



Relative Effectiveness of Co-Teaching and Solo-Teaching on Students' Achievement in Chemistry

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ABSTRACT

The study investigated the relative effectiveness of co-teaching and solo-teaching on students' academic achievement in chemistry. Three hypotheses were tested. The quasi-experimental design - non-equivalent pre-test posttest control group design was used. The sample for the study was 107 senior secondary school year two (SS II) chemistry students obtained from three schools in Uvwie local government area, Delta state. The instrument for data collection was Chemistry Achievement Test (CAT) validated by experts in science education. The reliability of the instrument was established using Kuder-Richardson formula 20 which yielded coefficient of internal consistency of 0.79. The data obtained were analyzed descriptive statistics and analysis of covariance. The results showed that there was a significant difference between the mean achievement scores of students in chemistry with co-teaching being the most effective and followed by solo-teaching. The results also showed that there was no significant main effect of gender on achievement. No significant interaction effect between teaching methods and gender on achievement scores in chemistry was observed. The study therefore, recommended that chemistry teachers should adopt co-teaching and solo-teaching when necessary.

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INTRODUCTION

The predominance of teacher-centered approach to instruction has continued to be a contributory factor to students' poor achievement in chemistry (Emmanuel & Rose, 2014). Studies show that when students are not actively involved in the learning process, they tend to be less motivated to learn (Chairam, Somsook & Coll, 2009; Durumus & Bayraktar, 2010). The lack of motivated impedes the students' desire to take responsibility for their own learning and relegate all activities of the learning process

to the teachers. Educational theories such as constructivism have continued to advocate for a learner centred-instruction. Social constructivists claim that learning is social and the absence of social interaction may result in rote learning (Chauhan, 1998). They posit that meaningful learning can only occur when the child makes sense of what is taught by their active role in the learning process (Tuckman & David, 2010). Thus, research has continued to focus on student-centred teaching methods and how to innovate traditional teaching methods. Little effort is geared towards improving on



the teaching centred approach to see whether it could improve achievement given its many advantages.

Teacher-centred instruction such as lecture method has been known to be a good approach for teaching large number of students (Brown & Ciuffetelli, 2009). In most public educational setting, the number of students in the classroom is quite large. Teacher given the duration of their lesson often find it difficult to cope with the large number of students. In many cases, teachers may not know all the members of the class. It is also demanded of the teachers to ensure they cover the scheme of work for the term. Teacher-centred instruction has also proven to be the easiest way of covering the expected syllabus for the term (Atadoga & Onalapo, 2009). Thus, teachers given the conditions of learning in their environment are often compelled to stick to expository, lecture and other forms of teacher-centred methods of instruction. There is need therefore, for researchers to discover a way of improving on these teacher-centred approaches to teaching and the order of their effectiveness on students' achievement especially in subjects perceived to be difficult by students such as chemistry. One way to innovate the teacher-centred approach is through co-teaching.

Co-teaching according to Tammy (2013) is when special education teacher and general education teacher work together to teacher students within general education setting. Friend (2008) viewed co-teaching as an approach to instruction where a general education teacher and a specialist education teacher such as a reading specialist, speech/language therapist, laboratory technologist, work as partners to teacher a diverse group of students. According to Tammy (2013), implementing co-teaching is not as simple

as defining it, given that its application is more broad in operation. Tammy distinguished amidst models of co-teaching, two commonly used models namely: the one teach, one assist model and parallel teaching model. In the one teach one assist model, the general education teacher monitors students' progress and assist students in the classroom while in the parallel teaching model, the class is split in half and both teachers deliver instruction to small groups (Tammy, 2013). Friend (2008) however noted that in co-teaching, the exact contribution that each person makes may vary, but together the educators create a learning situation that cannot be produced by a solo teacher.

Solo teaching involves a qualified teaching a group of students with varying method of instruction (Witcher & Feng, 2010). It is argued that although solo-teaching is effective in its own respect co-teaching has more to offer students in chemistry classes. For instance, students in a large class can be easily handles when a team of teachers work together and help students to master different chemistry concepts. On the other hand, not too many students are comfortable with different teachers handling the same subject as they may not get along with the different teachers. The questions therefore are, of the two methods: co-teaching and solo teaching, which will be more effective for teaching chemistry. There is also the question of whether either method may affect the performance of male and female students uniformly. The study therefore, sought to examine the relative order in the effectiveness of co-teaching and solo-teaching on the achievement of chemistry students.

Purpose of the Study

The purpose of this study is to examine the relative effectiveness of co-



teaching and solo-teaching on students' academic achievement in chemistry. The specific objectives of the study were to determine:

1. Effect of co-teaching and solo-teaching on the students' achievement in chemistry.
2. Effect due to gender on achievement.
3. Interaction effect of teaching methods and gender on students' achievement in chemistry.

Hypotheses

1. There is no significant difference in the mean achievement scores of students taught chemistry using co-teaching, solo-teaching and those taught using traditional method.
2. There is no significant difference in the mean achievement scores of male and female students.
3. There is no significant interaction effect of teaching methods and gender on students' achievement in chemistry.

