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Peer assisted cooperative instructional strategy and cognitive ability levels of chemistry students in Etinan Local Government, Akwa Ibom, Nigeria

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This study examined the effect of peer assisted co-operative instructional strategy on the ability levels of students. Two research questions and hypotheses were developed to guide the study. A non-randomized pre-test and post -test control group design was adopted for the study. A total of 110 Senior Secondary 2 Chemistry students were used. Cognitive Ability Test (CAT) and Chemistry Performance Test (CPT) were the instruments used to generate data. Reliability coefficients of 0.82 and 0.80 were obtained for CAT and CPT respectively using Kuder-Richardson formula 21. Data collected were analyzed using descriptive statistics of mean, standard deviation, independent t-test and analysis of co-variance. From the findings of the study, it was observed that peer assisted co-operative instructional strategy had effect on cognitive ability levels of chemistry students. The result also showed that there was no significant difference existing among the academic performance of male and female students taught with peer assisted co-operative instructional strategy. Recommendations included that teachers should vary their instructional strategy to meet with students' learning styles and cognitive ability levels instead of relying on the conventional method alone.

Key words: Peer assisted, cooperative instructional strategy, cognitive ability levels.

INTRODUCTION

Scientists and technologists are indispensable to the technological development of any nation. These professionals cannot be produced if science subjects including chemistry are not properly taught in our secondary schools. Effective and efficient teaching and learning of science require among others a combination of deliberately organized people, materials and procedures that interact cooperatively for the purpose of achieving predetermined educational goals and instructional objectives. Moreso, effective learning depends on effective classroom communication and interaction between the teacher and the learners, learners and materials, learners and learners. Hence, the teacher must adopt effective instructional strategy to ensure equally effective

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instructional delivery that will culminate in effective learning Many students in senior secondary schools in Nigeria shy away from offering pure sciences like chemistry. Keshinro (1998) asserts that in most secondary schools the number of students who offer subjects in Arts, Humanities and business has been much higher than those who offer pure science subjects like chemistry and physics. Students fear chemistry or develop what is referred to as "Chemphobia" so much that anyone who enrolls in chemistry is looked upon with awe, because the subject is believed to be difficult and not easy to pass in examinations. This stance may be due to the poor teaching strategies adopted in our secondary schools. To make chemistry more relevant, enjoyable, easy and meaningful to students, appropriate teaching strategies need to be employed as the teaching and learning situations may demand.

Co-operative instructional strategy is a teaching strategy in which small groups, each with students of mixed ability levels, use a variety of learning activities to improve their understanding of content. Each member of the group is responsible not only for learning what is taught but also for helping group members to learn, thus creating an atmosphere of achievement. Johnson and Johnson (1999) describe co-operative strategy as the instructional use of small groups in which students work together to maximize and gain from each other. In co-operative instruction students are expected to help, discuss and argue with each other and fill any gap as each other understands.

Peer assisted co-operative instructional strategy is a technique of co-operative instructional strategy where a member of the structured groups is appointed as a head or sage. This sage is usually more knowledgeable than the other members of the group. The sage then works co-operatively with other group members ensuring the contributions and understanding of other group members of the concept or materials being taught.

In the school system, classrooms are generally composed of students of different cognitive ability levels. The cognitive ability level of a student is a construct of his academic achievement. Studies have shown that learners are qualitatively different in their ability levels and in learning problems. Adesoji (2002) opined that students are not the same especially when we find out the rate at which facts and principles in sciences are being assimilated. Thus students of varying cognitive ability levels perform differently depending on the type of method of instruction.

Gender disparities have been noticed and reported by various researchers as concerning enrolment in science courses and poor learning outcomes. Reasons cited for poor female enrolment in sciences are fear of the subject and the belief that science education is a" man's land". Research findings indicate that male students are better academically than female students (Akanbi, 1998; Adebayo, 1997).

In contrast a growing number of studies have revealed that gender differences in academic performance do not exist (Ibitoye, 1998; Bello, 1999).

Statement of the problem

Poor performance of students in West African Schools Certificate Examination calls for concern. Out of candidates who sat for the May/June 2010 West African Senior School Certificate Examination, only 337,071 candidates had credits in English, Mathematics and three other science subjects representing an appalling 24.94%. The state of chemistry teaching and learning seems to be fast deteriorating in most secondary schools in Nigeria. This trend does not augur well for the Scientific and Technological development of the country. The question is, "Can the use of peer-assisted co-operative instructional strategy improve chemistry performance?

