

**Research Article****EFFECT OF BEADS INSTRUCTIONAL RESOURCE ON SENIOR SECONDARY SCHOOL STUDENTS' ATTITUDE IN GENETICS IN KARU LOCAL GOVERNMENT AREA, NASARAWA STATE, NIGERIA****<sup>1,\*</sup>Musa, Peter Eson, <sup>2</sup>Olayinka, Folasade Oluyemisi and <sup>3</sup>Ejimonu, Emmanuelalfeyinwa**<sup>1,3</sup>FCT Secondary Education Board, Area 3 Garki Abuja, Nigeria<sup>2</sup>Department of Science Education, Faculty of Education, Federal University Oye-Ekiti, Ekiti State, Nigeria**Received 27<sup>th</sup> October 2022; Accepted 25<sup>th</sup> November 2022; Published online 12<sup>th</sup> December 2022**

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**Abstract**

The study investigated the effect of beads instructional resource on senior secondary school students' attitude in genetics in Karu Local Government Area, Nasarawa State, Nigeria. The moderating effect of gender was also examined. The population of the study comprised of 18,486 SS2 biology students in Nasarawa State, Nigeria. Out of this number, males consisted of 8,834 SS2 students and females consisted of 9,652 SS2 students. The sample was made up of 150 students (84 males and 66 females). The design used in this study was quasi-experimental, the non-equivalent pre-test, post-test, control group design was employed and used for this study. Two research questions and two null hypotheses guided the study. Genetics Attitude Scale (GAS) was used for data collection. The reliability estimate of GAS was 0.73 using Pearson-Product Moment Correlation Coefficient. Frequency, Mean, Standard deviation and Standard Error was used to answer the research questions. Independent t-test was used to test the null hypotheses. The result revealed that students exposed to beads strategy of teaching achieved significantly higher mean attitude scores than their counterparts exposed to conventional lecture method. The male students taught genetics with the use of beads did not perform better than the female students taught with the use of beads when subjected to higher analysis. It was recommended that biology teachers should utilise pragmatic method of teaching and learning of genetics concepts by using beads to make concepts concrete, to facilitate learning outcomes and beads strategy should be incorporated into the Teacher Education Programme (TEP), by equipping biology teachers in training institutions with the requisite skills needed to equip students who would fit into the Country's economy after graduation.

**Keywords:** Biology, Genetics, Beads, Lecture method, Attitude.

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**INTRODUCTION**

Biology is one of the science subjects in the school curriculum designed to provide knowledge which is of value to the totality of education acquired. It is the science that is concerned with the study of living organisms, including their structure, function, growth, evolution, distribution, taxonomy, interrelationship between living things and their environment (Olayinka and Musa, 2021; Olayinka and Ayanda, 2019). Biology as a subject has sufficient capacity and plays pivotal role on humanity and the world in general. Biology is one core science subject taught in Nigerian senior secondary schools and all over the world which is of choice among the students. Musa (2020) reported that Biology is indispensable in Nigerian science education programme because it builds the basic foundation for science and technology related fields like Pharmacy, Nursing, Medicine, Biochemistry, Botany, Zoology, Physiology, Anatomy, among many others. Biology is a natural science which examines living things and how they interact with one another and their surroundings. It is therefore imperative that the contents of Biology curriculum and national policy should satisfy the requirement of teaching and learning if the objective of creating a scientifically literate society is to be achieved. Tugba (2012) stated that the study of Biology helps students to make more informed decisions about their own health, to recognize the importance of Agriculture and horticulture and develop skills of environmental management and sustainability.

