



Effect of Activity-Based Instruction on Performance in Biology among Secondary School Students, Gumel Education Zone, Jigawa State, Nigeria

¹Basiru M., ²Usaini J. & ³Abdulhafiz S. A.

¹Department of Biological Science
Government Technical College Gumel
&

² & ³Department of Biological Science.
Jigawa State College of Education, Gumel

Corresponding Author: basirumuhammad986@gmail.com

ABSTRACT

This study investigated the effect of Activity-Based Instruction on the performance of secondary school students in Biology in Gumel Education Zone, Jigawa State, Nigeria. The study adopted a quasi-experimental pretest-posttest non-equivalent control group design. The population comprised 2,465 Senior Secondary School Biology students from 15 public secondary schools in the study area. A sample of 174 students drawn from two randomly selected co-educational secondary schools participated in the study. The instrument used for data collection was the Genetics Concept Performance Test (GCPT). The instrument was validated by experts in Biology Education and Measurement and Evaluation. The reliability of the instrument was established using the Pearson Product Moment Correlation (PPMC), which yielded a reliability coefficient of 0.88, indicating that the instrument was reliable for the study. Data were collected through the administration of the GCPT as pretest and posttest to both the experimental and control groups. The experimental group was taught Genetics concepts using Activity-Based Instruction, while the control group was taught the same concepts using the lecture method. Mean and Standard Deviation were used to answer the research questions, while Independent Samples t-test was used to test the null hypotheses at 0.05 level of significance. The findings revealed that students taught using Activity-Based Instruction performed significantly better than those taught using the lecture method. The findings also showed no significant difference in the performance of male and female students exposed to Activity-Based Instruction. The study concluded that Activity-Based Instruction is an effective instructional strategy for improving students' performance in Biology and is gender-friendly. It was recommended that Biology teachers should frequently adopt Activity-

Based Instruction in teaching Biology concepts, especially Genetics, to enhance students' academic performance. It was further recommended that workshops and training programmes should be organized to equip teachers with the skills for effective implementation of Activity-Based Instruction in secondary schools.

Key words; Activity-based Instruction, Genetics, Performance.

Introduction

Science is a universal subject that span the branch of knowledge that examines the structure and behaviour of the physical and natural world through observation and experiment. Singh (2014) observed science as the study that involves systematic study of natural phenomena which allows the students to experience the richness and excitement of the natural world, the process of inquiring, critical thinking and demonstration of skill. Therefore, the importance of science in our society made the federal government of Nigeria, through the federal ministry of education to introduce science education in the Nigerian schools. Yunusa (2014) view science education is the field of study which scientific process is also concerned with teaching science content, and process to individual not traditionally part of the scientific community. The National Policy on Education (FRN, 2024) sets as a goal for science education in Nigeria that government shall popularize the study of science and production of adequate number of scientists to inspire and support national development. Based on this policy, Jafar (2025) deduced that the aim of science and technology education is to inculcate science and technology in the thinking and working processes of the society in order to create science and technology culture However, Yusuf (2024) and Jafar (2025) pointed out that the performance of science students in Nigeria school still leaves much to be desired right from the primary school through secondary school to the tertiary level of education. General view of Nigerian students' performance in biology as a science subject in the West African Examination Council Chief examiners reports from revealed fluctuations and down-ward trends in students' performance.

Biology is a natural science concerned with the study of life and living organism. According to Okenyi (2015) defined it as a branch of science that is structured to equip students with knowledge of life processes and phenomena of living organisms. Biology plays a vital role in providing knowledge of relevant concepts about living things and developing scientific skills and attitudes. Ibrahim (2015) further stated that

Biology is a subject specially designed to provide students with skills and attitudes of caring about themselves, other organisms and the environment. In fact, Jafar (2025) stipulates that when the knowledge of Biology is acquired and applied in any society, it can bring about rapid and sustainable national development. According to National Policy on Education (FRN2024) biology is one of the science subjects that senior secondary students offer in senior secondary certificate examination in Nigeria. Biology is very important science subject and requirement for further studies of other science related professional sources such as agriculture, pharmacy, biotechnology, medicine, biochemistry, anatomy, physiology, entomology, zoology and genetics.

