SUMMARY

INTRODUCTION

One of the important goals of education is to improve both scholastic as well as non-scholastic achievement in school, offering them better social relations in a properly articulated school environment. There is an urgent need to practice alternative education programmes new instructional strategies or methods to solve the problem of students’ poor achievement as well as to provide congenial school climate and curriculum that meet the needs of students. Cooperative Learning seems to be one such strategy to bank upon for better quality schooling.

Cooperation in simple terms means working or acting together for a common purpose. Cooperative learning is a teaching-learning strategy in which the students of a class engage themselves in a variety of useful learning tasks, in a cooperative and non-competitive embracing environment by forming a number of small group teams, each consisting of a small number of students of different levels of ability to learn together in a homely atmosphere.

EMERGENCE OF THE PROBLEM AND ITS RATIONALE

Research on students’ thought processes is based on the belief that teaching is mediated by the students’ thinking skills and that teachers influence students’ achievement, not directly, but by causing students to think and behave in certain ways (Wittrock, 1986). It is evident that everyone has one’s own individual learning style. Our interests and genetic make-up determine what we can learn, how well we may learn and how well we can apply what has been learnt. Consequently, all methods of instruction do not align with the learning capabilities of each individual learner. Either we must devote time to each learner individually or rely on other means to assist each learner to progress which may not be possible as it requires more human resources than are available to schools. There is a need of a team of individuals to pull together to get tasks accomplished (Flowers and Ritz, 1994).

Cooperative learning is one of the teaching-learning strategies which is not expensive, makes learning easier and more enjoyable for the students. It is an easy
technique to implement in the classroom, particularly in a block or a scheduled timetable. The rationale for using cooperative learning techniques is that the cooperative learning principles are important not only for helping people to work better together but also for recognition of every one’s gifts and strengths. Experimental studies (enhanced academic achievement, improved self-concept, greater motivation and better interpersonal relations) question continues to surface about students’ performance in small group settings and that not all students receive the same benefits from participation in heterogeneous cooperative groups.

Throughout the world, Mathematics is taught as one of the school subjects, but a majority of the students feel that mathematics is a difficult subject which leads to high failure rate because of: (a) lack of interest in mathematics; and (b) ineffective teaching methods. Majority of the Mathematics teachers follow the traditional methods of instruction and at times also feel like creating their own learning strategies (settings) in the classroom that enable the learners to actively participate in the instructional process rather than being simply passive listeners.

Co-operative learning is one strategy that can enable all learners in the classroom to learn or work together in smaller groups. This can contribute to intellectual, social and psychological development of learners unlike other methods of instruction. Cooperative learning also focuses on preventing and treating a wide variety of instructional and of society problems too, such as addressing diversity (racism, sexism, inclusion of handicapped, anti-social behaviour, delinquency, drug abuse, bullying, violence and incivility), lack of pre-social values and egocentrism psychological pathology, low self-esteem, etc.

In cooperative learning settings, groups of students of mixed abilities help each other to learn by actively participating and discussing the issues involved through cooperation, self-effort and understanding. The research indicates that high achievers gain from cooperative learning (relative to high achievers in the traditional classes) just as much as do low and average achievers (Slavin, 1995).

Cooperative interdependence in classroom settings is the basis of many interventions designed to improve both academic achievement and self-concept of
students in schools and as such it has been a primary focus in educational, social and psychological literature for quite a long while over the decades, which poses an obvious problem for an intensive study. Hence, the choice of the topic and the statement of the problem:

**STATEMENT OF THE PROBLEM**

A Comparative Study of the Effectiveness of Student-Teams Achievement Divisions (STAD) and Jigsaw Methods of Cooperative Learning

**OPERATIONAL DEFINITIONS**

The operational definitions of some of these frequently used terms having specific meaning for the present investigation are as given below:

i) **Cooperative Learning:** Cooperative Learning is the strategy that can enable all the learners in the classroom to learn or work together to contribute in turn to intellectual, social and psychological development of the learner.

ii) **Effectiveness:** Effectiveness for the present study will be measured in terms of scholastic achievement and enhancement of self-concept of students.

iii) **Academic Achievement:** Academic achievement referred as the degree or level of performance, success or proficiency attained in academic work.

iv) **Self-Concept:** Self-Concept stands for awareness of oneself as a human being and the importance or significance of oneself in the role of life (James, 1902)

