

# The Effect of Cooperative Learning on Academic Achievement of Grade Nine Students in Mathematics: The Case of Mettu Secondary and Preparatory School

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**Abstract**—The aim of this study was to examine the effect of cooperative learning method on student's academic achievement and on the achievement level over a usual method in teaching different topics of mathematics. The study also examines the perceptions of students towards cooperative learning. Cooperative learning is the instructional strategy in which pairs or small groups of students with different levels of ability work together to accomplish a shared goal. The aim of this cooperation is for students to maximize their own and each other learning, with members striving for joint benefit. The teacher's role changes from wise on the wise to guide on the side. Cooperative learning due to its influential aspects is the most prevalent teaching-learning technique in the modern world. Therefore the study was conducted in order to examine the effect of cooperative learning on the academic achievement of grade 9 students in Mathematics in case of Mettu secondary school. Two sample sections are randomly selected by which one section served randomly as an experimental and the other as a comparison group. Data gathering instruments are achievement tests and questionnaires. A treatment of STAD method of cooperative learning was provided to the experimental group while the usual method is used in the comparison group. The experiment lasted for one semester. To determine the effect of cooperative learning on the student's academic achievement, the significance of difference between the scores of groups at 0.05 levels was tested by applying t test. The effect size was calculated to see the strength of the treatment. The student's perceptions about the method were tested by percentiles of the questionnaires. During data analysis, each group was divided into high and low achievers on basis of their previous Mathematics result. Data analysis revealed that both the experimental and comparison groups were almost equal in Mathematics at the beginning of the experiment. The experimental group out scored significantly than comparison group on posttest. Additionally, the comparison of mean posttest scores of high achievers indicates significant difference between the two groups. The same is true for low achiever students of both groups on posttest. Hence, the result of the study indicates the effectiveness of the method for Mathematics topics as compared to usual method of teaching.

**Keywords**—Cooperative learning, academic achievement, experimental group, comparison group.

## I. INTRODUCTION

THE concept of cooperative learning is a learning strategy that boasts a rich and lengthy heritage. Cooperative learning has existed in several forms throughout history. One

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of the earliest evidences of cooperation appears in Ecclesiastes 4:9-10, 12: "Two are better than one", because they have a good reward for their toil. For if, they fall, one will lift up his fellow. But who to him who is alone when he falls and has not another to lift him up! And though a man might prevail against one who is alone, two will withstand him a threefold cord is not quickly broken. Being alone is not advisable in education system.

The ability to work cooperatively with others has been an important factor in the successful survival of cultures. The Talmud suggests that learning partners read together, arguing with each other to maximize their learning [1], [5], [13]. In ancient Greek society, Socrates taught those under his tutelage in small groups the art of discourse [9], [6]. Quintilian, the first-century Roman rhetorician, stated that students could benefit by teaching one another. In the early 1600s, Johann Amos Comenius, a prolific pedagogical reformer, believed that students could benefit in their own learning by teaching each other as peers [10], [11], [4], [5], [7], [8], [14]. Students achieve their learning goals by helping each other in a social setting, whereas education itself has been regarded as social adjustment of an individual. Education is the only means with a society to adjust with its needs. Therefore, societies can never exist without education. Through education, the members of society learn the skills to enrich transmit and transform cultural heritage as well as existing social and scientific knowledge for the continuous advancement of the society. Teaching-learning process has been inseparable to human beings since ancient times. Leaders of human thought have endorsed memorable words about education, knowledge and learning.

Human endeavors to explore the universe and foster social, cultural and economic needs have resulted in a widespread educational system on the global preview. Every society, every culture and every nation is in a race to build up its educational system on profound basis of knowledge, learning and expertise. Today a nation with superior educational system is superior and dominant. An educational system is explicitly based on the quest 'what to teach and how to teach' means the learning material. The continuum of learning material swings from linguistics to scientific knowledge. The choice of contents and subject matter from the multi-various branches of knowledge is subjected to societal needs. However, mathematics, as branch of knowledge, has been inevitable ingredient of core curriculum at basic stages in every society

since ancient times.