Purpose of the study

The purpose of the study was to determine the effects of peer assisted co-operative instructional strategy on secondary school student's cognitive ability levels in chemistry. The study sought to achieve the following objectives:

1. To determine the effects of peer assisted co-operative instructional strategy on students' cognitive ability levels in chemistry.
2. To determine the effect of peer assisted co-operative instructional strategy based on gender of chemistry students.

Research questions

Two research questions were raised to guide the study.

1. How does peer assisted co-operative instructional strategy affect cognitive ability levels of chemistry students?
2. What is the difference between the academic performance of male and female chemistry students taught with peer assisted co-operative instructional strategy.

Research hypotheses

1. Peer assisted co-operative instructional strategy has no significant effect on cognitive ability levels of chemistry students.
2. There is no significant difference between the academic performance of male and female chemistry students taught with peer assisted co-operative instructional strategy.

RESEARCH DESIGN

The research design for this study is non-randomized pre-test, post-test control group experimental design

Population of the study

The population of the study comprised all the 694 senior secondary two chemistry students in the 19 secondary schools in Etinan Local Government Area of Akwa Ibom State, Nigeria.

Sample and sampling technique

Two secondary schools were selected from the 19 secondary schools in Etinan Local Government Area using criterion sampling technique. The criteria were:

1. The school must have presented candidates for senior school certificate examination for at least 5 years.
2. The school must have a qualified chemistry teacher with at least B.Sc (Ed) in chemistry teaching the SS2 class.
3. The school must have a functional chemistry laboratory.

A sample of 110 students consisting of 58 boys and 52 girls, from two intact classes in the two selected secondary schools were used for the study.

Instruments for data collection

Two researcher-made instruments: Chemistry Cognitive Ability Test (CCAT) and Chemistry Performance Test (CPT) were used for data collection. Items for CCAT consisted of 20 multiple choice questions constructed from the ministry scheme of work for SS1 and SS2. The test was used to group the students in the experimental group into different cognitive ability levels as follows: 0-9 (low); 10-13 (average) and 14 and above (high).

Items for CPT also consisted of 20 multiple choice questions constructed on the topic chemical combination. The test was used to determine the performance of the students on the concept of chemical combination when exposed to peer assisted co-operative and expository teaching strategies.

Validation and reliability of instruments

The instruments were submitted to 3 independent assessors including experts in instructional design and measurement and evaluation. Validation carried out included face, content, construct and subject validation. All the comments and corrections of the valuators were incorporated in the final form of the instrument.

To ensure the reliability of the instruments, the 20 multiple choice items were administered to a trial testing group of 10 students who were not part of the main study but are equivalent in all respects to the subjects of the main study. The result obtained was subjected to Kuder-Richardson formula 21 and the reliability coefficients of 0.82 and 0.80 were obtained for CCAT and CPT, respectively.

Procedure for data collection

After obtaining permission from the principals of the two schools and chemistry teachers who were to serve as research assistants, the research assistants were given detailed information on the lesson package to be used for the study. Pre-test was given to the control and experimental groups at the same time and the result obtained. The control group was taught by the research assistants on the lesson: chemical combination.

The experimental group was divided into 6 sub-groups of 10 students each. A sage or substitute teacher was appointed for each group. The sage was instructed on the concept to be taught while the researchers lectured the 6(six) groups on co-operative skills to be adopted by the students.

After this, the students were allowed to discuss on the chosen concept with the sage acting as head to ensure the contribution and understanding of each group member. The teacher who was also the research assistant acted as lesson facilitator. He used the co-operative lesson plan developed by the researchers according to the model designed by Johnson et al. (1991) as a guide to ensure that the students do not get out of context. A post-test was administered by the two research assistants for 30 min to the experimental and control groups one week after the treatment. The research procedure lasted for 3 weeks.

Method of data analysis

The data collected were analyzed as follows: the research questions were answered using descriptive statistics of mean, standard deviation and variance while the hypotheses were tested using independent t-test and ANCOVA. All hypotheses were tested at 0.05 level of significance.

RESULTS

Research Questions 1: How does peer assisted co-operative instructional strategy affect cognitive ability levels of chemistry students?

Table 1 reveals that the mean gain score (5-12) of students with high cognitive ability level was greater than the mean gain score (4.00) of students with average cognitive ability level. The mean gain score of students with average cognitive ability level was greater than that of low cognitive ability level (3.00).

Research Question 2: What is the difference in performance between male and female chemistry students taught with peer assisted co-operative instructional strategy?

