

# EFFECT OF FREE AND CONTROLLED GROUPING SCHEMES ON STUDENTS' MATHEMATICS ACHIEVEMENT AND ATTITUDE TOWARDS GROUP WORK

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**Abstract:** Mathematics as a part of daily activities has become an essential element in life especially in the field of education. Mathematics is not only for an individual working on an exercise or problem, but it can be done by working together.

One of the problems encountered by teachers is the inability of the students to communicate in class. By working in small groups, the students may come to know and understand each other better, and consequently, be able to communicate more effectively.

The study focused on the comparison of the effectiveness of the free and controlled grouping schemes in improving students' Mathematics achievement and in fostering a more positive attitude towards group work.

The quasi-experimental research design, specifically the pre-posttest design was employed. The participants of the study were the two sections of BSE/BEE I students. To ensure that both groups have the same entry level, pairing scheme was done.

Based on the findings of the study, it is concluded that the integration of cooperative learning strategy, either free or controlled grouping enhances the Mathematics performance and attitude of students toward group work. However, the cooperative learning has far better results when free grouping scheme is employed among students.

Cooperative learning employing the free grouping scheme should be recommended to Mathematics teachers to encourage and promote active learning, thereby enhancing Mathematics performance and favorable attitude towards group work.

Keywords: Free Grouping Scheme, Controlled Grouping Scheme, Mathematics Achievement

# INTRODUCTION

The quality of education that teachers provide to students is highly dependent upon what teachers do in the classroom. Thus, in preparing the students of today to become successful individuals of tomorrow, Mathematics teachers need to ensure that their teaching is effective. Teachers should have the knowledge of how students learn Mathematics and how best to teach. Changing both process and content in Mathematics instruction is a continuing



professional concern. Efforts should be taken now to direct the presentation Mathematics lessons away from the traditional methods to a more student-centered approach.

Cooperative learning offers a pleasant learning situation for all students, all students have equal opportunity, competition is amended as friendship, the spirit of cooperation and participation is reinforced, and all students are entitled to be thoughtful and creative (Lavasani & Khandan, 2011).

Teachers can encourage students to ask for help to better understanding of the difficult subjects through forming cooperative groups; on the other hand, students will learn to ask for help in different occasions whenever help seeking transpires (Lavasani & Khandan, 2011).

Studies find that the cooperative learning that is generally implemented in schools consists of unstructured group work, with little individual accountability and no group goals. Students sit together and are allowed to share ideas, but they often simply share answers rather than trying to explain ideas to each other (Emmer & Gerwels, 2002). Sharing answers without explanation has been found to inhibit, not aid, learning of Mathematics in cooperative learning contexts (Webb & Palincar, 2008). One of the main reasons why cooperative learning is expected to enhance Mathematics development is its ability to structure experiences that promote metacognition, defined as knowledge of one's own cognition. It is the process of knowing why you know something and how you know it. Combining cooperative learning with metacognition training has been shown to be an effective pedagogical strategy.

The researcher had chosen this study because she wants to structure her Mathematics classroom around group work. There are many benefits to group work in a mathematics classroom if it is implemented effectively, but this takes some practice and may depend on the students, teacher, and topics. There is a lot to be said about effective group work and it seems to be somewhat of a gray area since there is no way to be exactly sure what effective group work entails.

Grouping within the class can be done in many ways depending upon the purpose for which it is done. This study aims to find out how free and controlled grouping schemes compare in terms of their effectiveness on the Mathematics achievement, attitudes towards Mathematics and group work.



# STATEMENT OF THE PROBLEM

The main concern of this study was to compare the free and controlled grouping schemes in Mathematics instruction in terms of their effectiveness in improving students Mathematics achievement and in fostering positive attitude towards group work.

