



COLLABORATIVE LEARNING IN ACTION: AN EVALUATIVE STUDY OF ITS EFFECTIVENESS AND AFFECTIVENESS IN ELEMENTARY MATHEMATICS CLASSROOMS OF DELHI

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Abstract- Collaborative learning is essential because higher mental functions such as reasoning, critical thinking and reflection originate in social interactions and are then internalised by the individuals in the group. The purpose of this study was to investigate the effectiveness and affectiveness of collaborative learning in the elementary mathematics classrooms and to designate students' perception on the process of collaborative learning. The sample of the study was 207 Class VII students in 5 (2 Govt. and 3 private) schools of Delhi. It was an experimental study with controlled group taught with traditional teacher led individual learning technique whereas the experimental group was provided with Collaborative learning Technique using Jigsaw model of grouping. In the study, the Collaborative Learning Process Scale and the Mathematics Achievement Test were used to collect data. In the light of the findings, it can be put forward that cooperative learning has a positive effect on student achievement. The cooperative learning activities done in the experimental group have meaningfully increased the student achievement, social skills, interpersonal relations as well as readiness to participate, share and initiate in learning process.

Keywords: Affectiveness , Collaborative Learning, Effectiveness , Jigsaw Technique, Mathematics Achievement.

1. INTRODUCTION

“Collaboration allows us to know more than we are capable of knowing by ourselves”

- Paul Solarz.

A teacher draws a pie-chart on the chalkboard, and poses some questions in context of that pie-chart. Incidentally, she was summoned by principal for some administrative work. She challenged the students to find the solution and promised a treat for success. There's a flurry of movement as students open their notebooks, grip their pens, and get to work for finding the solution. Each student collaborates with their neighbour to complete the questions, discussing the concept, theories, formulas and applications in hushed tones. When they finish, they eagerly waited for the teacher to check over their work. Upon returning, she does so but asked for the logic behind the solution. Each neighbour group teamed up to prove their solution right by providing arguments and counterarguments; resulting in re-evaluating and reforming their solutions. On the surface, it was a simple dedicated team effort to get a treat but in deep it was collaborating learning from each other in the guidance of a teacher.

Collaborative learning is an approach for learning that inculcate a group of learners into working together to solve a problem, to complete a task, or to create a product. It is based on the idea that learning is a naturally social act. Learning occurs though active engagement among peers, either face-to-face or online. The main characteristics of collaborative learning are: a common task or activity; small group learning, co-operative behaviour; interdependence; and individual responsibility, readiness to share, initiate & accountability.

1.1 Difference Between Collaborative Learning, Cooperative Learning & Peer Based Learning

Generally all the terms are loosely used as synonyms, but are significantly different from each other. Collaborative learning is similar to, but not the same as, cooperative learning. In cooperative learning the task is divided vertically (i.e., members work more or less concurrently on different aspects of a project), whereas in collaborative learning the task is divided horizontally (i.e., members work together more or less sequentially on different aspects of a project) (Dillenbourg, 1999).

At first, the differences between collaborative learning and peer learning can appear insignificant, as in both cases students work together to improve their learning experience. However, collaborative learning occurs when students work in groups to discuss ideas and solve problems together. But in peer-to-peer learning pupil leads another through a task or concept. A simple way of expressing this difference is that in collaborative learning, students learn alongside one another, whilst in peer learning they learn from one another.

1.2 Benefits of Collaborative Learning

Collaborative learning is a technique teachers' use to group students together to impact learning in a positive way. Proponents of collaborative learning believe it helps students in many ways, as we'll see below. They theorize that working together increases learning outcomes. Collaborative learning can occur between just two students or within a larger group, and it can take a variety of forms.

