



## Impacts of Demonstration and Reciprocal Peer Tutoring Instructional Strategies on Academic Performance in Genetics among Senior Secondary II Biology Students in Bauchi Metropolis.

Birni, Hamisu Adamu<sup>1</sup>, Abdulkarim Ali Deba<sup>2</sup>, Musa O. Dauda<sup>2</sup>, Ibrahim Mohammed<sup>2</sup>

<sup>1</sup>Staff Primary School,

<sup>2</sup>Dept. of Science Education,

Faculty of Technology Education,

Abubakar Tafawa Balewa University, Bauchi

### ABSTRACT

*This study investigated the Effects of Demonstration and Reciprocal Peer Tutoring Instructional Strategies on Secondary School Students' Performance in Genetics in Bauchi Metropolis. The design of the Study was a Quasi-experimental research design involving pre-test, post-test and non-equivalent control group design. Two research questions and two null hypotheses guided the study. The Population of the Study was 32,120 Senior Secondary School Students SS II in all the 22 Secondary Schools. Simple random Sampling technique was used to select three (3) Schools with sample size of 118. The instrument for data collection was Genetics Performance Test (GPT). The reliability coefficient of GPT was  $r = 0.50$ . Mean and Standard Deviation were used to answer the research questions, while Analysis of Variance and t-test were used to test the null hypotheses at  $\alpha = 0.05$  level of significance. The findings revealed that students taught genetics using Peer Tutoring Instructional Strategy performed significantly better than those taught using Demonstration and Conventional method. There was also significant difference between male and female students taught genetics using Reciprocal Peer Tutoring. Based on these findings, it was recommended that Biology teachers should use an instructional method such as Reciprocal Peer Tutoring Instructional Strategy in teaching Biology as its helps in improving Students' academic performance. Also, in collaboration with the state government, the ministry of education should organized seminars, workshops and conferences for training and retraining of Biology teachers on the use of Reciprocal Peer Tutoring.*

### ARTICLE INFO

Article History

Received: October, 2023

Received in revised form: October, 2023

Accepted: November, 2023

Published online: December, 2023

### KEYWORDS

Demonstration, Peer Tutoring,  
Conventional Method, Academic  
Performance and Genetics.

### INTRODUCTION

Education has been described as an instrument for scientific, political and economic development for all nations including Nigeria. This could be the reason why the Federal Government of Nigeria emphasized the teaching of Science, Biology inclusive in its National Policy on Education (F M E, 2013), to be solely activity-based and student-centered. It is in this regard that, adopting quality teaching methods for improved performance has been encouraged by

researchers in the area of science, technology and mathematics education (Nnorom 2015). The knowledge of biology among secondary school students would enable them to study some professional courses in higher levels of education. Despite this, the academic performance of students in biology at both internal and external examinations is not encouraging as reported by Chief Examiners Report of WAEC (2021) and Jibrin, Abba and Mohammad (2021). This is attributed to quality of instructional strategies

Corresponding author: Ibrahim Mohammed

✉ [ibrahimkaqyal@gmail.com](mailto:ibrahimkaqyal@gmail.com)

Department of Science Education, Abubakar Tafawa Balewa University, Bauchi, Nigeria.

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employed by most biology teachers, insufficient instructional materials, attitude of the learners towards Biology. In fact, these factors made students to see some concepts in biology as abstract. Some of these perceived abstract and difficult concepts include classification of living organisms, evolution, ecology and genetics among others. Genetics as aspect of biology deal with the study of heredity and variation in living organisms. The study of genetics helps students to understand how traits are transmitted from parents to their offspring. Despite this, the teaching strategies used by teachers makes the topics difficult for students to learn the concept meaningfully, as most teachers employed teacher-centre (WAEC, 2021) The chief examiner's reports of WAEC observed some weaknesses of candidates in putting "X" as a sign for crossing in questions relating to determination of genotypes and phenotypes of an individual, and inability to use technical terms to describe some processes. Based on this, Jibrin, Abba and Mohammad (2021) suggested that teachers need to employ different teaching methods that will ensure students understanding of genetically concept. This may enable the students to learn meaningfully (Jibrin 2014). In the light of this, the present study investigated the use of Reciprocal Peer-Tutoring and Demonstration instructional strategies on the academic performance of secondary students in genetics.

Demonstration method is the teaching method which is carried out in a systematic way often occurs when students have a hard time connecting theories to actual practice or when students do not understand application of theories. Demonstration methods explain the mechanism and the method which is use with great efficacy on science subjects and science related topics (Abeysekera, Lakmal and Division, 2015). According to Mundi (2006) Demonstration method of teaching could be described as a display or an exhibition usually done by the teacher while the students watch with keen interest.