Genetics is a branch of Biology that studies the function and behavior of genes. Genes influence many aspects of our daily life from the food we eat to identification of criminals, and treatment of diseases. In agriculture, genetics advances have enabled scientists to alter a plant or an animal structure to make it more useful. For instance, food crops such as oranges, potatoes, wheat, and rice have been genetically altered to make them withstand insect pests and harsh weather conditions. According to Sorajin (2015), tomato and apple have been genetically modified, so that they can withstand discoloration and bruising on their way to market, thus enhancing their appeal on supermarket shelves. The study of genetics today is important and as such considered as crucial to the scientific and technological development of the society. Etobro and Fabinu (2017) pinned that understanding of the concepts of genetics and its mode of operation appears to be more difficult than any other topic in Biology. Biology as a subject is required for everyday life on matter of personal and community health as Stated in the National policy on education (FRN, 2024). Despite the importance of Biology as a science subject, empirical studies such as those of Etobro and Fabinu (2017) have shown that students still perform poorly in Biology at Senior Secondary School level. This study therefore, find out the effect of activity-based instruction,

which is learner-centered in its characteristics, on genetic concepts for better understanding and performance among Senior Secondary School II Biology Students.

Activity-based instruction is a technique whereby the main focus is learning by doing, involving learners in physical and mental activities that develop understanding through experience. (Marley & Charbonneau 2014). According to Anwer (2019) Activity-based instruction is a learning process in which students are constantly engaged in activities rather than sit as passive listeners.

Activity-based are variety of activity that may or may not be actual experiments such as observation or measurement not necessarily carried out in the laboratory. Activity learning fosters the mind in more basic ways by extending the links between the brain and the hands. Materials such as auditory, visual, tactile and body motor function are all involved in hands-on learning activities and this makes information which involved all the memories become stronger and retrievable. Researchers such as Anwer (2019) have shown that students who were exposed to learning using hands activities in different areas achieved better than those not expose but Anwer (2019) posit that activity-based instruction involved the child in a total learning experience which enhance the ability to think critically, it is obvious, that any teaching strategy that is skilled towards this direction can be seen as an activity-oriented teaching method.

Activity-based Instruction is a method of instruction where students are guide to gain knowledge by experience. This mean giving the students the opportunity to manipulate the objects they are studying, for instance, plants, insects, rocks, water, gene, elementary canal and skeletal system. Activity-based instruction help students to interact and find out solution to the common problem by themselves. Through hands-on activities students are able to engage in real life illustration and observed the change in different variable, it offers concrete illustration of concepts. This method of centered learning which allows the learner to see, touch, and draw biological diagram. Therefore, there is need for considering Activity-based Instruction in design instruction for teaching and learning of biology s as to improve students' performance.

Another factor to performance in science and biology is gender, according to Barr e'tal (2024) Gender is a social and structural variable encompassing identity, roles, norms, power relations, and equity. It influences health outcomes and intersects with biological sex and other social determinants. Before now science was preserved for male with little participation of female students. This is due to the fact that girl did not embrace formal education and especially science education early enough as their male counterpart. However, Studies carryout on gender and academic performance such as those of Ibrahim (2015) observe that boys achieved better than girls, but studies by Maspupah and Ramdhan (2024) pointed out that girls performed better than boys. However, some other such as Abdulganiyu (2017) indicate that there is no significant difference in the academic performance of male and female biology students taught using instructional material like Activity-based Instruction it is against this background that this study seeks to figure out the effectiveness of Activity-based Instruction on academic performance of secondary biology students in Activity-based Instruction on self-efficacy and performance in genetic concepts in Gumel Education Zone Jigawa State.