**OBJECTIVES OF THE STUDY**

The main objective of the present study is to compare the effectiveness of Student-Team Achievement Divisions (STAD) and Jigsaw method of cooperative learning on the students’ learning outcomes or achievement and self-concept in a Mathematics classroom of seventh graders. Its specific objectives would be:

1. To compare the mean academic achievement scores of three groups of students taught mathematics with and without use of cooperative learning methods (Student–Teams Achievement Divisions (STAD) and Jigsaw) before the experimental treatment.
2. To compare the mean Academic achievement scores of three groups of students taught mathematics with and without use of Co-operative learning methods (Student–Teams Achievement Divisions (STAD) and Jigsaw) after the experimental treatment.

3. To compare the mean gain academic achievement scores of three groups of students taught mathematics with and without use of cooperative learning methods (Student-Teams Achievement Divisions (STAD) and Jigsaw) after the experimental treatment.

4. To compare the mean self-concept scores of three groups of students taught mathematics with and without use of cooperative learning methods (Students-Teams Achievement Divisions (STAD) and Jigsaw) before the experimental treatment.

5. To compare the mean self-concept scores of three groups of students taught mathematics with and without use of cooperative learning methods (Students-Teams Achievement Divisions (STAD) and Jigsaw) after the experimental treatment.

6. To compare the mean gain self-concept scores of three groups of students taught mathematics with and without use of cooperative learning methods (Students-Teams Achievement Divisions (STAD) and Jigsaw) after the experimental treatment.

7. To compare the effectiveness of STAD and Jigsaw methods on achievement of students.

8. To compare the effectiveness of STAD and Jigsaw method in developing self-concept of students.

**HYPOTHESES**

Converting the objectives in terms of hypotheses of following six would emerge as probable to be tested for their statistical significance:

**H₁**  At the end of experimental treatment the group of students taught mathematics through Student–Teams Achievement Divisions (STAD) and Jigsaw methods
under cooperative learning will score significantly higher mean on the academic achievement test than the group of students taught through traditional methods.

\( H_2 \) At the end of experimental treatment the group of pupils taught mathematics through STAD and Jigsaw under the cooperative learning will show a significantly higher mean gain score on the academic achievement test than the group of students taught through traditional method.

\( H_3 \) There exists significant difference between STAD and Jigsaw methods on achievement of students.

\( H_4 \) At the end of experimental treatment the group of students taught mathematics through STAD and Jigsaw under cooperative learning method will attain a significantly higher mean score on the test of self-concept than the group of students taught through traditional method.

\( H_5 \) At the end of experimental treatment the group of students taught mathematics through STAD and Jigsaw under cooperative learning method will attain a significantly higher mean gain scores on the test of self-concept than the group of students taught through traditional method.

\( H_6 \) There exists significant difference between STAD and Jigsaw methods in developing self-concept of students.

**TEACHING METHODS USED**

In the present study, two such methods of cooperative learning, that is, Student-Teams Achievement Divisions (STAD) and Jigsaw has been used to test their merit over traditional teaching methods.

**DELIMITATIONS OF THE STUDY**

Keeping in view obvious limitations and resources, the study has been delimited as under:-

1. The study is conducted on class VII students in Mathematics only.
2. The study is confined to two methods of cooperative learning, those are, STAD and Jigsaw.
3. The study is restricted to learning inside the classroom.
4. The study is conducted in one school at Karnal city only.
5. Study is delimited to only one subject, that is, Mathematics only and to five topics of Mathematics selected from the prescribed syllabus.
6. The experiment is delimited to 60 working days of the academic session.

**DESIGN OF THE STUDY**

In the present study pre-test, post-test group control quasi-experimental design was employed with a purposive sample in the form of intact sections of class VII of the same school. It involved three groups of students’, i.e., experimental groups (EI and EII) and control group (C). Experimental groups were taught in cooperative learning setting involving STAD and Jigsaw methods and the control group was taught through traditional approach.

The intact sections were equated on intelligence and socio-economic status. Quasi-experimental design of the study, as given in Table 1, comprising three stages. The first stage involved pre-testing of all the students of three groups on academic achievement in Mathematics, socio-economic status, intelligence and self-concept. The second stage involved the experimental treatment, which consisted of teaching five units of VII grade Mathematics through cooperative learning methods, i.e., STAD and JIGSAW approach to two experimental groups, EI and EII, respectively; and through traditional method to control group C.