Specifically, it sought to answer to the following questions:

- 1. What is the pretest and posttest scores of the students in the free and controlled groups?
- 2. Is there a significant difference between the pretest and posttest scores of students in the free and controlled groups?
- 3. What is the pre and post-assessment results on the students' attitude towards group work in the free and controlled groups?
- 4. Is there a significant difference between the pre-attitude and post-attitude towards group work of the students of free and controlled groups?
- 5. What is the extent to which the social skills were manifested by the participants in both groups after their exposure to the grouping schemes?
- 6. Is there a significant difference between pretest and posttest, their pre-attitude and post-attitude towards group work and manifestation of social skills of the students in the free and the controlled groups?

# **RESEARCH DESIGN**

The quasi-experimental research design, specifically the pre-posttest design was employed, since the objective of the study was to compare the effectiveness of the free and controlled grouping schemes in improving students' Mathematics achievement and in fostering a more favorable attitude towards group work.

This design involves two groups, the controlled and free groups. The researcher identified the section assigned to the controlled grouping and free grouping schemes through tossing of a coin.

Moreover, both groups were given pretest and posttest. The free grouping scheme was employed to the second section of first year students while the controlled grouping scheme was employed to the first section of the first year students.



## PARTICIPANTS AND SAMPLING PROCEDURE

The study was conducted at the College of Teacher Education of Cagayan State University Lal-lo Campus for the Second Semester of School Year 2015-2016. The participants of the study were the two sections of BSE/BEE I students. The BSE/BEE I students has a total population of 164 but not all were taken as respondents.

The first two sections were utilized in the study. To ensure that both groups have the same entry level, pairing scheme was done. The number of possible pairs taken based from their grade in Mathematics 11 (Basic and Contemporary Mathematics) determined the total participants in the study. The students from the two different sections with the same grade in Mathematics 11 make one pair. There were 20 pairs of students that were taken from the two sections.

## **RESEARCH INSTRUMENTS**

There were two research instruments that were developed in this study, one of which is the teacher-made achievement test which consists of 40-item questions which intends to measure the respondents' entry knowledge on College Algebra specifically on Rational Algebraic Expressions and Radicals, Functions and Relations, Linear and Quadratic Equations, and Inequalities.

Another research instrument that was developed and validated was the Mathematics activity sheets which were utilized to compare the effectiveness of free and controlled grouping scheme in improving students' achievement. The activity sheets were patterned from the Philippine-Australia Science and Mathematics Education project of UP-ISMED, BSE and PASMEP staffs.

The social skills questionnaire was utilized to determine the students' extent of manifestation of the desired social skills in performing the group activities. The social skills questionnaire was also patterned from the Philippine-Australia Science and Mathematics Education project of UP-ISMED, BSE and PASMEP staffs.

Another research instrument that was administered was the Attitude towards Group Work questionnaire. This instrument was used to determine the attitude of the students towards group work. For the participants' responses in this questionnaire, reverse scoring was done for negatively stated items.



# DATA GATHERING PROCEDURE

The following were the steps done in the conduct of the study:

A letter was forwarded to the Associate Dean of the College of Teacher Education, Cagayan State University, Lal-lo Campus to request permission for the conduct of the study.

The researcher also asked the consent of the first two sections of BSE/BEE 1 students to be the respondents of the study. Two first year classes of CSU Lal-lo, College of Teacher Education comprised the participants. The two classes were randomly assigned to the two treatments, namely, free and controlled grouping schemes.

At the start of the second semester SY 2015-2016, the two classes were taught until they were ready for the study of Rational Algebraic Expressions and Radicals, Functions and Relations, Linear and Quadratic Equations, and Inequalities. Then the questionnaire on Attitude towards group work and pretest were administered for the first time.

The same lessons were taught to the two classes. The researcher taught the controlled group at 10:00 AM to 11:00 AM and the free group at 11:00 AM to 12:00 Noon every Monday, Thursday and Friday. In contrast to the traditional teacher-centered approach, a greater part of each teaching/learning session was spent by the students in small groups that worked independently during the group activity periods. The social skills questionnaire which was designed to determine the extent of manifestation of social skills of group members to finish the assigned task within the allowed time was administered to each student every after the group activity to appraise their participation/involvement in the group activities.

