



Effects of Class Wide Peer Tutoring and Reciprocal Peer Tutoring on Students' Academic Achievement in Biology in Secondary Schools in Ogoja Education Zone

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Abstract

This study investigated the effects of Class Wide peer tutoring (CWT) and Reciprocal Peer Tutoring (RPT) on students' academic achievement in Biology in secondary schools in Ogoja Education Zone. Three research questions were posed and three hypotheses were formulated and tested at 0.05 probability level. Quasi experimental 2 x 2 factorial design was adopted for the study. The population of the study consisted of 1450 SSII Biology students with a sample size of 78. Purposive sampling technique and simple random sampling technique were used. The instrument used was Biology Achievement Test (BAT). The research questions were answered using mean and standard deviation, while Analysis of Covariance (ANCOVA) was used to test the hypotheses. The findings showed that there was a significant difference in the mean achievement scores of students taught using CWT strategy and those taught using the RPT and it is in favor of RPT amongst others. In line with the findings, some recommendations were made.

Keywords: Class Wide Peer Tutoring, Reciprocal Peer Tutoring, And Students Academic Achievement

Introduction

Biology is the science that deals with the study of living things. Biology is defined as the study of life or the study of plants and animals (Baba, 2014). Biology is the study of living organisms, and these include structure (gross and morphological), functioning, origin and evolution, classification, interrelationship and distribution. This role of biology as a central focus in some human activities including being a solution to the problem of food scarcity, health, hygiene, family life, poverty eradication, management and conservation of natural resources, biotechnology is enormous. Aina, (2013) asserted that, biology remains one of the basic sciences whose teaching and learning is universally known to be efficient and successful if undertaken simultaneously with the help of adequate instructional resources and facilities.

Biology as a branch of science and the pre-requisite subject for many fields of learning contributes immensely to the technological growth of the nation. The study of biology in both tertiary and senior secondary schools can equip learners with useful concepts, principles and theories that will enable them to face challenges before and after

graduation. The importance of biology for sustainable national development cannot be overemphasized as it finds its way into agriculture, pharmacy, ethno botany, medicine, biotechnology, and other related fields. Biology plays a vital role in the field of biochemistry, genetics, physiology and anatomy, ecology, medicine and molecular biology.

Student's understanding of concepts like those above can play a great role in improving their application skills which will be relevant to future careers through selection and the use of appropriate instructional strategies by experienced teachers. The teacher as the pivot of the educational process is expected to employ measures that would be favorably on classroom activities and environment. This conducive atmosphere can be achieved in many ways including individualizing the instruction using Peer tutoring (Akubue, 2010). The concept of peer tutoring is an innovative and interesting model of teaching and learning in the Nigerian education system. Peers learn more from each other than from parents and teachers (Gartner & Riessmann, 2008). The benefits of a peer tutoring strategy include effective learning of academic skills, developing of social behaviors,



discipline, and enhancing peer relationships (Greenwood, Carta & Hall, 2008). Biology students are not exempted from this trend. The teachers need to use student-centred instructional strategies in the teaching of biology. Among the effective instructional strategies that promote student-centered learning is Peer Tutoring Strategy (Perdavis, 2001). Peer tutoring provides an opportunity for individualized instruction in which learners acquire new knowledge, repeat, and practice a new skill, or clarify a given concept (Utley & Mortweet, 2007). In Peer tutoring non-professional teachers (fellow students) act as support providers and teachers to their peers in whole-class teaching, large-group learning, a small group or one-on-one instruction. The peer teachers in these situations are referred to as tutors. Research in the field of counselling psychology with special emphasis on intervention strategies for helping children have proven that peer group dynamics in counseling are very helpful (Brigman & Campbell, 2003; Obiunu, 2006). Such group dynamics either in the form of peer tutoring have participants ranging from 3 to 50 or more in a particular group. The assumption is that every member of the group will be allowed to play a significant role in the peer interaction process. The interaction within the group is very helpful for development of student's academic curiosity in biology. Peer tutoring is a flexible, peer-mediated strategy that involves students serving as academic tutors and tutees. Typically, a higher performing student is paired with a lower-performing student to review critical academic or behavioral concepts. Peer tutoring models or strategies are many and varied, we have; Class wide peer tutoring (CWPT), Cross-Age Peer Tutoring, Peer Assisted Learning Strategies (PALS), Reciprocal Peer Tutoring (RPT), etc. However, two types that are of interest to this study are class-wide and reciprocal peer tutoring.

