



## Effect of cooperative learning strategies on academic achievement in mathematics

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### Abstract

Cooperation, cognition and metacognition are all intimately related. Cooperative Learning provides the context within which cognition and metacognition take place. Within a Cooperative Learning Group, interpersonal exchange takes place, intellectual challenge result from conflicting ideas and conclusion they promote critical thinking, higher level reasoning and metacognitive thought. Cooperative Learning is the instructional use of small groups so that students work together to maximize their own and each other's learning. The present research aimed to study the effectiveness of cooperative teaching learning strategies in mathematics on academic achievement of secondary school students. The researcher have selected 50 students of VIII class from secondary schools of Aurangabad city by using the random sampling method. ANCOVA technique was used to test the hypothesis. After testing it was found that cooperative learning strategies proved to be more effective in enhancing academic achievement of students in Mathematics when compared to the traditional method which is in practice presently.

### Introduction

What is it about Cooperative Learning (CL) what causes it to continuously spread worldwide? Several factors come to mind. First, CL procedures combine and promote academic and social skills, to universal educational goals. Secondly, the increasing diversity in classroom everywhere incites teachers to turn to the large body of CL methods and procedures as the most flexible modes of instruction for the culturally diverse classroom. Moreover, CL practice is consistently supported by research, which leads to ongoing renewed examination of its effectiveness and constant revision and refinement of theory and cooperative procedures. CL, researchers and practitioners also offer wealth of books, guide books and teacher training programmes. Wherever teachers seek ways to enhance student's involvement in their learning and refine their ability to create an interactive and nurturing learning environment. The draw on the power of CL. It is therefore no surprise that a growing number of ministries of education that wish to modernise their country's education adopt CL as a major component of their policy.

### Cultural factors

Cultural factors are of paramount significance in implementation of CL, most intriguing are then constraints rooted in CL itself, or to be more exact in which CL has become, and in how teachers perceive it and prepare to use it. In this article I will focus on what has happened to CL on the

way of fame. Together with its thoroughly documented benefits there are misperceptions that results inadequate implementations, not only in countries that are new to CL, but wherever it is practised. Identifying these may help to make sense of mishaps and to establish conditions that will lead to better implementations.

### What is cooperative learning?

Cooperation, cognition and metacognition are all intimately related. Cooperative Learning provides the context within which cognition and metacognition take place. Within a Cooperative Learning Group, interpersonal exchange takes place, intellectual challenge result from conflicting ideas and conclusion they promote critical thinking, higher level reasoning and metacognitive thought. Cooperative Learning is the instructional use of small groups so that students work together to maximize their own and each other's learning.

In cooperative learning groups, students have two responsibilities:

- To learn the assigned material.
  - To make sure all other members do likewise.
- Simply placing students in groups and telling them to work together does not promote higher achievements and higher level reasoning. In order to be productive, cooperative learning groups must be structured to include the essential elements of:
- Positive interdependence (each member can succeed only if all members succeed).

- Face-to-face interaction.
- Individual accountability (each member does his fair share of work).
- Interpersonal and small group skills.
- Group processing (reflecting on how they work and improve).

Contrast of cooperative learning is competitive learning or individualistic learning, they are mutually beneficial. Impact of cooperation on cognition and metacognition studies also show the benefits on students.

### **Concept of cooperative learning**

Cooperative learning involves students working together in small groups to accomplish shared goals. One can see that several definitions of cooperative learning have been formulated. But the most widely used definition of cooperative learning in higher education is probably that of Johnson and Johnson (1994)<sup>[3]</sup>. According to him, cooperative learning is an instruction that involves students working in teams to accomplish a common goal.

### **Theories underlying cooperative learning**

A prominent social psychologist who contributed to the shaping of CL was Kurt Lewin, who laid the foundations for the group dynamics movement and organisational psychology. Lewin's ideas and methods form a basis to design effective relationships within groups, thus improving how people in groups relate to one another while carrying out group goals. Like Dewey, Lewin believed that learning was more effective. When it was an active rather a passive process, and was perceived in collaboration. He developed a systematic inquiry strategy for students learning together in small groups which combined the view of learning as the conduct of inquiry by cooperative small groups with the principles of effective group management, so that groups would successfully solve problems and make decisions based on all members.

### **Strategies of cooperative learning**

Jigsaw Strategy developed by Aronson (1978) is perhaps the earliest and best known way of organizing a classroom and a lesson plan in order to promote cooperative learning. It involves giving a diverse group of students a task to complete and making each child responsible for one piece of the puzzle. The essential component in the technique is structuring the classroom so that students succeed by working together rather than by competing.