When both classes finished the lesson on Rational Algebraic Expressions and Radicals, Functions and Relations, Linear and Quadratic Equations, and Inequalities, the achievement test and attitude scale were again administered.

6. At the end of the experiment, the scores of the two classes in the Achievement tests and the Attitude Scales were compared using the t-test.

# DATA ANALYSIS

The data were gathered, tallied, analyzed and interpreted according to the objectives of the study. Descriptive and inferential statistics like frequency count, percentage, mean and t-test were used to interpret the data. All hypotheses were tested at 0.01 level.



# **RESULTS AND DISCUSSION**

Test	Score	PRETE	ST	POST	TEST	Descriptive	
	Range	F	%	F	%	Interpretation	
Controlled	25-32	-	-	3	15.00	Very Satisfactory	
Grouping	17-24	1	5.00	14	70.00	Satisfactory	
Scheme	9-16	15	75.00	3	15.00	Fairly Satisfactory	
	0-8	4	20.00			Poor	
	Total	20	100.00	20	100.00		
	Mean Score	10.80( Fairly Satisfactory)		20.65 (Satisfactory)			
Free	25-32	-	-	12	60.00	Very Satisfactory	
Grouping	17-24	2	10.00	7	35.00	Satisfactory	
Scheme	9-16	15	75.00	1	5.00	Fairly Satisfactory	
	0-8	3	15.00			Poor	
	Total	20	100.00	20	100.00		
	Mean Score	11.20( Fairly Sa	tisfactory)	24.30 (Sat	isfactory)		

### Pretest and Posttest Scores of Students in College Algebra

Table 1. Pretest and posttest scores of the students in the free and controlled groups

As indicated in the table, with respect to the pretest scores, majority of the students from the controlled and free groups have fairly satisfactory performance which comprise 75% of the participants in each group. The table further reveals that the controlled and free groups had mean pretest scores of 10.80 and 11.20, respectively. The mean ratings indicate that both groups had a fairly satisfactory Mathematics performance before the conduct of the study; although the free group's mean score is higher than the controlled group's overall mean score. The result shows that the first year students have below basic level of competency in College Algebra. This finding implies that students have not mastered the basic skills and have not attained the competencies set in their high school Mathematics.

On the other hand, based on the posttest scores, the table also shows that majority or 70% of the students from the controlled group had satisfactory performance. Whereas, in the free group, majority or 60% of the respondents had very satisfactory performance. Furthermore, the table shows that the controlled group and free group obtained mean scores of 20.65 and 24.30, respectively, both of which reflect a satisfactory performance. Although, the posttest mean performance of the free group is higher than the controlled group. The data reveal that the Mathematics performance of both groups improved after the experimentation. This result evidently manifests and agrees with the findings of



Belango (2014) that employing a variety of instructional strategies in Mathematics teaching could enhance the Mathematics performance of the learners.

Comparison between the Students' Pretest and Posttest Scores in the Achievement Test of each group

Table 2. T-test on the significant differences of the pretest and posttest scores of the free

Grouping Scheme	Test	Mean	Standard	Computed	P Value	Interpretation
			Deviation	t Value		
Controlled Grouping	Pretest	10.80	3.22	10.06	0.00	Significant
Scheme	Posttest	20.65	3.75			
Free Grouping	Pretest	11.20	3.21	15.38	0.00	Significant
Scheme	Posttest	24.30	4.49			