The pursuit "How to teach" implies the teaching methodology. Education cannot be made more effective without effective teaching. There are so many devices for effective teaching. An effective teaching technique can ensure the effective learning. It is being felt that there should be new techniques of teaching and learning. At present, the educator different societies are evaluating different teaching-learning techniques. Many educator of modern age have recognized cooperative learning as a beneficial teaching-learning technique for different subjects. Students tend to become friends with their groups members, and the teachers-student's relationships tends to be more relaxed. In addition, many students maintain a high-level of interest in the mathematics activities and have an opportunity to pursue the more challenging and creative aspects of mathematics while they achieve, at least as much information and skills as more traditional approach.

Several studies have examined the effects of CL methods on student learning. For instance [3] compare cooperative, competitive and individualistic strategies in science classes and found that students who are taught by cooperative methods more learned and retained significantly more information than students taught by the other two teaching methods. Reference [12] also found similar results with [3] in study involving high school general mathematics classes taught by cooperative and individualistic methods. Other than this, the numbers of studies that have been conducted in Ethiopia on the effectiveness of this method are very little especially in mathematics. This is the reason why we focused on this area.

In general, research has to be conducted on all outcomes in high schools and in post secondary institutions and there is also a need for the development and evaluations of cooperative learning methods for young children [15], [16]. Hence, there is still much more to be done although cooperative learning has been studied in an extraordinary number of field experiments. So much has to be discovered such as, which kinds of students, which techniques and in which subjects do the methods have positive effects.

## II. STATEMENT OF THE PROBLEM

The skills gained from science education can help students in their daily activities. For instance creating job by themselves rather than expecting to have a job from any other body. Since mathematics has an important base in science and technology; it helps people to understand the increasingly technological changing society. Mathematics has many applications for example in information technology. This implies that Mathematics plays a vital role for our countries economic development by diffusing science and technology in to the society if students understand the subject and achieve better results in class exams as well as in EGSECE.

Besides the importance of Mathematics and the students low score in mathematics, it is important to adopt effective teaching and learning methods like cooperative learning. Since it is quite evident that the active involvement of students in classroom and outside the classroom teaching learning process

enables them to develop their critical thinking skills which may improves their achievement scores. It is essential to make students to learn by cooperative manner so as to see its effect on achievement.

So the researcher wants to conduct a research in the context of our country to see the effect of cooperative learning method over the usual teaching and learning method by giving a treatment on a school having students scoring lower result in Mathematics. Therefore, the researcher tries to investigate particularly the perceptions and the effect of cooperative learning on student's Mathematics achievement in Mettu secondary school. Hence, it is with this information that the researcher is initiated to conduct a research.

## III. RESEARCH QUESTIONS

This study tried to answer the following questions;

- Is there significant mean difference between the comparable and experimental group?
- Is there significant difference between the mean scores of high and low achievers of control and experimental groups on posttest?
- Is there significant difference between the mean score of high and low achievers of the control and experimental groups on retention test?
- What are the perceptions of students about cooperative learning method?

## IV. OBJECTIVE OF THE STUDY

The purpose of this study is to analyze the effect of cooperative learning on student's mathematics achievement in teaching of some units of mathematics of grade 9. A further concern is to determine the perceptions of students about cooperative learning method. In particular this study is aimed at exploring the effects of cooperative learning on the academic achievement of Mettu secondary school student in mathematics based on the following objectives:

- 1) Determine whether the cooperative learning is more effective than the actual method of teaching with respect to academic achievements of students in mathematics.
- 2) Examine the effects of cooperative learning on the academic achievements of students in mathematics.
- 3) Examine the effects of cooperative learning on the retention of students in mathematics.

## V. BOUNDARY OF THE STUDY

The study was delimited to only the Students Teams Achievement Division (STAD) method of cooperative learning because it is preferable to start with one simple method of cooperative learning method in order to become familiar with the implementation of the method in our country (secondary schools).