### **Think-Pair-share strategy**

This strategy was developed by Frank Lyman (1981) involves a three step cooperative structure, during the first step individuals think silently about a question posed by the instructor. Individuals pair up during the second step and exchange thoughts. In the third step, the pairs share their responses with other pairs, other teams, or the entire groups.

### **Round robin brainstorming strategy**

This strategy was developed by Kagan (1992) has class divided into small groups of 4 to 6 with one person appointed as the recorder. A question is posed with many answers and students are given time to think about answers. After the 'think time'

members of that team share responses with one another round robin style.

### **Group investigation strategy**

This strategy was developed by Sharan and Lazarowitz (1978) is a general classroom organization plan in which students work in small groups using cooperative inquiry, groups using and cooperative planning and projects

### **Student teach-Achievement divisions (STAD) strategy**

This strategy is developed by Slaving (1978). In this students are assigned to four member learning teams that are mixed in performance level, gender and ethnicity. The teacher presents a lesson, and then students work within their teams to make sure that all team members have mastered the lesson.

### **Teams-Games-Tournaments (TGT)**

This strategy was developed by De Vries and Slaving (1978) and is used at the conclusion of each unit. The usual heterogeneous groups are split up temporarily. Students are put into homogeneous ability groups of three or four students for a competition.

### **Design of the CL task**

CL grew out of three major theoretical underpinnings (Educational, social and, organisational psychology), distilled into one major principle – positive interdependence – from which the major CL components of individual accountability, responsibility, and associated social behaviour are derive and all activated by the design of the learning task.

Interdependence is the one constant principle, or rule, that serves as an anchor for the design of all methods. It generates three main components -

1. To help group members offer one another in the process of learning together.
2. Individual accountability, which is the responsibility each group member develops for completing his or her share of the learning task.
3. The mutual responsibility group members develop for contributing to the search and acquisition of knowledge to accomplish the group's learning goals.

### **Structure of the task assigned to students are**

- Group- Worthy task
- CL and the Intercultural Classroom
- Culturally sensitive Classroom
- Cultural diversity in every Subject
- Reflection
- Core Reflection

### **Scope of cooperative learning research and its review**

Studies from the research literature suggest that cooperative learning in its many forms has a variety of positive and measurable outcomes on students at a variety of cognitive levels and in a variety of disciplines. A meta-analysis conducted on 210 studies of cooperative learning done between 1942 and 1992. It was found that cooperative learning tends to promote higher achievement than does competition or individual work, with this finding holding for all age levels, all subject areas, and variety of tasks. The same results were

obtained by Slavin (1991) who identified 70 studies that evaluated various cooperative learning methods for periods or four week or longer. Sharan and Sharan (1987)<sup>[6]</sup> report that CL builds cooperative skills, such as, communication, interaction, cooperative, planning, sharing of ideas, decision making, listening, taking turns and exchanging and synthesizing ideas. In Teacher Education, Veenman (2002) studied the implementation effect of a course on cooperative learning for student teachers. It was seen that a course on CL can have a positive effect on the cooperative instructional skills of student teachers. The majority of the student teachers subscribed to cooperative learning to achieve both academic and social goals and also showed a readiness to use cooperative learning methods in their future lessons.

The pupils taught by the treatment student teachers also showed positive attitudes towards working in groups and rated the benefits of working in groups relative to working alone quite positively. Students perception on CL were also documented by Cowie and Rudduck (1988) in their four year cooperative group project in England, and led to multidimensional insight into what students think of CL, students who valued group work were those who by and large had prior experience in this approach to learning and stated that they believed CL could be integrated into all content areas.

Strategy based on cooperative learning is a means or the tool by which objectives are consciously and systematically pursued and obtained over time. In teaching it describes the process designed explicitly and systematically to ensure that the learners acquire the terminal behaviours and achieve the instructional objectives.

**Statement of problem**

The present study used a strategy based on cooperative learning in which small teams, each with students of different levels of ability, use a variety of learning activities to improve their understanding of a subject. Thus, the purpose of the study is to study the effectiveness of cooperative learning strategies in enhancing academic achievement in Mathematics among the students of VIII standard in Secondary Schools.

**Objectives of the study**

To study the effectiveness of cooperative teaching learning strategies in mathematics on academic achievement of secondary school students.

**Hypothesis**

There is a significant difference in the mean achievement scores of students who have studied maths through cooperative learning strategy and traditional method.

**Methodology of research**

The researcher has selected the quasi-experimental in nature with pre-test and post-test, non- equivalent group design.