and controlled groups in the achievement test

As shown in the table, the pretest mean score of 10.80 of the controlled group is much lower than the posttest mean score of 20.65. The t-test yielded a t-value of 10.06, which has an associated probability of 0.00. Similarly, the pretest mean score of 11.20 of the free group is much lower than the posttest mean score of 24.30. The t-test yielded a t-value of 15.38, which has an associated probability of 0.00, the obtained probability value leads to the rejection of the null hypothesis thus, indicating that a significant difference exists on the pretest and posttest scores of the free and controlled groups. On the whole, the finding means that the cooperative learning strategy is effective in enhancing learning of the concepts and skills covered in the course. Both grouping schemes have positively influenced Mathematics learning. Whatever grouping scheme is used, both can contribute to enhance Mathematics performance. Thus, the use of cooperative learning as a strategy significantly increases learning of Mathematics.

## Pre and Post Attitude towards Group Work of the Controlled Group

Table 3. Pre-attitude and Post-attitude to	wards group work of the controlled group
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	ITEMS RATED	PRE	-	POST-	
				ASSESSMENT	
		MEAN	DI	MEAN	DI
1	I am willing to participate in group activities.	4.90	VHF	4.90	VHF
2	Group activities can improve my attitude towards group work.	4.65	VHF	4.90	VHF
3	Group work helps me to socialize more.	4.80	VHF	4.75	VHF
4	Group work enhances group working relationships among students.	4.70	VHF	4.65	VHF
5	Group work enhances class participation.	4.45	VHF	4.50	VHF



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6	Creativity is facilitated in the group setting.	4.20	HF	4.30	VHF
7	Group activities make the learning experience easier.	4.30	VHF	4.80	VHF
8	I love to work with students who are different from me.	4.05	HF	4.65	VHF
9	I enjoy the learning activities more when I work with other	4.05	HF	4.45	VHF
	students.				
10	My work is better organized when I am in a group.	3.95	HF	4.10	HF
11	I think the overall process of evaluating the group work	4.20	HF	4.30	VHF
	assessed everyone's individual contribution fairly.				
12	I find that the criteria for the evaluation of group work are	4.30	VHF	4.50	VHF
	made clear and explicit.				
13	I believe that the process of evaluating group work helped	4.55	VHF	4.65	VHF
	me develop my skills in collaborating with the group				
	members.				
14	Group assessment promotes the spirit of collaboration	4.40	VHF	4.75	VHF
	and cooperation.				
15	Group assessment considers the unique contribution of	4.40	VHF	4.65	VHF
	the individual members to the group.				
16	Group assessment is necessary so that those poor	4.70	VHF	4.65	VHF
	students have opportunities to improve their				
17	performance.	4 50		4.00	
17	Every member of the group strives to contribute	4.50	VHF	4.60	VHF
	something for the group to ensure high group				
18	In a group assessment some members of the group just	3 80	HE	3 75	HE
10	rely on the contribution of those high performing group	5.00		5.75	
	members				
19	An individual rating is important in a group assessment	4 70	VHF	4 50	VHF
10	based on their contribution to the groups' output.				••••
20	Group assessment will just make other students	3.90	HF	3.90	HF
	dependent on those advanced learners.	0.00		0.00	
	OVERALL MEAN	4.38	VHF	4.51	VHF

Legend:

VHF – Very Highly FavorableHF -Highly FavorableF – Favorable

MF - Moderately Favorable NF - Not Favorable

As shown in the table, the participants in the controlled grouping scheme had a Very Highly Favorable attitude towards group work as revealed in their pre-attitude mean score of 4.38 and post-attitude mean score of 4.51. They strongly agree that group activities can improve their attitude towards group work, they love to work with students who are different from them and they are willing to participate in group activities. They also believe that group activities make the learning experience easier, the participants in the controlled grouping scheme also enjoy the learning activities more when they work with other students and the group assessment promotes the spirit of collaboration and cooperation. This finding implies that better learning is achieved when group learning is employed and students develop positive attitude.



