
ABSTRACT

The study aimed to find out the Algebra performance of the respondents exposed to cooperative learning approach and lecture method. The data were gathered with the use of evaluative test (pretest, weekly test and posttest) to determine the performance of the respondents in Algebra. The feedback evaluation sheet was used to draw opinion relative to the use of cooperative learning intervention. The descriptive statistics such as frequency count and mean were used to describe the performance of the respondents in the pre test, weekly test and posttest. The weighted mean was used to interpret results on the degree of agreement of the respondents on the use of cooperative learning approach. The t-test for dependent means was used to determine the Algebra performance of the respondents within the control and experimental groups. The t-test for independent means was used to determine the Algebra performance of students between the control and experimental groups. Results showed that the Algebra performance of the control and experimental groups in the pre test was both “satisfactory”. The control group had a “very satisfactory” performance in the weekly test, while the experimental group performed “outstanding”. The same result was obtained in the post test with respondents in the experimental group performing “very satisfactory”. A highly significant difference of Algebra performance of students within the control and experimental groups existed, which meant that either strategy used by the teacher causes or effects learning. In terms of performance in the pre test, weekly test and post test between the control and experimental groups, a significant difference was noted. In all these tests, learning was enhanced when respondents were exposed to the cooperative learning approach. The respondents commonly “agreed” to use the cooperative learning strategy because of the benefits that could be derived from it.

KEYWORDS: College Algebra; Approach; Cooperative Learning; Maritime Students.

INTRODUCTION

Mathematics plays a very important role in man’s life. Every citizen should acquire competence and development of power in quantitative thinking and in the use of mathematics procedure in daily living. Obviously, whether one is a businessman, a plain housewife, a vendor, an employee, a student, or just an ordinary laborer or factory worker, knowledge of the numerical system is important.

Undeniably, mathematics teachers have a unique opportunity to utilize a variety of effective teaching methods. It is important that they recognize the necessity of selecting techniques and instructional methods suitable to the goals, subject matter areas and the students.

At Naval Institute of Technology, the lecture is a traditionally used method in carrying out mathematics instruction. With traditional teaching strategy, students are never really encouraged to actively involve themselves in the process of learning. They are not exposed to experiential learning activities based on real-life situations that they are familiar with.

Inasmuch as maritime education is the flagship program of the Institute, and considering that mathematics is acceptably believed as a very important discipline in all aspects of human endeavor, the need to instill knowledge

and skills in numeracy among maritime students is thought of as a vital concern. With these factors in mind, there is a need for the use of more effective instructional strategies by teachers.

Cooperative learning, according to Schechty (1990), is a technique of putting children in work groups and assuring them that even if they have different backgrounds, different abilities and experiences, they work together in productive ways. This learning approach is perceived to raise the academic achievement and encourage learners to help and support peers in their group rather than compete against one another. Through this approach, the children learn from each other such that high and low ability children benefit from one another. Corollary to these advantages, Department Order No. 2, S. 2002 was issued by the Bureau of Secondary education redirecting the curriculum to adopt the strategies in mathematics which emphasized, among other things, on the mathematical investigation and cooperative learning to accelerate the achievement of students (DepEd, 2002). Perceived that mathematics usually scares students (Salamat, et al, 1997), cooperative learning approach is the most appropriate answer in dealing with this problem since the involvement and assistance of everyone in the group is sought thus, facilitating faster and better learning because they take active part in the lesson. With this approach, students will gain competence and confidence in dealing with mathematical situations readily.

In view of the foregoing circumstances, this study is wanting because of the belief that cooperative learning is an approach suitable to bring about improvement in Algebra performance of first year Marine Engineering students of this Institute.

Objectives of the Study

With the intent of coming up with inputs that will enhance the mathematical ability of students, this study was conducted with the following objectives:

1. To describe the process involved in employing the cooperative learning approach in teaching Algebra for the Maritime Education students;
2. To determine the Algebra performance of the students in the experimental and control groups in terms of: pretest performance, posttest performance, incremental scores, and weekly tests performance.
3. To determine the significant difference of the posttest and pretest performance within the control and experimental groups;
4. To determine the significant difference of Algebra performance between the control and experimental groups.
5. To ascertain students' feedback about the effectiveness of the cooperative learning intervention.

