students taught with instructional materials and those taught without instructional materials. However, the findings of this study statistically agreed with the research findings of Abidoye, Bello, and Ibrahim (2023) which examined the effect of biology teaching materials on the academic performance of senior secondary school students in Ilorin west, Ilorin, Kwara State, Nigeria and found out a significant positive effect of biology instructional materials on students' academic performance and asserted that students taught with these materials outperformed those without them. In the same vein, the findings of this study aligned with the research findings of Ekineh and George (2024) on effect of real objects on academic performance of biology students in secondary schools in Emuoha LGA of Rivers State which revealed that students taught with real objects perform better than those taught without the use of real objects. Therefore, secondary school students should be taught biology with biological resources in order to enhance their academic performance in the subject.

## Conclusion

There is statistically significant effect of biological resources on secondary school students' interest in biology in Sokoto metropolis. Based on the findings of this study which unveiled that students exposed to biological resources demonstrated high level of interest in biology, it is therefore concluded that biological resources has potential to improve secondary school students' interest in biology. Also, there is statistically significant effect of biological resources on secondary school students' academic performance in biology in Sokoto metropolis. This study revealed that students who were taught biology using biological resources outperformed those taught with

conventional method. Therefore, it is concluded that biological resources could enhance students' academic performance in biology and other subjects.

## **Recommendations**

There is statistically significant effect of biological resources on secondary school students' interest and academic performance in biology within Sokoto metropolis. Based on the findings of this study, it is therefore recommended that biological resources should be employed to improve secondary school students' interest in biology. Also, it is recommended that biological resources should be incorporated in teaching pedagogy in order to enhance students' academic performance in biology and other subjects.

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