

A STUDY ON THE EFFECTIVENESS OF A STRATEGY BASED ON COOPERATIVE LEARNING FOR SCIENCE TEACHING IN CLASS VII

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Education today needs to be responsive to the diverse needs of our learners in order to make them globally competent. Innovative initiatives need to be brought into the present education system in order to meet the growing demands of our society. Our education system does not function in isolation with our society and so, along with academic aspects, the social aspects of learning too, have to be focussed on. This is possible with quality teaching strategies being introduced in our teaching learning process and one such strategy promoting the same is Cooperative Learning. Cooperative learning involves students working together in small groups to accomplish shared goals. It is widely recognized as a teaching strategy that promotes socialization and learning among students from kindergarten through college and across different subjects and science is no exception. Science enables pupils to be involved in group work where they have the opportunity to share ideas and cooperate with each other in collaborative practical activity. What is needed today is a new wave of educated students ready for modern scientific research, teaching and technological development. With students of diverse abilities and differing rates of learning in our classrooms, it is, therefore, essential for the teacher to have the knowledge of how students learn science and how best to teach. The present study was taken up in this context to find out the effectiveness of cooperative learning strategy in science teaching.

KEYWORDS: Cooperative Learning, Science Teaching

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INTRODUCTION

Education comprises not only higher and technical education but also primary education. Primary education lays the foundation of all subsequent education, i.e. secondary and university education. The quality of secondary or university education cannot be high unless the quality of primary education improves. Also, for some children in our country primary education will be terminal. It is, therefore, important that it equips them fully to face the challenges of life ahead. Thus, with the quantitative development of the educational system, qualitative development is also essential. An important factor that affects the quality of education is the teaching- learning process. So it is high time that we give up the traditional methods of teaching and come up with innovative and effective teaching strategies in order to help and motivate our students to learn efficiently. One such strategy which is being largely supported and promoted today is group work. According to the National Curriculum Framework (NCF, 2000), at the upper primary stage children endeavour to establish an identity of their own. The process of identity formation requires taking into account one's own view as well as the views of others and of the society. Thus, the importance of peer group increases considerably. NCF (2005) also stresses on promoting constructivist approach in classrooms which leads to learners having autonomy for their own learning and opportunities for peer collaboration and support. Constructivist approaches to collaboration include peer collaboration, reciprocal teaching, problem based instruction, cooperative learning and other methods that involve learning with others. The UNESCO (1996) stated that one of the tasks of education is to teach pupils and students about human diversity and to instil in them an awareness of the similarities and interdependence of all people. From early childhood, it should focus on the discovery of other people in the first stage of education. In the second stage it should encourage involvement in common projects. Thus one of the essential tools for education in the twenty first century must be a suitable forum for dialogue and discussion. One such strategy promoting this aspect is cooperative learning.

COOPERATIVE LEARNING (CL)

The most widely used definition of cooperative learning in education is probably that of Johnson and Johnson (1994). According to them, cooperative learning is an instruction that involves students working in teams to accomplish a common goal, under conditions that include the following five essential elements:

1. Positive Interdependence- team members are obliged to rely on one another to achieve the goal. If any team member fails to do their part, everyone suffers consequences.

2. Individual Accountability- All students in a group are held accountable for doing their share of the work and for mastery of all of the material to be learned.
3. Face-to-Face Promoted Interaction- Although some of the group work may be parceled out and done individually, some must be done interactively, with group members providing one another with feedback, challenging reasoning and conclusions, and perhaps most importantly, teaching and encouraging one another.
4. Appropriate Use of Collaborative Skills- Students are encouraged and helped to develop and practice trust-building, leadership, decision-making, communication, and conflict management skills.
5. Group Processing- Team members set group goals, periodically assess what they are doing well as a team, and identify changes they will make to function more effectively in the future.

Cooperative learning is not simply a synonym for students working in groups. Learning exercise only qualifies as cooperative learning to the extent that the five listed elements are present.

COOPERATIVE LEARNING TECHNIQUES

There are very specific cooperative learning strategies teachers use to organize interactions between students. There are many such techniques that can be used in classrooms. The techniques used in the present study are:-

1. Jigsaw - this method was developed by Aronson (1978). In this method groups with five students are set up. Each group member is assigned some unique material to learn and then to teach to his group members. To help in the learning process, students across the class working on the same sub-section get together to decide what is important and how to teach it. After practice in these "expert" groups the original groups reform and students teach each other. Tests or assessment follows.

2. Student Teams - Achievement Divisions (STAD) – Developed by Slavin (1978a) wherein the 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. Finally, all students take individual quizzes on the material, at which time they may not help one another. Students' quiz scores are compared to their own past averages, and points are awarded on the basis of the degree to which students meet or exceed their own earlier

performance. These points are then summed to form team scores, and teams that meet certain criteria may earn certificates or other rewards.