#### Pre and Post Attitude towards Group Work of the Free Group

#### Table 4. Pre-attitude and Post-attitude towards group work of the free group

	ITEMS RATED		SSMENT	POST-ASSESSMENT	
		MEAN	DI	MEAN	DI
1	I am willing to participate in group activities.	4.50	VHF	4.80	VHF
2	Group activities can improve my attitude towards group work.	4.40	VHF	4.70	VHF
3	Group work helps me to socialize more.	4.45	VHF	4.70	VHF
4	Group work enhances group working relationships among students.	4.55	VHF	4.80	VHF
5	Group work enhances class participation.	4.25	VHF	4.80	VHF
6	Creativity is facilitated in the group setting.	4.25	VHF	4.50	VHF
7	Group activities make the learning experience easier.	4.05	HF	4.55	VHF
8	I love to work with students who are different from me.	3.80	HF	4.65	VHF
9	I enjoy the learning activities more when I work with other students.	4.25	VHF	4.35	VHF
10	My work is better organized when I am in a group.	3.75	HF	4.10	HF
11	I think the overall process of evaluating the group work assessed everyone's individual contribution fairly.	3.80	HF	4.50	VHF
12	I find that the criteria for the evaluation of group work are made clear and explicit.	4.10	HF	4.55	VHF
13	I believe that the process of evaluating group work helped me develop my skills in collaborating with the group members.	4.40	VHF	4.70	VHF
14	Group assessment promotes the spirit of collaboration and cooperation.	4.30	VHF	4.50	VHF
15	Group assessment considers the unique contribution of the individual members to the group.	4.05	HF	4.50	VHF
16	Group assessment is necessary so that those poor students have opportunities to improve their performance.	4.20	HF	4.60	VHF
17	Every member of the group strives to contribute something for the group to ensure high group performance.	4.30	VHF	4.50	VHF
18	In a group assessment, some members of the group just rely on the contribution of those high performing group members.	3.85	HF	4.00	HF
19	An individual rating is important in a group assessment based on their contribution to the groups' output.	4.25	VHF	4.70	VHF
20	Group assessment will just make other students dependent on those advanced learners.	3.75	HF	4.15	HF
	OVERALL MEAN	4.16	HF	4.53	VHF

As revealed in the table, the participants in the free grouping scheme had a Highly Favorable attitude towards group work with a mean score of 4.16 before the start of the experiment. However, a Very Highly Favorable attitude towards group work as revealed in their post-attitude mean score of 4.53 was attained after their exposure to group work. They strongly agree that group work enhances class participation, makes the learning experience easier and they love to work with students who are different from them. They also think that the



overall process of evaluating the group work assesses everyone's individual contribution fairly. They also find that the criteria for the evaluation of group work are made clear and explicit.

The participants in the free grouping scheme also believed that the group assessment considers the unique contribution of the individual members to the group and that individual rating is important in a group assessment based on their contribution to the groups' output.

Comparison between the attitude towards group work of the free and controlled groups

 Table 5. T-test on the significant differences of the pretest and posttest mean attitude

towards group work of the free and controlled groups

Grouping Scheme	Assessment	Mean	Standard	Computed	P Value	Interpretation
			Deviation	t Value		
Controlled	Pre-Assessment	4.38	0.41	2.28	0.03	Significant
Grouping Scheme	Post-Assessment	4.51	0.31			
Free Grouping	Pre-Assessment	4.16	0.48	2.67	0.02	Significant
Scheme	Post-Assessment	4.53	0.23			

As shown in the table, the pre-assessment mean attitude score of 4.38 of the controlled group is lower than the post-assessment mean attitude score of 4.51. The t-test yielded a t-value of 2.28, which has an associated probability of 0.03. Similarly, the pre-assessment mean attitude score of 4.16 of the free group is much lower than the post-assessment mean attitude score of 4.53. The t-test yielded a t-value of 2.67, which has an associated probability of 0.02.These findings mean that the cooperative learning strategy has significantly affected the attitude towards group work of the free group and the controlled group.

