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EFFECT OF THINK-PAIR-SHARE INSTRUCTIONAL STRATEGY ON SENIOR SECONDARY TWO STUDENTS' ACHIEVEMENT IN GENETICS IN ABUJA, NIGERIA

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ABSTRACT

The study investigated the effect of think-pair-share instructional strategy on senior secondary two (SS 2) students' achievement in genetics in Abuja, Nigeria. The research adopted the non-randomized pre-test, post-test quasi-experimental control group research design. The population of the study consisted of 1100 SS2 students. A sample of 224 students from two co-educational senior secondary schools (one public school and one private school) was used. Three research questions and three hypotheses guided the study. Think-pair-share instructional strategy was used to teach the experimental group the concept of Genetics while the lecture method was used to teach the control group the same concepts. The instrument used for data collection was a Students' Genetics Achievement Test (SGAT) with reliability index 0.99 established using Kuder Richardson's formula 21. Data collected from the participants were analyzed using Statistical package for Social Sciences (SPSS). Mean and standard deviation were used to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance. Findings revealed a significant difference between the achievement mean scores of students taught genetics using think-pair-share strategy and those taught using lecture method ($F(1,108) = 651.49$, $p < 0.05$). With respect to gender, there was no significant difference between the achievement mean scores of male and female students taught genetics using think-pair-share strategy ($F(1, 55) = .597$, $P > 0.05$). Furthermore, school type was found not to be significant in respect of achievement mean scores of students taught genetics using think-pair- strategy Based on the findings, it was concluded that the think-pair instructional strategy has the capacity to enhance students' achievement in genetics. Moreover, the strategy is both gender and environment-friendly. The study therefore, recommended among others that biology teachers should incorporate the think-pair-share instructional strategy into their techniques for enhanced achievement outcomes in biology, and particularly, genetics.

Keywords: Achievement, Genetics, Think-Pair- Share Instructional Strategy

INTRODUCTION

Biology is one of the basic science subjects which deals with the study of life. It provides an in-depth scientific understanding of how all living and non-living organisms interact with one another. Genetics, a branch of biology that deals with heredity and variation of organisms, the genetic make-up and phenomena of an organism, forms one of the central pillars in biology and overlaps with many other areas such as Agriculture, Pharmacy, Medicine and Biotechnology. As Nigeria aspires for technological growth, the study of genetics and biology generally at the senior school level of education needs to be given adequate attention. This is because the study of biology at this level is the bedrock for further studies, given its application in the fore-started fields, and many other fields and professions.

Despite the relevance of biology to humans and the technological development of the nation, achievement of students in the subject has consistently remained unimpressive (Abimbola, 2013; Fernando & Marikar, 2017; Awodun, Adekunle & Femi-Adeoye, 2019); Poor achievement of students in biology has been attributed to different factors which, according to Abimbola (2013); Omorogbe and Awasila (2013) include the use of ineffective teaching approaches in biology classrooms, dearth

of qualified teachers, as well as, the abstract and difficult nature of biology concepts, such as, ecology, evolution and genetics.

It has been acknowledged that think-pair-share strategy is one of the leading innovative strategies of teaching that could enhance students' academic achievement especially in biology (Lyman in Abdulrahman, 2015). Think-pair-share strategy helps to engage male and female students actively in learning, in such a way that their phobia to genetics on account of its difficult and abstract nature is done away with. The persistent under achievement in biology particularly, genetics concept by students made it imperative to search for innovative teaching strategies for effective teaching and learning of the said concepts which could enhance students' achievement in biology. The chief examiners' report of the West African Examination Council (2020) revealed that the overall achievement of candidates in biology did not show any remarkable improvement over those of the previous years. The reports further indicated that candidates had difficulties in answering questions on genetics. Apart from the fore-going factors, poor achievement in biology and genetics in particular, at the secondary school level has also been attributed to school type and gender-related issues. However, research findings show inconclusiveness with regard to these variables. For instance, findings from studies conducted by Obekpa (2013) Okafor (2016) and Ozoji (2020) showed no gender disparities between achievement of male and female students when active and innovative strategies were used in science instruction. On the contrary, these findings are at variance with those of Nnamani and Oyibe (2016) and Eze (2016) which revealed that the achievement mean scores of female students were higher than those of male students in biology. A study by Mijinyawa and Yeldu (2017) revealed that students in private schools achieved significantly higher than their counterparts in public schools in biology, chemistry and biology examinations. On the contrary, the study by Olutola (2020) showed that students in public schools achieved significantly higher than those in private schools in biology. Hence, the need for more empirical studies due to the conflicting findings.

