CHAPTER- 1
INTRODUCTION

1.1. GENESIS

Education is a very powerful instrument for the social, political and economic development of a country. The term ‘Education’ is derived from Latin Language in which “education” means “to educate” where ‘e’ means from ‘inner’ side and ‘duco’ means to ‘develop’. Therefore, education means to develop pupil’s innate power from inside to outside. Education is a wide concept which has a strong effect upon pupil’s success. Education is a never ending process of inner growth and development and its period stretches from cradle to the grave. It is very important for the progress of individuals and society. Education is the only means with a society to adjust with its needs. Therefore, a society can never exist without education. Through education the members of a society learn the skills to enrich, transmit and transform the cultural heritage as well as existing social and scientific knowledge for the continuous advancement of a society. Human endeavours to explore the universe and foster social, cultural and economic needs have resulted in a widespread educational system on profound basis of knowledge, learning and expertise. Today, a nation with a superior educational system is superior to others and indeed dominant in very many respects.

1.2 SMALL GROUP COOPERATIVE LEARNING STRATEGY: MEANING AND CONCEPT

As the name suggests, it stands for a learning process, a strategy which the students get opportunities to learn by themselves in a small group in a co-operative or a non-cooperative environment by forming a number of teams, each consisting of a small number of students of different levels of ability for the understanding of a subject. They share all information among themselves and help one another for having the required knowledge, understanding and application of one or the other aspects of the content material, or course units included in their syllabus.

Small group cooperative learning provides alternative to both traditional whole-class expository instruction and individual instruction systems. It seems quite
contrary to the practice of teaching-learning in our current educational system. Our on-going classroom teaching is totally teacher dominated and content centered. Here, the teachers are regarded as repositories of subject knowledge and their role is simply to pour into the open, empty and willing minds of students their vast reservoir of knowledge. They do not trust that their students would learn on their own. They think that they must tell them what to learn and provide all the structure for the learning to take place. This learning structure is highly individualistic. It encourages individual and competitive learning in place of group and co-operative learning. Here, the students are tempted to learn more and more in order to gain good grade, divisions, certificates and appreciations by excelling their own peers. Cooperative learning says no to such practices. Many educators of modern age have recognized “Cooperative Learning” as a beneficial teaching learning technique for different subjects.

Co-operative learning is one of the recommended teaching-learning techniques in which students achieve learning goals by helping each other in a small social setting. Education itself has been regarded as social adjustment of an individual in a society. It is more elaborate than group work activity. It is a successful teaching strategy 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. It should be employed as part of a classroom management system. It can be emphasized in curriculum areas and throughout most or all of the school day schedule. Pupils are serious achievers when working together with peers. Each one desires to do one’s fair share of work within a committee. Fast learners can assist the slower pupils to achieve and do well. They can learn as well from the slow learner, in return too. Pupils need to learn to get along with each other and to respect each others’ abilities to unitedly move towards a shared goal.

Together, the pupil may achieve more than working individually. Learners may motivate and challenge each other in a committee setting and yet efforts are harmonized to attain togetherness in an educational endeavour. They must respect diversity among pupils and ideas. Group cohesion is necessary so that the goals of cooperative learning are consistently attained. All need to participate actively and achieve maximally. Tasks need to become clear through interacting with each other.
The basic idea behind cooperative learning is grouping students in a classroom into small, usually four-person groups. Since the times of Socrates and to the beginning of formal education, group learning has been used as an intrinsic education technique. Students are grouped in various ways: by age, knowledge, or even sometimes by gender. A classroom in itself consists of students who seem to have been grouped, following one or more of these parameters. Social development is one of the fundamental aspects of constructive teaching, reason being, man is essentially a social animal. One of the most important characteristics of a social system is its interdependence. Human beings need each others’ help at different stages of their developmental tasks. Group work practice or cooperative learning dictates provision of such help. The cooperative learning happens spontaneously in the classroom all the time. 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.

The Indian classrooms are highly heterogeneous in nature. In the classroom, the students have different abilities. Some can master the subject quickly and some take more time to attain mastery. But the teacher tailors his instruction to the whole group without taking note of the heterogeneity of the group. As a result, the teaching may not be effective and fruitful. Therefore, the teacher ought to make his instruction more effective and meaningful, satisfying the needs of all the types of the learners in the class. The popular cooperative learning approaches cater 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). Today, cooperative learning is the one of the most researched instructional strategies in education.

All models of cooperative learning utilize the basic elements of positive interdependence, individual accountability, collaborative/social skills, and group processing. The teacher's role in cooperative learning changes from being in front of the learners doing most of the talking (and most of the work) to becoming a facilitator who guides the learner learning both in academic as well as the social realms. Cooperative learning may best be defined as small heterogeneously mixed working
groups of learners learning collaborative/social skills while working towards a common academic goal or task.