METHODOLOGY

The design of the study is quasi-experimental. The pretest posttest non-equivalent control group design was used.

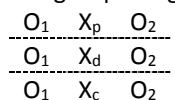


Figure 1: Diagrammatic representation of the design of the study

Where,

O_1 = pretest

O_2 = post-test

X_p = treatment using co-teaching

X_d = treatment using solo-teaching

X_c = treatment using lecture method

The area of the study is Uvwie local government area of Delta state. The population of the study comprised 2, 451

(1023 females and 1428 males) senior secondary year two (SS2) chemistry students in Uvwie local government area. The sample for the study was 107 SS2 chemistry students obtained through a multi-stage sampling procedure. The instrument for data collection was Chemistry Achievement Test (CAT) on the chemistry topics: periodic table, compound of sulphur and carbon compound. The instrument was validated by experts in science education. The reliability of the instrument was established using the Kuder-Richardson 20 (KR-20) which yielded a reliability coefficient of 0.79.

The experiment was conducted in two phases. In the first phase, the researcher briefed the regular chemistry teachers in one school on how to conduct the co-teaching exercise. In the second school, the regular SS2 chemistry teacher was briefed on solo-teaching and given the lesson plans prepared for the treatment. There was no briefing for the control group teacher in the third schools who was to use any traditional method of instruction. After the brief, the treatment commenced with the teachers of the three schools administering a pretest to the students. There was no feedback or revision on the pretest. The treatment for the first experimental group on co-teaching was conducted using parallel teaching. The class was split into two. Both teachers handled the same topic at the same time for the two groups. In the next period of the lesson, the teachers swapped their own groups and teacher the other group. In the solo-teaching, only a qualified regular chemistry teacher taught the students under the close supervision of the researcher. The control group was taught using the traditional instruction method. The treatment ended with the administration of the posttest on a differently coloured paper. The data generated from the study was analyzed



using analysis of covariance (ANCOVA) and descriptive statistics. The decision rule for testing the hypothesis was that whenever

pvalue was less than 0.05, we reject the null hypothesis; otherwise, we do not reject the null hypothesis.

RESULTS

Table 1: ANCOVA on effect of teaching methods and gender on achievement in chemistry

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	4427.558 ^a	6	737.926	24.601	.000
Intercept	20861.100	1	20861.100	695.454	.000
Pretest	23.718	1	23.718	.791	.376
Method	2439.630	2	1219.815	40.665	.000
Gender	.082	1	.082	.003	.958
Method * Gender	25.188	2	12.594	.420	.658
Error	2999.639	100	29.996		
Total	506830.000	107			
Corrected Total	7427.196	106			

1. There is no significant difference in the mean achievement scores of students taught chemistry using co-teaching, solo-teaching and those taught using traditional method.

106) = 40.665, $P < 0.05$. The null hypothesis was rejected. Thus, there is significant difference in the mean achievement scores of students taught chemistry using co-teaching, solo-teaching and those taught using traditional method. To determine the order of significant difference, Scheffe Post-Hoc test was done.

Table 1 shows that there was significant main effect of the treatments on students' achievement in chemistry $F(6,$

Table 2: Scheffe's Post-Hoc test

(I) Method	(J) Method	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Co-teaching	Solo-teaching	11.654*	1.458	.000	8.761	14.547
	Traditional method	16.706*	2.007	.000	12.724	20.688
Solo-teaching	Co-teaching	-11.654*	1.458	.000	-14.547	-8.761
	Traditional method	5.052*	1.552	.002	1.973	8.131
Traditional method	Co-teaching	-16.706*	2.007	.000	-20.688	-12.724
	Solo-teaching	-5.052*	1.552	.002	-8.131	-1.973

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

The scheffe's post-hoc analysis shows that there is a significant difference in the mean achievement scores of students taught chemistry using co-teaching and solo-teaching in favour of co-teaching.

There is also a significant difference in the mean achievement scores of students taught chemistry using co-teaching and those taught using traditional method in favour of co-teaching. There is a a



significant difference in the mean achievement scores of students taught chemistry using solo-teaching and those taught using traditional method in favour of tradition method. Table 2 shows that out of the three methods, the order of effectiveness is co-teaching, followed by solo-teaching.