Framework of the Study

The idea behind the conceptualization of this study is hinged on the principle that instructional strategy has something to do with the performance of students in Algebra. In fact, Morse and Wingo as cited by Aquino (1999) have stated that "effective teaching is doing the appropriate thing for the individuals in particular group to move toward specified goals". This means that the teacher, to be effective, must provide what he considers to be appropriate materials and methods and other inputs with a view to facilitating the attainment by the learners the desired learning outcomes. Involved in this study are two groups of subject. The first group (control) is exposed to the traditional method (lecture) of instruction; while the other, to the cooperative learning approach (experimental). In the latter group, students are viewed to work together effectively on a given problem or activity. Each member needs a feeling of having something to give and each one must do his/her share of the work. With their exposure to the respective instructional strategies, performance of students in Algebra is measured in terms of pretest, weekly test and posttest. From the studies reviewed, it is believed that cooperative learning experiences would be a solution to learning problems in Algebra.

The concept of this study is diagrammatically shown in Figure 1.

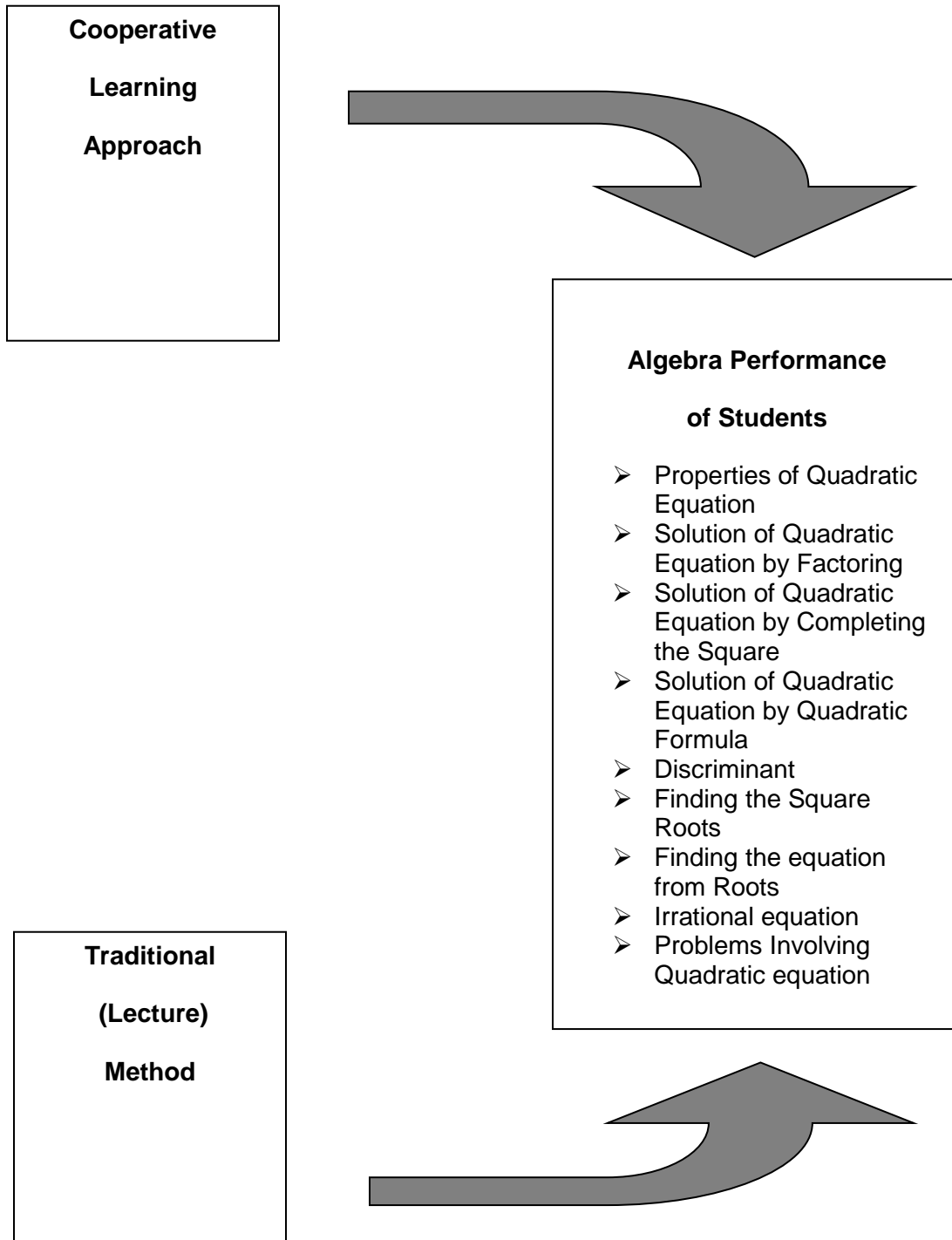


Figure 1. Conceptual framework of the study

Scope and Delimitation of the Study

This study was confined to the investigation of students' performance in Algebra while being exposed to the cooperative learning using the Student Team Achievement Division (STAD) approach of which students were assigned to five-member group that were mixed in abilities and sex. Sixty (60) first year Marine Engineering students in the College of Maritime Education of the Naval Institute of Technology shall serve as respondents of the study.

METHODOLOGY

The experimental research design was used because it was appropriate for this type of work. The use of cooperative learning approach in teaching Algebra serves as the experimental treatment; and the traditional method, the control. The independent variable in this study was the instructional/teaching method (cooperative learning approach and traditional method), while the dependent variable was the performance of the two groups of respondents, particularly their scores in the pretest, weekly test and posttest. The pretest-posttest design was used in this study. This involved the experimental and control groups which were carefully selected through randomization procedures (Calmorin and Calmorin, 2001). Both groups were given pretest at the beginning of the study and posttest at the end of the study. Each group constituted 30 respondents. For the experimental group, the respondents were divided into five subgroups with five members of different mathematics abilities in each group. This study was conducted at the College of Maritime Education of the Naval State University. The only state university in