**Table - 1**

<table>
<thead>
<tr>
<th>Design of the Study</th>
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<tbody>
<tr>
<td><strong>Groups</strong></td>
</tr>
<tr>
<td>Experimental Group (EI)</td>
</tr>
<tr>
<td>Experimental Group (EII)</td>
</tr>
<tr>
<td>Control Group (C)</td>
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</tbody>
</table>
In the third stage, students were post-tested on academic achievement in Mathematics and self-concept. A schematic view of the phases of the experiment is presented in the table 2

<table>
<thead>
<tr>
<th>Stage</th>
<th>Treatments</th>
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<tbody>
<tr>
<td>Treatment</td>
<td>Teaching Mathematics through traditional method</td>
</tr>
<tr>
<td>Post-testing</td>
<td><strong>Measurement of students</strong>&lt;br&gt;1. Achievement in Mathematics&lt;br&gt;2. Self-Concept of students</td>
</tr>
</tbody>
</table>

**SAMPLE**

In the present study, all the students studying at VII grade in Karnal is the population. Since the population, being usually too large, a smaller is chosen as representative of the population which is known as sample.

In the present study, the sample comprised 90 students studying in three sections of the VII class of S.B.S. Senior Secondary School, Karnal. Each of the three
sections/groups contained 30 students. One section formed the control group and the other two sections formed the experimental groups.

Table - 3
Sample of the Study

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Groups</th>
<th>Total no. of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Experimental group (EI)</td>
<td>30</td>
</tr>
<tr>
<td>2.</td>
<td>Experimental group (EII)</td>
<td>30</td>
</tr>
<tr>
<td>3.</td>
<td>Control group (C)</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>90</td>
</tr>
</tbody>
</table>

TOOLS USED

For the present investigation, the following tools were used.

A. Standardized Tests
1. Raven’s Standard Progressive Matrices, J.C. Raven, 1977

B. Self-Developed Tools
4. Achievement Test (developed by investigator)
5. Cooperative learning Lesson Plans (developed by the investigator)
6. Worksheets (developed by the investigator)
7. Formative Tests (developed by the investigator)

PROCEDURE FOLLOWED

Procedure of the experiment went through the following stages:

Stage I: Selection of the Sample

The sample of the study was comprised of 90 students of class VII (30 in control group, 30 each in two experimental groups (E₁ and E₁I)) studying in S.B.S. Senior Secondary School, Railway Road, Karnal.
**Stage II : Conducting the Experiment**

The experiment included three phases as given below:

**Phase I : Administration of pre-test**

**Phase II : Conducting the instructional programme.**

**Phase III : Administration of the post-test**

**Phase I : Administration of the Pre-test**

Raven’s Standard Progressive Matrices, Socio-Economic Status Scale, Achievement Tests and Self-Concept Inventory were administered on the control group and experimental groups respectively.

**Phase II : Conducting the Instructional Programme**

Same content was taught to all the three groups. The instructional treatment was given for about 60 days here control group was taught by traditional method and experimental group (EI and EII) were taught by cooperative learning methods (Student-Teams Achievement Divisions or STAD and Jigsaw) respectively.

**Phase III : Administration of the Post-Test**

Immediately after the instructional treatment was over, the students were assessed on criterion measure to know the effects of the treatment. Achievement Test in mathematics and Self-concept inventory were administered to the control and experimental groups.

**STATISTICAL TECHNIQUES USED**

The data collected was statistically analyzed to test objectives of the study by using the following techniques or statistical tools:

1. Descriptive statistics such as means and SD’s were worked out on the score of achievement, and self-concept.
2. Bartlett’s test and analysis of variance (ANOVA) were used in order to adjust pupils’ intelligence and socio-economic status.
The Bartlett test statistic is designed to test for equality of variances across groups against the alternative that variances are unequal for at least two groups.

\[
T = \frac{(N - k)\ln(S_p^2) - \sum_{i=1}^{k} (n_i - 1)\ln(S_i^2)}{1 + \frac{1}{3(k-1)} \sum_{i=1}^{k} \left( \frac{1}{n_i - 1} \right) - \frac{1}{N-k}}
\]

Where \( N = \sum_{i=1}^{k} (n_i) \) & \( S_p^2 = \frac{1}{N-k} \sum_{i=1}^{k} (n_i - 1)S_i^2 \)

In the above equation, \( S_i^2 \) is the variance of the \( i \)th group, \( N \) is the total sample size, \( n_i \) is the sample size of the \( i \)th group, \( k \) is the number of groups, and \( S_p^2 \) is the pooled variance. The pooled variance is a weighted average of the group variances.

