



## **Flipped Classroom Instructional Strategy and Secondary School Biology Students' Interest in Genetics in Akwa Ibom State**

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### **ABSTRACT**

The study investigated the effect of flipped classroom on secondary school Biology students' interest in Akwa Ibom State. Two research questions and two hypotheses guided the study. This study utilized quasi-experimental design. The population of this study consisted of 6810 SS3 students in 254 public senior secondary schools in Akwa Ibom State. A sample of 123 SS3 Biology students drawn through multi stage sampling process. The instrument used for data collection is Biology Student Interest Scale in Genetics (BISIG). The instrument was validated by three experts- two experts from Biology Education and one expert from Measurement and Evaluation. Mean and standard deviation was used to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the null hypothesis at 0.05 level of significance. Students taught genetics with flipped classroom had significantly higher interest score than students taught genetics with lecture method. Again, the male students had higher mean interest gain than their female counterparts taught genetics with flipped classroom but was not statistically significant. It was recommended that Biology teachers in secondary school in Akwa Ibom State, Nigeria should be encouraged to use flipped classroom instructional strategy to teach students since it is gender-friendly.

Key words: Flipped Classroom, Interest and Biology.

### **Introduction**

Education remains a vital instrument for sound national growth and development. The quality of education determines the extent to which recipients acquire the skills, knowledge and competencies to contribute effectively in national development. Thus, Inyang (2018) posited that no nation can develop to its fullest and keep pace with modern trends in science and technology without an effective educational system. Therefore education is the pivot for national growth, global competitiveness, and sustainable development of individuals and society at large, only possible with innovative teaching and learning of sciences.

Biology is a subject in Nigeria senior secondary school curriculum. It is a natural science that deals with the living world, how the world is structured, how it functions, how it develops, how living things come to existence and how they react to one another and the environment (Mader, 2017). As a Natural Science, Biology is designed to prepare students to acquire adequate laboratory and field skills, meaningful and relevant knowledge in biology and also to enable students apply scientific knowledge to everyday life in matters of personal, community, health and agriculture among others (Ado & Udoh, 2018). Biology is a natural science that deals with the living world, how the world is structured, how it functions, how it develops, how living things come to existence and how they react to one another and the environment (Edet, 2018).

Nevertheless, some of the Biology topics are still perceived difficult especially when describing things that cannot be seen or abstract concept that cannot be fully comprehended at the first time (Inyang, 2018). The abstract topics in Biology according to research include: Ecology, Respiratory system, Genetics, among others (Edet, 2018; WAEC, 2019 & WAEC, 2021). Also, some students have the notion that the concepts in Genetics are abstract, boring and extremely technical and acquired only rote memorization to pass (Edet, 2018 and Udoh, 2021).

Genetics is the branch of biology that deals with the study of heredity, variation function and behaviour of genes in living organism (Ramalingam, 2016). The sub-themes found under genetics as highlighted by Ramalingam (2016), include: principle of heredity, the transmission of inheritable characters from parents to their offspring via Deoxyribonucleic Acid (DNA) in genes and variation. The passing on and expression of traits or character from parent to offspring is termed heredity or inheritance. Heredity or inheritance may give rise to differences among individual organisms; this is termed hereditary variation (Bayers, 2015). Genetics seems abstract top students and needs to be taught with an effective instructional strategy so as improve students' interest.

Renninger & Hidi (2016) opined that interest is a powerful motivational process that stimulates learning, guides academic and career trajectories and essential to academic success. Interest is a psychological state of person's attention that can affect a particular object or topic and an enduring

predisposition to reengage over time (Renninger & Hidi, 2016). Thus, it has been seen as a vital factor in science learning as well as biology specifically (Reninger et al, 2015). But, evidence suggest that biology students may face challenges when it comes to building students' interest in Biology content, because, Biology is a subject with wider scope that leads to a variety of careers from medicine to conservation biologists to academic or industrial researchers. Therefore, students may offer the subject not because of their interest in Biology per se but because of other peripheral interests or career goals (Oyewumi & Alayonde, 2021). These suggest a potential lack of interest in Biology content and perhaps stronger interest outside the discipline itself. This low disciplinary interest poses a potential threat to motivation and ultimately, student lack of interest in certain Biology concepts.

In order to trigger and sustain interest in a learner, Renninger and Hidi (2016) suggest that, one needs to create the enabling environment that stimulate students' attention and engagement; select academic activities (content) and instructional strategy that connects the academic topic with student existing interest thus, increasing and strengthening their interest which can foster their academic achievement.

Instructional strategy is concerned with the skills teachers use to meet teaching objectives, including instructional organization and techniques, subject matter, and the use of teaching tools and materials (Onah & Onwubuariri, 2018). Strategy is very vital in any teaching-learning situation and the strategy adopted by the teacher may promote or hinder learning.

