

EFFECTS OF PRACTICAL ACTIVITIES ON ACADEMIC PERFORMANCE OF SECONDARY SCHOOL BIOLOGY STUDENTS IN ZARIA EDUCATION ZONE, KADUNA STATE NIGERIA

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Abstract

The study investigated 'Effects of Practical Activities on Academic Performance of Secondary School Biology Students in Zaria Education Zone, Kaduna State Nigeria'. The population consists of 18 public schools in Zaria Education Zone with a total number of 4,763 students. A random sample of 115 students was selected from the population in the study area. The study design was Quasi-experimental which adopted the pre-test, post-test experimental and control group design. The experimental group was exposed to practical activities while the control group was taught with lecture method. A validated instrument, Biology Performance Test (BPT) with a reliability coefficient of 0.82 was used to gather data which were analyzed using t-test and paired sample t-test. Two research questions and hypotheses guided the study. The hypotheses were tested at $p \leq 0.05$ level of significance. Findings revealed that: there was a significant difference in the academic performance of students exposed to practical activities compared to their counterparts; there was no significant difference in performance between male and female Biology students exposed to practical activities. The recommendation given was that practical activities should be encouraged in the teaching and learning of Biology for better understanding. The Federal and State Ministry of Education should sponsor Biology teachers for training and retraining of teachers to improve the academic performance of students in the subject..

Keywords: Biology, Practical, Activity, Performance

Introduction

Hornbly (2010) defined science as an intellectual and practical activity encompassing the systematic study of the structure and behavior of the physical and natural world through observation and experiment. Ifeakor (2019) sees science as the systematic study of the empirical world in order to understand and control it. Nwagbo (2020) defined science as intellectual activities carried out by scientists designed to discover information about the natural world in which we live and to discover ways in which this information can be organized to benefit human race. In this respect, the primary focus of science is to collect data and the ultimate purpose is to discern order that exist in natural phenomena and happenings around us. Therefore, Science can be view as a systematic and organized body of knowledge that inculcates into the learner the scientific theories, laws, facts, principles and skills that will enable him better the environment. Science as we know is divided into many different disciplines such as Chemistry, Physics, Biochemistry, Biology among others.

Biology is derived from two Greek Words: bios-meaning life and logos-meaning study. Biology can simply be defined as the study of life, a branch of science and the prerequisite subject for many field of learning which includes Medicine, Forestry, Agriculture, Biotechnology, Nursing amongst others. The study of Biology in Senior Secondary School can equip students with useful concepts, principles and theories that will enable them face the challenges before and after graduation. There are two aspects in the study of biology, the theorem and Practical aspect. The theorem aspect includes facts, principles, concepts, theories and laws. Modern Biology is a rapidly changing and interesting discipline which aim at presenting biology not as a body of scientific facts related to living things, but as a continuing activity in which man tries to find solution to his never-ending problems. The importance of Biology to modern society cannot be over emphasize, few among its benefit includes: preparing individual to challenge superstition, enlightening on body parts and their function, maintenance of good health and hygiene, exposing students on varieties of careers. Biology occupies a unique position as core subject in the senior secondary curriculum in Nigeria serving as pre-requisite for the study of many science-related courses such as Medicine, Pharmacy, Nursing, Microbiology and a host of others. It is therefore pertinent to study Biology to derive these benefits. Abubakar (2022), observed that Biology as a discipline has contributed tremendously to financial, physical and aesthetic benefits of mankind and to the nation building. Biology education is designed to help the students achieve the following: Ability to demonstrate sufficient knowledge of the concept of the interdependence of life, appreciate continuity of life through reorganization, inheritance and evolution.

According to FRN (2013), the broad objectives of senior secondary education are: preparation for useful living in the society and preparation for higher education. Biology as a science subject is very necessary for the realization of this objective, as it prepared professionals in scientific endeavours. From the objectives teaching should be practical in nature whereby the learner should be able to acquire knowledge, retain it and apply it in his day-to-day endeavors. Biology equips individuals with necessary knowledge, skills and attitudes to enable, him/her interact meaningfully with the environment, and solve life unending problems.