Fakunle (2012) opined that understanding of the concepts of genetics appears to be more abstract than any other topic in Biology. Genetics is a branch of Biology which is referred to as the science of genes, chromosomes, heredity and variations in living organisms. The knowledge of Genetics is very vital in all human endeavours (Dajal and Musa, 2022). According to Musa (2011 and 2020) and Singh and Ghandi (2015), Genetics is a branch of Biology that deals with the study of heredity and variations, the principles that account for the diversity of organisms and through the knowledge of Genetics, human life has improved effectively ranging from improved variety of plant and animal species through selective breeding, inbreeding, out breeding, sex determination and prevention of heritable diseases in the family. Genetics therefore, helps to explain how traits/characters are passed from parents to progeny. However, a lot of students avoid Genetics related questions in Biology at the senior secondary school level. According to the report from West African Examinations Council (2013 and 2015), students still perform poorly in the area of Genetics and only few candidates attempt questions on Genetics because it is abstract. Genetics has a lot of abstract concepts and terminologies that are hard to learn and to remember. Lecture method is a theoretical based method used by teachers in teaching all subjects including concepts in Genetics. It is frequently used by teachers to introduce new topic, summarize ideas and re-emphasized major points in a lesson. It is teacher-centered and uses a one-way channel of passing information (Okoli and Ofodum, 2017). It perceives learners as passive listeners in the learning process, and does not expose learners to conceptual change. Many researchers have emphasized and are still emphasizing learning that would bring about conceptual change, that is, student-centered

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approach to the teaching of Genetics. The various changes in the Biology curriculum present huge implication for its' study as an important school subject in Nigeria. One of such is the improvement in the method of presentation and delivery of Genetics concepts in the classrooms and laboratories. The following researchers investigated on different strategies to improve achievement in Genetics among them are Okoli and Ofodum (2017) "revealed that students exposed to Generative Learning Model (GLM) achieved significantly higher than their counterparts exposed to lecture method of instruction. GLM was gender-friendly in the study"; Lawal, Bichi and Shuaibu (2017) "showed that there was significant difference between the Mean scores of convergent and divergent students taught genetic concepts using collateral learning strategy and those taught using lecture method, in favour of the experimental group. Beads instructional resource is where abstract concepts are constructed with beads using threads to bring out the different concepts in genetics and to be used in the lesson for treatment (Musa, 2011; Musa, 2020 and Dajal and Musa, 2022). Beads are synthetically produced materials that are small, rounded, or flat structures that are of different colours which are connected by threads to represent the different abstract concepts in Genetics. These are used to teach students to facilitate meaningful learning. The use of beads instructional resource on senior secondary students for teaching of genetics concepts has been employed as an activity strategy in the effective teaching of Biology. For instance, Rotbain, Marbach-Ad and Stavy (2006), Musa (2011), Musa (2020) and Dajal and Musa (2022) reported that effective teaching and learning of Genetics is done through the use of beads. Therefore, this brings about conceptual change in the learner making it student-centered through the pragmatic approach of teaching Genetics. These beads when used effectively by teachers might help to make concepts in Genetics concrete hence facilitating learning by students.

Attitude is a key factor affecting learning. Attitude is the tendency of an individual to organise thoughts, emotions, and behaviours towards a psychological object. Shitu (2013) refers to attitude as an effective response that involves relatively stable positive or negative feelings. Harrell, (2005) reported that "attitude is one hundred percent (100%) of everything you do". Harrell also opined that attitude is the cornerstone upon which we build our lives. He also affirmed that a positive attitude can make an incredible difference in one's life and in the lives of others. Rotbain, et al (2006) and Musa (2020) reported that the use of beads has enhanced students' attitude and achievement towards the learning of Genetics. Could this beads instructional strategy be used to improve students' attitude in genetics irrespective of gender?

One related factor that is confronting the use of student-centered method of teaching is its ability to have the same impact on both male and female students equally. Researches on gender and academic achievement such as that of Ibrahim (2013), Olorukooba, Lawal and Jiya (2012) and Umar (2012) observed that boys achieved better in sciences than girls. In a related study Akanwa, Ndirika and Udoh (2018) stated that gender has no effect on students' achievement in science. Musa (2020) and Dajal and Musa (2022) reported that there is no difference between male and female students achievement in Genetics. To this extent, this study was prompted to investigate the effect of beads instructional resource on senior secondary school students' attitude in genetics in Karu LGA, Nasarawa state, Nigeria.

## Purpose of the Study

The purpose of the study was to determine the effect of beads instructional resource on senior secondary school students' Attitude in Genetics in Karu Local Government Area (LGA), Nasarawa State, Nigeria. Specifically, the objectives of study were to:

- i. Determine the effect of the attitude of students towards genetics taught using beads and their counterparts in the control group.
- ii. Determine the difference in the attitude of male and female students taught genetics using beads.