Reciprocal Peer-Tutoring is an instructional strategy that consists of pairing students together to learn or practices an

academic task. It can also be regarded as the process between two or more students in a group where one of the students act as a tutor for the other group mate(s). There are mainly two types of tutoring namely incidental peer tutoring (IPT) and structured peer-tutoring (SPT). Golding (2006) noted that peer tutoring gives teachers the capability to accommodate a classroom with diverse learners to improve academic performance across ability, levels and content areas. According to Ayuba (2011) considered peer tutoring as one of the effective and powerful strategies that can be used to develop academic as well as social skills in both the tutor and the tutee (the learner).

### **Statement of the Problem**

The components of science education among others are Biology, Physics, Chemistry, Mathematics and Integrated science. Biology as one of the Science Subject offered by Senior Secondary School level but Students Academic Performance is not encouraged in some Topic like genetics. According to David (2016) there are still existing poor Academic Performance in some biological concepts including like Genetics. WAEC Chief Examiners Report (2020 &2022) Reported that poor performance in genetics is associated to insufficient instructional materials, abstract nature of genetics concept due to poor methods of teaching employed by teachers. The question therefore, could demonstration and reciprocal peer tutoring instructional strategies be used to enhance students academic performance in genetics? Hence, the study wish to address this problem.

### **Research Questions**

The following research question guided the study

- i. What is the difference in the mean performance scores of students taught genetics using demonstration method, reciprocal peer tutoring strategies and those taught with lecture method?
- ii. What is the difference in the mean performance scores of male and female SSII

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Corresponding author: Ibrahim Mohammed

✉ [ibrahimkaqyal@gmail.com](mailto:ibrahimkaqyal@gmail.com)

Department of Science Education, Abubakar Tafawa Balewa University, Bauchi, Nigeria.

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Biology students taught genetics using reciprocal peer tutoring strategies?

### Hypotheses

The following null hypotheses were tested at  $p \leq 0.05$  level of significance.

**H0<sub>1</sub>** There is no significant difference in the mean performance scores of students taught genetics using Demonstration Method, Reciprocal Peer Tutoring Strategies and those taught using Lecture method.

**H0<sub>2</sub>** There is no significant difference in the mean performance scores of male and female SSII Biology Students taught genetics using Reciprocal Peer Tutoring Instructional strategy.

### METHODOLOGY

The study Adopted quasi-experimental research design involving pretest and posttest non equivalent control group design. They may insist on not having their arrangements in the classes disrupted by the researcher. Pretest was given to determine the student equivalent level in terms of performance while the post-test was given to the students after the treatment to see the effect of the treatment. The Population of this Study was all public Senior Secondary Schools II Biology Students in Bauchi metropolis. The target Population for the Study was thirty two thousand one hundred and twenty (32,120) Senior Secondary Schools II Biology Students in all the 22 secondary schools in Bauchi metropolis. From the 22 secondary schools, simple random sampling technique was used to select three 3 schools through balloting. From the selected schools, one intact class from each of the sampled schools was randomly selected by balloting and

the sample size of 118 was used for the study. The selected schools were randomly assigned into Experimental group I, Experimental group II and control group. Students in experimental 1 were taught genetics using demonstration method of teaching while in experimental group II were taught genetics using reciprocal peer tutoring instructional strategy. While, students in the control group were taught genetic using lecture method of teaching. The instrument for data collection was Genetic performance Test (GPT) adapted from WAEC passed questions and consisted of 22 multiple choice items with four options A-D.

The instrument was pilot-tested using test-retest method and the data collected were analyzed using Pearson product moment correlation and a reliability obtained was  $r = 0.56$ . In the experimental procedures for data collection, the experimental group I was taught genetic concept using Demonstration, while the experimental group II was taught using Peer Tutoring. And for the control group, they were taught the same concept using Conventional method. The teaching lasted for six weeks after which port-test was administered using the GPT. The data was analyzed using mean and standard Deviation to answer the research question, while ANOVA was used to test the hypotheses at  $P \leq 0.05$  level of significance.

### RESULTS

**Research question 1:** What is the difference in the mean performance scores of students taught genetics using Demonstration Method, Reciprocal Peer Tutoring Strategies and Lecture method?