Table 2 shows that mean gain score of female students (4.50) was greater than the mean gain score of male students (3.80) when taught with peer assisted co-operative instructional strategy. This implies that the performance of female students was slightly greater than their male counterparts.

Hypothesis 1

Peer assisted co-operative instructional strategy has no significant effect on cognitive ability levels of chemistry students.

Table 3 shows that the ability level main effects was significant at $P<.05$ alpha level since the calculated p-

Table 1. Mean and standard deviation of pre-test and post-test scores of students by their ability levels.

Cognitive ability levels	Pre-test Scores			Post-test Scores		Gain Scores
	N	X	SD	X	SD	Scores
High	17	10.53	2.50	15.65	1.54	5.12
Average	25	9.44	1.42	13.44	2.22	4.00
Low	15	8.67	2.53	11.67	2.50	3.00
Total	57	9.56	2.18	13.63	2.58	4.07

Table 2. Summary of mean and standard deviation of pre-test scores and post-test scores of performance of male and female chemistry students taught with peer assisted co-operative instructional strategy.

Gender		Pre-test	Scores	Post-test	Scores	Mean Gain
	N	$\overline{X}$	SD	$\overline{X}$	SD	Scores
Male	35	9.80	2.14	13.60	2.91	3.80
Female	22	9.18	2.24	13.68	1.99	4.50
Total	57	9.56	2.18	13.63	2.58	4.07

Table 3. One way analysis of covariance of post-test scores of students taught with peer assisted co-operative instructional strategy using pre-test scores as covariates.

			Sum of squares	df	Mean square	F.cal	Sg
Post-test	Covariates	Pre-test	41.276	1	41.276	9.276	.000
	Main effects	Ability level	95.005	2	47.503	47.503	.000
	Model	High	136.281	3	45.427	45.427	.000
	Residual	Average	234.982	53	4.434	4.434	
	Total	Low	371.264	56	6.630	6.630	

Table 4. Summary of Scheffe post hoc comparison of post-test scores of students by cognitive ability levels.

I Ability level	J Ability level	Main difference (I-J)	SIdenor	Sg
High	Average	2.21	.667	.007
	Low	3.98	.752	.000
Average	High	2.21	.667	.007
	Low	1.77	.693	0.46
Low	High	-3.98	.753	000
	Average	-1.77	.693	.046

ratio of .000 is less than the alpha level of .05. Thus, the null hypothesis which stated that peer assisted co-operative instructional strategy has no significant effect on cognitive ability levels of chemistry students was rejected.

This implies that peer-assisted co-operative instructional strategy has significant effect on cognitive ability levels of chemistry students. The scheffe post hoc comparative effect was used to ascertain the direction of significance as shown in Table 4.

The mean difference is 2.21 for high and average; 3.98 for high and low; and 1.77 for average and low. The levels

Table 5. Multiple classification analysis (MCA) of the post-test scores of students taught with peer assisted co-operative instructional strategy classified by cognitive ability levels.

Grand mean =13.63	N	Unadjusted	Adjusted for independent factor and covariate		
Variables+ Category		Dev'n	Eta	Dev'n	Beta
Cognitive ability level			0.587		0.535
High	17	2.02		1.84	
Average	25	-0.19		-0.17	
Low	15	-1.97		-1.80	

Multiple R. = 0.606; Multiple R. Squared = 0.367.

Table 6. T-test Analysis of post-tests scores of male and female students taught with peer assisted co-operative instructional strategy.

Gender	N	$\bar{X}$	SD	df	t	Sig
Male	35	13.60	2.91	55	0.15	.908
Female	22	13.68	1.99			

t is significant at p <.05 alpha.

of significance displayed on Table 4 indicate that students with high ability level significantly performed better than those with average ability. The average ability level students performed significantly better than those with low ability level.

In order to determine the index of relationship and also determine the variance in the dependent variable performance that is attributable to the influence of the independent variable cognitive ability level of students are shown in Table 5.

As shown in Table 5, the ability level has an index of relationship of Beta value of 0.535 with academic performance. The table also shows a multiple regression index (r) of 0.606 and multiple regression squared index (r^2) of 0.367, which implies that 36.7% of the variance in the enhancement of students' performance in chemistry is attributable to the influence of cognitive ability level.

Hypothesis 2

There is no significant difference between the academic performance of male and female chemistry students when taught with peer assisted co-operative instructional strategies.

The calculated P-value .908 for gender was greater than the alpha level .05. Hence the null hypothesis that proposed no significant difference between male and female students was accepted (Table 6). This indicate that there exists no significant difference between the academic performance of male and female chemistry students when taught with peer assisted co-operative instructional strategy.

