

Effect of Peer Tutoring Instructional Strategy on Students' Achievement and Self-Esteem in Genetics in Plateau North, Nigeria

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Abstract

This study examined the effect of peer tutoring instructional strategy on secondary school students' achievement and self-esteem in genetics in Plateau, the study employed a quasi - experimental study of non-randomized, non-equivalent pre-test, post-test control group design. Four research questions guided the study and four hypotheses were formulated and were tested at 0.05 level of significance. A multi stage random sampling technique was used. The population for the study was all the senior secondary II students in 2023/2024 with a total of 4,270 students. A30-multiple choice item on genetic achievement test, a 20-item Self-esteem questionnaire were employed for data collection. Descriptive statistics were used to answer the research questions and ANCOVA was used to test the hypothesis at 0.05 level of significance. Significant differences exist in the achievement of senior secondary school students taught genetics using peer tutoring instructional strategy. No significant difference between male and female students' achievement. Self-esteem of male students in genetics do not significantly differ from those of female students. The study concluded that Peer Tutoring Instructional Strategy can improve Students' Achievement and Self-esteem in Plateau North.

Keywords: Achievement, Genetics, Peer tutoring, self-esteem,

Introduction

Science education is unique because it seeks ways to provide opportunities for students to acquire relevant, realistic and functional knowledge and skills that are associated with scientific process needed for advancement in a science and technologically driven world (David, 2018). There is no doubt therefore that any strategy to improve Science teaching and learning should be encouraged. Biology is one of the important Science subjects in the school curriculum. The knowledge of biology is needed to be able to function effectively in our modern world where the effects of climate change threaten our health by affecting the food we eat, the water we drink, the air we breathe, and the weather we experience. It's expedient to be biologically literate. The secondary school Biology Curriculum consists of five broad areas these areas are broken down into sixty-four units. These contents are arranged spirally such that the concepts to be taught are repeated yearly throughout the three- year duration of the subject at the senior secondary school (SS1-SS3). All repeated

concepts are presented with greater complexity as the subject progresses over the three-year period (FRN 2014). One potential source of data is examiners' report; Examiners' reports provide details commentary on students' understanding of different question. These analyses describe whether students in general, performed well or not on a question and state common mistakes found in answers. It's on the examiners' report that the present study found genetics as an area of perceived difficulty by students. Genetics is perceived difficult because it contains many abstract concepts that cannot be seen directly and are beyond our senses. Many abstract concepts exist at the molecular level, such as "Genes" and "DNA". Since this level includes invisible concepts in genetics the learning seems abstract. Concepts in genetics exist in different levels of representation (macro, micro, molecular and symbolic). For example, learning about macroscopic level (eg. phenotype), microscopic level (eg. Chromosomes),

molecular level (eg. Genes and mutation) and symbolic level (eg. Punnett squares).

Researchers suggest the use of different methods and strategy that will help students gain understanding of the concepts taught. Among these methods is peer tutoring strategy. The history of tutoring has undergone an evolution which can be traced back to Roman and Greek age. At that time, as far as peer tutoring is concerned, it was a teaching strategy where a group of students interact to help each other's learning by one student occupying the role of tutor and the others the role of tutees. The activity was not formally organized by any teacher but volunteer students who are good in some subjects and willing to help others or when their mates have asked them to help in difficult areas in some subjects. The students learn new ways and short-cuts to solving problems by applying new skills, knowledge and solution to each other's problems through playing, quarreling and sharing ideas. Students explain to each other using the language best understood among them. However, PTIS has its challenges when poorly manage.

The Class-Wide Peer Tutoring (CWPT) involves dividing the entire class into groups of two to five students with different ability levels, students then act as tutors, tutees or both tutors and tutees. Class-Wide Peer Tutoring was chosen for this study because of its well-structured procedures and the reality of large-class sizes in our schools. Any other teaching strategy other than peer tutoring strategy in this study is referred to as conventional or traditional method or lecture method. The purpose of peer tutoring is to help students engage their own active learning and critical thinking (Aina, & Keith, 2015, Alegre, Moliner, Moroto, Lorenzo-Valentin 2019; Inyang, 2019).