**Table 1:** Mean and Standard Deviation of Experimental I, II and Control group.

Group	N	Mean	Std Deviation
EXP I	40	11.83	2.45
EXP II	33	17.27	2.84
Control	45	9.29	1.50

The result in table I shows that Experimental group I which was taught genetics using Demonstration had a mean score of 11.83 and Standard Deviation of 2.45, while those in

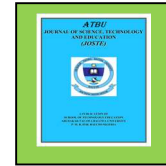
Experimental 11 taught genetics using Reciprocal Peer Tutoring recorded a mean score of 17.27 and Standard Deviation of 2.84. For the Control group which was taught using Conventional method had

Corresponding author: Ibrahim Mohammed

✉ [ibrahimkaqyal@gmail.com](mailto:ibrahimkaqyal@gmail.com)

Department of Science Education, Abubakar Tafawa Balewa University, Bauchi, Nigeria.

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a mean score of 9.29 and Standard Deviation of 1.50. From these, Students taught using Reciprocal Peer Tutoring achieved better than those taught using Demonstration Instructional Strategies and those in the Control group. The

difference in the mean scores was tested statistically in hypothesis one.

**H<sub>01</sub>** There is no significant difference in the mean scores of SS11 Biology Students taught genetics using Demonstration, Reciprocal Peer Tutoring Instructional Strategy and Lecture Method.

**Table 2:** Analysis of Variance (ANOVA) for the Mean Score of Students in EXP 1, EXP II and Control groups

Variable	Sum of Squares	DF	Mean Square	F-value	p-value	Remark
Between Group	1232.274	2	616.137			Sig
					0.00	
				19.777		
Within Group	591.565	115	5.144			
Total	1823.839	117				

The result in table 2 shows that there is a significant difference between students taught genetics using Reciprocal Peer Tutoring, Demonstration and Lecture method at  $F=119.777$  with P-value calculated at 0.00 level. Since the calculated P-value of 0.00 is less than 0.05 level of significance. The hypothesis which stated that, there is no significant difference in the mean scores of SS11 Biology Students taught genetics

using Demonstration, Reciprocal Peer Tutoring Instructional Strategy and Lecture Method is rejected.

To establish where the significance difference exists between the groups, a multiple comparison of post-hoc test was employed in this case, sheffes test was used and is presented below.

**Table 3:** Post Hoc Sheffes Test of Mean Score of Students in Experimental 1, Experimental 11 and Control group.

Variable	J	Mean Diff	Std Error	P-Value	Remark
Demonstration	Reciprocal	-5.448	0.533	0.00	Sig
	Control	2.536	0.493	0.00	Sig
Reciprocal	Demonstration	5.448	0.533	0.00	Sig
	Control	7.984	0.520	0.00	Sig
Control	Demonstration	-2.536	0.493	0.00	Sig
	Reciprocal	-7.984	0.520	0.00	Sig

The results of post hoc Sheffes test in table 3 shows revealed that, a significant difference exist at 0.05 level between the mean scores of students taught genetics using Reciprocal and Demonstration, Reciprocal and Lecture, Demonstration and Lecture.

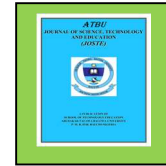
This has confirmed the ANOVA results of the significance differences, hence showing where the difference lies. In fact, the mean scores of the three groups shown in table 6 earlier presented revealed that students taught genetics using peer Tutoring achieved higher than those in the Demonstration group, while those taught

Corresponding author: Ibrahim Mohammed

✉ [ibrahimkaqyal@gmail.com](mailto:ibrahimkaqyal@gmail.com)

Department of Science Education, Abubakar Tafawa Balewa University, Bauchi, Nigeria.

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using Lecture method achieved lower. This result shows that teaching genetics using Peer Tutoring enhanced student academic performance significantly better in genetics concepts than Demonstration and Lecture methods.

**Research question 2:** What is the difference in the mean performance scores of male and female SSII Biology students taught genetics using Reciprocal Peer Tutoring Strategies?

**Table 4:** Mean and Standard Deviation of the Mean Scores of Male and Female Students Taught Genetics Using Reciprocal Peer Tutoring Instructional Strategy.

Variable	N	Mean	Std. Deviation	Mean Diff.
Male	15	18.33	2.16	1.94
Female	18	16.39	3.09	

Results in table 4 shows that the male students had a mean score of 18.33 and standard deviation of 2.16, while the female students achieved a mean score of 16.39 and standard deviation of 3.09. From this, a mean difference of 1.94 exist, which indicated that the male students achieved higher than their female counterparts.

Hence, the mean difference was tested statistically as shown in hypothesis two.