DISCUSSION

The results of the investigation as shown in Tables 1 and 4 indicated that peer assisted co-operative instructional strategy has significant effect on cognitive ability levels of chemistry students. The result in Table 4 indicated that students having high cognitive ability level performed better than those having average ability, students of average ability level performed significantly better than those having low ability.

More so, the result in Table 5 showed that 36.7% of the variance in the performance of students in chemistry was attributable to the effect of cognitive ability level. These findings are in line with Okebukola (1984) who confirmed that the use of co-operative instructional strategy can influence the performance of low ability students. This might be due to the influence of the high ability students within the mixed ability co-operative groups. This finding is also supported by Dougherty (2000) who observed that peer assisted co-operative strategy improved the cognitive ability levels of students in her science classroom. This might be due to the productive interactions within the co-operative groups. This finding is at variance with Leung and Chung (1994) who observed that though high ability students outperformed the low and average ability students. The difference was not significant since low ability students benefited from mixed ability grouping under co-operative conditions.

Another area of concern in this study was to find out the effect of the independent variable based on gender. The result of the investigation as shown on Tables 2 and 6 indicated that female chemistry students performed better than their male counterparts; however, the difference

was not significant. This could be due to the pro-motive interactions and positive interdependent between both sexes in the co-operative groups, thus promoting understanding and enhancing motivation and interest in the subject. This finding is consistent with the studies of Ibitoye (1998), Bello (1999) who are of the view that gender difference in academic performance does not exist. However, the finding is at variance with the study of Aregbesola and Odusola (2003) who revealed that there was gender difference in science achievement as the general performance was low for girls and high for boys.

Conclusion

The following conclusions were drawn based on the findings of this study. Peer assisted co-operative instructional strategy affects student's cognitive ability levels in chemistry. There exists no significant difference in the academic performance of male and female chemistry students taught with peer assisted co-operative instructional strategy.

RECOMMENDATION

Consequent upon the findings of this study the following recommendations were made,

1. Chemistry students should be made to learn in small co-operative groups especially when dealing with difficult concepts in chemistry.
2. High performers with high cognitive ability should be identified by chemistry teachers in their classes and used as sages or peer tutors.
3. Care must be taken in the choice of sages as not to allow the same students occupy the position for too long.
4. Female students should be encouraged to take up studies in the field of sciences. They can also act as sages in the cooperative science classroom.

Conflict of Interests

The authors have not declared any conflict of interests.

REFERENCES

Adebayo OA (1997). ''Gender environment and co-education as factors of performance in the ravens standard progressive matrics.'' Gombe Tech. Educ. J. 1:33-35.

Adesoji FA (2002). Modern strategies in the teaching of integrated science. In: Ayodele SO (Ed). Teaching strategies for Nigerian secondary schools. Ibadan: Power house press publishers.

Akanbi T (1998). Cognitive preferences, instructional modes, cognitive development levels and achievement in chemistry. Unpublished doctoral thesis Ilorin; University of Ilorin.

Aregbesola T, Odusola O (2003). "Achievement in physics, gender attitude towards technology oriented career among Nigerian adolescents" Niger. J. Soc. Educ. Res. 3(1):54-162.

Bello G (1999). Comparative effects of two forms of concept – mapping instructional strategies on senior secondary schools students' achievement in biology Unpublished Ph.D. Thesis. Department of Curriculum Studies and Educational Technology. University of Ilorin.

Dougherty LA (2000). Peer tutoring: Can it have effect on science in the content? Paper presented at language minority beginning teacher induction project at Ellen Glasgow Middle School, Alexandrna , Virginia.

Ibitoye SJ (1998). Gender difference and achievement in the secondary school agricultural science in Kwara state. Nig. J. Tech. Educ. 6(1):148-153.

Johnson DW, Johnson RT, Holubec EJ (1991). Cooperation in the classroom. Edina; Interactions Book Co.

Johnson DW, Johnson RT (1999). Making cooperative learning work: Theory Pract. 38(2):67-73.

Keshinro A (1998). Student's perception and attitude towards learning chemistry in senior secondary schools in Nigeria. AJOPASE (1)85-92.

Leung CD, Chung C (1997). Students achievement in an educational technology course as enhanced by cooperative learning. J. Sci. Educ. Technol. 6(4):337-342.

Okebukola PA (1984). Effects of cooperative, competitive and individualistic laboratory interaction patterns on students performance in biology Unpublished Ph.D Thesis University of Ibadan. Ibadan.