Based on the conflicting results on the effects of instructional strategies on students' interest in Biology in regards to gender, this study therefore, intend to address this gap and investigate whether Biology students' interest will be positively affected with Flipped Classroom Instructional Strategy.

A flipped classroom is an instructional strategy and a type of blended learning which aims to increase students' engagement and learning by having student complete readings at their home and work on live problem-solving during class time (Oyewumi & Adeoye, 2021). The flipped classroom intentionally shifts instruction to a learner-centred model in which time the classroom is used to explore topics in greater depth and create meaningful learning opportunities while students are initially introduced to new topics outside the classroom. In a flipped classroom, 'content delivery' may take a variety of forms. Often, video lessons prepared by the teacher or third parties are used to deliver content, although online collaborative discussions, digital research and text readings may be used. It has been claimed that the ideal length for the video lesson is eight to twelve minutes (Oyewumi & Adeoye, 2021). The flipped classroom is an innovative strategy that is part of a teaching and learning revolution. The principal goals of flipping are as follows: It makes the classroom an active learning environment. It enables students to learn at their own pace. It also give instructor more time to teach students individually or in a group each, rather than as a whole. Flipped classroom is an active learning strategy where the student learns the concept at home and practices it in school. It involves role reversal of the traditional pedagogy of teaching. Here the students take active role in the classroom rather than being a spectator.

According to Abeysekera, Lakmal and Davison (2015), Flipped classroom is viewed as a student-centred approach to learning where the students are more active than the instructor in the classroom activity. In this case, the instructor acts as a facilitator to motivate, guide, and give feedback on students' performance.

Applying flipped classroom strategy also contributes to better understanding of technology use in teaching and learning activities. Students will use various media in learning activities independently, while the teacher will use various media likewise in their teaching practices unlike the conventional strategy (Zainuddin & Attaran, 2018).

Moreover, Conventional teaching strategy refers to the traditional teaching method which is teacher centred. It is mainly authoritarian in nature whereby teaching-learning process is not based on hands-on activities. In this teaching strategy, teachers often teach sometime using only textbook and notebook. According to Etiubon (2017), in conventional teaching strategy, teachers are expert information providers while students learn by rote memorization, regurgitation of facts and reproduce the facts during the examinations.

The effectiveness of the Flipped classroom strategy from empirical evidence in Enugu and Adamawa states of Nigeria, other science field like Physics and Mathematics; and other biological concepts (circulatory system, Osmosis and diffusion) inspired the researcher for further study. However no study, known to the researcher has compared effect of flipped classroom strategy on students' interest in genetics. Therefore, the researcher intends to investigate effect of flipped classroom on secondary school Biology students' interest in Akwa Ibom State, Nigeria.

**The specific objectives of the study is to:**

1. Determine the mean interest scores of students taught Genetics with Flipped Classroom Instructional Strategy and Lecture method.
2. Find out male and female Biology students' mean interest scores when taught genetics using Flipped Classroom strategy.

**Research Questions**

1. What are the mean interest scores of students taught Genetics with Flipped Classroom Instructional Strategy and Lecture method?
2. What are the mean interest scores of male and female students when taught genetics using flipped classroom strategy?

**Hypothesis**

HO<sub>1</sub>: There is no significant difference in the mean interest scores of Biology students taught Genetics with Flipped Classroom Instructional Strategy and Lecture method.

HO<sub>2</sub>: There is no significant difference in the mean interest scores of male and female Biology students taught genetics with Flipped classroom strategy.

## Methodology

The study investigated the effect of Flipped Classroom Instructional Strategy on secondary school Biology students' interest in genetics in Akwa Ibom State. The study utilized co-educational secondary schools in Akwa Ibom State, Nigeria. The study was delimited to senior secondary three (SS3) students. The choice of SS3 students is due to the reason that the concept of the study is usually taught in Senior Secondary Three (SS3) class. The Biological concept used for the study was Genetics. Specifically, Deoxy-ribonucleic Acid (DNA): components of DNA, structure of DNA, Replication and function of DNA were the subtopics under Genetics to be considered. The treatment session lasted for six weeks. The researchers employed quasi-experimental research design. Specifically, a pre-test, post-test non-equivalent control design was used for the study. The area of study is Akwa Ibom State.