Achievement has been identified as the measurement of the amount of academic content a student learns in a given time frame, as the extent to which a learner has attained their short- or long-term educational goals. Achievement refers to performance outcomes in intellectual domain taught at school, colleges, and universities level of attainment of the pre-determined learning objectives by the teacher. Due to individual differences that exist in students' intellectual domain, students are usually categorized as low high and average (Kola A.J, 2017; Alegre Moliner Morota and Loranzo, 2020) reveal that Peer tutoring enhance students' achievement increased opportunities to interact in smaller group, Peer plays a special role in children's development in addition to parents and teachers. (Adesoji, Omilami, Nyeibi, 2015) opined that

must of what women encounter in education has been attributed to gender bias.

Self esteem can be seen as a belief and confidence in one self and abilities, pride in oneself, faith and dignity one has in his or herself. Encompasses one's emotional states such as triumph, despair and shame. Students with low self-esteem will not progress academically at an optimum rate until their self-esteem is strengthened (Manisha, Sharma, & Parika, 2020) Peer tutoring seems to increase students' self-esteem as students have increased opportunities to interact in smaller group. Peer plays a special role in children's development in addition to parents and teachers. However, the greater fluidity, freedom and equality of peer relationships offer children the opportunity for a new kind of interpersonal experimentation and exploration.

Statement of Problem

Students' Achievement in the West African Examination Council according to the Chief Examiner's report of June 2014-2024 has been consistently poor as a result of poor knowledge of biology concepts by candidates. Genetics has been identified as one of the difficult concepts in which students perform woefully. The effects of the poor achievement in genetics translate to poor achievement in biology because 25% of the questions during West African Examination cover the area of genetics. Genetics is so important in view of the fact that urbanization, land shortage, and climate change are posing a serious threat. There is the need to continue to look for ways to reduce the causes of poor achievement because of its adverse consequences particularly on students' enrollment. Studies have confirmed that ineffective teaching methods and strategies utilized by biology teachers may be responsible for this dwindling achievement of students in public Examinations. The commonly used traditional teaching methods of lecture and demonstration are not producing desired results in the students' achievement so a search for alternative teaching strategies is being conducted in various researches to enhance and ameliorate students' achievement. Among such strategies is peer tutoring which this study is out to find out its effects on students' achievement and self-esteem in genetics in Plateau north

Research Questions

The following research questions guided the Study:

1. What are the mean achievement scores of students taught genetics using Peer Tutoring

Instructional Strategy and those taught using lecture method?

2. What are the mean self-esteem scores of students taught genetics using Peer Tutoring Instructional Strategy and those taught using Lecture Method?
3. What are the mean achievement scores of male and female students when taught genetics using Peer Tutoring Instructional Strategy?
4. What are the mean self-esteem scores of male and female students taught genetics using Peer Tutoring Instructional Strategy?

Statement of Hypotheses

The following null hypotheses were formulated and were tested at 0.05 level of significance:

- H₀₁: There is no significant difference in the mean achievement scores of students taught genetics using Peer Tutoring Instructional Strategy and those taught using Lecture Method
- H₀₂: There is no significant difference in the mean self-esteem scores of students taught genetics using Peer Tutoring Instructional Strategy and those taught using the lecture method
- H₀₃: There is no significant difference between the mean achievement scores of male and female students taught genetics using Peer Tutoring Instructional Strategy.
- H₀₄: There is no significant difference between the mean self-esteem scores of male and female

student taught genetics using Peer Tutoring Instructional strategy

Methodology

This study adopted the quasi-experimental design of non-equivalent pre-test, post-test group type that involves two intact groups of one experimental and one control group. The population of the study comprised all the senior secondary school 2 biology students of 2023/2024 academic season in Plateau with total 4270 (2380 male and 1890 females), and a sample size of 100 students in government-owned co-educational School. The study maintained the regular class periods, the pretest, post-test was similar (difference was only in test item reshuffling).

Two instruments were used for data collection: Genetics Achievement Test (GAT), developed by the researcher drawn from past WAEC and NECO examinations in biology focusing on genetics. The reliability of GAT items sought was using Kuder-Richardson (K-R20) method of reliability. The coefficient obtained was 0.94 for test items, while the reliability for Self-esteem questionnaire (SEQ) was established using (Cronbach Alpha) method. All analysis was done using SPSS (standard package for social sciences). Mean and standard deviation were used for the research questions. ANCOVA was used to test the hypotheses at 0.05 level of significant.

