



Effect of Think Pair Share and Group Investigation Cooperative Learning Strategies on Students' Performance in Biology in Ekiti State Nigeria.

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Abstract:

The study investigated the effect of Think Pair Share and Group Investigation Cooperative strategies on students' academic performance in Biology in Ekiti State. It also studied the moderating effect of mental ability and gender on academic performance. The research adopted quasi-experimental design 3x3x2 factorial matrix. A sample of 142 students from six intact classes was purposively selected from Ekiti West Local government. The instruments used were Biology Performance Test (BPT), Mental Ability Test (MAT). Kuder Richardson (KR-20) was used to obtain the reliability and the values of 0.82 for BPT and 0.78 for MAT were obtained. Data were analysed using Analysis of Covariance (ANCOVA) and multiple classification analysis. The findings of the study revealed a significant main effect of treatment on students' academic performance. Based on the findings, it was recommended that Biology teachers should employ the strategies to improve student performance.

Keyword: Think Pair Share, Group Investigation, Cooperative Learning, Performance, Mental Ability and Gender

Introduction

The development plans of many nations both developed and developing for advancement and prosperity is centred on science and technology. This had led to the production of scientifically literate among a sizeable proportion of the society. For Nigeria to expedite her development in the 21st century, she needs qualitative science education in schools, especially Secondary Schools. Science is a systematic process that builds and organizes knowledge in form of explanations and predictions about the universe. It can also refer to as the organized body of knowledge in form of concepts, laws, theories, and generation (Ayoola & Owolabi, 2018). Biology is one of the major science subjects in the Nigerian school system. It is broadly defined as the study of life in terms of its function and structure (Adeleye, 2020). Federal Ministry of Education (FME, 2013) clearly stated the main objectives of biology curriculum as provided in the National policy on education (NPE, 2011) as to prepare the students to acquire meaningful and relevant knowledge in biology, ability to appropriate scientific knowledge to human activities. Despite the importance of this subject, the performance of students in Biology at the West African Examination Council and National Examination council is worrisome (Ogunleye, 2019, Adeleye & Omotayo, 2020). The use of traditional teacher centred-method for teaching biology by the

teacher has been considered by researchers as one of the factors that have contributed to this poor performance of Biology students (Ogundiwin, 2016). It seems the traditional teaching method is inadequate for biology teaching as it seems it leads to rote learning and the inability to apply knowledge gained to the new situation. Therefore, there is a need for a more interactive approach to the teaching Biology.

Cooperative Learning is one of the student-centred teaching methods which comprises instructional methods in which teachers organize students into small groups, which then work together to help one another learn academic content (Slavin, 2011). When students work together in a team to achieve the same goal, it produces a good learning environment, lively participation; develops oneness that helps group members succeed by helping each other to achieve a common goal.

Think-Pair-Share (TPS) is a type of cooperative learning strategy that allows students to engage with materials on an individual level, in pairs, and finally as large group. It involves the following steps: the first step, groups of students listen to the problem proposed by the teacher. Secondly, individual students are given time to think and then write their responses. Thirdly, pairs of students read and discuss their responses. Finally, a few students are called on by the teacher to share their thoughts and ideas with the whole class. The questions are based on the pre-class assignment



previously given to the students. The students then engage in class-wide discussion on the concept questions, which foster collaboration and emphasizes conceptual understanding. TPS learning help students with different ability to work together to solve problems (Didimus & Duran, 2014).

Group investigation is another cooperative learning strategy formed on common interest that emphasizes more student choice and control of their learning. Students are involved in planning what to study and how to investigate. Cooperative groups are formed on the basis of common interest in a particular aspect of a general topic. All group members help to plan how to research the topic and divide the work among themselves. Then each member carries out his/her part of the investigation. The group synthesizes and summarizes the work and presents their findings to the class (Ogunleye, 2019 cited Sharan & Sharan 1990).

Mental ability is another important variable that can influence students' performance in Biology. It is the capability of students to demonstrate certain knowledge depending on the nature of the situation in which the individual first has the chance to construct the items of knowledge and the requirements of the learning material. That is; the level of intellect or cognitive development of students to cope with the learning in the classroom. If students lack a proper mental level of comprehension and application, it will be difficult for them to apply knowledge in the classroom.