Collaborative learning activities create opportunities for students to:

- Engage in subject specific discussions with peers
- Learn how to work cooperatively and support each other
- Develop effective teamwork and communication (including interpersonal and cross cultural awareness) skills
- Assimilate multiple views to deepen knowledge and promote critical thinking
- Foster individual accountability to the team
- Develop independent learning strategies
- Structure out-of-class learning
- Mitigate learner isolation

The Idea of collaborative Learning has originated from the very concept of "Zone of Proximal Development by Vygotsky. Vygotsky emphasized that: "The separation of the intellectual aspect of our consciousness from its affective and volitional aspect is one of the major and fundamental shortcomings of all traditional psychology. Thinking is thereby inevitably transformed into an autonomous current of ideas that think themselves; it is cut off from all the fullness of real life, impulses, interests, and real tendencies of Man who thinks." (Vygotsky 1997: 61). Vygotsky forcibly argued that students can do and understand much better when aided by peers and groups. Groups tend to learn through discussions, clarification of ideas and evaluation of others' ideas, which in turn leads to better understanding and longer retentions.

Researchers have placed social interaction at the focus, arguing that knowledge is built together in a social context (Sawyer 2006). Social interaction with learning orientation has been explored, for example, in studies on cooperation (Johnson & Johnson 1986), peer and group learning (O'Donnell 2006), group cognition (Stahl 2006), and collaborative learning (Baker et al. 1999, Crook 2000, Dillenbourg 1999, Dillenbourg et al. 1996, Roschelle & Teasley 1995). The general consensus has been reached (e.g. Sawyer 2006) that interaction is the mediating mechanism whereby specific cognitive, motivational and emotional factors are activated that can contribute to individuals' learning and collaboration within groups (Blumenfeld et al. 2006, Dai & Sternberg 2004).

2. PURPOSE OF THE STUDY

The purpose of this study is to investigate the effectiveness of collaborative learning on the maths lessons achievement of elementary school students and to designate their views on the collaborative learning process.

In the study, the techniques of collaborative learning were used throughout a unit and finding out whether the process was carried out as necessary was aimed. To this end, answers to the following questions were sought:

- Is the collaborative learning method used in the unit 'Area of regular and irregular shapes' effective on the academic achievement of seventh grade students?
- What are the student perceptions regarding the process of collaborative learning and their readiness to be an active participant in it?

The Study implicates to help Teachers in understanding the pros and cons of Collaborative Learning. It will not only evaluate the effectiveness but also the affectiveness of Collaborative Learning in mathematics Classrooms.

3. METHOD

The research was conducted in a Pretest-Posttest Control Grouped Half Experimental Pattern. This experimental research project focuses on students' mathematics academic performance on a pre-test and post-test when taught using a traditional technique Vs Collaborative Learning using Jigsaw Technique. The research was conducted using quantitative research protocol as well as qualitative research Protocol. Quantitative data were obtained via the pre/post-test, treatment-control groups test model. The data was collected through student test scores on a pre-test given before the unit was taught and a post-test given after the unit was taught. The treatment process took 10 class hours in total. The statistical analysis was repeated measures ANOVA. Using this analysis, the differences between pre- and post-tests for each group was compared as well as the overall comparison between the two groups. The pre-test served as a baseline measure.

3.1 Sample of Study

The sample of study was 203 Class VII students in 5(2 public and 3 private) schools of Delhi. The Detail Diversification of Sample is as follows:

Table-3.1 Sample Diversification

Sample Diversification	Total (203 students)
Male: Female	125:78
Public: Private School Students	74:129
Experimental: Control Group	97:106

4. PROCEDURE INSTRUMENTS

- The Curriculum used as base concept was Mensuration, where the Topic of Study was areas of regular and irregular shapes.
- The Control group was taught through traditional method with complete guidance and instructions of Teacher led individual learning methods.
- The jigsaw technique was used for Collaborative Learning Grouping. It is a method of organizing classroom activity that makes students dependent on each other to succeed. It breaks classes into groups and breaks assignments into pieces that the group assembles to complete the (jigsaw) puzzle. It was designed by social psychologist Aronson (2011) to help weaken racial cliques in forcibly integrated schools.