Class wide peer tutoring evolved from tutorial instruction as the first pedagogy among primitive societies in modern times when the teacher uses students as resources for other students based on the assumption that the latter category of students can learn better and faster from fellow students in the former category who have mastered a particular concept or skill. Class wide peer tutoring involves dividing the entire class into groups of two to five students with differing ability levels. Students then act as tutors, tutees, or both tutors and tutees. Typically, CWPT involves highly structured procedures, direct rehearsal, competitive teams, and the posting of scores

(Maheady, Haper, & Mallette, 2001). The entire class participates structure peer tutoring activities two or three times per week for approximately 30 minutes (Maheady, Haper, & Mallette, 2007). While procedure and routine remain the same, student's pairings or groups may change weekly or biweekly. In CWPT, student pairing may be based on achievement levels or student compatibility.

There are however intra-variations for these strategies. Class wide peer tutoring (also referred to as peer learning, cooperative/collaborative learning and peer collaboration), is taken here to refer to as the use of teaching and learning strategies in which students learn with and from each other without the immediate intervention of a teacher, Boud et al., 2000). The literature shows evidence that peer tutoring is being increasingly used across all disciplines as a type of supplemental instruction or surrogate support. Peer tutors help other students either on a one-to-one basis or in small groups by continuing classroom discussions, developing study skills, evaluating work, resolving specific problems, and encouraging independent learning (Colvin 2007; Falchikov, 2001 & Boud, 2001).

Class wide Peer Tutoring is peer learning strategy in which knowledge and skill are acquired as a result of people of equal status or matched companions helping each other (Topping, 2005). Those who are receiving the instruction and doing the learning are called tutees. Class-wide peer tutoring is distinguished from other forms of peer learning or cooperative learning in that peers are taking specific roles as tutors or tutees (Topping, 2005). These roles can be fixed in which one with a little bit higher status or prior information always take the tutor role and others receive the teaching and hence are tutees. In CWPT power imbalance among peers may be created over time as tutors act as true knowledge providers and sources of final answers while tutees gradually acknowledge the role of knowledge recipients (Miravet et al., 2014). However, exchanging of roles in reciprocal peer tutoring tackles these problems and gives equal opportunity to all the group members of learning by teaching content (Cheng & Ku, 2009).

Reciprocal peer tutoring is used in the same learning programme in which peers take responsibility for teaching the sequence of subject content interchangeably (Topping, 2005). Topping (2013) illustrated a little bit different application of reciprocal peer tutoring in which pair of peer tutoring students was responsible to tutor each other. Less knowledgeable



learners were found motivated to engage in reciprocal peer tutoring and to encourage better learning outcomes (Topping & Dehkinet, 2016). Even though abler tutors may feel at a disadvantage in engaging with less able tutees in heterogeneous groupings, careful structuring and implementation of principles of cooperative learning ensure equal benefits in reciprocal peer tutoring (Supanc et al., 2017). Reciprocal peer tutoring is in fact, a situation where two groups of students tutor each other in different subjects or the same subject with different topics. In doing this, the students are motivated to learn more (Topping, Dehkinet, Blanch, Corcelles, & Duran, 2013).

Reciprocal Peer Tutoring is a form of collaborative learning strategy where pairs of students interact to assist each other's academic achievement by one student adopting the role of a tutor. Releasing the benefits from acting as tutors, reciprocal peer tutoring formalizes a process enabling both a peer tutoring pair to participate and experience the role of a tutor. In reciprocal peer tutoring, two or more students alternate between acting as the tutor and tutee during each session, with equitable time in each role. Often, the higher-performing students are paired with lower-performing students. RPT utilizes a structured format that encourages teaching material, monitoring answers, and evaluating and encouraging peers. The professional teacher facilitates the activity of the non-professionals or student tutors as they teach their peers or tutees. It is used primarily in the classroom to allow students to help each other to learn (Webb, Tropper and Fall, 2007) and it addresses the issue of individual differences in terms of rates of learning. Thus, a student who is adjudged to be effective in learning tasks could assist as a tutor in helping their novice classmate acquire and develop specific skills. This can enhance student's academic achievement.

Academic Achievement is of great importance to the teacher, learner and society. Therefore, it is important to investigate the level of academic achievement of students. This is because of the massive failure of students in external examinations such as the senior school certificate examination (SSCE) in Biology, chief examiner's report, (2019). Frightened by the decline in the performance of the student in biological sciences of which biology is one, the Science Teachers Association of Nigeria (STAN) have worked tirelessly for almost two decades to deal decisively with student's academic under-achievement in science by developing innovative teaching strategies that would improve the learning of science. Oehen-Ozen (2017)

noted that the students' academic under achievement is worst for the female gender. This shows that gender disparity in science learning has not been resolved hence, this study will determine the influence of gender on students' academic achievement in biology. The issue of gender disparity in biology performance of secondary school students as noted by Orhen-Ozen (2017) during his studies shows that despite the improvement in science achievement recorded, there still existed a significant difference in the achievement of male and female students in favour of male.