This study was therefore carried out to investigate the effect of think-pair-share instructional strategy on senior secondary two students' achievement in genetics. The study was guided by the following research questions and hypotheses:

Research Questions

1. What are the pre-test and post-test achievement mean scores of SS2 students in experimental and control group?
2. What are the post-test mean genetics achievement scores of SS2 male and female students in the experimental group?
3. What are the pre-test and post-test mean achievement scores of students in public and private schools in the experimental group

Hypotheses

1. There is no significant difference between the post-test achievement mean scores of SS2 students in the experimental and control groups.
2. There is no significant difference between the achievement mean scores of SS2 male and female students in the experimental group.
3. There is no significant difference between the post-test achievement mean scores of SS2 students in experimental group in public and private schools.

METHOD

The study employed the non-randomized pre-test, post-test quasi-experimental control group research design. A sample of 224 senior secondary two students from two public and two private senior secondary schools was taken from the students' population of 1100 using stratified sampling technique. Researchers' developed instrument namely, Genetics Achievement Test (GAT) was used to collect data from the students. The instrument was validated by three experts from the

University of Jos (two from Biology Education unit of the Department of Science and Technology Education and one from Research, Measurement and Evaluation unit of the Department of Educational Foundations. The instrument was pilot tested using Kuder Richardson (K-R21) which yielded a coefficient of 0.78. Think-pair-share strategy was used to teach the experimental group for eight weeks while the lecture method was used to teach the control group the concepts of genetics. Data were collected after the teaching period and analyzed using Statistical Package for Social Services (SPSS). Mean and standard deviation were used to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the three hypotheses at 0.05 level of significance.

RESULTS

Research Question One

What are the pre-test and post-test achievement mean scores of SS2 students in experimental and control groups?

Table 1

Pre-test and Post-test Achievement Mean scores of SS2 Students in the Experimental and Control Groups

Group		Pre-test		Post-test			
	N	Mean	SD	Mean	SD	Mean Gain	$\bar{x}$- difference
Experimental	58	24.17	7.47	64.60	7.75	40.43	34.82
Control	53	22.81	6.31	28.42	9.45	5.61	

Table 1 reveals the pre-test and post-test achievement mean scores of SS2 students in the experimental and control groups. From the results, the experimental group had a post-test achievement mean score of 64.60, with a SD of 7.75 and a pre-test mean score ($\bar{x}$=24.17, SD =7.47) with a mean gain of 40.43, indicating that there was improvement in the achievement of students after treatment. For the control group, the mean score was 22.81 and a standard deviation of 6.31 in the pre-test. The findings show that students in the experimental group had a higher mean score (64.60) after treatment using think-pair-share instructional strategy than those in the control group (28.42) who were not given treatment with a mean difference of 34.82.

Research Question Two

What are the post-test genetics achievement mean scores of SS 2 male and female students in the experimental group?

Table 2

Post-test Genetics Achievement Mean Scores of Male and Female Students in Experimental group

Group	Gender	N	$\overline{X}$	SD	$\overline{X}_{Diff}$
Experimental	Male	28	65.25	5.99	1.25
	Female	30	64.00	9.16	

Table 2 shows the post-test mean and standard deviation scores of male and female students in the experimental group. The table recorded a post-test mean score of 65.25 and a standard deviation of 5.99 for male, while the female recorded a post-test achievement mean score of 64 and a standard deviation of 9.16.