Furthermore, the research on gender and performance in science has been vast but inconclusive. Some researchers have reported a significant difference to exist between the performance of male and female students (Omotayo, Adedayo & Ayeni, 2014 and Owioye, 2017). While some reported that there is no significant effect of gender on students' academic performance (Eya, Okebanama & Umate, 2020). Due to this conflicting result, more study is still needed on the effect of gender on students' academic performance. It is against this background that this study embarked upon to investigate the effects of the Think-pair-share and Group Investigation cooperative learning strategies with moderating effect of mental ability and gender differences on students' performance in Biology.

Statement of the Problem

There has been a trend of poor performance in biology in Senior Secondary Certificate Examination results (SSCE) conducted by the West African Examination

Council (WAEC). And yet, it seems that the conventional teaching method is mostly employed by teachers in our Senior Secondary School. There is no doubt that the method is inadequate for students to actively participate in the classroom as they hardly contribute meaningfully to the lesson or benefit maximally from it. Although research work in Biology Education has been geared up to tackle this challenge that is responsible for student's failure in the subject little attention has been drawn to cooperative learning strategies. Hence this study investigated the effect of Think-pair-share and Group Investigation and Conventional method (the control) on Senior Secondary School Biology. The study also investigated the moderating effect of mental ability and gender on performance in Biology.

Purpose of the study

This study investigated the effect of Think-pair-share and Group Investigation Cooperative learning strategies had on the academic performance of students in Biology in senior secondary schools. Specifically, the study was designed to:

1. Determine the effect of Treatment on students' academic performance in Biology.
2. Determine the influence of gender on students' academic performance in Biology
3. Determine the influence of mental ability on students' academic performance in Biology
4. Determine the interaction effect of treatment and gender on students' academic performance in Biology.

Hypothesis

H₀₁: There is no significant effect of treatment on students' academic performance in Biology

H₀₂: There is no significant influence of gender on students' academic performance in Biology

H₀₃: There is no significant influence of mental ability on students' performance in Biology

H₀₄: There is no significant interaction effect of treatment and gender on students' academic performance in Biology.

Methodology

Research Design

The study employed quasi-experimental design since the subject cannot be totally controlled using a 3x3x2 factorial matrix. The pattern of the design is shown below:

P ₁	E ₁	P ₂
P ₃	E ₂	P ₄

 P_5 E_3 P_6

Where P_1 , P_3 and P_5 are pre-test scores of experimental and control groups respectively.

P_2 and P_4 , P_6 are post-test scores of experimental and control groups respectively.

E_1 is the Experimental group one (Think Pair Share).

E_2 is the Experimental group two (Group investigation)

E_3 is the control group (Conventional Teaching method).

Participants in the study

Senior secondary school one (SSS1) students were used for the study. Six schools were purposively selected from Ekiti-West Local Government Area in Ekiti-State. One intact class was selected randomly from the SSS1 classes in each school. Schools that were selected for experimental and control groups were purposively selected based on the following criteria:

1. The schools were public and co-educational that had been offering candidates for WAEC and NECO for at least seven years without interruption in Ekiti-State
2. The schools have qualified and experienced Biology Teacher with at least three years of experience
3. Willingness of the students and Biology Teacher to participate in the study
4. Having a well-equipped and functioning library
5. Easily accessible to the researcher

Research Instruments

Two instruments were used for the study to collect data which include: Biology performance Test (BPT), Mental Ability Test (MAT). BPT was developed by the researcher and was divided into two sections. Section A consists of the personal data while Section B consists of 22 multiple-choice items with four options A-D to measure the knowledge acquisition level of students on topics using for the study. MAT is 30 items 4-option multiple-choice test adapted from the Australian Council for Educational Research standardized Mental Ability Test (ACER Ability Test).

Validity and Reliability of the Instruments

The face and content validity of BPT was done by science educators to determine its suitability. The reliability coefficient of 0.82 was obtained using Kuder Richardson (KR-20). MAT reliability was also determined using Kuder Richardson (KR-20) and the value obtained was 0.78.

