

ORIGINAL ARTICLE**Teaching Chemistry in Secondary Schools: A Case for Cooperative Instructional Strategy****Dr. K. O. Aluko****ABSTRACT**

The study investigated the relative effectiveness of cooperative instructional strategy on students' performance in secondary school chemistry. Two hundred and fifty (250) Senior Secondary two (SS II) chemistry students were purposively sampled from three public secondary schools in Ilesa Local Government Area of Osun State, Nigeria. Two research instruments: Researcher's Instructional Packages for solving Chemistry Problems (RIP) and Chemistry Performance Test (CPT) were developed, validated and used for the study. The reliability of the Chemistry Performance Test (CPT) was determined and found to be 0.62 using the Pearson Product Moment Correlation formula. Three hypotheses were raised and tested using Analysis of Covariance (ANCOVA). The study covered a period of six (6) weeks. The experimental group, which is Cooperative instructional group and a Control group, were used. The results of the analysis showed that there was a significant difference in the performance of chemistry students exposed to cooperative instructional strategy and conventional teaching method. The cooperative instructional strategy was found to be more effective in enhancing better performance of the learners. Some recommendations were also made.

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INTRODUCTION

The responsibility of the class teacher is to help students attain maximum achievement in their learning tasks. Several competencies are expected of the teacher in order to achieve this goal. Some of the competencies include ability to use appropriate instructional strategies in teaching. Chemistry as a branch of science is highly important in modern societies because of its requirement as a pre-requisite to the study of many other science oriented courses. It thus appears that for a nation to develop in science and technology, the teaching and learning of chemistry need to be improved. It is therefore becomes pertinent that performances in chemistry and in science generally should be of high levels. However, this seems not to be the case in Nigeria because students' performances have not been encouraging (Ajeyalemi, 1983; Bojuwoye, 1985; Adeyegbe, 1993). There are several attempts through the use of carefully planned instructional strategies and models to improve the status of chemistry teaching and learning. Despite all these efforts, students' performance in chemistry has remained persistently poor at the Senior Secondary Certificate Examination (SSCE), (Salami, 1992; Adeyegbe, 1993).

Prominent factors contributing to the persistence of students' poor performance in chemistry are:

1. Ineffective teaching methods adopted by the chemistry teacher.
2. Lack of infrastructures and teaching materials.
3. Lack of professionally qualified teachers.
4. Lack of technicians/laboratory attendants.

5. Lack of organized strategies for problem solving and poor reasoning.

6. Poor mathematics background.

In an attempt to address the problems highlighted above, some researches have been carried out. These include, team teaching approach (Amiodoh, 1984); formative testing with remediation (Ugamadu, 1990); algorithms strategy in solving chemical arithmetic problems (Adeyegbe, 1994); concept mapping (Novak, 1990 and Okebukola, 1997). All these strategies gave a little improvement on the conventional lecture method, which is being used in our secondary schools.

This paper therefore attempts to present the effort being made to rectify the ugly situation, that is, the poor performance in chemistry and to give a practically oriented teaching strategy that had been tried and found to be practicable and adaptable to the Nigerian Secondary Schools. This strategy is an adapted version of the popular cooperative learning strategy (Okebukola, 1985; Adigwe, 1999). These researchers have reported the potency of this strategy in enhancing students' performance in science and related subjects. This adapted version is called "Cooperative Instructional Strategy"(CIS) which was specifically aimed at improving problem solving abilities among learners.

However, it is disheartening that the strategy is not popularized due to limited awareness about the concept and non-exposure to the methods of application.

Concept and Features of Cooperative Instructional Strategy (CIS)

Aluko (2004) reported that as an adapted version of cooperative learning strategy, CIS requires students to solve chemistry problems together in small groups (usually

5-6 members per group) and the teacher acting as a facilitator. The groups adopt the Ashmore et. al (1957) model for solving chemistry problems. The Ashmore's heuristics are as listed below:

1. Definition of the problem.
2. Selection of appropriate information.
3. Combination of separate pieces of information.
4. Evaluate.

Specifically, the following features are adhered to when using CIS in the classroom situations.

1. The class is rearranged to allow for working in a mixed-ability group of 4-6 each.
2. Share a clear group goal of solving problems together.
3. Work together as a team.
4. Make decisions by consensus.
5. Each person should be free within his team to ask and answer questions.
6. Each person should be willing to listen to one another.
7. Each person should be willing voluntarily teach and encourage one another.
8. Each person should respect and trust each other.
9. Each person should desire the progress and success of the team at all times.
10. Each person should put in all efforts to score maximum point for the team.
11. Each group is rewarded based on individual learning contribution.

Purpose of the study

The study is carried out to examine the effect of cooperative instructional strategy on the performance of senior secondary school students in chemistry.

Research hypotheses

The following hypotheses were generated and tested for the study;

Ho₁: There is no significant difference in the performance of chemistry students exposed to cooperative instructional strategy.

Ho₂: There is no significant difference in the performance of male and female chemistry students exposed to cooperative instructional strategy.

Ho₃: There is no significant difference in the performance of high scorers, medium scorers and low scorers in chemistry exposed to cooperative instructional strategy.

METHOD

This strategy, CIS was applied to teach a group of two hundred and fifty (250) Senior Secondary two (SS11) chemistry students and were purposively sampled from three public secondary schools in Ilesa East Local Government Area of Osun State, Nigeria as reported by Aluko (2004). In this study, a 3x3x2 quasi-experimental, non-randomised, factorial design was employed and three hypotheses were tested. The experimental group was divided into mixed ability groups of five members.