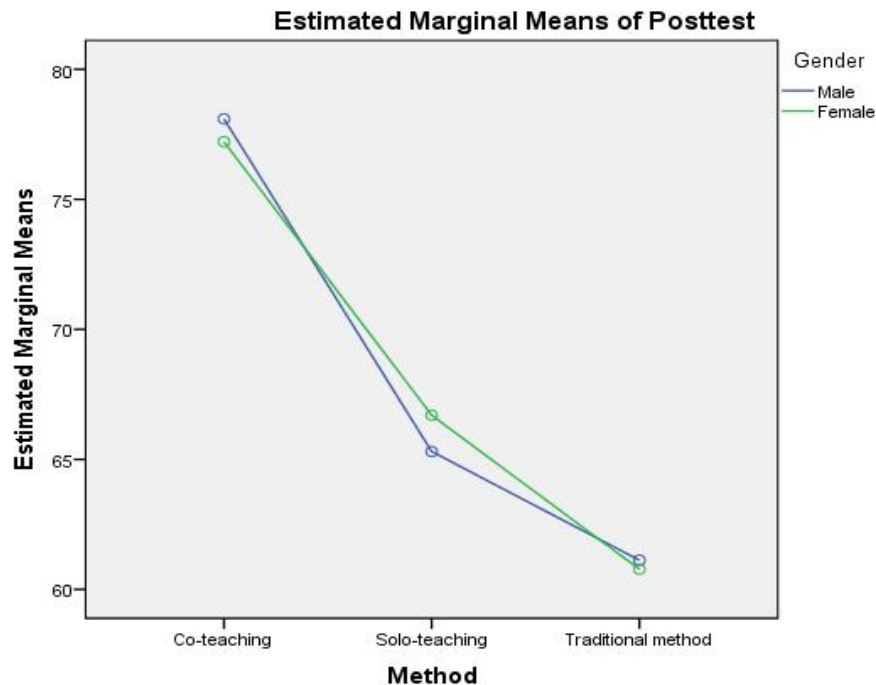
2. There is no significant difference in the mean achievement scores of male and female students.

Table 1 also shows that at 0.05 level of significance, there was no significant main effect of gender on achievement $F(6, 106) = .003, P > 0.05$. Null hypotheses two was therefore not rejected.

Thus, there was no significant difference in the mean achievement scores of male and female students.

3. There is no significant interaction of teaching methods and gender on students' achievement in chemistry.

Table 1 further shows that there was no significant interaction of teaching methods and gender on students' achievement in chemistry, $F(6, 106) = .420, P > 0.05$. Null hypothesis three was not rejected. Therefore, there is no significant interaction effect of teaching methods and gender on students' achievement in chemistry. The interaction is shown in figure 2.



Covariates appearing in the model are evaluated at the following values: Pretest = 23.19

Figure 2: Plot of the interaction between teaching methods and gender on achievement

The plot of the interaction effect between teaching methods and gender is not significant and disordinal. This shows

that the methods of teaching are gender sensitive.



DISCUSSION AND CONCLUSION

The study revealed that co-teaching is the most effect method of teaching chemistry followed by solo teaching. The observed finding of the study could be attributed to the fact that co-teaching avails the students opportunity to learn from two different teachers. Each teacher has a style and approach to teaching. When co-teaching, the students may find a teaching quite interest and may adapt to learning from such teachers, thus, students rotate form one teacher to another for their varied learning needs. Co-teaching which provides for teachers teaching the same content in different ways give room for flexibility of instruction. Students who have difficulty learning during an approach that is not compatible with their learning needs may still learn when a different teacher adopts a teaching style that meets their need. Such enormous benefit arises from the very fact that co-teaching has become a model to differentiate instruction for all students.

Co-teaching may have also proved most effective because it gives the teachers the time to assist the students according to their needs during the learning process. Students who find a particular aspect of the material difficult or needs further clarity may easily consult with the second teacher who will assist the students. Co-teaching enables teachers to scaffolding learning for the students, enabling them to proceed with little effort into learning new concepts. Students may have properly conceptualized the learning materials by synthesizing the multiple perspectives of the teachers in the co-teaching classroom. The findings of the study is in line with those of Khoury (2014) who noted that co-teaching had significant effect on achievement than for those not exposed to co-teaching. The finding of the study contrasts the findings of Gonzalez (2015) who found no significant difference

in the mean achievement scores of students exposed to co-teaching and those exposed to solo teaching. The findings of the study also contrast that of Witcher (2010) who reported that although noticeable difference was observed in the mean achievement scores of the students in favour of co-teaching, the difference in the mean achievement scores was not significant.

The findings of the study also revealed that solo teaching significantly improved achievement in chemistry more than traditional method of instruction which is completely teacher-centred. In the study, solo-teaching was carried out in such a way that facilitated greater interaction between the teacher and the students unlike what obtains in the traditional teaching methods where students are passive learners. Solo-teaching gave room for students to ask questions, contribute in the learning process and have some class discussions over what they are learning. The study further showed that gender had no significant effect on the achievement of the students. This is to say that all the instructional methods uniformly affected the male and female students. However, the plot of the non-significant interaction effect of teaching methods and gender showed that the methods were gender sensitive. Thus, some methods favoured the males more while the other favoured the female more.

RECOMMENDATIONS

In the light of the following findings, the study recommended that:

1. Chemistry teachers should adopt co-teaching for better achievement among the students. In order to achieve this, educational stakeholder should organize workshops to acquaint chemistry teachers with co-teaching method of instruction.



2. When adopting solo teaching, chemistry teachers should modify their instruction to ensure greater interactivity among students, between students and teacher and between the students and the learning materials.

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