Experimental Procedure

One week was used by the researcher to visit the selected schools and trained their biology teacher on how to use the instructional guides for the experimental and control groups to enable them acquire the necessary competencies required for implementing the different treatment conditions. Another week was used for the selection of experimental and control groups and administration of pretest on the participating students using the following instruments BPT and MAT. Six weeks was used for treatment (Think Pair Share instructional guide and Group Investigation instructional guide) on the experimental groups and control group (Conventional Teaching Method instructional guide) teaching Living and Non-living things, Plants Nutrition, Animal Nutrition, Food Test, and Mode of Nutrition. After the treatment, one week was used for the post-test administering BPT to ascertain the effect of the treatment.

Method of Data Analysis

Data collected were analyzed using inferential statistics of Analysis of Covariance (ANCOVA) of the post-test scores with the pre-test scores as the covariates. Multiple classification analysis was used to determine the estimated marginal means of different groups.

Result and Discussion

Hypothesis 1

There is no significant effect of treatment on students' academic performance in Biology

Table 1: Analysis of co-variance (ANCOVA) of the post-test performance of students by treatment.

Source	sum of square	DF	Mean Square	F	Sig.	Eta ²
Corrected Model	1195.300	12	99.610	9.000	.000	.500
Pre Achievement	456.200	1	456.200	40.310	.000	.240
Treatment	198.600	2	99.300	8.800	.000	.120
Error	1460.100	130	11.200			
Total	2655.400	142				



(R-squared=.500, Adjusted R-squared=.400)

The result indicated that there was a significant main effects of treatment groups on the students' post-test performance scores ($F(2,130)=8.800$, $P < .05$, $n^2 = .120$). The effect size of 12.0% was fair. Hence, null hypothesis is rejected. To find out the magnitude of

the mean scores of the group performance, the table 2 is presented as follows:

Table 2: Estimated Marginal Mean of the Treatment group on Students' performance in Biology

Treatment Groups	N	Mean	Std Error
Group Investigation Strategy	48	12.00	.500
Think-Pair-Share Strategy	55	12.30	.470
Conventional Teaching Method	39	9.00	.600

Based on the estimated marginal mean Think Pair Share learning strategy and Group Investigation had higher mean scores ($x=12.30$ and $x=12.00$ respectively) than conventional teaching method.

Hypothesis 2: There is no significant effect of gender on students' academic performance Biology.

Table 3: Analysis of co-variance (ANCOVA) of the post-test performance of students by Gender.

Source	sum of square	DF	Mean Square	F	Sig.	Eta ²
Corrected Model	1195.300	12	99.610	9.000	.000	.500
Pre Achievement	456.200	1	456.200	40.310	.000	.240
Gender	8.570	1	8.570	.757	.386	.006
Error	1460.100	130	11.200			
Total	2655.400	142				

(R-squared=.500, Adjusted R-squared=.400)

From table 3 above, there was no significant main effect of gender on students' performance in biology ($F(1,130)=.757$, $P>.05$, $n^2=.006$). The effect size of 0.6% was negligible. Therefore, null hypothesis was not rejected.

Hypothesis 3: There is no significant main effect of mental ability on students' performance in Biology

Table 4: Analysis of co-variance (ANCOVA) of the post-test performance of students by Mental Ability.

Source	sum of square	DF	Mean Square	F	Sig.	Eta ²
Corrected Model	1195.300	12	99.610	9.000	.000	.500
Pre Achievement	456.200	1	456.200	40.310	.000	.240
Mental ability	13.050	1	13.050	1.200	.300	.010
Error	1460.100	130	11.200			
Total	2655.400	142				

(R-squared=.500, Adjusted R-squared=.400)

The result in table above showed that there was no significant main effect of Mental Ability on the post-test performance score of students in Biology ($F(1,130)=1.200$, $P>.05$, $n^2=.010$). The effect size of 0.1% was negligible. Therefore, null hypothesis is accepted.

Hypothesis 4: There is no significant interaction effect of treatment and gender on students' academic performance in Biology.

Table 5: Analysis of co-variance (ANCOVA) of the post-test performance of interaction effect of treatment and gender of students.