The technique splits classes into mixed groups to work on small problems that the group collates into a final outcome. For example, an in-class assignment is divided into topics. Students are then split into groups with one member assigned to each topic. Working individually, each student learns about his or her topic and presents it to their group. Next, students gather into groups divided by topic. Each member presents again to the topic group. In same-topic groups, students reconcile points of view and synthesize information. They create a final report. Finally, the original groups reconvene and listen to presentations from each member. The final presentations provide all group members with an understanding of their own material, as well as the findings that have emerged from topic-specific group discussion. A diagram of this design is as follows:

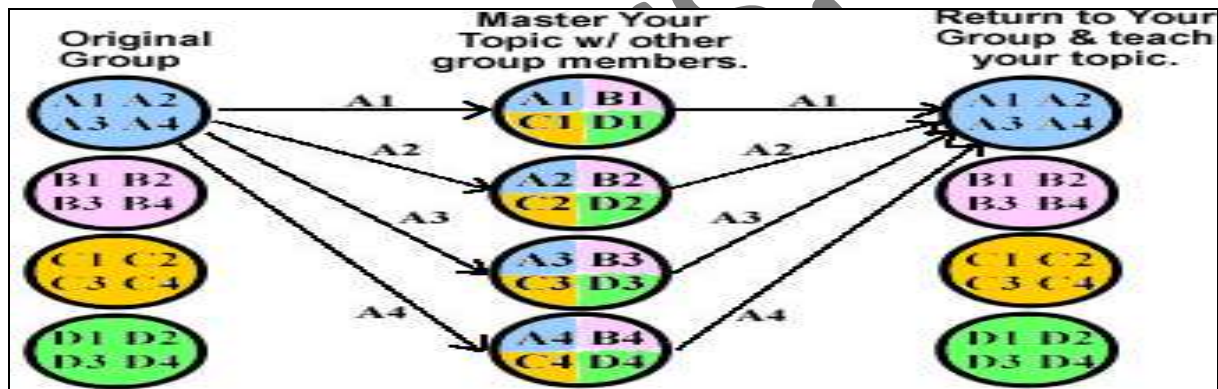


Fig. 4.1 Jigsaw Technique of Grouping for Collaborative Learning

Hence, the experimental group was taught using collaborative learning techniques. Given below are the topic titles, time allocated and techniques used:

Table 2: The Process of Collaborative Learning

Step	Content	Activity
1: Main Groups Consisting of 5 members was Formed	Definition of Regular & irregular Shapes	Brain Storming, Group Discussion & Technology Usage
2: Each group was further divided into 5 subgroups Regrouping for specific subtopic Learning	Irregular shapes, triangle, Square, Rectangle, Circle,	Brain Storming, Group Discussion & Technology Usage
3. The Group reunites to share the information, learn the concepts from each other and present the report.	Full Unit	Presentation of Final Report

5. DATA COLLECTION TOOL

In the study, the Collaborative Learning Process Scale (CLPS) (Bay and Cetin, 2012) and the Maths Achievement Test (MAT) were used to collect data.

Collaborative Learning Process Scale (CLPS) The scale prepared to determine whether the collaborative learning process took place as intended. The two half reliability coefficients belonging to the entire scale developed by Bay and Cetin (2012) was calculated at 0.93. The scale has five sub-dimensions that are titled

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‘positive interdependence’, ‘individual responsibility’, ‘face to face supportive interaction’, ‘small group skills’ and ‘group process’. The Cronbach alpha coefficient of the scale in this study was calculated at 0.94.

Maths Achievement Test (MAT) The achievement test was prepared and developed by the researcher. It was utilised in the study as pretest and posttest. The KR-20 reliability coefficient of the up-to-date achievement test was calculated at 0.81.

Hence, Sample Diversification was as follows:

Table-5.1 The Pre-test Post-test Method Detail

Group	Pre test	Technique	Post test	Students
Experimental Group	MAT	Jigsaw Collaboration	MAT, CLPS	97
Control Group	MAT	Traditional	MAT	106

6. DATA ANALYSIS

SPSS program was used for the analysis of the data. In attaining the findings, the pretest-post-test control group pattern was used for SAT and for the posttest control group pattern, dependent and independent t test analyses were done.