## VI. RESEARCH DESIGN AND METHODOLOGY

Since the classes existed as intact groups and could not be reconstituted for research purposes, the study was quasi-experimental that uses pretest posttest non equivalent

TABLE I  
 QUASI-EXPERIMENTAL RESEARCH DESIGN

Experimental Group	$O_1$	$X$	$O_2$
Comparison Group	$O_3$	—	$O_4$

group design. Symbolically the design looks like where  $O_1$  and  $O_3$  represent the pretest for experimental and control group respectively and  $O_2$  and  $O_4$  represent posttest for experimental and control group respectively. There are a number of factors which affect the internal and external validity of this quasi experimental design. Relevant to internal validity, there are different factors (these include history, maturation, testing, instrumentation, statistical regression, differential selection, experimental mortality, selection - maturation interaction, John Henry effect and treatment diffusion). If these factors are not controlled in the design, they may produce adverse effects which confound the effects of the independent variables shown on the final test scores. For this reason the researcher tried to control the major threats to internal validity with this design as attached in Appendix I. whereas factors affecting internal validity operate on the scores derived from the dependent variables and, therefore, make the experiment poor as an experiment, the factors affecting external validity operate upon the experimental treatments.

The independent variables of the research consist of the STAD method of cooperative learning and traditional teaching method and these teaching methods are applied on students of grade 9 for one semester. But here the cooperative learning method is applied to the experimental group students and the traditional teaching method is applied to the comparison group students. The academic achievement tests, questionnaires which are distributed to the students concerning the treatment effect as well as observations are all the dependent variables of the study.

## VII. DATA SOURCE

### A. Target Population

The target population of this study was grade 9 secondary school students in Mettu secondary school of Illu Abba Bora zone which is located at Western part of Ethiopia in Oromia Regional State. The researcher selects the school purposely, because it is convenient to conduct the research by giving a treatment in a school which is not far from the researcher working place. Since the aim of this study is to investigate the relative effectiveness of cooperative learning on the mathematics academic achievement of students of this secondary school, students learning in this secondary school are considered as the population of the study.

### B. Sampling Technique

Random cluster sampling techniques were used to identify the two sections participating in the study for this grade level from the population and to assign the selected sample sections in to the experimental and comparison group.

## VIII. METHOD AND INSTRUMENT OF DATA COLLECTION

### A. Method

We go through three steps to collect data for the study. First, relevant literature was reviewed to get adequate information on the topic. Second, objectives and research questions were formulated to show the direction of the study. Third, data gathering tools were developed and piloted. Then after the treatment and comparison groups were randomly assigned, the students in both groups were pre tested on their previous knowledge of course content. The selected mathematics topics for conducting the research were:

- Sets
- Relation
- Linear equations
- Vectors

Pretest scores were used to provide baseline data with which to compare posttest scores to determine if the STAD method of cooperative learning techniques were effective in improving achievement. Following the pretest, the students in the experimental group were divided into many groups of four or five members. The students are assigned to groups in such a manner as to reflect a heterogeneous mixture of academic ability. These treatment groups were trained in cooperative group skills prior to the treatment period. After the treatment was over, the researcher made posttest for both the experimental and comparison groups at the end of each of the units treated. The purpose of the posttest is to find out whether there were any achievement differences between the marks of the posttest scores of both groups of students. These both tests, the pretest and the post test, were constructed by the researcher after a thorough review of the techniques of test construction and related units of mathematics topics. The questionnaires were also distributed and collected from the students which are treated in a cooperative learning method after the complement of treatment.

### B. Instruments of Data Collection

Mathematics achievement test was used to collect data for this study, in order to answer the research questions. The calculated value for the item difficulty level and item discrimination index is found to be greater than 0.73 and 0.8 respectively by discarding one item which does not meet the criteria of a good item from the posttest exam without reducing the content validity. In addition to this, the reliability of the achievement tests was calculated using Kuder Richardson (KR-21) reliability coefficient formula, which is higher reliability as indicated in the following table.