Source	sum of square	DF	Mean Square	F	Sig.	Eta ²
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Corrected Model	1195.300	12	99.610	9.000	.000	.500
Pre Achievement	456.200	1	456.200	40.310	.000	.240
Treatment x gender	83.200	2	41.600	3.700	.030	.080
Error	1460.100	130	11.200			
Total	2655.400	142				

(R-squared=.500, Adjusted R-squared=.400)

From table 5 above, the interaction effect of treatment and gender on students' performance biology was statistically significant at ($F(2,130)=3.673$, $P>.05$, $n^2=.077$). The effect size of 7.7% is small but not negligible. Therefore, the null hypothesis stated there is no significant interaction effect of treatment and gender on students' academic performance in biology was rejected.

Discussion

The focus of this study was to investigate the effect of Think Pair Share (TPS) and Group Investigation (GI) Cooperative Learning Strategies on Students' Performance in Biology. The finding revealed that these learning strategies (GI and TPS) had significant effects on students' performance in biology. Those exposed to TPS had the highest performance mean score followed by GI and the least performance mean score was found in conventional teaching method. This showed that students in TPS group performed better than students in GI and Conventional method. This might be as a result of the fact that the students were able to reflect, converse and share their thought with each other which enhance good understanding and learning. It may also due to the opportunity given to the low achieving students to benefit maximally from high achieving students. As rightly observed by Ogunleye (2019 cited Grace and Raheem 2011), that when learning task involves complex learning and problem solving skills, cooperation leads to higher performance especially among students with low and high achieving students. It may also be as a result of the reason given by Didimus and Duran, (2014) that TPS enhances the student social interaction, metacognitive ability, creative thinking skills as well as cognitive abilities that are important for learning because higher mental functions, such as reasoning, comprehension and critical thinking, originate in social interactions and are then internalized by individuals, thus TPS provides the social support and scaffolding that students need to move learning forward. The students in GI group performed better than those in the conventional method might be because they were free to put down their ideas without the teacher's interruption which enables them to learn better from

one another. It may also be a result of the fact that the strategy helped the students in the groups to create knowledge through the transformation of experience. The students were helped by the strategy to learn through reflection on doing i.e. active participation, which focuses on the learning process in which student help each other to learn. This finding was in agreement with the finding of Kingdom, Etokeren and Okwelle (2019); Emmanuel, Musa and Zipporah (2013); Vandattra, (2013) and Didimus and Duran, (2014) who confirmed that students who were taught by cooperative learning methods learnt and retained significantly more information than students taught by conventional teaching methods.

Furthermore, the study showed that gender has no significant effect on students' academic performance. This finding disagrees with the finding of Omotayo, Adedayo and Ayeni, (2014). However, is in agreement with the finding of Eya, Okebanama and Umate (2020) who's reported that there is no significant effect of gender on student academic performance. The reason for the insignificant difference could be attributed to the fact that the instructional strategies used which was learner-centred and provided equal learning opportunities for both sexes. Both males and females were given the same opportunity to participate actively in all the processes of the two instructional strategies without discrimination and this makes them gain equal knowledge.

The study also revealed that there was no significant difference of mental ability on students' academic performance. This may be as a result of peering the two groups of student together during the study which resulted in social interaction that improve the performance of low mental ability group. Another reason may be the liberty to proceed or recede and collaboration among low and high mental ability students which allow self-pacing, an important fact to enable learners to learn according to their individual pace and that will insure both groups of students to perceive information equally. This is in agreement with the findings of Ogunleye, (2015) and Johnson and Johnson cited by Grace and Raheem (2011) that cooperation helps students with low mental ability to improve their performance with the help of high mental ability students.



Lastly, the study showed that the treatment and gender has a significant interaction effect on students' academic performance in biology. This is in agreement with of Ogunleye (2019) but disagreed with Ogundiwin (2013) and Oladiran (2014).

Conclusion

The results of the study have shown that Think Pair Share and Group Investigation Cooperative learning strategies are more effective in enhancing students' academic performance in Biology than the conventional method. Think Pair Share and Group Investigation produced better performance in biology than the convention method. This means that the trend in poor academic performance caused by inadequate traditional teaching methods could be effectively tackled through the use of Think Pair Share and Group Investigation Strategies.