6.1 MAT Analysis

As shown in Table 6.1, Experimental group had a sample size of $n = 97$. The baseline mean for Experimental group was 8.27 with a standard deviation of 4.10. Control group had a sample size of $n = 106$. The baseline mean for control group was 7.67 with a standard deviation of 4.97. The post-test mean for experimental group was 18.27 with a standard deviation of 3.98. Control group had a post-test mean of 12.67 with a standard deviation of 4.37.

Table-6.1 Mean Scores and Standard Deviations for Experimental & Control Group I Pre-test and Post-test

Group		Mean	Standard deviation	Sample size	T-Value
Experimental Group Control Group	Pre- Test	8.27	4.10	97	1.61
		7.67	4.97	106	
Experimental Group Control Group	Post-Test	18.27	3.98	193	
		12.67	4.37	207	

Results of repeated measures ANOVA showed a significant main effect of the test with $F(1,50) = 166.12$, and Wilk's Lambda = .23, $p < .001$. This means that the performance on the post-test was better than the performance on the pre-test for both experimental and control group. The significant results of the tests of between-subjects effects, with $F(1,50) = 5.20$, $p < .05$, suggested that the overall performance of experimental group was better than control group. The descriptive statistics shows that the mean improvement score (defined by the post-test score minus the pre-test score) for experimental group was higher than that of control group. This means that the students taught with Collaborative activity showed more improvement than those taught with traditional technique.

An independent samples t-test was conducted to compare the improvement scores of experimental group and control group to check if there was a significant difference. The group statistics shows that $t = 1.61$ which shows significant change in post test results.

6.2 CLPS Analysis

For the collaborative process scale and its sub-dimensions, the Mann-Whitney U test was used.

Table-6.2 Students Level of Acceptance for Cooperative Learning Process

Students' level of Acceptance	Frequency	Percentage	Level of Participation
0-1	0	0	No
1-2	12	12.37	Low
2-3	56	57.73	Medium
3-4	29	29.89	High

Moreover the Descriptive findings of Lowest & Highest Points in CPLS:

Table-6.3 Students Perception of Lowest & Highest Points in Collaborative Process Learning System

Lowest Points	Frequency	Highest Points	Frequency
Group members share the idea 'we go down together or ascend together': Positive interdependence	2.39	Group members endeavour to do their best: Group processing	4.21
Group members are constructive in their criticisms: Social skills	2.91	Group members convey the results (information) they receive to each other: Face to face supportive interaction	3.98
Each group member feels responsibility for the learning of other group members: Positive interdependence	2.97	Each group member is responsible for contributing to the achievement of the group: Individual and group accountability	3.55

Table 6.2 and 6.3 expresses students' perceptions, readiness and concerns for the collaborative learning in classes. The level of acceptance of the experimental group was medium (57.73%) students liked the process and wanted to participate in Collaborative learning again. No student found disinterested in the technique. The Descriptive explanation of the six dimensions of CPLS explained the limitations students' faced during the experiment. The students were apprehensive about the Positive interdependence and social skills. It was observed that the students had difficulty in this implementation which they did for the first time. The ego clashes, the unaccepted criticism, the dedication on the part of some group members were concerns. Meanwhile, the support system of group, confidence building and new friendships were highest points of the Collaborations.

CONCLUSION

Cooperative learning is essential because higher mental functions such as reasoning, critical thinking and reflection originate in social interactions and are then internalised by the individuals in the group. In the light of the findings, it can be put forward that cooperative learning has a positive effect on student achievement. The cooperative learning activities done in the experimental group have meaningfully increased the student achievement, social skills, interpersonal relations as well as readiness to participate, share and initiate in learning process. Thus Collaborative learning is not only effective but also affective in improving the Learning environment of Mathematics Classrooms.

According to the results of this research, the below suggestions can be made:

- Cooperative learning is also underused because many students do not understand how to work cooperatively with others. So students have to be taught how to work cooperatively.
- Cooperative learning groups should be utilised in methods that lead students to making research and questioning, such as Problem-Based Learning.
- Various cooperative learning implementations such as Web-based/online should be performed and their results should be shared.

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