TABLE II  
 KUDER RICHARDSON (KR-21) RELIABILITY COEFFICIENT FORMULA

Achievement test	Coefficient Reliability
Pretest	0.73
Posttest	0.87

### IX. SELECTION AND TRAINING OF TEACHER FOR EXPERIMENT

Selection and training of teacher for experiment: Volunteer teachers to perform this experiment were selected from mathematics teachers of this secondary school. After that, training was given for the teachers for three weeks about the cooperative learning methods by the researcher. Contents of this training includes:

- Concepts of cooperative learning.
- Experience with cooperative learning activities.
- Class climate building techniques.
- Team building techniques.
- Strategies for students centered learning.
- Lesson planning.
- Social skills and Implementation of the STAD method of cooperative learning in the classroom.

### X. TREATMENT

After the experimental group, students were divided into several heterogeneous groups of four and five students, each lesson proceeds using the regular cycle of instructional activities of STAD as follows.

- Teaching: The teacher presented the lesson using lecture method providing sufficient guided exercise according to the lesson plan (first day).
- Team Study: In the second day, discussion topics and problems covering the contents of lesson taught on the previous day were provided to each cooperative group. The students worked on their teams to master the topics (exercise).
- Test: In the third day, students continue working in their teams for 20 minutes by summarizing the important points of the lesson. In the next 20 minutes, students took individual test (quizzes).
- Team Recognition: Team scores are computed based on team members improvement scores and certificates recognize high scoring teams. The treatment in the 3 days cycle continued until the end of the study.

### XI. RESULTS AND DISCUSSION

In this section, the data collected through Mathematics achievement tests and questionnaires are presented by using tables followed by descriptive statements for analysis and interpretation so as to give answers to the four basic research questions set in the study.

#### A. Results: Mathematics Achievement Test Analysis and Interpretation

This research was conducted to examine the effect of cooperative learning on the academic achievement of Mettu secondary school students in some selected mathematics units. One of the groups, i.e., the experimental group was taught with STAD method of cooperative learning as a treatment and the other group which was used as the comparison group was taught with the usual learning method. At the beginning of the

study, to determine their difference in academic achievement between experimental and comparison groups, a self prepared achievement test was administered to both groups. Scores obtained from the achievement scale used as a pretest were analyzed by applying independent samples t-test and the following results were obtained.

TABLE III  
 SIGNIFICANCE DIFFERENCE BETWEEN THE MEAN SCORES OF THE EXPERIMENTAL AND COMPARISON GROUPS ON PRETEST

Group	N	M	SD	SE	t
Comparison Group	45	34.14	13.54		
Experimental Group	45	34.88	12.59	2.76	-0.266*

t at 0.05=1.98

Table III Significance Difference between the Mean Scores of the Experimental and Comparison Groups on Pretest table.3 indicates the difference between the mean scores of the experimental and comparison group on pretest was found to be insignificant (t calculated < t critical, p > 0.05) at 0.05 levels for. Hence, both of the groups were almost to be equal. In order to check for the dependence of the effectiveness of cooperative learning on the achievement level of students, it is necessary to see whether there is a significance difference in mean scores of high achievers as well as low achievers of the two groups on pretest. This was a necessary condition so as to compare the results of the posttest score of the two groups. The obtained data from the pretest are presented as follows.

TABLE IV  
 SIGNIFICANCE OF DIFFERENCE BETWEEN MEAN SCORES OF HIGH ACHIEVERS OF EXPERIMENTAL AND COMPARISON GROUP ON PRETEST

Group	N	M	SD	SE	t
Comparison Group	22	45.25	4.15		
Experimental Group	22	45.77	4.11	1.24	-0.42*

t at 0.05= 2.03

Table IV Significance of Difference between Mean Scores of High Achievers of Experimental and Comparison Group on Pretest table.4 reflects that no significant difference (t calculated < t critical, p > 0.05) was found between mean scores of high achievers of the experimental group and high achievers of the comparison group on pretest. Hence, there was no significant difference in the performance of high achievers of the experimental group and the comparison group on the pretest. Table V Significance of Difference between

TABLE V  
 SIGNIFICANCE OF DIFFERENCE BETWEEN MEAN SCORES OF LOW ACHIEVERS OF THE EXPERIMENTAL GROUP AND COMPARISON GROUP PRETEST

Group	N	M	SD	SE	t
Comparison Group	23	24.96	9.48		
Experimental Group	23	23	9.22	2.76	0.709*

t at 0.05= 2.02

Mean Scores of Low Achievers of the Experimental Group and Comparison Group Pretest table.5 shows that there was no significance difference between the performance of low achievers of the experimental and comparison group on the pretest.