Practical activity is a teaching method with a high level of interaction between teacher and student, with the teacher as facilitator or a guide. The expression “hands-on, minds-on” summarizes the philosophy that incorporated activities- mainly, students will learn best if actively engaged and if these activities are closely linked to understanding important Biological concepts. According to Nwagbo (2019) the importance of practical activities in science is widely accepted and it is acknowledged that good practical activities promote the engagement and interest of students as well as developing a range of skills, science knowledge and conceptual understanding. Finch (2012) practical activities can be put into three broad groups: core activities, directly related activities and complementary activities. Nzewi (2017) practical activities in science include the core activities and the directly related activities. The complementary activities (science-related visits, surveys, presentations and role play, simulations including the use of models and modeling, group discussion and group text-based activities) are important in supporting the development of conceptual understanding in science through practical activities. Millar (2022) the core activities in practical include investigation, laboratory procedures and techniques, and fieldwork while the directly related activities include: designing and planning investigations, data analysis using ICT, analyzing results, teachers’ demonstrations and experiencing phenomena. When students are exposed to these activities they acquire skills of measuring, identifying, observing, interpreting data,

analyzing, using numbers, inferring, formulating models, questioning, controlling variables, hypothesizing and designing experiments.

Performance means accomplishment or proficiency of achievement in a given skill or body of knowledge. Ricarda (2015) academic performance is the outcome of educational output, the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments, specifically in school, college and university. Birgit (2015) defined academic performance as an expression used to present students scholastic standing and which is a function of a various factors such as method of teaching, teacher qualification, children background, school environment, attitude, interest among others. Stoker (2024) defined academic performance as the display of knowledge attained or skills developed in school subjects designated by test and examination scores or marks assigned by the subject teachers. Therefore, the study investigates the effects of practical activities on academic performance of Biology students in Zaria Education Zone.

Statement of the Problem

Various researches (Damide, 2019, Obiekwe, 2020, Ahmed & Abimbola, 2021, Boniface, 2022, Abdullahi, 2024), showed that poor performance in biology among Nigerian students in West Africa Senior Secondary Certificate Examination (WASSCE) could be indicative of inadequate and perhaps declining quality of education at the secondary school level. Teachers lay extreme emphasis on content and the use of lecture method neglecting practical activities which could enhance effective teaching and learning (Abdullahi, 2024). This attitude of one-way flow of information from the teacher to the students (lecture method) makes the students passive listeners and less active leading to abstraction and rote learning (Okebukola 2009). WAEC Chief Examiner Report (2017-2023), shows that the total numbers of students that pass biology at credit level fall below expectation for seven consecutive years (Table 1).

Table 1: Academic Performance of Practical Biology Students in May/June SSCE, 2017-2023 in Nigeria

Year	Total No. Registered	% Passed	No. Passed (A₁-C₆)	% Failed	No. Failed (D₇ – F₉)
2017	1,351,557	23.6	315,723,72	76.64	1,035,883,28
2018	1,540,250	30.9	475,937,25	69.1	1,064,312,75
2019	1,672,224	38.81	648,990,13	61.19	1,023,233,87
2020	1,689,188	64.26	1,085,472,21	35.74	603,715,79
2021	1,417,432	31.28	443,372,73	68.72	974,059,27
2022	1,393,907	38.6	538,078,10	61.4	855,858,89
2023	1,552,758	53.5	830,725,53	46.5	722,032,47

Source: Chief Examiners Report 2024 (WAEC Office Kaduna)

The fluctuations in the performance ability of the students from year 2017-2023 as observed in Table 1.1 could be attributed to: Negative attitude of both teachers and students towards the learning of practical Biology (Lawal, 2019). Lack of availability of learning materials (Zayun, 2019) and Damide, (2020) revealed that lack of adequate laboratory equipment as one of the factors that attributed to poor academic performance in practical Biology. Oloyede, (2020), also stated that some teaching methods adopted by Biology teachers contributed to secondary school students' low performance in practical Biology.