Statement of the Problem

The persistent poor academic performance of secondary school students in science subjects, particularly Biology, has remained a major concern among parents, educators, examination bodies, and other stakeholders in education. Biology is one of the most popular science subjects offered at the secondary school level in Nigeria and serves as a prerequisite for many science-related courses in higher institutions. However, students' performance in the subject has continued to be unsatisfactory over the years.

Several studies have investigated the factors responsible for the poor performance of students in Biology. For instance, Lawal (2009) and Lakpini (2013) reported that students' persistent low achievement in Biology in Senior Secondary School Certificate Examinations (SSCE) is largely attributed to ineffective instructional strategies employed by teachers. Similarly, Etobro and Fabinu (2017) as well as Jafar (2025) revealed that students continue to perform poorly in Biology at the senior secondary school level.

Reports of the West African Examinations Council (WAEC Chief Examiners' Reports, 2022–2025) indicate that students experience difficulties, misconceptions, and confusion in understanding several Biology concepts. These difficulties are particularly evident in complex topics such as Genetics. Researchers such as Lawal (2009) and Shuaibu (2017) identified factors such as inappropriate teaching methods, inadequate laboratory facilities and instructional materials, low student motivation and self-efficacy, and lack of teacher creativity as major contributors to students' poor performance in Biology.

Despite various efforts and recommendations from previous studies, students' achievement in Biology remains low. This situation suggests that the conventional teaching methods commonly used in schools may not be effective in promoting meaningful learning and improving academic performance. Consequently, there is a need to explore learner-centred instructional approaches that actively engage students in the learning process.

Activity-Based Instruction is one such approach that emphasizes students' active participation through practical activities, experimentation, collaboration, and problem-solving. Answer (2019) found that students taught using Activity-Based Instruction performed significantly better than those taught using conventional methods. However, there is limited empirical evidence on the effectiveness of this instructional approach among secondary school students in Gumel Education Zone, Jigawa State.

Therefore, the problem of this study is to determine whether the use of Activity-Based Instruction can significantly improve the academic performance of secondary school students in Biology in Gumel Education Zone, Jigawa State.

Objectives of the Study

The study has the following objectives

1. ascertain the effect of activity-based instruction on performance of secondary school students in genetics in Gumel education zone, Jigawa state.
2. examine the effect of activity-based instruction on performance of male and female secondary school students in genetics in Gumel education zone, Jigawa state

Research Questions

The study has the following research Questions

1. What is the difference between the mean academic performance scores of secondary school students taught genetics concepts using Activity-based Instruction and those taught with lecture method?
2. What is the difference between the mean academic performance score between male and female secondary school students taught genetics concepts using Activity-based Instruction in Gumel education zone, Jigawa state?

Null Hypotheses

The following null hypotheses were formulated to guide the study:

Ho₁. there is no significance difference between mean performance score of secondary school students taught genetics concepts using activity-based Instruction and those taught with lecture method in Gumel education zone, Jigawa state.

Ho₂. there is no significance difference between mean performance score of male and female secondary school students taught genetics concepts using Activity-based Instruction in Gumel education zone, Jigawa state

Methodology

The study adopted quasi-experimental design, specifically the pre-test, post-test, quasi experimental and control group design. Pre-test was administered before treatment to measure the students' academic performance in Genetics Concept. The students in the experimental group were taught using activity-based instruction while those in the control group were taught using lecture method. Treatment lasted for six weeks each. After the treatment post-test, was administered to both groups to measure their academic performance ability of learnt concepts. The population of this study is made up of two thousand, four hundred and sixty-five (2465) SS2 Secondary school Biology students in the study area. One hundred and seventy four (174) SS2 Secondary school Biology students constituted the sample for this study and were derived from two (2) co-educational schools sampled from the fifteen (15) public senior secondary schools in Gumel Education Zone. The instrument used for data collection is Genetics Concept Performance Test (GCPT) with has 40-item multiple-choice test with a reliability coefficient of 0.88. The data obtained were analyzed using descriptive statistics, specifically the mean and standard deviation, to address

the research questions, while the independent samples t-test was employed to test the null hypotheses at the 0.05 level of significance. All analyses were done using the Statistical Package for Social Sciences (SPSS) IBM Version 26.