Research Question Three

What are the pre-test and post-test genetic achievement mean scores of SS2 students in public and private schools in the experimental group?

Table 3
Mean and Standard Deviation of Achievement Mean Scores of Students in Genetics in the Experimental Group based on School Type

Group	Gender	N	Posttest		$\bar{X}_{Diff}$
			X	SD	
Experimental	Private	29	65.41	7.60	1.62
	Public	29	63.79	7.94	

Table 3 shows the mean and standard deviation of post-test Achievement mean scores of public and private school students in the experimental group. The mean scores are 65.41and standard deviation of 7.60 for private school students, and a mean of 63.79 and standard deviation of 7.94 for private school students after treatment. This indicates a mean difference of 1.62. This implies that private school students achieved better than counterparts in public-school counterparts in Genetics when taught using think-pair-share instructional strategy.

Hypothesis 1**:** There is no significant difference between the achievement mean scores of SS2 male and female students in the experimental group.

Table 4
Summary of ANCOVA result on Posttest Achievement Mean Scores of Experimental and Control Groups in Genetics

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	38684.288[a]	2	19342.144	369.462	.000	.872
Intercept	8188.406	1	8188.406	156.410	.000	.592
Pre	2416.711	1	2416.711	46.163	.000	.299
Group	34107.008	1	34107.008	651.492	.000	.858
Error	5654.036	108	52.352			
Total	292933.000	111				
Corrected Total	44338.324	110				

a. R Squared =.872 (Adjusted R Squared =.870)

Table 5
Result of Sidak Post hoc Comparison between the Achievement Mean Scores of students in the Experimental and Control Groups

I Experimental	J Control	X-diff. (I – J)	Std. Error	P value
64.16	28.89	35.27	1.38	0.000

P<0.05

Analysis of Covariance (ANCOVA) was employed to determine if a significant difference existed between achievement mean scores of the SS2 students in Genetics in the experimental and control groups. Table 4 shows that $F(1,108) = 651.49$, $p < 0.05$, partial $\eta 2 = .870$. Since the p value of 0.000 is less than 0.05 level of significance with an effect size of 87%, the null hypothesis was rejected, indicating that there was a significant effect of think-pair-share instructional strategy on students' achievement to Genetics. The result further reveals an adjusted R squared value of .872, which means that 87.2 percent of the variation in the dependent variable which is students' achievement is explained by variation in treatment, while the remaining is due to other factors not included in this study. The Sidak post hoc test in Table 5 confirmed that the corrected difference between experimental group and control group was statistically significant, (I - J) =35.27. Hence, it

could be said that think-pair-share instructional strategy improved students' achievement mean score in Genetics.

Hypothesis Two

There is no significant difference between the achievement mean scores of SS2 male and female students in the experimental group.

Table 6

Summary of ANCOVA Result on Post-test mean Achievement scores in Genetics in the Experimental Group based on Gender

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2212.638[a]	2	1106.319	50.236	.000	.646
Intercept	9858.544	1	9858.544	447.656	.000	.891
Pre-test	2190.009	1	2190.009	99.444	.000	.644
Gender	13.158	1	13.158	.597	.443	.011
Error	1211.241	55	22.023			
Total	245493.000	58				
Corrected Total	3423.879	57				

a. R Squared =.646 (Adjusted R Squared =.633)

Data on achievement scores of students in Genetics was subjected to a one-way analysis of variance (ANCOVA) having two levels of gender (male, female). Table 6 shows that the effect of gender was found not statistically significant at the 0.05 level of significance. The main effect of gender yielded, male (M =65.25; SD = 5.99) and female (M = 64.00; SD =9.16); and F (1, 55) =.597, P > 0.05. Since P-value of .443 is greater than the 0.05 level of significance. It indicates that the mean achievement score of male students did not significantly differ from that of female students in Genetics, this shows that the effect of gender was statistically insignificant.

Hypothesis Three

There is no significant effect of think-pair-share strategy on the post-test mean achievement scores of SS2 students in experimental group in public and private schools.