### **Extent of Manifestation of the Social Skills**

Table 6. Extent of manifestation of the social skills of the free and controlled groups

SOCIAL SKILLS		CONTROLLED GROUP		FREE	GROUP
		MEAN	DI	MEAN	DI
1	Shows leadership.	4.45	VHE	4.27	VHE
2	Shows perseverance.	4.52	VHE	4.39	VHE
3	Works steadily and systematically.	4.38	VHE	4.41	VHE
4	Values accuracy that reflects on results.	4.51	VHE	4.39	VHE
5	Participates constructively.	4.53	VHE	4.51	VHE
6	Listens to others.	4.70	VHE	4.50	VHE
7	Participates cooperatively and actively.	4.51	VHE	4.55	VHE
8	Manages time.	4.46	VHE	4.45	VHE
	OVERALL MEAN	4.51	VHE	4.43	VHE



Legend: VHE –Very High ExtentHE-High ExtentM– Moderate L– Low VL-Very Low Both groups showed a remarkable level of acquisition of social skills. The controlled group had a mean score of 4.51 and the free group had a mean score of 4.43 which reveals that the two groups had acquired social skills to a very high extent. The controlled group believed that they would have a better result in terms of their group output if they should listened to others, while in the free group, if they had participated cooperatively and actively with the other members of the group. Both groups manifest social interdependence as shown in the findings.

Free Grouping Scheme VS Controlled Grouping Scheme

Table 7. The differences between the pretest and posttest scores, their pre-attitude andpost-attitude towards group work and the manifestation of social skills of the free andcontrolled groups

Tests	Grouping	Mean	SD	Computed t	P Value	Interpretation
	Scheme	Score		Value		
Pretest	Controlled	10.80	3.22	0.39	0.69	Not Significant
	Free	11.20	3.21			
Posttest	Controlled	20.65	3.75	2.79	0.01	Significant
	Free	24.30	4.49			
Pre-Assessment	Controlled	4.38	0.41	1.50	0.14	Not Significant
(attitude)	Free	4.16	0.48			
Post-Assessment	Controlled	4.51	0.31	0.23	0.82	Not Significant
(attitude)	Free	4.53	0.23			
Social Skills	Controlled	4.51	0.25	0.83	0.41	Not Significant
	Free	4.43	0.31			

As reflected on the table, the pretest scores of the two groups yielded a computed t-value of 0.39 and a probability value of 0.69 at 0.05 level. This finding means that there is no significant difference between the Mathematics performance of the two groups before their exposure to group activities. This finding signifies that the participants are initially comparable in terms of their Mathematics performance prior to the conduct of the activity. The table also reveals that the posttest scores of the free and controlled groups recorded a computed t value of 2.70 and a probability value of 0.01 at 0.05 level.

computed t-value of 2.79 and a probability value of 0.01 at 0.05 level. Hence, there is a significant difference between the Mathematics performance of the two groups after their exposure to group activities. This finding signifies that Free Grouping Scheme tends to enhance Mathematics performance better. It implies that the students' effective way of



learning through cooperative learning is achieved when they are free to choose their group members during the group activity, in this case, the members whom they work with could be their friends or someone whom they are comfortable to work with.

Furthermore, this result contradicts the findings of Gillies (2004). Gillies found that students in structured groups were more willing to work with others on assigned tasks and provide assistance to their peers than the students in the unstructured groups.

In terms of the pre-attitude of the free and controlled groups, the table shows that the preassessment yielded a computed t-value of 1.50 and a probability value of 0.14 at 0.05 level. This finding means that there is no significant difference in the attitude of the participants in both groups based on the pre-assessment results. This finding implies that the favorable attitude of both groups signify equal entry requirement for the subject prior to the exposure to the group activities.