3. ‘t’-test was employed for testing the significance of difference between the means of pupils’ achievement in mathematics, their self-concept on pre-test, post-test and gain scores. The value of ‘t’ was computed with the help of the following formula:

\[
t = \frac{M_1 - M_2}{\sqrt{\frac{\sigma_1^2}{N_1} - \frac{\sigma_2^2}{N_2}}}
\]

Where

- \( M_1 \) → mean of first group;
- \( M_2 \) → mean of second group;
- \( \sigma_1 \) → variance of first group;
- \( \sigma_2 \) → variance of second group;
- \( N_1 \) → number of cases in first group;
- \( N_2 \) → number of cases in second group.
FINDINGS

The results drawn during this study support that:

(i) At the end of experimental treatment the group of students taught mathematics through Student-Teams Achievement Divisions and Jigsaw methods under cooperative learning scored significantly higher mean on the academic achievement test than the group of students taught through traditional methods. It suggests that Students-Teams Achievement Divisions (STAD) and Jigsaw methods under cooperative learning contribute towards raising the academic achievement of students in Mathematics in contrast to traditional methods.

(ii) The group of students taught Mathematics through STAD and Jigsaw methods under the cooperative learning showed a significantly higher mean gain score on the academic achievement test than the group of students taught through traditional method at the end of experimental treatment.

(iii) At the end of experimental treatment, there existed a significant difference between STAD and Jigsaw methods on the Academic Achievement of students. Jigsaw showing a significant higher on achievement than the Students-Teams Achievement Divisions (STAD) method under cooperative learning.

(iv) At the end of experimental treatment the group of students taught Mathematics through STAD and Jigsaw under cooperative learning method attained a significantly higher mean score on the test of self-concept than the group of students taught through traditional methods. It suggests that STAD and Jigsaw methods under cooperative learning contribute towards raising the self-concept of students in Mathematics.

(v) The mean gain scores of both the experimental groups, the group of students taught mathematics through STAD and Jigsaw under cooperative learning method were also found to have attained
significantly higher on the test of self-concept than the group of students taught through traditional method called as control group.

(vi) At the post experimental stage, there existed no significant difference between Students-Teams Achievement Divisions (STAD) and Jigsaw methods under cooperative learning in developing self-concept of students. It suggests that STAD and Jigsaw are equally effective in developing self-concept among students even though Jigsaw appeared to be much too higher in mean scores than the mean score of STAD which may be due to an error of minor consequence.

CONCLUSION

The popular cooperative learning approach caters to the needs of students having different mental abilities in organizing students to work together in small group which has been "an ancient practice in education throughout the world" (Slavin, 1995). Cooperative learning instructional approaches provide opportunities for a learner to interact with other learners in the class, and thus the approaches maximize the learner’s intrinsic interest in learning. Children’s improved behaviour and attendance and increased liking of school are some of the benefits of co-operative learning (Slavin, 1987). Although much of the research on cooperative learning has been done with older students, cooperative learning strategies are effective with younger children in pre-school centres and primary classrooms as well, in addition, cooperative learning promotes students’ motivation, encourages group processes, fosters social and academic interaction among students and rewards successful group participation in the learning of school subjects.

Finally, if we are to accept the proposition that Cooperative Learning has a far broader intention than simply a set of strategies to use in a classroom, there is a need to examine the public purpose of education and to congregate research and argument as to how this needs to be articulated in future.