the Province of Biliran offering various college degree programs and one of those is the Maritime Education program. The respondents of this study were the first year students taking Algebra during the first semester, school year 2007-2008, who were officially enrolled in the College of Maritime Education taking Bachelor of Science in Marine Engineering (BSMarE) at the Naval Institute of Technology, Naval, Province of Biliran. Of the total number of second year BSMarE students enrolled, only 60 were considered respondents based on the result of the pretest. These students were organized into two major groups which were composed of 30 students in a group. The test instruments were constructed so as to draw out the answers needed to support or prove the hypotheses advanced in this study. With the help of other mathematics teachers, an item analysis was done to determine what question were retained and improved in the evaluation of both groups (control and experimental) of respondent. To ensure reliability and validity of the test instruments, a dry run (tryout) examination was administered to "other" first year BEEed students in the College of Education. These "tryout" takers were not used as respondents of this study. After the dry run of the test instruments, the results were used as bases for rejection or retention of test items in the process of test revision. The revised version became the final test instruments for both groups of respondents. Results of the pretest, weekly test, posttest and feedback of the respondents on the use of the cooperative learning strategy, were described with the use of descriptive statistics such as frequency count, mean and rank. As to the existence of significance difference on the test mentioned above of the two groups of respondents exposed to cooperative learning approach and lecture method, the data were analyzed with the use of t-test set at 0.05 level of significance. To determine the significant difference of performance within groups, the t-test for dependent means was used, and to evaluate the significant difference of performance between groups, the t-test for independent means was used.

RESULTS AND DISCUSSION

The results of the statistical tests from the data gathered are contained in this section. The data are presented in tabular form with corresponding textual explanation.

Process Involved in Employing the Cooperative Learning Approach in Teaching Algebra

The Student Team Achievement Division (STAD) of cooperative learning approach was employed in this study. According to Slavin (1986), STAD is a prevailing and simple technique in cooperative learning consisting of five major components, namely: (a) class presentation, (b) teams, (c) quizzes, (d) individual improvement scores, and (e) team recognition. These components were all considered in this study but with a very slight modification. As applied, the students were assigned to a five-member learning group (team) based on the results of their pretest; hence, they were composed of members of varied abilities and mixed gender.