Results

Question one; what is the difference between the mean academic performance scores of secondary school students taught genetics concepts using Activity-based Instruction and those taught with lecture method? The statistical used are.

Table 1: Mean, Standard Deviation Statistics Posttest GCPT Scores for Students in Experimental and Control Groups

Group	N	Mean	Std	Mean diff
Experiment group	88	34.42	1.73	12.60
Control group	86	21.81	2.69	

Table 1. The results of the descriptive mean statistics showed a difference in the performance of SSII Biology students taught Genetics using Activity-Based Instruction and those taught with the Conventional Method. The mean scores were 34.42 and 21.81, respectively, showing a mean difference of 12.60 in favour of students taught with Activity-Based Instruction.

Hypothesis One: there is no significance difference between mean performance score of secondary school students taught genetics concepts using activity-based Instruction and those taught with lecture method in Gumel education zone, Jigawa state

Table 2 Summary of Independent Sample t-test of Mean Posttest GCPT Scores for Experimental and Control Groups.

Group	N	Mean	Std	t-crit;	p	R
Experimental Group	88	34.42	1.73	36.79	0.000	S
Control Group	86	21.81	2.69			

Significance at $P < 0.05$ -level

Table 2. Result of the independent t-test statistics showed that significant difference exist between the mean performance scores of SSII Secondary School Biology students taught Genetics Concept using Activity-based Instruction and their counterparts taught using Conventional method. Reasons being that the calculated p-value at 0.00 is lower than the 0.05 alpha level of significance and the computed t-value of 36.79 is greater than 1.96 t-critical value at df 172. Therefore, the null hypothesis which states there is no significance difference between mean performance score of secondary school students taught genetics concepts using activity-based Instruction and those taught with lecture method in Gumel education zone, Jigawa state, is hereby rejected.

Question Two: 1.What is the difference between the mean academic performance score between male and female secondary school students taught genetics concepts using Activity-based Instruction in Gumel education zone, Jigawa state?

Table 3: Mean, Standard Deviation Statistics of Posttest GCPT scores for Male and Female Students in Experimental Group

Gender	N	Mean	STD	Mean diff
Male	51	34.59	1.63	0.39
Female	37	34.19	1.87	

Table 3. Result of the descriptive Mean statistics showed that there is no difference between the mean performance score of male and female SSII students taught Genetics Concept using Activity-based Instruction. Their computed mean performances are 34.59 and 34.19 of The mean performance scores of male and female SSII Biology students taught Genetics using Activity-Based Instruction differed by 0.39. This shows that both male and female students have the same level of mean performance when taught Genetics Concept using Activity-based Instruction.

Hypothesis Two: there is no significance difference between mean performance score of male and female secondary school students taught genetics concepts using Activity-based Instruction in Gumel education zone, Jigawa state

Table 4: Summary of Independent Sample t-test of Mean Posttest GCPT Scores for Male

and Female in Experimental Group.								
Gender	N	Mean	STD	Df	t	t-crit.	p	R
Male	51	34.59	1.63	86	1.07	1.96	0.289	NS
Female	37	34.19	1.87					

Significance at $p < 0.05$ level

Table 4. Result of the independent t-test statistics showed that there is no significant difference between the mean performance score of male and female SSII students taught Genetics Concept using Activity-based Instruction. Reasons being that the calculated p-value of 0.289 is greater than the 0.05 alpha level of significance and the computed t-value of 1.07 is lower than 1.96 t-critical value at df 86. Therefore, the null hypothesis which States that there is no significance difference between mean performance score of male and female secondary school students taught genetics concepts using Activity-based Instruction in Gumel education zone, Jigawa state is hereby retained.