Usman (2020) posits that most problem attributed to students' poor academic performance could be due to improper exposure to laboratory activities, poor science background at the junior secondary school level and lack of problem-solving ability. To curb this dilemma of students' poor academic performance in practical Biology final examination, there is need to investigate Effects of Practical Activities on Academic Performance of Biology Students in Zaria Education Zone, Kaduna State Nigeria.

Objectives of the Study

The objectives of this study are to:

- I. Determine the effects of practical activities on academic performance in Biology among secondary schools in Zaria Education Zone.
- II. Compare science skills acquired and performance in Biology among male and female students in the experimental group.

Research Questions

The following research questions are formulated to guide the study.

- I. What is the effect of practical activities on students' academic performance when taught Biology using practical?
- II. What is the difference in performance among male and female Biology students in the experimental group?

Null Hypotheses

The following hypotheses were formulated to guide the study and was tested at $P \leq 0.05$ level of significance.

- I. H01: There is no significant difference in the academic performance of Biology students exposed to practical activities and those thought with lecture method.
- II. H02: There is no significant difference in performance between male and female Biology students of experimental groups.

Scope of the Study

The study was limited to all Government Senior Secondary Schools in Zaria Education Zone of Kaduna State, Nigeria. There are twenty-nine (29) senior government secondary schools of which eighteen (18) are co-educational schools and eleven (11) single-sex schools (six male schools and five female schools). The sample size for the study was 115 SS2 Biology students because they are relatively stable with adequate exposure to the learning of biology. SSI & SSII are avoided because the former has not yet stabilized in the school system while the latter are busy preparing for their final examination. SS II biology curriculum was used which focused on the following topics: Digestive system. Subtopics: Parts of the alimentary canal of a typical mammal. (rat), Pollution (water pollution), Cell and its Environment (diffusion and osmosis) and Food test.

Methodology

Research Design

The study was quasi-experimental and adopted the pre-test, post-test experimental and control group design.

Population of the Study

The population of the study was made up of all the Public Senior Secondary two (SSII) Biology Students in Zaria Education Zone. It consists of eighteen (18) co-educational schools and eleven (11) single-sex schools (six male schools and five female schools). The size of the population is four thousand seven hundred and sixty-three (4,763) students.

A simple random sampling technique involving the balloting method was used to select two senior secondary schools for the study. A minimum of 30 sample size from each school was used for the study which conforms with the central limit theorem (Tuckman 1975 and Sambo 2008). This number is considered viable given the design of the study as conceded to by Roscoe and Damide (2020) who stated that 10% of the study population up to 500 is a viable sample size for experimental research.

An instrument used for data collection was: Biology Performance Test (BPT) consisting of twenty five (25) multiple choice questions with four options A,B,C and D distributed among general Biology knowledge based on the topics taught. It was developed by the researcher using WAEC past standardized questions and was used for pre-test and post-test to measure the level of students' academic performance in Biology. The instrument was submitted to two experts who are PhD holders with minimum rank of Senior Lecturer in the Department of Science Education Ahmadu Bello University, Zaria and a biology teacher for validation.

Biology Performance Test (BPT) was pilot tested using SS II Biology Students. The test item of BPT was administered to thirty (30) students with the assistance of the school Biology teacher. After two weeks interval the second test was administered to the same subjects in conformity with Tuckman (1975), who suggested the use of two weeks interval for test-retest procedure. Pearson Product-Moment Correlation Coefficient (PPMC) statistic was used to analyze the reliability of the instruments. Reliability coefficient was found to be $r=0.82$ for BPT. This shows that the instrument is reliable and could be used for the study.

Administration of Treatment

In treatment administration, the experimental group and control group was taught by the researcher. The experimental group was taught using practical activities. The teaching was done for six weeks of twelve periods. A period is allocated for Biology per week and each period is forty minutes. BPT were used for pre-test and post-test. Lesson plan for the experimental group was developed by the researcher and the teaching was done for six weeks. At the end of the six (6) weeks of twelve periods, the researcher solicited assistance from colleagues to help administer the post-test to the subjects at the same day.