The teacher (researcher) presented the lesson and the students were made to work within their group. The team (group) met to study the lesson or assignment, discussed problems together and corrected misconceptions. This was so because the teacher provided the students with key answer for their assigned task/problem. The key answer served as “cross-check” guide for comparison of their answer to make sure that all group members had mastered the lesson. With the key answer, the students were sure of their learning outcome; otherwise, they would not stop working until correct answer is attained or arrived at. A weekly test (quizzes) was given to measure how well the students had mastered the material/lesson. Based on the result, their progress was determined and those with improved performance received recognition by way of certificates or rewards. Finally, upon the termination of the study (experiment), all students took the examination but assistance from group mates was strictly not allowed anymore. All questions asked in the test were taken from topics assigned to, and discussed with them. Questions asked in the posttest were the same as in the pretest but sequencing was disarranged to avoid recognition or detection by students, thus averting guesswork. The scores of the respondents in the posttest were compared with those in the pretest for statistical analysis. When they were through with the examination, all of the respondents in the experimental group (cooperative learning approach) were asked to provide information and/or feedback about the use of cooperative learning approach in their Algebra lesson.

Respondents’ Pretest Performance

This test was given to the students prior to their exposure to the lecture and cooperative learning strategies to determine their knowledge level on the subject. As shown in Table I, the performance of the control and experimental groups was quite similar obtaining practically the same scores. In fact, of the 40-item test, both groups scored 20 and 8 as the highest and lowest, respectively.

With an average score of 13.27 (control) and 14.20 (experimental), their respective performance in the pretest was said to be “fair” and “satisfactory”. Considering this fact, it is implied that both groups of respondents had a little knowledge about the subject or the lesson being covered. Furthermore, this implies that the result serves as a good basis in determining the level of performance of the respondents in the posttest.

Table 1. Performance of the respondents in the pretest

Control Group			Experimental Group		
Score (x)	f	fx	Score (x)	f	fx
20	1	20	20	1	20
19	0	0	19	2	38
18	2	36	18	3	54
17	1	17	17	3	51
16	2	32	16	4	64
15	4	60	15	1	15
14	4	56	14	3	42
13	3	39	13	3	39
12	3	36	12	2	24
11	5	55	11	3	33
10	3	30	10	2	20
9	1	9	9	2	18
8	1	8	8	1	8
$\sum f = 30$ $\sum fx = 398$ $\bar{X} = 13.27$			$\sum f = 30$ $\sum fx = 426$ $\bar{X} = 14.20$		

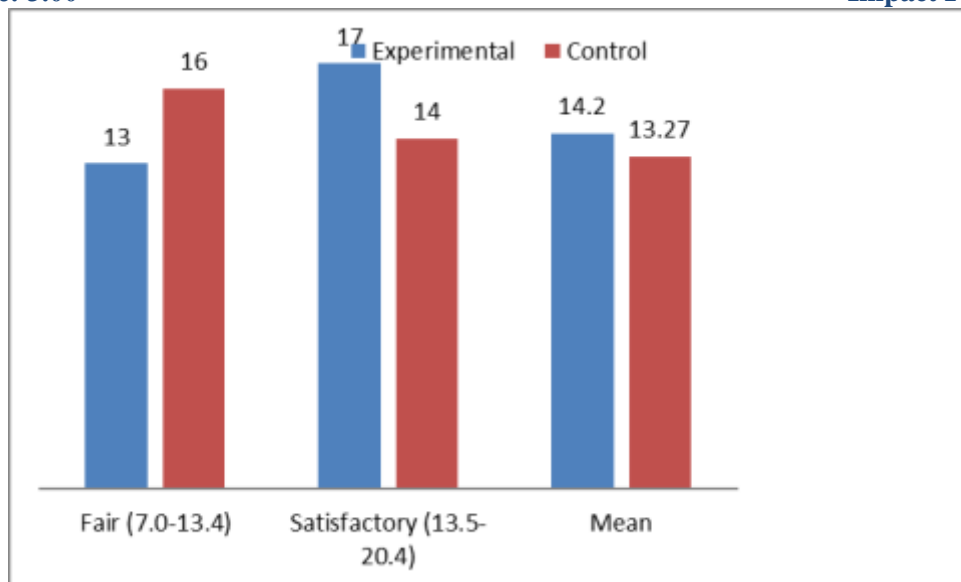


Figure 2. Pretest level of performance of the experimental and control groups

Respondents' Posttest Performance

This test was given to both groups when the study was terminated. The results of this test were used as bases for establishing the effect of cooperative learning approach on the Algebra performance of the respondents. In other words, this test was important because it measured how well the students learned or mastered the lesson during their exposure to cooperative teaching method.

M As presented in Table 2, the control and experimental groups differed in terms of highest and lowest scores. In the former, the highest score was 29; and the lowest, 17; while in the latter, the highest was 32, and the lowest, 16.