Table 7

Summary of ANCOVA Result on Posttest mean Achievement of Experimental Group in Genetics based on School Type

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2213.717[a]	2	1106.859	50.305	.000	.647
Intercept	9858.541	1	9858.541	448.056	.000	.891
Pre-Achievement	2175.631	1	2175.631	98.879	.000	.643
School type	14.237	1	14.237	.647	.425	.012
Error	1210.162	55	22.003			
Total	245493.000	58				
Corrected Total	3423.879	57				

a. R Squared =.647 (Adjusted R Squared =.634)

Analysis of Covariance (ANCOVA) was employed to determine if there was a significant effect of think-pair-share strategy on the post-test achievement mean scores of SS2 students in experimental group in public and private schools. The result on Table 7 shows that the effect of school type was found to be statistically significant at the 0.05 level of significance. The main effect of school type yielded a mean score of 63.79 and standard deviation of 7.94 for public school students, while private school students have a mean score of 65.41 and standard deviation of 7.60 with F (1, 55) =.647, P = 0.425. Since the P-value of .425 is greater than the 0.05 level of significance. This indicates that the achievement mean score of public schools students was not

significantly different from that of private schools. This shows that the effect of school type was not statistically significant.

DISCUSSION

The findings of the study revealed that think-pair-share strategy was effective in improving the achievement of SS2 students in genetics. For instance, the students in experimental group scored higher marks in genetics than students in control group irrespective school type or gender. This may be attributed to the fact that the students in experimental group were engaged in critical thinking and reflection and as such, gained a better insight into the topics being taught than students in control group. This clearly indicated that the use of think-pair-share strategy had significant effect on the students' achievement in genetics. Think-pair-share strategy enabled students to relate parts of the topic to the whole and thereby, facilitated understanding of the concept of genetics. The result in Table 4 revealed that the achievement mean scores of students in experimental group was higher than that of students in control group. This means that there was a significant difference between the achievement mean score of students in the experimental group and that of the control group. Therefore, the null hypothesis was rejected. This finding agrees with the finding of Ogundiwin, Asaaju, Adegoke and Ojo (2015); Achor and Agamba (2016); Ezra and Agah (2019) which revealed that students in the experimental group achieved higher than those in the control group in biology achievement.

Result in Table 6 indicated that there was no significant effect of gender on the achievement mean scores of SS2 students in the experimental group. The result showed that the achievement mean score of senior secondary two male and female biology students in experimental group did not differ significantly. The finding corroborates those of Obekpa (2013) Okafor (2016) and Ozoji (2020) which showed no gender disparities between achievement of male and female students when active and innovative strategies were used in science instruction.

However, the finding of this study is at variance with that of Nnamani and Oyibe (2016) and Eze (2016) which revealed that the achievement mean score of female students was higher than that of male students in biology.

With regard to the achievement of students in public and private schools who were taught genetics with think-pair-share strategy, results on Table 7 indicated that the achievement mean score of public schools' students was not significantly different from that of students in private schools. This shows that the effect of school type was not statistically significant in students' achievement in genetics. This means that what is important in science instruction is exposing students to interactive, collaborative and innovative activities that are capable of engaging them in higher order thinking for enhanced learning outcomes.

CONCLUSION

Based on the findings of the study, the researchers concluded that the use of think-pair-share instructional strategy enhanced students' achievement in genetics. The implication is that the persistent poor achievement of students in genetics could be improved upon if biology teachers incorporate effective and innovative strategies such as think-pair-share strategy in their instructional delivery. Furthermore, the think-pair-share instructional strategy was rewarding to students (in terms of achievement) regardless of gender and school type.

RECOMMENDATIONS

From the findings of the study, the following recommendations were made:

1. Biology teachers should incorporate think-pair-share instructional strategy which provides students the opportunity to share ideas and cognitions with their peers in biology' classrooms.
2. The think-pair-share should be used as an environment and gender friendly strategy to improve students' achievement in biology and genetics in particular.

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