Discussion of Findings

The results revealed that students taught Genetics using Activity-Based Instruction achieved significantly higher mean performance scores than those taught with the Conventional Method, This significant difference led to the rejection of the null hypothesis and acceptance of the alternative, indicating that Activity-Based Instruction enhanced students' performance more effectively than the Conventional Method. This finding supports that of Razia and Abdul (2019). These researches revealed that students exhibited significant improvements in performance as a result of treatment with Activity-based Instruction as compared to the conventional method. The findings of this study also are in agreement with findings of Mahmud (2017) and Danjuma (2017). The finding of this study also concurs with the assertion of Tile (2013) that effective use of Activity-based Instruction facilities in teaching should be employed as it will enhance student's performance. The finding also provides support

to the research findings of Ekweueme and Ezenwa, (2015) that students exhibited significant improvements in performance as a result of treatment with activity-based as compared to the conventional method.

it was revealed that no significant difference in the performance of male and female students when exposed to Activity-based Instruction. This showed that the strategy is gender friendly in terms of performance. This is in harmony with the findings of Danjuma (2017) and Jafar (2025). Found that boys in heterogeneous groups do not dominate their female counterparts in performance. Razia and Abdul (2019) in their independent studies revealed that gender has no significant on performance among secondary school students when exposed to Activity-based Instruction. The findings is in different with Ongowo (2017) indicated that significant differences exist among male and female students in their acquisition of science process skills.

Conclusion

Based on the findings of this study, it was concluded that the use of Activity-Based Instruction significantly enhances students' academic performance in Genetics concepts. The approach provides learners with hands-on experiences that promote deeper understanding and retention of knowledge. Furthermore, Activity-Based Instruction is gender-inclusive, fostering self-efficacy and improving academic performance among both male and female students alike. It encourages active participation, collaboration, and confidence in learning scientific concepts.

Recommendations

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

1. Secondary School Biology teachers should frequently employ the Activity-based Instruction in teaching difficult and abstract concept in Biology.
2. Biology teachers should consistently encourage students to actively participate in Activity-based Instruction explorations, discussions and elaboration of learnt concepts for better performance in Biology.
3. The state Governments through the Ministries of Education should provide standard Biology laboratories and adequate instructional materials in secondary schools to enable Biology teachers use the Activity-based Instruction for better performance of the students in Biology.

Reference

- Abdulganiyu, M. (2017) Impacts of instructional material on academic performance in ecology concepts among secondary school students in Katsina state, seminar paper presented in the departments of science education, Ahmadu Bello University Zaria.
- Anwer, F. (2019). Activity-based teaching, student motivation and academic achievement. *journal of education and educational development*, 6(1), 154–170. Available at: retrieve 15th March 2026 <https://files.eric.ed.gov/fulltext/EJ1216784.pdf>
- Barr, E., Popkin, R., Roodzant, E., Jaworski, B., & Temkin, S. M. (2024). *Gender as a social and structural variable: research perspectives from the NIH*. Translational Behavioral Medicine, 14(1), 13–22. Oxford Academic.
- Danjuma, I.M. (2005). An investigation of pre-service teachers' problem-solving behaviour in solving selected numerical problems in chemistry. unpublished Ph.d. dissertation, science education programme, Abubakar Tafawa Balewa university, Bauchi.
- Etobro, A. & Fabinu, O.E. (2017). Students' perception of difficult concepts in Biology in senior secondary school in Lagos State. *Global Journal of Educational Research*.
- Federal Republic of Nigeria (2013). National policy on education; Abuja, Federal Ministry of education.
- Fakunle, J.A. (2012). Relationship among school location, student level of cognition development and achievement in Genetic. *Journal of science teachers association of Nigeria*, 4(7), 11-16.
- Ibrahim, S.T. (2015). Impact of 5e teaching cycle on attitude, retention and performance in genetics among pre-Nce biology students of different ability levels in north-west zone. Unpublished Phd thesis, department of science education, Faculty of Education, Ahmadu Bello University, Zaria.
- Jafar U. (2025). Effects of scaffolding instructional strategy on interest and performance in ecology concept among secondary school students in Gumel, Jigawa state, Nigeria. Unpublished M.Ed. Thesis, Department of science education, Faculty of Education, Ahmadu Bello University, Zaria.
- Lakpini, M. A. (2013). A Comparison of numeracy achievement of primary school pupils taught using whole class and varied classroom organization instruction. proceedings of multicultural African Conference held at Faculty of education, Ahmadu Bello university, Zaria.
- Lawal F. K. (2009) Effects of conceptual change on instruction strategy in remediating misconception in genetics concepts among senior secondary school Students in Kano. An Unpublished Ph.D. Dissertation Faculty of education, A.B.U. Zaria.