Gender can be referred to as the socially constructed roles, behaviour expression and identities of girls, women, boys and men (Borgatta & Montgomery, 2010). Gender in the above definition is the societal meaning ascribed to males and females with the difference in the role they play. Nworgu (2014) observed that there is gender differentiation in the achievement of some students in science courses. Gender differences exist in student's academic performance in some science subjects including biology and can lead to variations in the academic achievement of male and female students. It would therefore be of interest to see the influence of gender on class-wide peer tutoring (CWPT) and reciprocal peer tutoring.

Innovative teaching strategies such as reciprocal and class wide peer tutoring are some of the attempt made to facilitate teaching and learning in science courses and biology in particular, the problem of mastering subject matter and skills in studying biology could be addressed through the use of strategies such as class-wide peer tutoring (CWPT) and reciprocal peer tutoring (RPT) strategies. This study aligned with the findings of Azuibuke, (2012) peer tutoring strategy has significant positive effect on the academic achievement of slow learner, which was carried out in Anambra State, and therefore, this study is geared towards determining the effects of class-wide peer tutoring and reciprocal peer tutoring strategies on student's academic achievements to study biology and was carried in secondary schools in the Ogoja Education Zone of Cross River State.

Research Questions

To guide this study, the following research questions were posed;

1. What are the effects of class-wide peer tutoring and reciprocal peer tutoring on the mean achievement score of students in biology?

2. What is the influence of gender on the mean achievement score of students in biology?
3. What is the interaction effect of strategy and gender on the mean achievement score of students in biology?

Hypotheses

The following null hypotheses guided the study:

- Ho₁: There is no significant effect of class-wide tutoring and reciprocal tutoring on the mean achievement scores of students in biology.
- Ho₃: There is no significant influence of gender on the mean achievement scores of students in biology.
- Ho₅: There is no significant interaction effect of strategy and gender on the mean achievement scores of students in biology.

Methods

This study employed a quasi-experimental 2 x 2 factorial research design. The design aligned with Fraenkel and Wallen (2009) who noted that a quasi-experimental factorial design is a quasi-experimental design modified to permit the investigation of the additional independent variable. The population of the

study consisted of 1450 SSII Biology students and a sample size of 78 SSII Biology students was used for the study. This sample was drawn using purposive sampling technique to select one LGA or the study, simple random sampling technique was used to draw two coeducational schools out of the 9 in the selected LGA, all the biology students in the two coeducational secondary schools constituted the sample. Intact classes were used for both experimental group A and B. The instruments used for the study is Biology Achievement Test (BAT). The adapted instrument was trial tested and a reliability index of 0.97 was obtained using K-R 20. The content validity was established for BAT by using test blue print/table of specification while the lesson plans were subjected to face validity by experts in Education Biology. The research questions were answered using mean and standard deviation, while the hypotheses were tested using the Analysis of Covariance (ANCOVA) at an alpha level of 0.05. Effect size (Eta-Squared) was used to determine how important any observed differences are. An effect size of 0.05 and above indicates an important or substantial difference (Cohen, 1988).

Results

Table 1: Mean (M) and Standard Deviation (SD) achievement scores of students taught Biology using CWT and RPT Strategy

Strategy	N	Pretest		N	Posttest	Mean Gain	
		\bar{x}	SD			\bar{x}	SD
CWT	45	41.33	8.55	45	50.76	10.38	51.60
RPT	33	45.48	10.91	33	57.55	10.65	56.39
Total	78	43.09	9.77	78	53.63	10.96	

Table 1 revealed that the posttest mean score for students taught using Class Wider Tutoring learning strategy was (M = 50.76, SD = 10.38) and mean gain of 51.60 while students taught with Reciprocal Peer Tutoring was (M = 57.55, SD = 10.65) and mean gain of 56.39. And pretest mean score for students taught using class wide peer tutoring strategy was (\bar{x} = 41.33, SD= 8.55) while students taught using reciprocal peer tutoring had (\bar{x} = 45.48, SD = 10.91. Students taught

Biology using Reciprocal Peer Tutoring learning strategy therefore, performed better than students taught with Class Wider Tutoring Strategy. The mean gain for CWT strategy was 51.60, while that for the RPT was 56.39. The difference was in favour of the RPT strategy. Therefore, the RPT was superior to the CWT in Biology. The actual difference in mean scores between the groups was not substantial. The effect size, calculated using eta squared, was .063.

Table 2: Mean (M) and Standard Deviation (SD) achievement scores of students according to gender

Gender	N	Pretest		N	Posttest		Mean Gain
		\bar{x}	SD		\bar{x}	SD	
Male	43	43.53	9.53	43	53.67	10.08	53.25
Female	35	42.54	10.18	35	53.57	12.10	54.09
Total	78	43.09	9.77	78	57.88	12.63	

Table 2 showed that the posttest mean score for male students was (M = 53.67, SD = 10.08) and adjusted mean of 53.25 while the female students was (M = 53.57, SD = 12.10) and mean gain of 54.09. Female students therefore, performed better than male students in Biology.