In this context, the observations made by the UNESCO International Commission on Education for the twentyfirst century (1996) are quite relevant. It ‘discussed the need to advance towards a ‘Learning Society’. The Truth is that every
aspect of life, both at the individual and social level, offer opportunities for both learning and doing….Better still, school should impart both the desire for, and pleasure in, learning, the ability to learn how to learn, and intellectual curiosity. One might even imagine a society in which each individual would in turn be both teacher and learner” (UNESCO, 1996). “Not only must it adapt to changes in the nature of work but it must also constitute a continuous process of forming whole human beings – their knowledge and aptitudes, as well as the critical faculty and ability to act. It should enable people to develop awareness to them and encourage them to play their social role at work and in the community” (ibid). Education is a deeper, more profound, undertaking than the hope, in the political entities that are schools serving a purpose in a democratic society. The UNESCO document (1996) spells out education along Four Fundamental Pillars of Education– Learning to Know, Learning to Do, Learning to Be, and Learning to Live Together. The investigator thought it well to develop new dimension of the study in the light of four fundamentals pillars of learning suggested by UNESCO. If cooperative learning could be used well in the educational system then it addresses each of these four elements.

The Commission further observed, ‘Formal education systems tend to emphasize the acquisition of knowledge to the detriment of other types of learning; but it is vital now to conceive education in a more encompassing fashion. Such a vision should inform and guide further educational reforms and policy, in relation both to contents and to methods’. It, therefore recommend Four pillars of learning as the principal focus of schooling which may be achieved best through cooperative learning.

Student-Teams Achievement Divisions and Jigsaw methods under cooperative learning improve the scores of students of the respective experimental groups in their Academic Achievement and Self-Concept and as such prove more meaningful and effective than the conventional methods of teaching and learning. At the end of experimental treatment the effects may be relatively small, even then it reflected significant differences on the measure of academic achievement and self-concept indicating that students in cooperative learning strategies out-performed those in the traditional methods of teaching.
This study is focused on the use of cooperative learning methods in the area of academic achievement and self-concept of seventh grade students at the elementary school stage to compare the effectiveness of the STAD and Jigsaw methods in teaching of mathematics vis-à-vis the traditional teaching methods. Thus, the fundamental variables of this study included:

(a) Learning method as specially cooperative learning methods such as Student-Teams Achievement Divisions (STAD) and Jigsaw
(b) The learning outcomes in terms of Academic Achievement
(c) Self-Concept, as stands for awareness of oneself as a human being and the important or significance of oneself in the role of life.

The present study retained five hypotheses out of the six namely:

• $H_1$, at the end of experimental treatment the group of students taught mathematics through Student-Teams Achievement Divisions (STAD) and Jigsaw methods under cooperative learning scores significantly higher mean on the academic achievement test than the group of students taught through traditional methods;

• $H_2$, at the end of experimental treatment the group of students taught mathematics through STAD and Jigsaw under the cooperative learning shows a significantly higher mean gain score on the academic achievement test than the group of students taught through traditional method;

• $H_3$, there exists significant difference between STAD and Jigsaw methods on academic achievement of students;

• $H_4$, at the end of experimental treatment the group of students taught mathematics through STAD and Jigsaw under cooperative learning method attains a significantly higher mean score on the test of Self-Concept than the group of students taught through traditional method; and

• $H_5$, at the end of experimental treatment the group of students taught mathematics through STAD and Jigsaw under cooperative learning methods shows a significantly higher mean gain scores on the test of Self-Concept than the group of students taught through traditional method, which proves
effectiveness of cooperative learning methods like STAD and Jigsaw over the traditional classroom teaching methods and processes.

It further shows that (H₃) Jigsaw was found better than STAD to improve academic achievement in mathematics. It also revealed a few corollaries of H₂ which are as follows:

- that both Jigsaw and STAD proved to be more significantly effective in raising the academic achievement of students than the traditional method;
- that Jigsaw proved to be more effective than the STAD in raising the academic achievement of students;
- that the Jigsaw proved to be the more effective than the traditional method in raising the academic achievement of students; and
- that the STAD proved to be more effective than the traditional method in raising the academic achievement of students.