## Research Questions

1. What is the effect of the attitude of students towards genetics taught using beads and their counterparts in the control group?
2. What is the difference in the attitude rating of male and female students taught genetics using beads?

## Hypotheses

**H<sub>01</sub>:** There is no significant difference in the attitude of students towards genetics taught using beads and their counterparts in the control group.

**H<sub>02</sub>:** There is no significant difference in the attitude rating of male and female students taught genetics with beads.

## RESEARCH METHOD

The study adopted non-equivalent quasi-experimental design. The researchers adopted the design because in a co-educational school system, class registers, schedules, subject allocations, time table and so on, cannot be disrupted for the purpose of a research work. The study used two (2) groups: the experimental (EG) and the control (CG). The EG was exposed to treatment, that is, teaching students using beads strategy, while the CG was taught using conventional lecture method. The design was considered appropriate because the sample were used in their intact classes. The study was carried out in Karu Local Government Area in Nasarawa State, North Central Nigeria. The population of the study comprised of 18,486 SS2 biology students in Nasarawa State. Out of this number, males consisted of 8,834 SS2 students and females consisted of 9,652 SS2 students in Nasarawa State (Nasarawa State Ministry of Education). The sample constituted the number of students that are in the intact classes in the co-educational senior secondary schools. Nasarawa State has thirteen (13) Local Government Areas. Using simple random sampling technique, one Local Government was picked out of the thirteen Local Government Areas in Nasarawa State. Simple random sampling is a sampling technique where every item in the population has an equal chance and likelihood of being selected for the study. The sample size for the study was 150 SS2 biology students. The two schools selected were assigned as experimental and control group. The researcher used 79 (43 males and 36 females) students as experimental and 71 students as control group. Thereafter, two schools were purposively sampled. The instrument used in this study was Genetics Attitude Scale (GAS). The reliability of GAS was obtained using Pearson Product Moment Correlation Coefficient (PPMCC) which gave a reliability index of 0.73. The descriptive statistics of

frequency, mean, standard deviation and standard errors was used to analyze the data and provide answers to the research questions. The two null hypotheses were tested using independent t-test at 0.05 level of significance. The level of significance was at 0.05 for rejection or acceptance of the hypotheses. The Modified four-point Likert type scale was used to rate students based on the following:

Strongly Agree (SA) = 4 points  
 Agree (A) = 3 points  
 Disagree (D) = 2 points  
 Strongly Disagree (SD) = 1 point

A weighted score point of 2.50 upwards was chosen as the benchmark where the responses were recorded as agreement, which means positive attitude towards learning Genetics concepts; while below benchmark were rated as disagreement, which also means negative attitude towards learning Genetics concepts. This benchmark was arrived at by simply finding the average of the four scales. That is,  $4+3+2+1 = 10 \div 4 = 2.50$ .

## RESULTS

**Research Question 1:** What is the effect of the attitude of students towards genetics taught using beads and their counterparts in the control group?

To answer this research question, frequency count, Mean, Standard deviation and Standard error were used for the analysis reported in Table 1

**Table 1. Descriptive Statistics Showing Mean scores of Groups in the Attitude of Students towards Genetics Taught Using Beads and Their Counterparts in the Control Group**

Groups	N	Mean	S.D	Std. Error
Experimental	79	3.80	0.46	0.94
Control	71	2.79	0.68	

Results on Table 1 indicated that subjects in the experimental group had a mean score of 3.80 with a standard deviation of 0.46 while those in the control group had mean score of 2.79 with a standard deviation of 0.68. In other words, the students in the experimental group had higher mean scores (in terms of attitude) than their counterparts in the control group.

**Table 3. Two-tailed t-Test Result in Respect of Genetics Attitude Scale (GAS) of Secondary School Students taught Genetics with Beads and those taught with Conventional Method**

Group	N	$\bar{X}$	S.D	d.f	t-value	Std.Error	Sig.@0.05	Decision
Experimental	79	3.80	0.46	148	8.801	0.94	0.000	Significant
Control	71	2.97	0.68					

**Table 4: Two-tailed t-Test Result in Respect of Genetics Attitude Scale (GAS) of Male and Female Secondary School Students taught Genetics with Beads**

Gender	N	$\bar{X}$	S.D	d.f	t-value	Std.Error	Sig.@0.05	Decision
Male	43	3.84	0.37	77	0.831	0.105	0.408	Not Significant
Female	36	3.75	0.552					

**Research Question 2:** What is the difference in the attitude rating of male and female students taught genetics using beads?