Table 2. Performance of the respondents in posttest

Control Group			Experimental Group		
Score (x)	f	fx	Score (x)	f	fx
29	1	29	32	1	32
27	2	54	29	3	87
26	2	52	28	3	84
25	3	75	27	4	108
24	3	72	26	2	52
23	1	23	25	3	75
22	5	110	24	2	48
21	1	21	23	2	46
20	2	40	22	1	22
19	4	76	21	3	63
18	3	54	19	3	57
17	3	51	17	2	34
			16	1	16
$\sum f = 30$ $\sum fx = 657$ $\bar{X} = 21.90$			$\sum f = 30$ $\sum fx = 724$ $\bar{X} = 24.13$		

Having obtained an average score of 21.90, the performance of the control group in the posttest was said to be “very satisfactory”, while the experimental group which obtained a higher average score of 24.13 was perceived as having had a “very satisfactory” performance in the same test. The result suggest that in the cooperative learning approach,

the students are given the freedom to discuss the lesson among themselves and engage them actively in the process of learning toward a goal, hence the higher score.

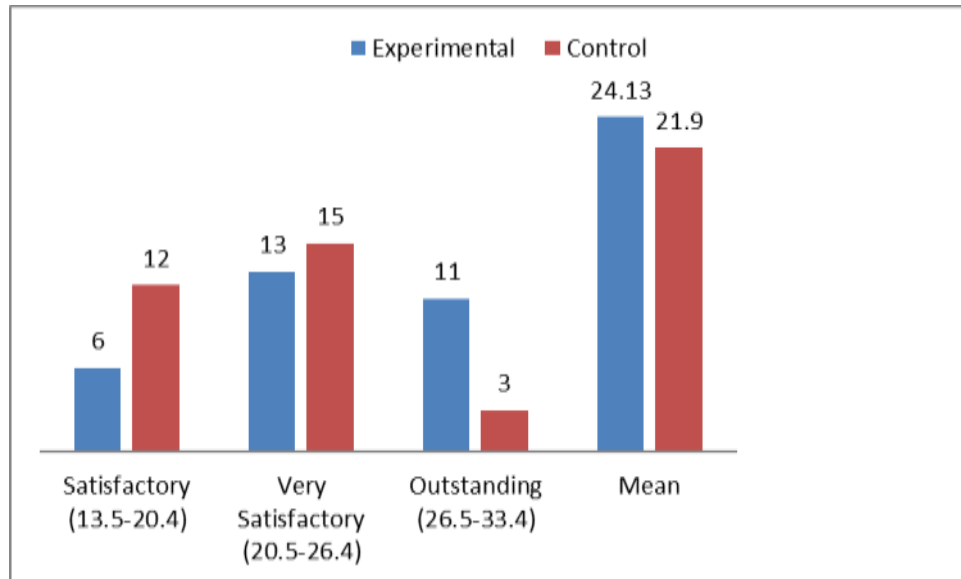


Figure 3 . Post test level of performance of the experimental and control groups

Incremental Scores of the Respondents

Shown in Table 3 is the incremental scores of the respondents in mathematics as a result of their exposure to the lecture method (control) and cooperative learning (experimental) approach. Both groups differed in their highest and lowest increment. The respondents exposed to the lecture method (control) of teaching obtained highest and lowest incremental scores of 20 and one respectively, while the highest incremental score of those exposed to the cooperative learning (experimental) was 18 and the lowest was zero, which meant that there was no increase at all. Plainly stated, the score of said respondents in the pretest and posttest were exactly the same, hence the zero increment.

Table 3. Incremental scores of the learners in the control and experimental groups.

Control Group			Experimental Group		
Score (x)	f	%	Score (x)	f	%
1	1	3.33	0	1	3.33
4	1	3.33	3	3	10
5	1	3.33	4	2	6.67
6	6	20	5	1	3.33
7	3	10	7	2	6.67
8	3	10	8	2	6.67
9	3	10	9	1	3.33
10	3	10	10	2	6.67
11	5	16.7	11	1	3.33
12	3	10	12	3	10
20	1	3.33	13	2	6.67
			14	2	6.67
			15	2	6.67
			16	4	13.33
			17	1	3.33

$\bar{X} = 8.63$	18	1	3.33
	$\bar{X} = 9.93$		

The Table further shows that most (20%) of the respondents in the control group obtained an incremental score of six, while in the experimental group, most 13.33% of them obtained an increment of 16. As to their mean incremental scores, those exposed to cooperative learning had an increment of nearly 10 points compared to those exposed to lecture method whose increment was just more than 8 points (Table 3 Figure 4). The result suggests that the exposure of the respondents to the cooperative learning approach was believed to influence their enhanced performance in mathematics.