The population of this study consists of all Senior Secondary Three (SS3) Biology students in 2023/2024 academic session from twenty five (25) Local educational Committee/Boards in Akwa Ibom State. The population size was six thousand, eight hundred and ten (6,810) students. Out of these, three thousand, eight hundred and seventy one (3871) were female students while two thousand, nine hundred and thirty nine (2,939) were male students (Akwa Ibom State Secondary Education Board, class by class students' enrolment for 2023/2024 academic session). The study sample consisted of one hundred and twenty three (123) senior secondary three (SS3) students of 2023/2024 academic session. This comprises sixty nine (69) female and fifty four (54) male students. The instrument used for data collection is Biology Student Interest Scale in Genetics (BISIG). The BISIG was Forty (40) item adapted by the researcher to ascertain the level of student's interest in Biology before and after teaching the concept of genetics with Flipped classroom instructional strategy as well as lecture method. A four point Likert scale of Strongly Agree (SA), Agree (A), Disagree (DA), Strongly Disagree (SD) was used with positive worded items on (BISIG). The Strongly Agree (SA) was scored 4 point, Agree (A) 3 points, Disagree (DA) 2 point and Strongly Disagree (SD) 1 point and the same was in the case of the negative worded items. The BISIG was adapted in the interest scale in Effiong, (2016) and Udoh, (2021).

The experimental and control groups were both pretested before the study. The regular Biology teachers of the selected schools for the study were trained as research assistants. The teachers from the schools assigned experimental group taught using Flipped Classroom Instructional Strategy while that assigned control group was taught using the traditional/lecture method. Six weeks was used for the teaching of the same content units in all the groups. At the end of the six weeks of the experiment, the teachers administered the post-test. In all, the experiment lasted for eight weeks. Data collected from these tests were used to answer the research questions and test the hypotheses formulated for the study.

Mean and standard deviation were used in answering the research questions while the analysis of covariance (ANCOVA) was used in testing the hypotheses at .05 level of significance. This implies that any p-value that is less than 0.05 is significant and therefore the null hypothesis will be rejected. Any p-value that is equal to or greater than .05 is not significant and therefore the null hypothesis will not be rejected.

## Results

### Research Question One

What are the mean interest scores of students taught Genetics with Flipped Classroom Instructional Strategy and Lecture Method?

Table 1: Mean and Standard Deviation of Pre-Interest and Post-Interest Scores of Students taught Genetics Classified by Instructional Strategies

Instructional strategies	N	Pre-Interest		Post-Interest		Mean Gain
		X	SD	X	SD	
Flipped classroom	64	59.03	5.77	114.84	14.78	55.81
Conventional learning	59	60.36	10.32	73.12	21.59	9.76

Result in Table 1 shows that the mean pre-interest scores of the students taught the concept of Genetics using flipped classroom and conventional learning strategies are 59.03 and 63.36 respectively with standard deviation of 5.77, and 10.32 respectively while their post-interest scores are 114.84 and 73.12 with their standard deviation scores as 14.78 and 21.59 respectively. This shows that the mean interest scores of the three groups increased from pre-interest to post-interest. The table also shows the mean gain scores of students taught the concept of genetics using flipped classroom and conventional learning strategies as 55.81 and 9.76 respectively. Therefore, comparing the mean gain scores of the two groups, it indicates that flipped classroom strategy with the mean gain of score of 55.81 had higher mean interest score than conventional strategy with the mean gain score of 9.76 in enhancing student's interest in genetics..

### Hypotheses One

There is no significant difference in the mean interest scores of Biology students taught Genetics with Flipped Classroom Instructional Strategy and Lecture method.

Table 2: Summary of Analysis of Covariance (ANCOVA) of mean interest scores of Students' Post-interest Scores Classified by Instructional Strategies with Pre-interest as Covariate

Source	Sum of Squares (SS)	Df	Mean Square (MS)	F-value	Sig.	Partial Eta Squared (P-v)
Corrected Model	89482.64 <sup>a</sup>	2	29827.55	5.18	.00	.08
Intercept	41447.85	1	41447.85	7.20	.01	.04
Pre-Interest	231.08	1	231.08	0.04	.84**	.00
Strategies	85865.71	2	42932.85	7.46	.00*	.07
Error	1081657.73	120	5753.49			
Total	3290251.00	123				
Corrected Total	1171140.37	122				

\*=Significant at 0.05 level of significant \*\*= Not significant at 0.05 level of significant

The result in Table 2 shows that the Analysis of Covariate (pre-interest scores) of the two groups of students taught genetics using flipped classroom and conventional classroom strategies have F-value of .04 having a calculated p-value of 0.84 which is greater than the significant level of 0.05, indicating that the mean pre-interest of the three groups were significantly equivalent. The Table also shows that the calculated Fvalue of 7.50 and p-value of 0.00 of the main effects of the strategies. Since the calculated F- value (7.50) with calculated p-value 0.00 is less than the significant level of (0.05), indicating that the null hypothesis one is rejected. Therefore, this implies that there exist significant differences among Biology students' interest scores when taught Genetics using Flipped classroom and those taught with conventional strategy.

### Research Question Two

What are the mean interest scores of male and female students when taught genetics using flipped classroom strategy?