In general, comparison of pretest scores of both the experimental and comparison groups by applying statistical

analysis reflected the existence of no significance difference between the two groups Table III Significance Difference between the Mean Scores of the Experimental and Comparison Groups on Pretest table.3 and hence, both the groups were almost equal with respect to the mathematics units treated in this study. Moreover, the comparison between mean pretest scores of high achievers of the experimental and comparison groups shows that the difference between mean scores on pretest was in significant at 0.05 levels table, Table IV Significance of Difference between Mean Scores of High Achievers of Experimental and Comparison Group on Pretest table.4 indicating that those high achievers of both the experimental and the comparison groups were almost equal at the beginning of the experiment for the mathematics units treated. Similarly, the difference between the mean scores on pretest of low achievers of both the experimental and comparison groups was also insignificant at 0.05 levels table, Table V Significance of Difference between Mean Scores of Low Achievers of the Experimental Group and Comparison Group Pretest table.5. This also shows that low achievers of both the experimental and the comparison groups had almost equal mathematics base at the commencement of the experiment.

After provision of instructions and practice on the lesson plans covering some mathematics units for grade 9, the academic achievement of the comparison group and experimental group was examined through a researcher made posttest. The obtained results are presented as follows. Table VI Significance of Difference between Mean Scores of

TABLE VI  
 SIGNIFICANCE OF DIFFERENCE BETWEEN MEAN SCORES OF THE EXPERIMENTAL AND COMPARISON GROUP ON POSTTEST

Group	N	M	SD	SE	t
Comparison Group	45	32.69	19.66		
Experimental Group	45	78.4	13.75	3.58	-12.78*

t at 0.05= 1.98

the Experimental and Comparison Group on Posttest table.6 reflects that at the end of the application, the difference between the mean scores of the experimental and comparison groups was significant on posttest. [12] conducted research to compare the effectiveness of cooperative learning and individualistic instruction in secondary school classroom. On posttest the cooperatively goal-structured class was significantly achieves than the individualistic group. Beside to this idea [17] investigates the effectiveness of cooperative learning on student's achievement and attitude in secondary school mathematics classroom. Students in the cooperative learning group were significantly higher test scores than students in the comparison group. Table VII Significance of

TABLE VII  
 SIGNIFICANCE OF DIFFERENCE BETWEEN MEAN SCORES OF THE EXPERIMENTAL GROUP AND COMPARISON GROUP ON RETENTION TEST

Group	N	M	SD	SE	t
Comparison Group	45	30.93	19.25		
Experimental Group	45	78.56	13.61	3.51	-13.55*

t at 0.05= 1.98

Difference between Mean Scores of the Experimental Group

and Comparison Group on Retention Test table.7 reflects that at the end of the application, the difference between the mean scores of the experimental and comparison groups was significant on retention test which was distributed for both comparison and experimental groups after three weeks. This result indicates that the students taught by cooperative approach internalize the concept and those students learnt by usual approach taught the concept for the sack of memorization.