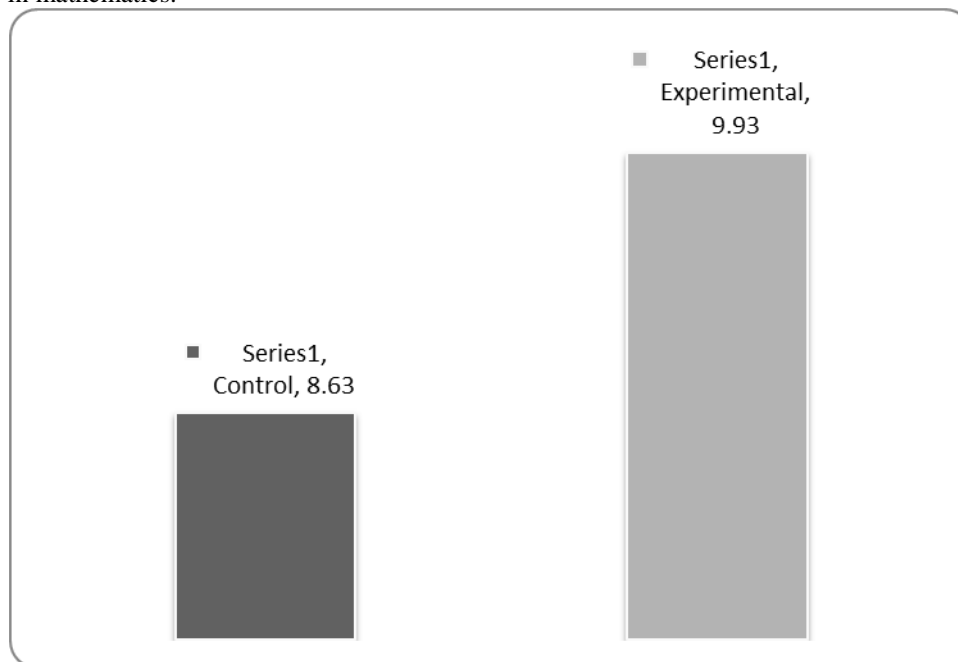


Figure 4. Mean incremental scores of the control and experimental groups

Respondents' Weekly Test Performance

The performance of the respondents in the weekly tests differed as gleaned from Table 4. Comparatively, it is clearly noted that students who got the highest score of 53 were those in the experimental group, while those in the control group got only 45.

Table 4. Performance of the respondents in the weekly tests

Control Group			Experimental Group		
Score (x)	f	fx	Score (x)	f	fx
45	2	90	53	1	53
44	1	44	51	1	51
43	1	43	48	1	48
42	1	42	47	1	47
41	2	82	46	2	92
40	1	40	45	3	135
38	2	76	44	1	44

37	2	74	43	2	86
36	5	180	42	2	84
35	3	105	41	1	41
34	2	68	40	3	120
33	1	33	39	1	39
32	2	64	38	2	76
31	2	62	37	1	37
30	2	60	36	2	72
29	1	29	35	1	35
$\sum f = 30$ $\sum fx = 1,092$ $\bar{X} = 36.40$			34	3	102
			32	2	64
			$\sum f = 30$ $\sum fx = 1,226$ $\bar{X} = 40.87$		

On the average, the control group scored 36.40; while the experimental group, 40.87, describing their respective performance in the weekly tests as “very satisfactory” and “outstanding”. This finding indicates that cooperative learning approach is far better and more effective than the lecture group because members commonly work hard together to achieve their goal and are held responsible for their learning outcome.