Control group was taught by the researcher using lecture method only. The lesson plan is the same with the experimental in terms of content, objectives, duration of lesson and evaluation except for the activities in the experimental group. After six weeks of twelve

periods the researcher solicited assistance from colleagues to help administer the post-test to the subjects at the same day and time.

Procedures for Data Analysis

Mean standard deviation of BPT was used to answer research questions 1-2 so as to determine the subjects' performance. t-test statistical tool was used to test null hypotheses 1-2. The level of significance is $P \leq 0.05$ for retaining or rejecting the null hypotheses.

Results

The presentation of results revolved round the research questions and null hypotheses of the study. Data collected with BPT instrument were analyzed. Two groups of students were involved in the study. One group was taught with lecture method (Control) while the other group was taught with practical activities which designated the experimental group. The BPT was used for assessing general Biology knowledge based on the topics taught. BPT data were collected before and after the experiment.

Research Question 1: What is the effect of practical activities on students' academic performance when exposed to practical activities and those taught with lecture method?

Table 2: Mean Scores Difference on Academic Performance for Experimental and Control Group

Groups	N	Mean	SD	Std.Err	Mean Difference	Remarks
Experimental	51	40.98	5.034	.705	16.82	Experimental students have higher performance than control students
Control	64	24.16	3.272	.49919		

Table 2. shows that students who were exposed to practical activities performed better in the selected Biology concepts compared with their counterparts taught with lecture method. The computed mean score of the control group and experimental group are 24.16 and 40.98 respectively. The mean difference of 16.82 is in favor of the experimental group. The higher score in the Table is a clear indication that practical activities have greater impacts on students' academic performance than the lecture method of teaching. The statistical validity of this statement is left for the test of the related hypothesis of the study.

Research Question 2: What is the difference when performance is compared between Biology students exposed to practical activities?

Table 3: Mean Scores Difference on Comparison of Academic Performance between Male and Female Biology Students for Experimental Group

Gender	N	Mean	SD	Std.Err	Mean Difference	Remarks
Male	28	44.20	20.084	1.804	0.522	Practical activity has positive effect

on boys and girls

Female	23	43.68	20.259	1.968
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Result in Table 3 reveal that there is no significant difference in the performance between boys' and girls' Biology students exposed to practical activities. The computed mean score for males and females are 44.20 and 43.68 respectively. Mean difference is 0.521. This implies that there is no difference in the performance between boys' and girls' Biology students exposed to practical activities.

Hypothesis 1: There is no significant difference on the academic performance between biology students exposed to practical activities and those thought with lecture method

Table 4: Summary of t-test Analysis on Academic Performance between Biology Students for Experimental and Control Group

Groups	N	Mean	SD	Std.Err	Mean Diff.	df	t-value	P
Experimental	51	40.98	5.0343	.705				
Control	64	24.16	3.272	.4991	16.82	113	21.62	0.001

$P \leq 0.05$

Table 4 reveals that students exposed to practical activities have a higher mean score of 40.98 compared with 24.16 of those taught with lecture method with a mean difference of 16.82 in favor of those exposed to practical activities. It could be concluded that students exposed to practical activities achieved significantly higher than their counterparts taught with the lecture method. The null hypothesis which states that there is no significant difference in the academic performance between biology students exposed to practical activities and those taught with lecture method is hereby rejected.

Hypothesis 2: There is no significant difference on performance between boys' and girls' Biology students exposed to practical activities

Table 5: Summary of t-test Analysis on Difference on Academic performance between Boys and Girls Biology Students for Experimental Group

Gender	N	Mean	SD	Std.Err	Mean diff.	df	t-value	P
Male	28	42.82	20.142	1.816				
					0.72	49	0.186	0.781
Female	23	43.54	20.221	1.822				

$P \leq 0.05$

Table 5 revealed that male and female in the experimental group have a mean score of 42.82 and 43.54 respectively with a mean performance difference of 0.72. The t value of 0.186 is lower than the 1.96 t critical value at df 49 while the calculated p value of 0.781 is higher than the 0.05 alpha level of significance. This implies that there is no significant difference in the skills acquisition of boys and girls biology students exposed to science process skills. Therefore, the null hypothesis which states that there is no significant

difference in skills acquisition between male and female biology students exposed to practical activities is hereby retained.