- Marley, S. C., and Charbonneau, K. J. (2014). Theoretical perspectives and empirical evidence relevant to classroom instruction with manipulatives. *Educational Psychology Review*, 26(1), 1–7. DOI: 10.1007/s10648-014-9269-0
- Maspupah, M and Ramdham, R.(2024). The influence of gender differences on academic abilities of biology education students in animal structure practicum. *Bioedunis Journal Vol 3 No. 01 June 2024, E-ISSN:2829-7601*
- Obochi, M. U. (2016) Effect of age and gender on learning ability, attitude, retention and academic performance of SSII biology students in Zaria educational zone Kaduna State Nigeria. *Nigerian Journal of Science and Educational Research*. 12(1) 213-217.
- Ongowo, R.O. (2017). Secondary school students' mastery of integrated science process Skills in Siaya County, Kenya. *Creative education*, 8, 1941-1956.
- Okenyi, C.I. (2015). The problems and prospects of biology education development in Nigeria beyond 2020. *knowledge review*, 33(1).
- Ozlem, A and Ali, E, (2011) Effectiveness of hands on approach and minds-on activities on student's achievements and attitude towards physics. *Journal of science learning and teaching volume 12*
- Razia, N., Abdul, M. K. R. (2019). Activity-based teaching versus traditional method of teaching in mathematics at elementary level. *Bulletin of Education and Research*, 41(2), 145-159.
- Sorajini, R.T. (2015). *Modern biology for senior secondary schools*. Nigeria: Africana first publishers limited.
- Shuaibu, A.M. (2017). Effects of collateral learning on attitude and performance in genetics among convergent and divergent secondary school students in suleja education zone, Nigeria. Unpublished M.Ed. Thesis, department of science education, Ahmadu Bello University, Zaria.
- Singh, S. (2014). *Geography for state civil service and other competitive examinations*, New Delhi: McGraw Hill education private limited, 7(9), 239-240.
- Tile, M. T. (2013). Effect of activity-based method on psychomotor skills acquisition and interest of senior secondary school students in biology. Unpublished M.Ed Dissertation. Benue state university, Makurdi.
- Umeh, G.L. (2010). *College Biology*. Benin City Idodo-Umeh Publisher Limited
- Vygotsky, L. S (1978). *Mind in the society; the Development of high psychological Processes*, Cambridge Harvard University press.
- Yunusa, M. (2008). *Issues on curriculum*. Sankore educational publisher company limited.

Yusuf, A. (2024). Effects of integrating instructional models with lecture method on academic achievement and retention of students of various class-sizes in some Biology concepts unpublished M.Ed. Thesis department of science education, Faculty of Education, Ahmadu Bello University, Zaria.

Zeidan, A.H. & Jayosi, M.R. (2015). Science Process skills and Attitudes towards Science among

Palestinian Secondary School Students. World Journal of Education, 5(1), 13-24.

