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ENHANCING CHEMISTRY TEACHING IN SECONDARY SCHOOLS: AN ALTERNATIVE TEACHING APPROACH

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Abstract

This study adopted the quasi-experimental research design to examine the alternative teaching methods in secondary chemistry using the cooperative instructional strategy dimension. The sample consists of two hundred and thirty (230) Senior Secondary two (SS II) chemistry

students were drawn from three out of ten (10) public secondary schools in Tai Local Government Area of Rivers State, Nigeria. Two research instruments were developed for the study: Researcher's Instructional Packages for solving Chemistry Problems (RIP) and Chemistry Performance Test (CPT). The instrument was validated and its reliability of the Pearson Product Moment Correlation formula value of 0.62. Three hypotheses were formulated and tested using Analysis of Covariance (ANCOVA). The instrument was administered on both the experimental group and Control group. 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 among which were that the current prevailing teaching and learning approach should be restructured.

Key Words: *Teaching Approach, chemistry, Cooperative Instructional Strategy, Secondary school, Performance and Students.*

Introduction

Chemistry as a branch of science is highly important in modern societies because of its requirement as a prerequisite 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. There are several attempts through the use of carefully planned instructional strategies and models to improve the status of chemistry teaching and learning. It is therefore becomes pertinent that performance 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; Aluko, 2004; Nbina and Viko, 2012). Despite all these efforts, students' performance in enhancing chemistry has remained persistently poor at the Senior Secondary Certificate Examination

(SSCE), (Salami, 1992; Adeyegbe, 1993, WAEC, 2007; Uwadiac, 2010).

There are factors responsible for the persistence of students' poor performance in chemistry, these are: Poor mathematics background; Lack of technicians/laboratory; Lack of infrastructures and teaching materials; Ineffective teaching methods adopted by the chemistry teacher; Lack of professionally qualified teachers and Lack of organized strategies for problem solving and poor reasoning.

In an attempt to address these problems of students' poor performance in chemistry, the following researches have been carried out; 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 leaning 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.

The study is carried out to examine the alterative teaching methods in secondary chemistry: the cooperative instructional strategy dimension

Research Hypotheses

The following hypotheses were tested at 0.05 level of significance.

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 scorer's medium scores and low scorers in chemistry exposed to cooperative instructional strategy.

Method

This strategy, CIS was applied to teach a group of two hundred and thirty (230) Senior Secondary two (SS II) chemistry students and was drawn from three out of ten (10) public secondary schools in Tai Local Government Area of Rivers State

A quasi-experimental, non-randomized, factorial design was adopted and three hypotheses were tested for this study.

Cooperative instructional package was developed by the researcher and the experimental group was divided into mixed ability groups of five members. The control group was exposed only to the lecture method. The aspects of chemistry taught to the two groups were (i) The gas laws and (ii) the mole. This experiment lasted for nine weeks. At end of treatment period, Chemistry Performance Test (CPT) was administered to all the students as a post-test. The CPT consists of twenty (20) test items covering areas of knowledge, comprehension and application. The result obtained from this test was processed for statistical analysis. While 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 Schaffer 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	Remarks
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 on treatment, which 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 significant 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	Remarks
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 scores, Medium scores and Low scores

Source of variation	Sum of squares	Df	Mean squares	F	Sig. Of F	Remarks
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 scores while the medium scorers in turn performed significantly better than the low scores 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 study examined the alternative teaching methods in secondary chemistry using the cooperative instructional strategy dimension on students' problem solving abilities in secondary school chemistry.

The method in which 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 students in the subject also calls for improvement in the teaching and learning of the subject. This had 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 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. Teachers should be encouraged to adopt CIS as supplementary or alternative strategy to the conventional methods of teaching.
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. 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.

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