3. Group Investigation – Developed by Sharan and Lazarowitz (1978), this is a general classroom organization plan in which students work in small groups using cooperative inquiry, group discussion, and cooperative planning and projects. In this method, students form their own two-to-six-member groups. After choosing subtopics from a unit that the entire class is studying, the groups break their subtopics into individual tasks and carry out the activities that are necessary to prepare group reports. Each group then makes a presentation or displays to communicate its findings to the entire class.

4. Teams-Games- Tournaments (TGT) – Developed by De Vries and Slavin (1978), it is used at the conclusion of each chapter. The usual heterogeneous groups are split up temporarily. Students are put into homogeneous ability groups of three or four students for a competition, using the list of questions at the end of the chapter. Students randomly select a numbered card corresponding to the question they are to answer. Their answers can be challenged by the other students and winner keeps the card. Students earn points (one point for each card won) to bring back to their regular teams, a team average is taken, and the teams' averages are announced and all congratulated.

5. Think- Pair- Share – Developed by Lyman (1981), it 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 group.

6. Round Robin Brainstorming – Kagan developed this method in 1992. The Class is divided into small groups (four to six) 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 the team share responses with one another in round robin style. The recorder writes down the answers of the group members. The person next to the recorder starts and each person in the group in order gives an answer until time is called.

THE BENEFITS OF COOPERATIVE LEARNING

Johnson et al. (1987) conducted a Meta analysis of 122 studies of CL and it was found that CL tends to promote higher achievement than does competition or individual work, with this finding holding for all age levels, all subject areas, and a variety of tasks. The same was reported by Slavin (1991) who identified 70 studies that evaluated various CL methods for periods of 4 week or longer. A study by Battistich and Watson (2003) revealed CL experiences to enhance the

development of positive social attitudes towards other group members. Ryan, Reid and Epstein (2004) also found that CL experiences enhanced the development of positive social attitudes toward other group members in students with emotional and behavioural disorders. Kishore (2012) also found that social acceptability of students increased after undergoing CL. An important factor that plays a crucial role in the success of an individual is self-esteem. According to Uscher (1986), CL breaks down stereotypes and leads to an increase in self-esteem. These results are supported by the findings of Kalaiyarasan and Krishnaraj (2004) and Tripathi (2004). Study by Ballantine and Larres (2009) reported that the CL cohort perceived their learning experience to be significantly more effective at enhancing interpersonal and communication skills than that of the simple group learning cohort. Apart from all the above-mentioned outcomes, CL contributes to an enhanced sense of psychological health and well being as per the findings of Johnson and Johnson (2000). This is supported by the results revealed by Johnson, Johnson and Stanne's (2000) study that CL experiences are crucial to preventing and alleviating many of the social problems related to children, adolescents and young adults.

COOPERATIVE LEARNING AND SCIENCE TEACHING

According to Sherman (1994), the investigative nature of science provides a unique setting for group work particularly cooperative learning to build its framework. Wong (2001) reports, that cooperative classrooms can effectively foster discussion, which is so essential for understanding in science as well as other subjects. The combining of cooperative learning with science is seen as a natural union for many experienced science teachers who have worked extensively with small groups. When cooperative learning is properly implemented, it provides a vehicle for student teams to share materials and equipment as well as ideas. The National Curriculum Framework (2005) also emphasizes that rote learning be discouraged in science and group work be promoted. It says that at upper primary level, apart from simple experiments and hands on experiences, an important pedagogic practice at this stage is to engage the students (in groups) in meaningful investigations- particularly of the problems they perceive to be significant and important. This maybe done through discussions in the class with the teacher, peer interactions, gathering information from newspapers, talking to knowledgeable persons in the neighbourhood, collecting data from easily available sources and carrying out simple investigations in the design of which the students have a major role to play. Thus science teachers should give more emphasis on students' understandings of a particular concept, guiding students in active learning,

providing opportunities for discussion and elaboration and encouraging them to work with peers and teachers and this is what cooperative learning does. Dickens (2005) says that to model real science in the making, instructional activities and situations should engage students in more student-to-student discussion of scientific ideas and more cooperative group work. There have been many studies conducted abroad on the effect of cooperative learning in science and almost all have found cooperative learning to have a positive impact on science learning. But in spite of this, CL is not being used in our classes frequently. According to Umasree (1999), students are rarely given opportunities to do things or take the initiative in classes. The student participation is limited only to seeking clarification on their teaching points. Lecture method is used in seventy percent of the cases observed. Similar findings were also reported by Ramkumar (2003). Shukla (2005) indicates that, in India, science education needs to be strengthened in terms of methods of teaching, teacher quality and infrastructure. This observation has been found valid for all regions of the country. So this calls for research to be done on these aspects and thus the present study was taken up.