The rejection of the hypothesis H₆ shows that there existed no significant difference between STAD and Jigsaw methods in developing Self-Concept of students. H₆ stands partially retained on the basis of better mean scores in favour of Jigsaw over STAD and partially rejected on ‘t’ scores. It does not show however, any controversy in the above results. It clearly indicates, on the other hand, similar significant effectiveness of STAD and Jigsaw in raising the Self-Concept of students. The results of the study do not, in any way, discard or undermine these techniques, nor was it the objective of the study, but it only shows that methods of cooperative learning as STAD and Jigsaw are quite crucial to the inculcation of values like living together, mutual sharing and understanding, and healthy cooperation rather than stark competition that narrows down the process of education to self-directed individualized learning. Quite significantly, both healthy cooperation as well as healthy competition complement and supplement each other in making the learning process tangible to sustainable human development. Therefore, both of them are obligatory in their own right to an effective schooling. They favourably compare in their effectiveness with different methods of cooperative learning vis-à-vis the conventional teaching methods and programmes.
Indeed it has been the growing demand of the fast changing educational scenario today, making schooling a playful endeavour for all practical and methodological purposes of sustainable development and joyful learning, especially at the elementary school level.

EDUCATIONAL IMPLICATIONS

The present research offers many an implication for parents, teachers, guidance workers and all educational stakeholders and even administrators. Parents need to identify the latent talents and potentialities of their wards being their first mentors of the child in her most impressionable period of development as an infant and early childhood before putting the child in the four walls of the formal schools; and also to actively participate and cooperate with school teachers for wholesome and sustainable development of the child as a joint and shared responsibility of the parents and school authorities. They should inspire the children to develop self-confidence and self-concept better which, in turn, would lead to better academic achievement. Teachers in the classroom confront with different potentialities, attitudes, aptitudes, propensities and academic abilities of the students coming from the different areas, class, caste and economic status. It is responsibility of teachers and the school system especially to provide congenial environment for meaningful development of every child in terms of various life skills like building self-confidence, self-respect, interpersonal skills and social relationships etc. as part of the schooling process, besides imparting the knowledge and skills of learning the academic context as well as the incumbent practices.

The present study clearly shows that changing from a traditional competitive classroom to cooperative settings does not diminish student’s achievement; in fact, it significantly improves their academic achievement in mathematics as also their self-concept in a cooperative learning environment. In that way, cooperative learning improves student perception about learning and decrease the feeling of alienation also that groups of students taught through STAD, Jigsaw methods of cooperative learning and shows higher gain scores on academic achievement and self-concept in comparison to traditional method of teaching, which conveys that cooperative
learning reduced individual differences, enhances self-concepts and enables all type of students to perform better. It highlights the comparative merits of the cooperative learning methods vis-à-vis traditional classroom teaching, on the one hand and their intra-merits on the other. It does not counter any method but only seeks an ambitious amalgam of all methods and techniques of teaching in the school to promote educational excellence all round development of children put to their charge. Teachers, Teachers educators and indeed the system as such need to be fully awake about their role models and duties per se. An insight into pedagogy both traditional as well as the emergent, developed over a period of time- goes a long way in boosting the spectrum of schooling in a wholesome and holistic way. Hence, the need for innovative pedagogies all the while.

In the present study, groups were intimately rewarded based on their members’ learning and also students were expected and made individually accountable for their academic performance. Thus, a positive effect on students’ self-concept and academic achievement in Mathematics was found to be there to suggest the usefulness and effectiveness of cooperative learning for improving their academic achievement and also their self-concept. Any study of multifaceted programme leaves many questions unanswered and this one seems to be no exception. Perhaps the most evident question revolved around the relative impact of each of the methods, that is, STAD and Jigsaw under cooperative learning in producing the various effects on achievement and students’ self-concepts. It was found that cooperative learning methods like STAD and Jigsaw proved to be more tangible in its effectiveness on achievement and self-concepts between students and peers as also with teachers than the traditional classroom approach which has remained by and large teacher-oriented than students-initiated, in any way, since its inception in the hoary past in human history. Despite its being too old and on its last legs, as some people do believe under the heavy weight of imminent ICT, the fact still remains that the sinews of the traditional pedagogy are so strong that no new pedagogical technology whatsoever can overthrow or ignore it to be successful in itself. No pedagogy can ever exist sans teacher-taught interaction and close-knit relationship between them. Cooperative learning proves to be practical and widely acceptable to students. When students are
not able to understand teacher’s explanation, group members including peers are able to explain and communicate in simpler words that are more easily understood.

The merits of a few other sundry cooperative learning inputs and their implications for educational purposes could be gauged on the basis of observations like the following.

- Cooperative learning methods like STAD and Jigsaw have shown different ways of instructional arrangement which can be used to foster active student learning, which shows an important dimension of mathematics learning. Students can be given tasks to discuss, solve problem and accomplish quizzes, riddles and puzzles.