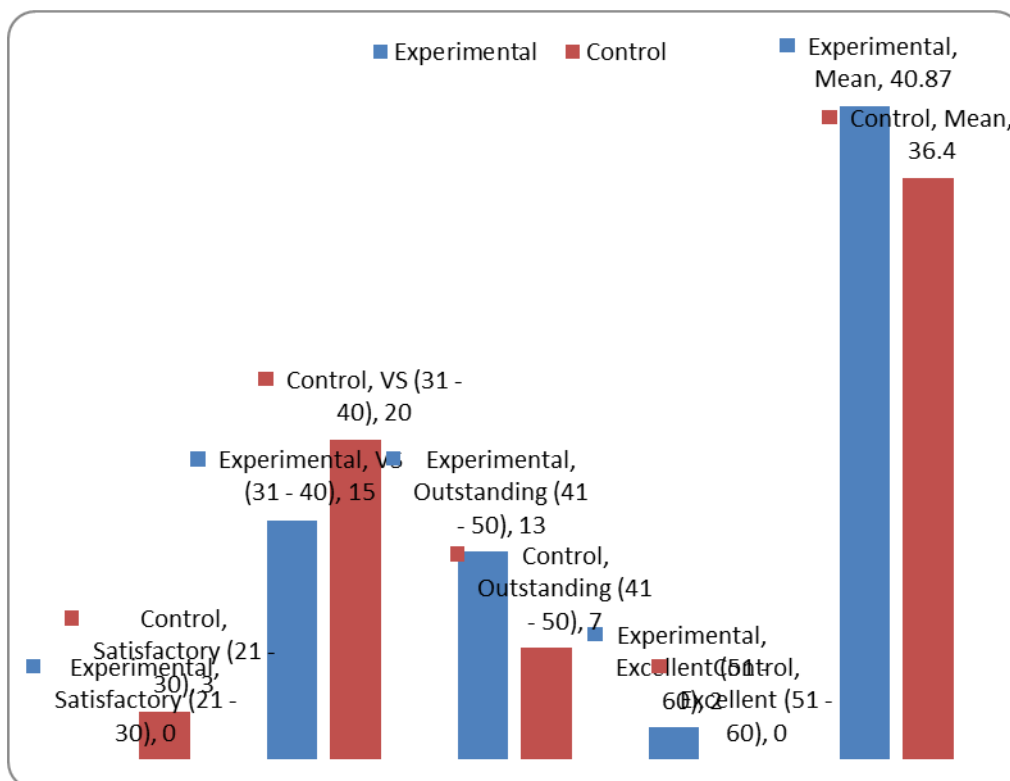


Figure 5. Weekly tests level of performance of the experimental and control groups

Difference of Algebra Performance within Groups

Table 5 presents the Algebra performance of the respondents within the control and experimental groups based on their pretest and posttest results.

Table 5. Difference of Algebra performance of students within groups

Control Group					Experimental Group				
Test	\bar{x}	t_c	t_t		Test	\bar{x}	t_c	t_t	
			0.05	0.01				0.05	0.01
Pretest	13.27	-13.79**	2.045	2.756	Pretest	14.20	-10.67**	2.045	2.756
Posttest	21.90				Posttest	24.13			

** highly significant

A highly significant difference in Algebra performance exists within both groups. In the control group (lecture), a highly significant difference of performance was noted considering that the absolute value of the computed t-value (-13.79) is greater than the tabular t-value (2.756) at 0.01 level of significance. This means that the students being taught the traditional (lecture) way learned the lesson very well. It should be clearly understood that while it is revealed in this work that a highly significant difference was observed on students learning taught the traditional way, it is an established fact that the lecture is a teaching method employed by schools over the years and is as effective as other methods when used appropriately.

The same result was obtained in the experimental group (cooperative learning). There was a highly significant difference of performance of students exposed to cooperative way of learning as statistically supported by the higher computed t-value of -10.678 compared with the tabular t-value of 2.756 at 0.01 level of significance. This implies that the exposure of students to cooperative learning strategy has, without doubt, made the students learned the lesson very well.

With this finding, the hypothesis propounding the nonexistence of significant difference of performance of students in Algebra within the control (lecture) and the experimental (cooperative learning) groups is rejected. The rejection of the null hypothesis has erased doubts that whether a teacher uses lecture or other methods of teaching apart from cooperative learning method, learning still takes place, or is still effected.