**H0<sub>2</sub>** There is no significant difference in the mean performance scores of male and female SSII Biology Students taught genetics using Reciprocal Peer Tutoring Instructional strategy.

**Table 5:** Summary of Independent t-test Statistics of Mean Scores of Male and Female Taught Genetics Using Reciprocal Peer Tutoring Instructional Strategy.

Variable	N	Mean	SD	DF	t-cal	P-value	Remark
Male	15	18.33	2.16			0.04	Sig
Female	18	16.39	3.09	31	2.05		

**Sig, at 0.05 alpha level.**

The results in table 5 shows that significant difference existed in the mean scores of male and female students taught genetics using Reciprocal Peer Tutoring Instructional Strategy. This is indicated from the calculated P value of 0.04 at the degree of freedom of 31 and the calculated t value of 2.05. Therefore, the null hypothesis which stated that, there is no significance difference between the mean scores of male and female SSII Biology Students taught genetics using Reciprocal Peer Tutoring is rejected, since the p-value calculated is less than alpha level. Hence, the use of Reciprocal Peer

Tutoring was in favor of male students, as they achieved better than the female students.

**DISCUSSION OF FINDINGS.**

The finding revealed that students who were taught genetics using reciprocal peer tutoring instructional strategy achieved higher than those taught using Demonstration method. This is in support of the finding of Adedeji (2013) who investigated pupils' performance in mathematics by comparing peer tutoring and the conventional method of teaching. At the end of this study, it was found by the researcher that those

Corresponding author: Ibrahim Mohammed  
✉ [ibrahimkaqyal@gmail.com](mailto:ibrahimkaqyal@gmail.com)  
Department of Science Education, Abubakar Tafawa Balewa University, Bauchi, Nigeria.  
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that were exposed to peer tutoring had a better mean achievement score than their counterparts that were exposed to the Demonstration method and control group. Similarly, Nworgu(2013) explored the effectiveness of peer tutoring and gender on the achievements of students in biology and found that peer tutoring was effective on students performance in biology.

The result is also in agreement with the study of Okoye (2013) who discovered that peer tutoring technique yield higher mean Score in home economics than those taught using conventional method. Similarly, Tella (2013) also, reported that Reciprocal Peer Tutoring Instructional Strategy enhanced Students performance than Conventional method. Similarly, the results also confirmed the earlier finding of Rizve (2012) who reported that, peer tutoring enhance students learning outcomes. The result also supported the claims of studies such as Comfort (2014) that peer tutoring has significant effects on academic performance in the subject of biology. One of the reasons for improvement in academic performance may be learning from peers, as they likely understand and interact freely among themselves. Such an improved performance may be attributed to the interactive nature of the strategy and its potential benefits in knowledge construction among learners.

The study also revealed that, Male Students exposed to Reciprocal Peer Tutoring Instructional Strategy achieved higher mean scores than the Female Students in genetics. The finding gain support from the work of Nwafor and Aja (2017), who also reported that male students performed better than female students in basic science. Similarly, the study of Ezenwusu and Nworgu (2013) revealed that Male students performed better than Female students in task involving Peer Tutoring.

## CONCLUSION

The study here clearly indicated that students centered learning strategies is relevant in teaching and learning of abstract biological concept such as genetics. This implies that when students are exposed to learn actively, it could result to meaningful learning as shown in teaching

genetics using Demonstration and Peer Tutoring as against the use of conventional method.

## RECOMMENDATIONS

This research work would hopefully be beneficial to Students, teachers, curriculum planners, textbook publishers and examination bodies.

- i. Biology teachers should use an instructional method such as Reciprocal Peer Tutoring Instructional Strategy in teaching biology as it helps in improving students' academic performance in genetics.
- ii. Authors and textbook writers should apply and provide illustration of genetics problems in different areas of genetics. This may enable this students generate their own algorithms and generalize it into specific set of application into genetics.

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Corresponding author: Ibrahim Mohammed

✉ [ibrahimkaqyal@gmail.com](mailto:ibrahimkaqyal@gmail.com)

Department of Science Education, Abubakar Tafawa Balewa University, Bauchi, Nigeria.

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Corresponding author: Ibrahim Mohammed

✉ [ibrahimkaqyal@gmail.com](mailto:ibrahimkaqyal@gmail.com)

Department of Science Education, Abubakar Tafawa Balewa University, Bauchi, Nigeria.

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Corresponding author: Ibrahim Mohammed

✉ [ibrahimkaqyal@gmail.com](mailto:ibrahimkaqyal@gmail.com)

Department of Science Education, Abubakar Tafawa Balewa University, Bauchi, Nigeria.

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