Research question 1

Table 1: Result of Achievement Mean Score of Students in the Experimental and Control Groups

Group	N	Pretest		Posttest		Mean Gain
		X	SD	X	SD	
Experimental	33	33.10	11.54	70.20	9.88	37.1
Control	17	39.21	8.48	47.66	4.18	8.45

Table 1 reveal the result for experimental group yielded a mean score (=33.10, SD =11.54) and control group had a mean score of (= 39.21, SD = 8.48 before treatment. After treatment the results for experimental

group yielded a mean score (= 70.20, SD = 9.88) and the control group (= 47.66, SD = 4.18). Mean gain =37.1, for experimental group, control group =8.45.

Table 2: ANCOVA Result of Students Taught Genetics Using PTIS and CTM

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	6532.990	2	3266.495	63.268	.000	.729
Intercept	8130.640	1	8130.640	157.480	.000	.770
Pre-test	1108.317	1	1108.317	21.467	.000	.314
Group	6208.543	1	6208.543	120.251	.000	.719
Error	2426.601	47	51.630			
Total	205674.600	50				
Corrected Total	8959.591	49				

a. R Squared = .729 (Adjusted R Squared = .718)

Table 2: shows that $F(1,47) = 120.25$, $p < 0.05$, partial

$\eta^2 = .719$, since the p value of 0.000 is less than 0.05 level of significance with an effect size (72%), the null hypothesis was rejected.

Research Question 2

Table 3: Result of Mean Self-esteem Score of Students in the Experimental and Control Groups

Group	N	Pretest		Posttest		Mean gain
		X	SD	X	SD	
Experimental	33	42.67	4.92	63.76	7.20	21.09
Control	17	41.06	4.82	47.82	4.33	6.76

Table 3 reveal the result for experimental group yielded a mean score (=42.67, SD=4.92) and control group had a mean score of (= 41.06, SD = 4.82) before treatment. After treatment the results for experimental group

yielded a mean score (= 63.76, SD = 7.20) and the control group (= 47.82, SD = 4.33). Mean gain for Experimental group =21.09, Control group =6.76.

Null Hypothesis 2

Table 4: ANCOVA Result of Mean Self-esteem Scores of Students in Genetics in the Experimental and Control Groups

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	3195.893	2	1597.947	37.946	.000	.618
Intercept	2264.760	1	2264.760	53.780	.000	.534
Pre-test	9.508	1	9.508	.226	.637	.005
Group	3083.995	1	3083.995	73.235	.000	.609
Error	1979.227	47	42.111			
Total	186618.000	50				
Corrected Total	5175.120	49				

a. R Squared = .618(Adjusted R Squared = .601)

Table 4: shows that $F(1,47) = 73.24$, $p < 0.05$, partial $\eta^2 = .609$, since the p value of 0.000 is less than 0.05 level of significance with an effect size (61%), the null hypothesis was rejected.

Research Question 3

Table 5: Mean and standard Deviation of Male and Female Students Taught Genetics Using Peer Tutoring Instructional Strategy

Gender	N	Pre-Test		Post-Test	
		Mean	SD	Mean	SD
Male	15	31.46	9.32	67.10	8.52
Female	18	34.46	13.22	72.78	10.40

Table 5, reveal the result for male yielded a mean score of 67.10 with standard deviation of 8.52, while the female had a mean score of 72.78 and standard deviation of 10.40 after treatment.

Hypothesis 3

Table 6: ANCOVA Result on Posttest Mean Achievement Scores of Male and Female Students taught Genetics using PTIS

Source	Type III Sum of Squares	df	Mean Square	F	P-value	Partial Eta Squared
Corrected Model	656.606 ^a	2	328.303	3.997	.029	.210
Intercept	12348.434	1	12348.434	150.354	.000	.834
Pre-test	392.331	1	392.331	4.777	.037	.137
Gender	182.522	1	182.522	2.222	.146	.069
Error	2463.874	30	82.129			
Total	165745.800	33				
Corrected Total	3120.480	32				

a. R Squared = .210 (Adjusted R Squared = .158)

Table 6: reveals scores of male and female students taught genetics using Peer Tutoring Instructional Strategy (PTIS); $F(1, 30) = 2.222$, $P > 0.05$, partial $\eta^2 = .069$. Since the p-value of .146 is greater than the 0.05 level of significance, the null hypothesis was retained.