Discussion

This study investigated the Effects of Practical Activities on Performance among Biology Students in Zaria Education Zone, Kaduna State Nigeria. Four hypotheses were stated and tested based on the scores of the subjects obtained in the Biology Performance Test (BPT).

Hypothesis 1: There is no significant difference on academic performance between Biology students exposed to practical activities and those taught with lecture methods

From the test of hypothesis one, and the data relating to research question one, the result of the findings showed that there was a significant difference in the academic performance between biology students exposed to practical activities and those taught with the lecture method. The difference was in favor of the experimental group. This shows that practical activities produce a significant effect on students' mean performance in Biology. The null hypothesis was therefore rejected. This conforms with the findings of Chukwuemeka (2023), who investigated the Academic Achievement of Biology Students with Pre-practical knowledge of Biology Concepts in Delta State Capital Territory Nigeria. It was revealed that the experimental group had a higher mean academic score than the control group. Also, Nzewi (2017), investigated the Effects of Biology Practicals on Secondary Students' Academic Performance in Biology in Enugu State, Nigeria. It was revealed that there was high academic performance in the group exposed to practical activities than those exposed to lecture method. The result disagrees with Sani (2017), who discovered a significant difference in the performance of the control group taught using lecture method over the experimental group.

Hypothesis 2: There is no significant difference when performance is compared between male and female Biology students

From the test of hypothesis two, and the data relating to research question two, the result of the Paired sample t test revealed that there was no significant difference between the mean scores of students' performance when exposed to practical activities. This is not in conformity with the findings of Danjuma (2017), who investigates the effects of Inquiry-based instruction on performance in ecology among secondary school Biology students. The results of the study revealed that differences existed on academic performance when students are exposed to inquiry-based instruction in favor of male Biology students.

Conclusion

The following general conclusion can be deduced as the outcome of the study:

- I. The Practical activities method is very effective in increasing the academic performance of Biology students, when compared with those taught with lecture method.

Recommendations

On the basis of the findings from this study the following recommendations are put forward:

- I. Teachers should be encouraged to participate in workshops, seminars and other in-house trainings to continually improve on how to use activity methods.
- II. Teachers should continually record and measure the performance and skills acquisition when using this method so as to ascertain the effects on biology students.
- III. This method should be used in conjunction with other similar modern methods for maximum outcome on the biology students mean performance and skills acquisition.

References

- Abdullahi, M. (2024). Influence OF Advanced Organizers on Students Performance and Retention of Ecology Concepts in Senior Secondary Schools in Giwa Education Zone. *Thesis Submitted to the Department of Science Education ABU Zaria.*
- Abubakar, A.A. (2012). Effects of a Mastery Learning Strategy on Achievement, *Journal of Research in Science Teaching*, 16(6) 33-37.
- Adamu, G.J. (2023). *Effect of Problems-Solving Instructional Strategy on Self Efficacy, Creativity and Academic Performance in Genetic Among NCE Students. Unpublished PhD. Thesis Ahmadu Bello University, Zaria.*
- Ahmed, M.A. & Abimbola, I.O. (2021). Influence of Personality Factors on Biology Teachers Assessment on Genetics Concepts in Nigerian Secondary Schools. *Unpublished Ph.D thesis. University of Ilorin, Ilorin, Nigeria*
- Birgit, P.S (2015). Academic Performance in Encyclopedia of Human Behavior. 2nd (ed). Vilanayur S. Ramachandran, 1-8. San Diego, CA: Academic Press.
- Boniface, S. (2022). Effects of Guided Enquiry on Performance and Interest among Senior Secondary Biology students. *Unpublished M.Ed Thesis ABU Zaria.*
- Chuckwuemeka, P.I. (2023). Students' Pre-practical Experiences and Academic Achievement in Senior School Biology Theory Lesson. *Journal of Resourcefulness and Distinction*; 5(1):1-8
- Damide, C.O (2009). Enhancing the Transition from Concrete to Formal Cognitive Achievement in Chemistry. *An unpublished M.D thesis at ATBU University, Bauchi pp51.*
- Danjuma, S. (2017). Effects of inquiry-based instruction on acquisition of process skills, interest and performance in ecology among secondary school students in Lere Education zone, kaduna Nigeria. *Unpublished M.Ed thesis Ahmadu Bello University, Zaria.*