O1 X O2	O1 O3 = Pre-test X = Experimental Group
O3 X O4	O2 O4 = Post-test C = Control Group

The difference in the pre test scores was overcome by applying ANCOVA technique. The treatment was given to an

experimental group using cooperative learning strategies for a period of two months. The same content was taught to the control group students using traditional method.

**Sample**

The researcher have selected 50 students of VIII class from secondary schools of Aurangabad city. The researcher has selected the sample by using the random sampling method.

**Data collection**

Achievement in mathematics in the present study was measured by administering an achievement test constructed and validated on five selected units by the investigator of class eight secondary school students. The academic achievement test was validated through item analysis and establishing reliability and validity indices using relevant techniques.

**Statistical techniques used**

Comparison of Academic Achievement in Mathematics taught through cooperative learning and traditional methods.

The null hypothesis formulated was there is no significant difference between mean scores of achievement of students who studied through cooperative learning strategy and traditional method. To test this hypothesis ANCOVA technique was used. The ANCOVA is a statistical method for equating randomly formed groups on one or more variables and is most appropriate when a study deals with intact groups. ANCOVA adjusts scores on a dependent variable for initial differences on some other variable. It is used in two major ways, as a technique for controlling extraneous variables and as means of increasing the power of a statistical test.

**Data analysis**

After calculation the estimated marginal mean of post test scores obtained by experimental and control groups. It can be seen that the experimental group has a higher value than control group. Before applying an ANCOVA technique however, the assumptions underlying ANCOVA were tested. The assumptions to be met in ANCOVA are –

- i. Various treatment groups are selected at random from a population.
- ii. Regression is linear and same from group to group, and variability. First, the homogeneity of regression assumption was tested and then Levene’s test was applied to check the assumption of constant variance. Results obtained are given as follows.

**Table 1:** Table showing the Mean and standard deviation of pre-test and post-test of Experimental and control groups

Group	Pre-test		Post-test	
	Mean	SD	Mean	SD
Experimental	36.96	3.67	53.21	8.74
Control	31.45	2.98	41.75	9.15

The test of homogeneity of regression (table 1) assumption evaluates the interaction between covariate and the factor. Since the p-value for the interaction between pre-test (covariate) and group factor in the above table is greater than the significance level (0.05), the interaction is not significant and ANCOVA can be applied.

**Table 2:** Table showing ANCOVA Output –Pre test Scores and Group

Source of Variation	Df	Mean Square	F-Value	p-Value
Pre-test	1	684.45	5.78	0.031
Group	1	560.76	29.89	Less than 0.001
Error	57	189.21		
Total	5	215.770		

From Table 2, it can be seen that p-value is less than the tabled value at 0.05 level and hence null hypothesis is rejected. This means that there is a significant difference between Mean scores of achievement of the students who studied through cooperative learning strategy and the conventional method.

**Conclusion**

When implemented successfully cooperative learning affords students the experience of learning in an environment where knowledge is not a stilted, externally prescribed and measured product, but a dynamic, creative element that grows out of the interaction between students, however diverse their background, interest, ideas and experiences. The unabated flow of research into all as aspects of CL and the accumulated lessons from widespread practise provide clear implications for what implementation requires of students and teachers preparation. In this research, researcher has attempted to shed light on some of the challenges that are often encountered in the process and I have founded that, cooperative learning strategies proved to be more effective in enhancing academic achievement of students in Mathematics when compared to the traditional method which is in practice presently.

**Educational implications**

- Cooperative learning based on research encourages educational policy makers and educators in better solutions and decisions, it is equally important to be aware of the pitfalls of implementations, which are not always as carefully documented as CL’s success.
- There is need for further research into the factors that impede sustainable implementation and the ways to overcome them. Awareness of these factors may also contribute to the policy makers and educators consideration of the optimal conditions for sustainable implementation of cooperative learning.
- Cooperative learning technique are very specific cooperative learning strategies which the teachers use to recognize interactions between students. There are many such techniques that can be used in any of the subjects’ curriculum though it will be most useful in teaching Mathematics, science, social science and languages. Working in groups and performing activities together will have more relevance in these teaching classes. It will help in teaching classes. It will help students learn the concepts more easily in an interesting way.

**Table 3:** Estimated Marginal Means of Post-test of Experimental and Control Groups

Group	Mean	Std. Error	95% of confidence interval	
			LB	UP
Experiment	66.988	2.201	63.003	72.435
Control	48.124	2.097	44.388	53.215

**Table 4:** Mean and Standard Deviation of Pre-test and Post-test of Experimental and Control Groups

Group	Pre-test		Post-test	
	Mean	SD	Mean	SD
Experiment				
Control		48.124	2.097	44.388

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