Table 3: Mean and standard deviation of male and female Biology students when taught genetics using flipped classroom strategy.

Gender	N	Pre-Interest		Post-Interest		Mean Gain
		X	SD	X	SD	
Male	25	58.80	6.02	117.96	13.06	59.16
Female	39	59.18	5.68	112.85	15.62	53.67

Result in Table 43 shows that the mean pre-interest scores of the male students taught genetics using flipped classroom strategy is 58.80 with standard deviation score as 6.02 and scores of their female counterparts is 59.16 with standard deviation as 5.68, and the respective post-interest score of the male is 117.96 with standard deviation score as 13.06 and their female post-interest score is 112.85 with standard deviation score as 15.6. Table 3 also show the mean gain scores of student taught concept of genetics using flipped classroom strategy 59.16 and 53.67 respectively. Comparing the mean gain scores of the male and female students, it indicates that the male students' interest with mean gain of 59.16 was highly enhanced than their female counterparts with the mean gain score of 53.67.

### Hypotheses Two

There is no significant difference in the mean interest scores of male and female Biology students taught genetics with Flipped classroom strategy.

Table 4: Summary of Analysis of Covariance (ANCOVA) of Students' Post-Interest Scores Classified by Flipped Classroom Strategy with Pre-interest as Covariate

Source

	SS	Df	Square	F-value	Sig	
Corrected Model	409.14 <sup>a</sup>	2	204.57	0.94	.40	
Intercept	8542.11	1	8542.11	39.03	.00	
Pre-Interest	10.74	1	10.74	0.05	.83**	NS
Gender	393.77	1	393.77	1.80	.19**	NS
Error	13351.29	61	218.87			
Total	857862.00	64				
Corrected Total	13760.44	63				

\*=The mean diff, is significant at 0.05 level \*\*= The mean diff, is not significant at 0.05 level

Result of Table 4 shows that the analysis of covariance (pre-interest scores) of the male and female Biology students when taught genetics with Flipped classroom strategy had the calculated F-value of 0.05 and the calculated p-value of 0.83 which is greater than the significant level (0.05). Thus, indicating that the mean pre-interest score of both male and female Biology student taught genetics using Flipped classroom were statistically equivalent before treatment. The table also shows that the calculated F-value of 1.80 with calculated p-value of 0.19 of the main effects of the strategy on gender is greater than the significant level 0.05. This, implies that the null hypothesis is not rejected, indicating that there is no significant different between the mean interest scores of male and female Biology students taught genetics using Flipped classroom strategy.

## Discussion of Findings

The result of the finding shows that the Biology students taught using flipped classroom strategy had higher interest gain than the conventional classroom strategy group. This implies that teaching with flipped classroom strategy enhances students' interest than conventional classroom strategy. The corresponding hypothesis also affirmed that there exist a significant difference in the mean interest scores of students taught using flipped classroom and conventional lecture strategies. The superior achievement of students taught with flipped classroom over those taught with conventional classroom strategy could be attributed to the facts that flipped classroom provide students an opportunity to gain first exposure prior to the class, it provide the students with incentive to prepare for the class and also provide in-class activities that focus on higher level of cognitive activities (Bergmann & Sam 2015). This present study is in line with that of Oyewumi and Adeoye (2021) who investigated the effects of flipped classroom strategy on senior secondary school Biology students' interest and academic achievement. The finding of the study indicated that mean interest score of the students taught with flipped classroom was higher than their counterpart taught with other instructional strategies. Therefore, the use of flipped classroom strategy facilitated students' interest, clearer understanding and retention of genetic concept. The present study also agreed with Udoh (2021) who investigated improvised DNA model. Realia, visual reality and Biology students' interest, academic achievement and retention in genetics, the result of the finding shows a significant difference in students' interest.

Again, the male students had higher mean interest gain than their female counterparts taught genetics with flipped classroom but was not statistically significant.

## Conclusion

Based on the findings of this study, the following conclusion was made:

There exists a significant difference in the mean interest scores of Biology students taught genetics using flipped classroom and conventional/lecture strategies in favour of flipped classroom group which achieved higher than their counterpart taught using conventional strategy. Again, the male students had higher mean interest gain than their female counterparts taught genetics with flipped classroom but was not statistically significant. This results showed that flipped classroom strategy stimulates students' deeper understanding of the concept taught, thus, enhances their academic achievement.

## Recommendations

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

1. Biology teachers in secondary school in Akwa Ibom State, Nigeria should be encouraged to use flipped classroom instructional strategy to teach in order to enhance students' interest in teaching of genetics and other concepts in Biology since it is gender-friendly.
2. Seminars and workshops should be organized for training and re-training of new and old teachers on the various ways of using Flipped Classroom for effective classroom instructions. This will ensure continuity and flexibility in teaching-learning delivery.

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