- Federal Republic of Nigeria (FME, 2013). National Policy on Education. Federal Government Press Lagos, Nigeria.
- Hornbly, E. (2010). Understanding the Nature of Science: A comparison of Scientist and Science Teachers. *Journal of Research in Science Teaching*, 4, 110-120
- Ifeakor, E.A. (2019). Level of Acquisition of Science Process Skills among Secondary School Students. *Journal of Science Teachers Association of Nigeria. (STAN) 31 (1&2)39-46*
- Kerlinger, F.N. (1973.). Foundations of Behavioral Research. New York. Holt Rinechart and Winston Inc. Paper I. Abuja, Federal Government Press.
- Lawal, C.O. (2019). Improvisation of Teaching Aids for fine and Applied Arts in Secondary Schools. A paper Presented at the National Conference of the FCET, Omoku, River State.
- Millar, W. (2022). *The Training of Secondary Science Educators. A Workshop Approach: Science and Technology Document Series. Paris: UNESCO*
- Nwagbo, C.R. (2019). Practical's Approach to Effective Teaching of Local and Major Biotic Communities (Biomes) to Secondary School Students for Sustainable Development. *Science Teachers' Association of Nigeria (STAN) Biology Panel Series 2008. 41-55.*
- Nwagbo, C.R. (2020). Effects of two Teaching methods on the Achievement and attitude of biology students of different levels of scientific literacy. *International Journal of Educational Research. 45 (206) 216-229.*
- Nzewi, U.M. (2017). Practical Approach to Effective Teaching of Ecological Concepts for Sustainable Development. Science Teachers' Association of Nigeria (STAN) Biology Panel Series. 2008, 1-6.
- Obiekwe, CL. (2020). Effects of Constructivist Instructional Approach on Students' Achievement and Interest in Basic Ecological Concepts in Biology. *Unpublished M.Ed Dissertation, Department of Science Education, Bayero University Kano, Nigeria.*
- Okebukola, P.A.O (2019). Repositioning Nigeria's Educational System for the Achievement of National 20-20-20 Vision; Educational Reform Imperatives for Achieving Vision 20-20-20. One of the lead papers presented at the National Education Summit Organized by the Senate Committee on Education held between 10th and 11th Dec 2009, Abuja.
- Oloyede, O.I (2020). Problem of Teaching and Learning Science in Primary and Junior Secondary Schools. A Workshop Paper Presentation at SUBEB Teaching Training Workshop Bauchi State, 28th-31th Jan, a Lokatosian Interpretation Science Education 72, 19-36.
- Ricarda, S. (2015). The Relatively Efficiency of Laboratory Teaching Method for Enhancing Performance in Sciences, *Journal of Studies in Science and Mathematics Education. 1 (4) 26.*

- Sambo, A.A. (2008). *Research Method in Education Study*. Horenden Publishers Nigeria Limited. Ibadan Oyo State, Nigeria.
- Sani, A.G. (2020). *Effectiveness of Science Process Approach on Remedial Science Students' Performance in Jigawa State*. A Thesis Submitted to Ahmadu Bello University Zaria.
- Stoker, C.I. (2024) *Science Process Skills in Kenya Certificate of Secondary Education Biology Practical Examinations*. (<http://www.scirp.org/journal/ce>)
- Tuckman, B.W. (1975). *Measurement Educational: Fundamental of Testing*. New-York: Harcourt Brace Jovanovich, Inc.
- Usman, A.I (2010). *Effects of Class Size on Students Academic Performance in Integrated Science at Junior Secondary School Level*, 1(1) 144-149.
- West African Examination Council Annual Report. (2017-2023)
- Zayun, S.D (2019). *Performance Enhancement Skills for Teachers of Junior Secondary Schools*. A Paper Presented at Bauchi; SUBEB Workshop 23th-31th Jan.