The table further reveals a computed t-value of 0.23 and probability value of 0.82 at 0.05 level for the post-assessment of the attitude towards group work. The finding indicates that there is no significant difference in the attitude towards group work after their exposure to group activities. This finding implies that the participants have fostered a favorable attitude towards group work before the start of the study and is enhanced after the exposure to group work.

As revealed in the table, a computed t-value of 0.83 and probability value of 0.41 at 0.05 level were obtained for the acquisition of the social skills. It means that there is no significant difference in the acquisition of social skills of the participants. Whether they are working in the free or controlled group, they both reveal a very high extent of participation and cooperativeness with their group mates.

## SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

### **Summary of Findings**

The main concern of this study was to compare the free and controlled grouping schemes in Mathematics instruction in terms of their effectiveness in improving students Mathematics achievement and in fostering positive attitude towards group work of first year College of Teacher Education students enrolled in College Algebra at Cagayan State University, Lal-lo Campus, for second semester school year 2015-2016.

Based on statistical analysis, this study yielded the following findings:



1. Mathematics performance in College Algebra of the two groups of students based on the pretest and posttest results.

Both the free group and the controlled group had a Fairly Satisfactory Mathematics performance as reflected in their mean scores before their exposure to the cooperative learning strategy.

The free group and the controlled group had a Satisfactory Mathematics performance after their exposure to the cooperative learning strategy.

2. Test of significant difference between the Mathematics performance of the free and controlled groups.

There is a significant difference in the Mathematics performance of the free group and the controlled group before and after their exposure to cooperative learning strategy. The free and controlled groups had a fairly satisfactory Mathematics performance before their exposure to the group activities and had significantly improved to a satisfactory Mathematics performance after the integration of group work.

3. Attitude towards group work of the free and controlled groups.

The participants in the controlled grouping scheme had a very highly favorable attitude towards group work before and after the conduct of the study.

The participants in the free grouping scheme had a highly favorable attitude towards group work before the conduct of the study. However, a very highly favorable attitude towards group work was attained after their exposure to group work.

4. Test of significant difference between the attitude towards group work of the free and controlled groups.

There is a significant difference between the pre-attitude and post-attitude towards group work of the free group and the controlled group.

- 5. Extent of Manifestation of the Social SkillsThe free and controlled groups acquired social skills to a very high extent.
- 6. The differences between the pretest and posttest, their pre-attitude and postattitude towards group work and the manifestation of social skills of the free and controlled groups



There is no significant difference between the pretest scores of the free and controlled groups.

There is a significant difference between the posttest scores of the free and controlled groups.

There is no significant difference between the pre-attitude scores of the free and controlled groups.

There is no significant difference between the post-attitude scores of the free and controlled groups.

There is no significant difference in the acquisition of social skills of the participants of the free and controlled groups.

### Conclusion

Based on the findings of the study, it is concluded that the integration of cooperative learning strategy, either free or controlled grouping enhances the Mathematics performance and attitude of students toward group work. However, the cooperative learning has far better results when free grouping scheme is employed among students.

#### Recommendations

In view of the findings and conclusions of the study, the following recommendations were made:

- Cooperative learning employing the free grouping scheme should be recommended to Mathematics teachers to encourage and promote active learning, thereby enhancing Mathematics performance and favorable attitude towards group work.
- The cooperative learning strategy is just one of the many ways to introduce the lesson, it is further recommended that the University through the Mathematics Department should establish linkages with other agencies to be updated with the latest trends in Mathematics teaching.
- To attain the objectives of the college freshmen Mathematics instruction, University administrators concerned should support the use of cooperative learning through free grouping scheme to develop globally competitive learners equipped with 21<sup>st</sup> century skills and values.



- 4. Since the study dealt only on college freshmen Mathematics students, it is recommended that the researcher recommends that the cooperative learning through free grouping scheme should also be used in other Mathematics subjects.
- 5. Future researchers should conduct parallel studies in other areas of Mathematics or other subjects to include other variables that may affect the effectiveness of cooperative learning through free grouping scheme.

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