Hundreds of CL techniques have been created into structures to use in any content area. In the present study however only six cooperative learning techniques were used. They are Jigsaw, STAD, Group Investigation, TGT, Round Robin Brainstorming and Think-Pair-Share. From review of literature it could be seen that STAD, TGT, Jigsaw and Group Investigation have been very successfully used in teaching science. According to Jolliffe (2007), round robin brainstorming and think-pair-share are two simple and easy techniques, which are widely recommended for implementing in the introduction and conclusion part. Also the investigator found these techniques more simple and easy. According to Felder & Brent (2007), instructors new to cooperative learning should take a more gradual approach, choosing mainly the methods with which they feel most comfortable and adopting additional methods only when they have had time to get used to the current ones.

COOPERATIVE LEARNING AND THE STATE OF KERALA

The present study was conducted on seventh standard students in Kerala. It is in the seventh grade that most of the important concepts of science get introduced. If only they develop a strong knowledge base of the subjects in the early stage can they build on it at higher level. In Kerala, the seventh standard books were revised in 2001 as a part of the on-going curriculum and textbook revision. The child centered, activity based and enjoyable learning methods that characterize the new curriculum provides the basis for these textbooks. Thus the content of these textbooks provide ample scope for group work. But,

in spite of all the efforts in terms of curriculum and textbook revision, science education in Kerala still has a far way to go. George and Kumar (1999) state, that the pedagogic practices followed by the State's educational system are equally outmoded. They do not take into account either the social or physical realities of Kerala. They are entirely teacher oriented and non-participatory. They encourage only rote learning. According to the Kerala Curriculum Framework (2007), science teaching in Kerala is examination oriented and not learner centred. Encouragement is given to rote learning and not to learners' curiosity and interest in investigations. Scientific attitude is also not being developed. In today's science classes, individual and competitive learning is given more importance. Thus the curriculum framework stresses for a change in this present system and emphasizes the importance of cooperative learning in science teaching. It states that cooperative learning is an effective strategy for science teaching and should be used in classes by teachers. It further goes on to point out the advantages of using cooperative learning, which are:

1. It makes teaching-learning process learner centered
2. Each child gets individual attention
3. It enhances creative thinking, problem solving abilities, reasoning power and communication skills
4. It helps the weak as well as bright students equally and
5. Finally, it helps them to respect and accept other people and their views too.

As a member of the educational community committed to the success of our students, it is our duty to work out on these areas and come up with possible solutions to help them. Thus, the present study was taken up keeping in mind all the above things.

OBJECTIVE OF THE STUDY

To study the effectiveness of the strategy based on cooperative learning in science for class VII students in terms of their academic achievement.

HYPOTHESIS OF THE STUDY

There will be no significant difference between mean scores of achievement of the students who studied through cooperative learning strategy and that with conventional method.

EXPLANATION OF TERMS

Strategy Based on Cooperative Learning

It broadly constitutes the methods, procedures and techniques that the teacher

uses to confront students with the subject and to bring about an effective outcome, with each method, procedure and technique having its components and procedures. Steps involved are: selection of content, analysis of content, preparing list of instructional objectives and designing activities based on specific learning outcomes and students' needs. The appropriate techniques of cooperative learning were linked with identified content areas of class VII science and accordingly lesson plans designed.

Table 1**Example of Strategy Based on Cooperative Learning.**

CONTENT	OBJECTIVES	TEACHER ACTIVITY	STUDENT ACTIVITY	EVALUATION
1) Methods of Cultivation	Students (i) Compares advantages and disadvantages of methods (ii) Differentiates between them (iii) Infers which method is better and why (iv) Summarizes all points (v) Concludes which method is better	Teacher narrated the example of two farmers using different methods of cultivation. Asked students to discuss on how these methods differ, which method is better and why. Gave hints on crop rotation and intercropping.	Technique of Round Robin Brainstorming was used. Students were made to sit in groups of five. One student was made recorder. Each student expressed his ideas and views on the example of the two farmers. All the points of each student regarding methods of cultivation, which method is better and why were noted down by a recorder in the group. Group discussion followed. Students reached final answer that crop rotation and intercropping are better methods of cultivation.	After the allotted time teacher asked questions to each group and based on that evaluated them on content. Field diary was used to note down activities and progress of every group.

Units of Science

Units of science refer to the five chapters of science included in the study. They are Green Cover, Water to be Conserved, When Heat Acts, The World of Sound and Let us Grow Together.