TABLE VIII  
 SIGNIFICANCE OF DIFFERENCE BETWEEN MEAN SCORES OF HIGH ACHIEVERS OF EXPERIMENTAL GROUP AND COMPARISON GROUP ON RETENTION TEST

Group	N	M	SD	SE	t
Comparison Group	22	90.73	5.33		
Experimental Group	22	46.5	16.26	3.47	12.12*

t at 0.05= 2.03

Table VIII Significance of Difference between Mean Scores of High Achievers of Experimental Group and Comparison Group on Retention Test table.8 reflects that at the end of the application, the difference between the mean scores of high achievers of experimental and comparison groups was significant on retention test which was distributed for both comparison and experimental groups after three weeks. Table IX Significance of Difference between Mean

TABLE IX  
 SIGNIFICANCE OF DIFFERENCE BETWEEN MEAN SCORES OF LOW ACHIEVERS OF EXPERIMENTAL GROUP AND COMPARISON GROUP ON RETENTION TEST

Group	N	M	SD	SE	t
Comparison Group	23	66.91	7.32		
Experimental Group	23	16.04	3.78	1.72	29.6*

t at 0.05= 2.02

Scores of Low Achievers of Experimental Group and Comparison Group on Retention Test table.9 reflects that at the end of the application, the difference was significant at 0.05 levels between the mean scores of low achievers of experimental and comparison groups on retention test in favor of experimental group. According to [2] report that low achiever students benefited from cooperative learning than high achiever. From Table X Significance of Difference

TABLE X  
 SIGNIFICANCE OF DIFFERENCE BETWEEN MEAN SCORES OF HIGH ACHIEVERS OF EXPERIMENTAL GROUP AND COMPARISON GROUP ON POSTTEST

Group	N	M	SD	SE	t
Comparison Group	22	90.73	5.32		
Experimental Group	22	48.5	16.84	3.77	11.22*

t at 0.05=2.03

between Mean Scores of High Achievers of Experimental Group and Comparison Group on Posttest table.10 at the end of the application, there was a significant difference (t calculated > t critical, p < 0.05) for experimental group students between posttest achievement score averages of high achiever of the experimental and comparison group students. According to Table XI Significance of Difference between Mean Scores of High Achievers of Experimental

TABLE XI  
 SIGNIFICANCE OF DIFFERENCE BETWEEN MEAN SCORES OF HIGH  
 ACHIEVERS OF EXPERIMENTAL GROUP AND COMPARISON GROUP ON  
 POSTTEST

Group	N	M	SD	SE	t
Comparison Group	23	66.61	7.32		
Experimental Group	23	48.5	3.50	1.69	29.01*

t at 0.05=2.02

Group and Comparison Group on Posttesttable.11, at the end of the application, the difference was found significant at 0.005 level between the mean scores of low achievers of the experimental and comparison group on posttest. Hence, the comparison of mean scores of high achievers of the experimental and comparison groups on posttest table, Table XSignificance of Difference between Mean Scores of High Achievers of Experimental Group and Comparison Group on Posttesttable.10 reflects a significant difference at 0.05 levels. Similarly, the comparison of mean scores of low achievers of both the experimental and comparison groups on posttest table, Table XISignificance of Difference between Mean Scores of High Achievers of Experimental Group and Comparison Group on Posttesttable.11 shows a significant difference at 0.05 levels in favor of the experimental group.

### B. Discussion

This study was conducted in Mettu secondary school in which two sections was randomly selected as a sample from grade 9. The objectives of the study included examining:

- The effects of cooperative learning on the academic performance of students in mathematics at this secondary school.
- The effects of cooperative learning method over a usual teaching method when the method is used to teach high school mathematics.
- The effects of cooperative learning on the student's level of achievement while teaching mathematics.

A quasi experimental research with a pretest posttest research design is used to examine the effects of cooperative learning method on student's mathematics achievement. Pretest and posttest was used as data gathering tools. The reliability of the tests was ensured during the pilot study. After the pretest is administered to both groups of students at the start of each unit, the STAD method cooperative learning is for the experimental group students while the usual teaching method is used to teach the comparison group students. The experiment was conducted for six weeks. When the treatment was over, the academic achievement of the experimental and comparison groups was examined through a posttest given at the end of each of the units separately.

Significany difference between the mean scores of the experimental and comparison groups on the variables of the pretest and posttest was tested by applying the independent samples t test. The equality of high achievers as well as low achievers of the two groups was also checked using the independent samples t test while the Cohen's d effect size was calculated to see the strength of the treatment. Moreover, the

results of the questionnaires are also analyzed in percentages so as to answer the fourth research question.