Recommendations

In view of these findings it was recommended that biology teacher should be made to recognise the potentials of Think Pair Share and Group Investigation Cooperative Learning Strategies and utilize them for better performance of students in Biology. Also teaching strategies like Cooperative Learning that reduce the gender and mental ability difference in biological concepts performance as recorded in this study could be used to reduce learning anxiety for both male and female students.

References

- Adeleye, A.M. & Omotayo, K.A. (2020). Effects of Spaced and Blended Learning on Senior Secondary School Student's Interest in Biology in Ekiti State. *Euro Afro Studies International Journal*. Retrieved from <https://www.easij.com/all-issues/>
- Ayoola, Y.A. & Owolabi, O.T (2018).Effects of inquiry-Based Method and Computer-Assisted-instruction on students' performance in Physics in Nigeria Federal Government College.*Journal of research in science education*, 2-(1)
- Didimus, T.B. & Duran, A.C. (2014). Cooperative learning models having better potency to improve social attitude of multiethnic Senior high School Students at Samarinda Indonesia. *Journal of Educational Research and*
- Reviews*,2-(3) 36-44. Retrieve on August 2014 from <http://sciencewebpublishing.net/jerr>
- Emmanuel, E.A., Musa, H. W. & Zipporah, P.D. (2013). Do cooperative learning strategies have the potentials to eliminate Gender differences in Students, achievement in Biology? Effect of STAD and Jigsaw cooperative strategies; *Journal of Science Technology, Mathematics and Education* 10.1:136-146. Retrieved from www.tandfonline.com on July 2014.
- Eya, N.M., Okebanama, C.L. and Umate, B.A. (2020). Chemistry Students' Conceptual Understanding of Rate of Chemical Reaction and Equilibrium Using Two Tiers Multiple Choice Test. *African Journal of Science Technology and Mathematics education*,5-(1) 21-27
- Federal Ministry of Education, (2013).*Senior secondary school curriculum: biology for senior secondary school*. Abuja: Educational Research and Development Council(NERDC).
- Graceful, O.O. and Raheem, A.L. (2011). Cooperative instructional strategies and performance levels of Students in reading comprehension. *International Journal of Science Education* 3-(2):103-107
- Kingdom- Aaron, G. I., Etokeren, I. S. and Okwelle, P. C. (2019). Effect of Cooperative Learning Strategy on Biology Students' Academic Performance in Senior Secondary School in Rivers State. *Journal of Scientific Research and Report* 23-(6):1-11. Retrieved from www.journaljsrr.com.
- Ogundiwin O. A (2013).*Effect of pre-theoretic intuition quiz and puzzle-based critical thinking motivation strategies on students learning outcomes in selected environment related concepts, in biology*.Unpublished Ph.D Thesis University of Ibadan.38-40.
- Ogundiwin, O.A. and Ahmed A. A. (2016).Effects of meaning focus, practice and invention, strategies on problem-solving skills of senior secondary school students in ecology.*Journal*



of Education and Policy Review, 7-(1): 28 – 48.

Ogunleye, A.T. (2019), Effects of Thought-Peer-Review and Peer Investigation on Students' Academic Performance in Biology in Ekiti State, *Journal of Science Education*, 14-(2): 69-76

Oladiran, O. (2014). Effect of Outdoor classroom and pictorial presentation instructional strategies on students' achievement and attitudes to Biology. An unpublished M.Ed dissertation, department of Teacher Education. University of Ibadan.

Omotayo K.A, Adedayo J.O and Ayeni M.F (2014). Science Education Reform Effort: Effect of Utilising Laboratory Method of Instruction on Students' Performance in Science. *Asian Journal of Education and e-learning* 2-(3)

Slavin, R.E. (2011). *Instruction Based on Cooperative Learning*. in R. Mayer (Ed), *Handbook of Research on learning and Instruction*. London: Taylor & Francis.

Vandrattan, T.(2013). Effects of Student teams achievement Division (STAD) on academics achievement and attitudes of Grade 9th Secondary School Students Toward Mathematics. *International Journal of Science*. Retrieved on www.ijsciences.com