DELIMITATIONS OF THE STUDY

The study was delimited to:

1. English medium Upper Primary Schools
2. Five Units of Class VII Science

DESIGN OF THE STUDY

Study is quasi experimental in nature. The Pre-test Post-test Non Equivalent-Groups Design was used. This design is often used in classroom experiments when experimental and control groups are such naturally assembled groups as intact classes, which may be similar.

POPULATION AND SAMPLE

The study was carried out in Ernakulam district, Kochi in the state of Kerala. There are 105 English medium schools with upper primary classes in Ernakulam following Kerala State Board Syllabus. All class VII students (approximately 8400 students) of Ernakulam district formed the population of the study. From this, two schools were randomly selected and from these two schools, students of class seven from one school were randomly selected as experimental group and the other as control group. All students in the class were included. There were thirty-six students in experimental group and thirty-nine in control group. Thus in a way this becomes cluster sampling.

TOOL USED

Science achievement test was used. Achievement test was designed based on the selected five chapters of science. The same test was used in parallel form for the pre-test and post-test. The tool was sent to experts for validation and based on their suggestions it was finalized.

DATA COLLECTION

Data was collected for one term of the year i.e. six months from June to November. First the pre-test was administered to both the groups. Then the respective five chapters in science were taught to the experimental group using

the strategy based on cooperative learning techniques. The control group was taught by their class teacher using regular classroom teaching. After that, post-test was administered to all students of both control and experimental group. The presence of control group took care of the threats to internal validity like maturation, history and testing. To make up for experimenter bias a teacher from that school was asked to assess the students for the five essential elements of cooperative learning using rating scale along with the investigator. For dealing with potential threat investigator directly observed classes to make sure process was carried out as intended by investigator. Thus every effort was made to minimize threats wherever possible and accordingly interpret results.

DATA ANALYSIS

In the present study, existing or intact groups were involved but treatments were assigned to them randomly and to take care of that, Analysis of Covariance (ANCOVA) was used for analysis.

Table 2
ANCOVA Output for the Data.

Source of Variation	Sum of Squares	df	Mean Square	F	p - value
Pre-test	883.545	1	883.545	5.429	0.023
Group	6192.939	1	6192.939	38.054	<0.001
Error	11717.205	72	162.739		
Total	18793.689	74			

Significant at 0.05 Level

From above table 2 it can be seen that p value is less than 0.05 and so 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 that with conventional method.

FINDINGS OF THE STUDY

There was a significant difference between mean scores of achievement of the students who studied through cooperative learning strategy and that with conventional method. Experimental group students scored higher than control group students and thus cooperative learning helped in increasing science achievement of students than the traditional method of teaching.

RECOMMENDATIONS FOR IMPLEMENTATION OF COOPERATIVE LEARNING

On the basis of the findings of this study the following recommendations are given:

- CL should be promoted as one of the major teaching strategies for science in schools.
- Policy makers and School authorities should frequently conduct workshops and training programmes on CL and its implementation for teachers and encourage teachers for the same.
- Regular monitoring of CL implementation in schools should also be done. An expert committee should be set up for the same by policy makers with the support of school authorities. The committee should make timely visits to schools and submit report on the issues and problems being faced while implementing CL. This will help bring to limelight the major hindrances coming in the way of CL and expert guidance can be sought for remedial measures for the same.
- Recognition and rewards should be given to teachers who implement CL successfully and come up with innovative ideas for the same. The techniques and guidelines used by such teachers should be made available to teachers of all schools for reference by higher authorities.
- Higher authorities should also try to locate and collaborate with those educational institutes abroad, wherein CL is being carried out effectively and regularly. Interaction with such institutes and educationists who practice CL regularly will help get a clearer picture on the ground reality of implementing CL.
- School authorities and teachers should build a strong alliance with parents by explaining to them the importance of CL as well as the challenges to be addressed while implementing it.
- Teachers new to CL can start with those techniques of CL with which they feel most comfortable. During the initial stage teachers should be more flexible with CL and make students feel comfortable. Students should be given time to understand and get adjusted with CL techniques.

CONCLUSIONS

It can be therefore seen from the present study that CL helped in increasing science achievement of students than the traditional method of teaching. Implementing CL and assessing students in CL, however, needs a lot of patience and time and is not an easy task. Only with the joint efforts of school authorities, teachers, students and parents, can these goals of CL be achieved.

So it is high time that more researches be done to investigate these areas in depth. The present study is a step made in this regard. The findings of such studies can help teachers, parents, students and others involved in the educational field to cope with the present problems and issues being faced while implementing CL in classrooms, as well as while assessing students in CL, and thus exploit the benefits of CL to the maximum.

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