Table 7: Result of Mean self-esteem scores of male and female students taught genetics using PT

Gender	N	Pre-Test		Post-Test	
		Mean	SD	Mean	SD
Male	15	42.60	4.87	63.27	6.40
Female	18	42.72	5.12	64.17	7.96

Table 7: reveals the result for male yielded a mean score of 63.27 with standard deviation of 6.40, while the female had a mean score of 64.17 and standard deviation of 7.96 after treatment.

Hypothesis 4

Table 8: ANCOVA Result on Mean Self-esteem Scores of Male and Female Students taught Genetics using PTIS

Source	Type III Sum of Squares	df	Mean Square	F	P-value	Partial Eta Squared
Corrected Model	19.707 ^a	2	9.854	.180	.836	.012
Intercept	2012.167	1	2012.167	36.845	.000	.551
Pre-test	13.080	1	13.080	.240	.628	.008
Gender	6.862	1	6.862	.126	.725	.004
Error	1638.353	30	54.612			
Total	135804.000	33				
Corrected Total	1658.061	32				

a. R Squared = .012 (Adjusted R Squared = -.054)

From Table 8, $F(1, 30) = .126$, $P > 0.05$, partial $\eta^2 = .004$. Since the p-value of .725 is greater than the 0.05 level of significance, the null hypothesis was retained.

Discussion of findings

Findings with respect to hypotheses 1

There was a significant effect of peer tutoring instructional strategy on students' achievement in genetics. Since P value 0.000 is less than 0.05 level of significance, so the null hypotheses was rejected, indicating that there was a significant effect of peer tutoring Instructional strategy on students' achievement in genetics, students exposed to peer tutoring did better than their counterpart who were denied the treatment. This is in conformity with studies carried out by Inyang (2019) whose studies find out that peer tutoring instructional strategy could be used to enhance students' acquisition and retention in order to improve students' achievement in chemistry. (Manisha, Sharma, and Parika, 2020) whose studies found that peer tutoring enhances students' achievement at the secondary level. (Alegre, moliner, maroto and Lorenzo, 2020) whose studies reveal that peer tutoring instructional strategy increase students' achievement in biology.

Findings with respect to hypotheses 2

There was a significant effect of peer tutoring instructional strategy on students' self-esteem in genetics since P value of 0.000 is less than 0.05 level of significance so the null hypotheses were rejected indicating that there was a significant effect of Peer Tutoring Instructional Strategy on students' self – esteem in genetics. The result of the study agreed with studies carried out by Manish, Sharma, and Parika (2020) whose studies found out that students' confidence and self-esteem was boated when physics

students were exposed to reciprocal peer tutoring achieve better than those that were denied the treatment.

Findings with respect to hypotheses 3

The result indicates that the achievement of male students in genetics do not significantly differ from those of females students since the p-value of .146 is greater than the 0.05 level of significance, the null hypotheses was retained no significant difference in academic achievement between boys and girls, the result is in conformity with (Adesoji, Omilami, and Nyiebi, 2015), who argued that so far there is no biological evidence that boys have innate superior intellectual abilities more than girls, so if differences in achievement occur, they may be cause by other factors.

Findings with respect to hypotheses 4

There was no significant difference between male and female mean self esteem score when taught Peer tutoring Instructional strategy on student' self-esteem in genetics since P value of .725 is greater than 0.05 level of significance so the null hypotheses was retained indicating that the self esteem of male students in genetic class do not significantly differ from those of female hence Peer tutoring Instructional strategy is gender friendly. Base on these findings Peer Tutoring Instructional Strategy is a proven pedagogical strategy effective at improving students' achievement and self-esteem in genetics in Plateau north.

Conclusion

Peer Tutoring Instructional Strategy is a proven pedagogical strategy effective at improving students 'achievement and self-esteem in genetics in plateau north and can be useful in science education. This is evidence by the results of this study reported.

Recommendations

1. Biology Teachers in Plateau state should emulate this method to teach genetics to help student overcome the challenge they face in this area of biology
2. The use of Peer Tutoring Instructional Strategies is highly recommendable due to its usage to promote students' self esteem in a genetic classroom; Science teachers should utilize peer tutoring strategies in their lesson delivery for the enhance students' achievement in sciences to overcome the poor achievement in public examinations.

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