Data analysis revealed that the difference between the mean scores of the two groups on pretest was insignificant at 0.05 level implying that both groups were almost equal in the Mathematics units treated in this study. The difference between mean scores of high achievers of both groups was also insignificant at 0.05 levels on pretest. So, high achievers of both groups were almost equal at the beginning of the experiment for the mathematics units treated.

Similarly t-test did not reveal significant difference between the performances of low achievers of the two groups this indicates that low achievers of both groups had almost equal mathematics base at the commencement of the experiment. After the treatment, it is found that there is a significant difference between experimental and control group students on posttest. So that, the experimental group performed significantly better than the comparison group on posttest in each unit. This indicates the tendency of the method to teach different mathematics units. There was also a significant difference for high achievers of the experimental group students between posttest achievement score. In addition to this, there is a significant difference for low achievers of the experimental group students between posttest achievements. In this case since the Cohen's d effect size for low achievers is greater than the Cohen's d effect size of high achievers of the experimental groups, the cooperative learning method seems to enhance the achievement of low achiever students better than high achiever students. Hence, there is a difference in the effectiveness of cooperative learning due to the achievement level of students. On the other hand, based on the ideas of students it can be noted that cooperative learning method provides a better learning environment with discussions while learning mathematics topics and helps students to learn in an easy, effective and meaningful way. Their ideas also suggested that cooperative learning methods improve social abilities of the students. The observation of the classes also revealed a high level of motivation by most of the students to complete the tasks and to perform well on the quizzes given to them at the end of the week showing evidences for

- Positive interdependence,
- Individual accountability,
- Face to face interaction,
- Social skills and group processing even though some grade 9 students looks like being exhausted while learning the unit on wave.

## XII. RECOMMENDATIONS

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

- 1) Previous studies, which were conducted on cooperative learning method in different cultures by different researchers, as well as this study prove cooperative learning as more effective method of instruction for mathematics topics as compared to usual method of teaching. So it is advisable if the cooperative learning method should be continued as a teaching method to

enhance the academic achievement as well as the social skills among the students in the group. This is because the method offers the chance to develop positive and productive relationships among themselves by offering some students the academic support that will help them to excel in their studies. Therefore, Mathematics teachers should have to use the cooperative learning method as an alternative teaching method to improve the academic achievement of students.

- 2) As cooperative learning is a new technique of teaching, students have to be taught social skills because some students cannot get used to the new strategy. Because of this, teachers need to teach the students the basics of the cooperative learning method such as how to ask for help, how to listen to others and how to give opinion. In addition to this, students must get to know and trust each other, communicate accurately and unambiguously, accept and support each other and resolve conflict constructively.
- 3) Studies on cooperative learning method provide an extensive field of research if we examine the relative effectiveness of different cooperative learning methods. Thus researchers should also consider this aspect of research.

In general, the results of a few studies are sufficient to decide about the maximum use of cooperative learning method in our culture. Since this study examined only the academic achievement of students about the cooperative learning methods in certain units of grade nine mathematics, we recommend further studies for other topics besides those treated in this study so as to see the effectiveness of the method on other Mathematics topics.

### XIII. CONCLUSION

In the light of statistical analysis and the findings of the study, the following conclusions were drawn.

- On the whole, cooperative learning method is a more effective teaching learning method for mathematics topics as compared to the usual teaching method. This is because the experimental group student's achievement is better than those students found in the comparison group for all the units treated in this study.
- Low achievers in cooperative groups have significant superiority over high achievers learning mathematics by the cooperative learning method even though the low as well as high achiever student's achievement is better than the low and high achiever students found in the comparison group. Thus, cooperative learning seems like a very effective method for teaching for low achievers in mathematics as compared to the high achiever students.
- High achievers whether they are taught mathematics by cooperative learning or traditional method, retain learnt material at the same rate.

In general, from the findings, the cooperative learning method might not be beneficial for every student. However,

majority of the students would benefit both socially and academically if cooperative learning is implemented in the classroom.

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