To answer this research question, frequency count, Mean, Standard deviation and Standard error were used for the analysis as reported in Table 2.

**Table 2. Descriptive Statistics Showing Mean Scores of Male and Female Students on Attitude in the Post-test**

Gender	N	Mean	S.D	Std. Error
Male	43	3.84	0.37	0.105
Female	36	3.75	0.55	

Results on table 2 indicated that Male students had a mean attitude score of 3.84 with a standard deviation of 0.37 while the female students had a mean attitude score of 3.75 with a standard deviation of 0.55. In other words, the male students slightly developed positive attitude towards learning Genetics than the female students.

**Hypothesis 1:** There is no significant difference in the attitude of students towards Genetics taught using Beads and their counterparts in the control group.

The hypothesis was tested using independent t-test and the results were presented in table 3. Result on Table 3 showed that there was significant difference in the attitude to Genetics as a result of difference in method of teaching ( $p = 0.000$ , which is less than 0.05 level of significance). As a result, the first hypothesis was rejected. In other words, students taught genetics with the use of beads significantly developed positive attitude to genetics better than those taught with conventional method.

**Hypothesis 2:** There is no significant difference in the attitude rating of male and female students taught genetics with beads. The hypothesis was tested using independent t-test and the results were presented in table 4. Result on Table 4 showed that there was no significant difference in the attitude to Genetics as a result of gender ( $p = 0.408$ , which is greater than 0.05 level of significance). As a result, the second hypothesis was accepted. In other words, male students taught genetics with the use of beads did not perform better than female students taught with the same method.

## DISCUSSION OF FINDINGS

The results on tables 1 and 3 showed that the students in the experimental group had higher mean attitude scores (3.80) than their counterparts in the control group (2.79). There was a significant difference in the attitude to Genetics as a result of difference in method of teaching. This result affirmed with the studies conducted by Rotbain, Marbach-Ad and Stavy (2006), Musa (2011), Singh and Ghandi (2015), Okoli and Ofodum (2017), Lawal, Bichi and Shuaibu (2017), Musa (2020) and Dajal and Musa (2022). Result on table 2 indicated that Male students had a mean attitude score of 3.84 with a standard deviation of 0.37 while the female students had a mean attitude score of 3.75 with a standard deviation of 0.55. In other words, the male students slightly developed positive attitude towards learning Genetics than the female students. This result agreed with the findings of Ibrahim (2013), Olorukooba, Lawal and Jiya (2012) and Umar (2012) observed that boys achieved better than girls. Despite the fact that beads strategy of teaching genetics is gender sensitive, this method could be used to teach both males and females in schools. This result is in disagreement with studies by Akanwa, Ndirika and Udoh (2017), Musa (2020), and Dajal and Musa (2022) reported that male and female students perform equally in attitude and achievement scores in genetics. Therefore, gender has a small effect on students' attitude in genetics. The result on Table 4 showed that there was no significant difference in the attitude to genetics as a result of gender ( $p = 0.408$ , which is greater than 0.05 level of significance). In other words, male students taught genetics with the use of beads did not perform better than female students taught with the same method. This is in agreement with studies conducted by Dajal and Musa (2022), Musa (2020), Akanwa, Ndirika and Udoh (2018) and Okoli and Ofodum, (2017) that reported that gender has no effect on students' attitude in genetics and science. Beads instructional resource is gender friendly for both sexes.

## Conclusion

The result of this study shows that beads instructional resource is effective in enhancing the attitude of male and female students in genetics concepts. Therefore, students taught genetics with the use of beads significantly developed positive attitude to genetics better than those taught with conventional lecture method.

## Recommendations

- i. Biology teachers should utilise pragmatic method of teaching and learning of genetics concepts by using beads to make concepts concrete facilitate learning outcomes.
- ii. Beads strategy should be incorporated into the Teacher Education Programme (TEP), by equipping Biology teachers in training institutions with the requisite skills needed to equip students who would fit into the Country's economy after graduation.

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