Cooperative instructional package was developed by the researcher and given to the participating group using the heuristics of solving chemistry problems as outlined by Ashmore et. al (1957). The control group was exposed only to the lecture method without any reference to the Ashmore heuristics for solving chemistry problems. The aspects of chemistry taught to the two groups were (i) The gas laws and (ii) the mole. This experiment lasted for six weeks. At the end of treatment period, Chemistry Performance Test (CPT) was administered to all the students as a posttest. The CPT consists of twenty test

items covering areas of knowledge, comprehension and application. The result obtained from this test was processed for statistical analysis.

Data Analysis

The data collected were subjected to both descriptive and inferential statistics.

RESULTS AND DISCUSSION:

Specifically, the Analysis of covariance (ANCOVA) was used to test the hypotheses at 0.05 probability level. Where the results were found significant, the Scheffe Post-hoc Analysis was used to detect the source of variation and the direction of significance.

Table 1
ANCOVA Summary Table on Posttest Performance Scores According to Treatment.

Source of variation	Sum of squares	DF	Mean squares	F	Sig. Of F	Remark
Covariates	415.881	1	415.881	139.022	.000	*
Pretest	415.881	1	415.881	139.022	.000	*
Main Effects	257.110	2	128.555	42.974	.000	*
Treatment	257.110	2	128.555	42.974	.000	*
Explained	672.991	3	224.330	74.990	.000	*
Residual	735.905	246	2.991			
Total	140.896	249	5.658			

* Significant at $P < 0.05$

The result of this study showed that there was a significant main effect of treatment that is using the cooperative instructional strategy to teach some concepts in secondary school chemistry. The result on Table 1 has an F value of 42.974, which is significant at 0.05. This is because; the significance of F value of 0.000 is less than

0.05 ($F = 42.974, 0.005 > 0.000$). Treatment had a significant effect on the performance of students in chemistry as shown in the table, $F(2, 0.05) = (42.974)$. The finding of this study corroborates the earlier study of Okebukola, 1985. From this study, CIS is found to be more potent in enhancing students' performance in chemistry.

Table 2
ANCOVA Summary Table on Posttest Performance Scores According to Gender.

Source of variation	Sum of squares	DF	Mean squares	F	Sig. Of F	Remark
Covariates	179.001	1	179.001	77.150	.000	
Pretest	179.001	1	179.001	77.150	.000	
Main Effects	1.496	1	1.496	.645	.424	
Gender	1.496	1	1.496	.645	.424	
Explained	180.497	2	90.249	38.898	.000	
Residual	208.815	90	2.320			Not Significant
Total	389.312	92	4.232			

The result on Table 2 shows an F value of 0.645, which was not significant at the 0.05 levels. This was because the significance of F value of 0.424 is greater than 0.05 ($F = 0.645, 0.05 < 0.424$). Hence, there was no

significant difference, as a result of which Null hypothesis was accepted. This means therefore that gender had no significant effect on the performance of students in chemistry.

Table 3
ANCOVA Summary Table on Posttest Performance Scores According to High scorers, Medium scorers and Low scorers.

Source of variation	Sum of squares	DF	Mean squares	F	Sig. of F	Remark
Covariates	179.001	1	179.001	253.794	.000	
Pretest	179.001	1	179.001	253.794	.000	
Main Effects	147.539	2	73.769	104.593	.000	
Scorers	147.539	2	73.769	104.593	.000	
Explained	326.540	3	108.847	154.326	.000	
Residual	62.772	89	.705			Significant
Total	389.312	92	4.232			

The result on Table 3 has an F value of 104.593, which is significant at the 0.05 levels. This is because the significance of F value of .000 is less than 0.05 ($F = 104.593, 0.05 > .000$).

The high scorers performed significantly better than the medium scorers while the medium scorers in turn performed significantly better than the low scorers as can be seen from Table 3.

The Null hypothesis concerning ability groupings in respect of cooperative instructional strategy can thus be rejected.

CONCLUSION

The way chemistry is being taught in our secondary school has called for an appraisal because of its importance among other science subjects. The poor performance of learners in the subject also calls for improvement in the teaching and learning of the subject. This has led to the focus of the present study to find an alternative method apart from the conventional method commonly used by most schools.

The study examined the effect of cooperative instructional strategy on students' problem solving abilities in secondary school chemistry.

The study presented cooperative instructional strategy (CIS), its characteristics, features and application to the teaching and learning of chemistry in the classroom. CIS as an innovative technique has been found to be effective in enhancing students' performance in chemistry. As a result, CIS is therefore recommended for use in the classroom by the teachers in order to induce in learners the inquiry skills necessary for problem solving.

Recommendations

1. The current prevailing teaching / learning approach should be restructured government and relevant educational agencies so as to give room for cooperative instructional strategy which will make students good problem-solvers.
2. The curricula of the institutions where teacher (that is, graduates and NCE) are being trained should be broad based so as to encompass the cooperative instructional strategy that promotes problem-solving skills.

3. Government and relevant professional agencies should organize workshops, seminars and conferences to address the innovative techniques of chemistry teaching.

4. Teachers on the job should be made to aware the technique as a way of popularizing it.

5. Teachers should be encouraged to adopt CIS as supplementary or alternative strategy to the conventional methods of teaching.

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