Difference of Algebra Performance Between Groups

Presented in Table 6 is the performance between the control and experimental groups in terms of their scores in the pretest, weekly test and posttest. In the pretest, the Algebra performance between the control and experimental groups did not significantly differ inasmuch as the computed t-value of 1.148 is very much lesser than the tabular t-value of 2.0 at 0.05 level of significance. Considering that the difference between the control and

Table 7. Feedback of the respondents on the benefits gained from cooperative learning intervention

Feedback (Opinion)	5	4	3	2	1	Weighted Mean	Interpretation
Academic achievement of students is enhanced because they are free to ask question and share ideas without fear of being rejected	28	8	1	0	0	4.67	Strongly Agree
Develops friendliness and willingness to help one another to learn	21	8	1	0	0	4.60	Strongly Agree
Develops helping behavior, interest, personal liking and mutual concern among members of the group	16	13	1	0	0	4.5	Strongly Agree
There is respect for other member's ideas or point of view	17	11	2	0	0	4.47	Agree
Learning assigned task is enjoyable	14	14	2	0	0	4.43	Agree
There is greater motivation and desire in learning assigned task	12	18	0	0	0	4.40	Agree
Students are more responsible for their own work	14	13	3	0	0	4.37	Agree
Promotes better exchange of ideas on the process of discussing the lesson	10	19	1	0	0	4.30	Agree
Involves the learner in the learning process	9	21	0	0	0	4.27	Agree
Achieves/develops unity through harmonious relationship	8	20	2	0	0	4.23	Agree
Creates a positive impact on the Learner's self-worth and self-confidence	11	16	3	0	0	4.23	Agree

Task is finished more efficiently than done individually	6	23	1	0	0	4.17	Agree
Avoids competitive behavior among students	2	21	7	0	0	3.87	Agree
Grand Mean						4.35	Agree

With an overall mean score of 4.35, the respondents “agreed” to use the cooperative learning intervention in teaching Algebra in the College of Maritime Education of this Institute because of the benefits derived from it.

CONCLUSIONS

In the light of the results obtained in this study, the following conclusions are drawn: The Algebra performance of the control (lecture) and experimental (cooperative learning) groups in the pretest is comparable. Both obtained a “satisfactory” performance. The performance of the control group in the weekly test is “very satisfactory”, while that of the experimental is “outstanding”. The control group has a “satisfactory” performance in the post test, while the experimental group whose score is higher, and also has a “satisfactory” performance. There is a significant difference of Algebra performance of students within the control and experimental groups. Whether a teacher uses lecture or cooperative learning, learning still occurs. When cooperative learning approach is compared to the lecture method in terms of student performance in the pretest, weekly test and post test, a significant difference exists. The performance of the respondents in all these tests is enhanced when taught the cooperative way. Respondents exposed to the cooperative learning strategy commonly “agreed” to use the same because of the benefits that can be derived from it.

RECOMMENDATIONS

As revealed in this study, the use of cooperative learning approach in teaching Algebra is reinforcing and effective for it generates higher learning achievement. On the basis of the same, the following recommendations are deemed necessary for adoption: The use of cooperative learning approach should be promoted or encouraged not only in the teaching of algebra, but other subjects, as well. Instructional materials and facilities necessary to carry out the teaching-learning process should be adequately provided to effect a more meaningful learning. A training activity should be developed to equip teachers with knowledge and skills necessary for the use of this approach. Inclusion of this strategy in the teacher-education curriculum be pursued. A similar work of wider scope be conducted to establish more reliable generalizations pertinent to its practical applicability or workability in the field.

REFERENCES

1. Dela Cruz, M.C. and Cesista. (2001). “The effects of cooperative learning on mathematics achievement and attitudes of sophomore Students of Sagkahan National High School!” Unpublished Master’s Thesis, Leyte Normal University, Tacloban City.
2. Department of Education, (2002). Bureau of secondary Education Operations Handbook in Mathematics.
3. Llanas, D..M. (2005). “The Effect of Student-Pairing on the Achievement in Mathematics of the Sophomore Students of Taberna National High School?”. Unpublished Master’s Thesis, PIT, Palompon, Leyte.
4. Lumbab, S.G. (2008). “Effect of the fair-share learning together model on the English reading performance and self-esteem of pupils at Lucso-on elementary school?”. Unpublished Master’s Thesis, Naval Institute of Technology, Naval, Biliran.
5. Ruelos, R.M. (2001). “Using Manipulatives in Mathematics”. *The Modern Teacher*, XLIX (9).
6. Salamat, L.G., Sta. Maria, A.C. and Sevilla, M.R. (1997). *College Algebra* (3rd ed.), Echanis Press, Inc., Mandaluyong City.