While the pretest mean score for male students was (\bar{x} = 43.53, SD = 9.53) and the pretest mean score for female (\bar{x} = 42.54, SD = 10.18)

Table 3: Mean (M) and Standard Deviation (SD) achievement scores by strategy and Gender

Methods	Gender	N	Pretest		N	Posttest	
			\bar{x}	SD		\bar{x}	SD
CWT	Male	23	41.13	9.04	23	50.83(50.96)	9.37
	Female	22	41.55	8.22	22	50.68(50.55)	7.83
RPT	Male	20	41.33	8.55	20	56.95(56.62)	10.08
	Female	13	44.23	13.05	13	58.46(58.98)	11.83

Note: mean gain are in parentheses

Table 3 revealed an adjusted mean score of 50.96 for male students who were taught with CWT, while their female counterparts had adjusted mean score of 50.55. Male students who were taught with RPT had an adjusted mean score of 56.62 while their female counterparts had an adjusted mean score of 58.98. The results do not suggest the ordinal interaction effect between strategy and gender on students' achievement scores in Biology. This was because, at all levels of

gender, the adjusted mean scores were higher for the RPT. This shows that students taught with reciprocal peer tutoring performed better than those taught using class wide peer tutoring. It also shows that this strategy changes learning form private activity to social activity.

The three hypotheses were tested using the Analysis of Covariance. The summary of the analysis for the null hypotheses were shown in Tables 4

Table 4: Analysis of Covariance of Students’ Biology Achievement Scores by Strategy, and Gender

SOURCES OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIG.	PARTIAL ETA SQUARED
Covariates Pretest	2230.363	1	2230.363	24.839	.000	
Main Effects (Combined)	417.817	2	208.908	2.327	.105	
Strategy	404.241	1	404.202	4.502	.037	.063
Gender	13.576	1	13.576	.151	.699	.003
2-Way Interactions Strategy X						
Gender	39.157	1	39.157	.436	.511	.006
Model	2687.337	4	671.834	7.482	.000	
Residual	6554.881	73	89.793			
Total	9242.218	77	120.029			

Data in Table 4 showed a statistically significant main effect for Strategy $F(1,73) = 4.502, p = .037$, partial $\eta^2 = .063$. The null hypothesis, therefore, was rejected, indicating that there was a significant difference in the mean achievement scores of students taught using CWT strategy and those taught using the RPT

Table 4 revealed no significant main effect of gender $F(1,73) = .151, p = .699$, partial $\eta^2 = .003$. The null hypothesis was not rejected, indicating that there was no significant difference in the mean achievement scores of male and female students in Biology. The eta-squared statistic (.003) indicated a very small effect.

Table 4 indicated no significant interaction effect of strategy and gender $F(1,73) = .436, p = .511$, partial $\eta^2 = .006$. The null hypothesis was not rejected. The interaction effect of strategy and gender on students' mean achievement scores in Biology was, therefore, not statistically significant. The eta-squared statistic (.006) indicated a very small effect.

The result of the study on the mean achievement scores of student taught biology with class wide tutoring and those taught with reciprocal peer tutoring showed the the students taught biology using reciprocal peer tutoring performed better.

Discussion of Findings

The result of the study showed that the students taught biology using reciprocal peer tutoring performed better than the students taught using class wide tutoring. And the difference was significant. The result also showed that the female students performed slightly better than the male students in biology achievement test. The difference was not statistically significant and the interaction effect of strategy and gender on the mean

achievement scores of students in biology was not statistically significant.

Conclusions

Based on the findings of the study and the interpretation of results, it is therefore concluded that reciprocal peer tutoring proved to be more effective in enhancing students’ achievement in biology than class-wide tutoring. The difference in the mean achievement scores of male and female students in biology is not statistically significant. The interaction effect between peer tutoring strategies and gender on students’ mean achievement scores in biology is not statistically significant.

Recommendations

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

1. Seminars and workshops should be organized by the government for teachers on the importance and how to use reciprocal peer tutoring instructional strategy. When this is properly done, it will improve students’ academic achievement in biology since the students will be tutored by their peers.
2. The RPT strategy should be properly planned and adopted by the classroom teacher, hence it proves to aid in saving the teacher’s time and reduce stress.
3. Curriculum planners and professional bodies including teachers training colleges and in-service teachers should acquaint themselves with the techniques of these modes of peer tutoring and how they can be applied successfully in the classroom. This will help students to achieve more academically as they will now be part of the teaching.



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