- Cooperative learning teachers/facilitators, instead of dealing with so many students simultaneously in the class; deal with small groups of students and group facilitators; that saves a lot of time and energy to devote to planning and initiating cooperative learning projects and programmer.

- Cooperative learning suggests a new role for the teacher. A teacher, accustomed to being the sole source of information for teaching the passive learners in the classroom has to change to be a facilitator in the learning process to actively encourage the student to:
  - Help each other and learn from each other.
  - Participate in discussions.
  - Facilitate each others’ learning.
  - Engage in problem solving in a free democratic way.
  - Structure the lessons and curriculum cooperatively.

- The study suggests that teachers can use cooperative learning activities to provide students with opportunities to practice newly introduced or to review skills and concepts.

- Sometimes students explain things to each other better than a teacher can do to an entire class of students. This usually results in better retention of the learnt material.
The study shows that students make connections between the concrete and abstract level of instruction through peer integration and carefully designed activities.

The study has important implications for teacher education. Given the current wide-spread use of cooperative learning at various levels, it is imperative that pre-service teachers understand how to structure and monitor meaningful learning experiences for students.

The present study suggests that mathematics is conceptually dense having its own language. Cooperative learning can be used to promote classroom discourse and oral language development of concepts, connotations and symbols. In cooperative learning activity, mathematics vocabulary and symbolic understanding can be facilitated with peer interactions.

The study shows that students today seem to have a much shorter attention span than they did years ago. With cooperative learning used on regular basis, they are less likely to become restless or misbehave during a teacher-directed part of a lesson since they know they will have time in groups.

The study tells that teacher should design activities to promote mathematics understanding by having students practice, manipulate reason and solve problem. For example, learn algebraic formulae and apply them to solve equation together helping each other in mathematical constructions, solve word problems related to daily life etc.

The study shows that shy students are more likely to ask and answer question in a group setting. The same is true for low-skills students.

The study interprets that today’s job market is looking for people with good interpersonal skills, high self-concepts and problem solving skills. Regular participation in cooperative learning activities can help them develop these skills. Important skills such as critical thinking, creative problem solving and the synthesis of knowledge can easily be accomplished through cooperative group activities an inclusive cooperative learning classroom.

Meaningful content in cooperative lessons is critical for the success of all students. For students to succeed within their groups, careful consideration
regarding group heterogeneity must be in conjunction with roles that ensure active and equal participation.

- Students in heterogeneous classroom team try to solve complex cognitive tasks and the progress of the lower achieving students does not occur at the expense of the higher achievers or vice versa. So, cooperative learning is recommended for fostering students’ reasoning and communication.

**SUGGESTIONS FOR FURTHER RESEARCH**

No research can say any final word on a problem because it is very difficult for a researcher to touch all the complex aspects of a problem that demands probing. In light of findings and conclusions of the study, the following few suggestions for further research in this area of study may not be out of place. Some of these can be enumerated as:

- The present study examined only the academic achievement and self-concept of students in Mathematics. Further studies may be conducted to investigate the effectiveness of cooperative learning for other dependent variables, such as attitude towards subjects, self-esteem, peer relation, social skills and academic motivation for different subjects.

- The studies can also be conducted to compare the different cooperative learning methods with other methods of instructions at different grade levels.

- Similar studies can also be conducted in other subjects like languages, Social Science, etc.

- There is a need to explore the relation of cooperative learning with other emotional and motivational variables.

- A study can also be conducted to compare and explore how cooperative learning methods affect the students of various abilities on cognitive, emotional and motivational dimensions; as well as on cognitive and non-cognitive dimensions of the high achievers, average and low achievers.

- The study can be repeated to compare the effectiveness of various strategies under cooperative learning in different situations like – rural, urban, male, female students and mixed genders at different levels, which may be elementary, secondary, higher secondary or university level of education.
A study needs to undertaken on a larger sample, and for a longer durations to examine the effects so that results can be confirmed better on non-cognitive variable like social skills or some other personality variable which take more time to bring about a change.

A comparative study is needed to analyze the effect of different cooperative learning methods on special groups of children such as the gifted, the learning disabled and other handicapped students in cognitive and non-cognitive domains.