Working in cooperative groups, students learn valuable social skills, use higher-order thinking and rehearse and practice new concepts, processes and information. Cooperative group learning does not happen successfully unless it is well-orchestrated and certain healthy considerations prevail. “These considerations increase the chances that the groups will work well together and achieve targeted standards.” (Gregory and Chapman, 2002)

Over the last two decades, Co-operative learning has achieved broad-based support from researchers and classroom teachers (Slavin, 1999). Accordingly “the frequency of references to Co-operative learning in textbooks on instructional materials indicates that this approach to instruction is well suited in the educational mainstream.” (Antil, Jetkins, Wayne and Vadasy, 1998)

By definition, co-operative learning is “the instructional use of small groups, so that students work together to maximize their own and each other’s learning; a method of instruction by which students work together in small groups to reach a common goal; and an activity that facilitates collaborative efforts among students.” (Griswold and Rogers, 1995)

Cooperative learning is a strategy that develops healthy interaction skills, promotes success of the individual student and group members, and forms personal and professional relationships (Johnson & Johnson, 1999).

Cooperative learning has several techniques for promoting an educational experience that facilitates students to move beyond standard classroom parameters (Fantuzzo, Ginsburg-Block, Miller, & Rohrbeck, 2003).

Foyle and Lyman (1988) defined cooperative learning as a teaching strategy involving children's participation in small group learning activities that promote positive interaction.

Co-operative learning is a process by which students work together in groups “to master the material initially presented by teacher” (Slavin, 1990). To be
successful, all members in a group must achieve mastery of the material or contribute to the completion of a group assignment. Co-operative learning promoted academic achievement is a relatively easy to implement and is not expensive. Children improved behavior 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 centre 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.

Johnson, Johnson and Smith (1991) referred to cooperative learning as the instructional use of small groups so that students work together to maximize their own and each other’s learning. Cooperative learning produces higher achievement, more positive relationships among students and healthier psychological adjustment than do competitive or individualistic experiences.

Flowers and Ritz (1994) viewed cooperative learning as a teaching strategy where teams of two or more work together on learning tasks. Each member of the team brings special talents to the group, i.e., concrete or analytical abilities or others. Also other team members cooperate on the achievement of the tasks and learn from each other. It also means taking the talents of individuals and pooling these together to get the job done. As a result, students learn both academic and social skills from a cooperative learning environment. Cooperative learning is an arrangement in which students work in mixed ability groups and are rewarded on the basis of the success of the group (Woolfolk, 2001).

In cooperative learning, teams, each with students of different levels of ability, use a variety of learning activities to improve their understanding of a subject. Each member of a team is responsible not only for learning what is taught but also for helping team mates learn, thus, creating an atmosphere of achievement. Cooperative effort results in participants striving for mutual benefits so that all group members:

- Gain from each other’s efforts.
• Recognize that all group members share a common fate.
• Know that one’s performance is mutually caused by oneself and one’s team members.
• Feel proud and jointly celebrate when a group member is recognized for achievement (Johnson and Johnson, 2001).

Co-operative learning is a relationship in a group of students that requires positive interdependence; individual accountability; interpersonal skills; face-to-face promotive interaction and processing. Each member of a team is responsible not only for learning what is taught, but also for helping team-mates learn, thus creating an atmosphere of achievement.

1.3 RE-VISITING DEFINITIONS OF CO-OPERATIVE LEARNING

Some of the prominent definitions of co-operative learning include:

Artzt & Newman (1990): “An activity involving a small group of learners, who work together as a team to solve a problem, complete a task or to accomplish a common goal.”

Davidson (1990): “A task for group discussion and resolution, requiring face-to-face interaction, an atmosphere of cooperation and mutual helpfulness and individual accountability.”

Johnson, Johnson & Smith (1991): “The instructional use of small groups so that students’ work together to maximize their own and each other’s learning.”

Goodsell, Maher & Tinto (1992): “Co-operative learning also falls in the more general category of collaborative learning which is described as working in groups of two or more, mutually searching for understanding solutions or meanings or creating a product.”

1.4 ASPECTS OF COOPERATIVE LEARNING

Johnson and Johnson (1999) differentiated cooperative learning from competitive and individualistic learning on four bases: goal; levels of cooperation; interaction pattern; and evaluation of outcomes, as defined as follows:
- **Goal:** Class members are assigned to small group (often heterogeneous) and instructed to (a) learn the assigned material and (b) ensure all other group member does likewise.

- **Levels of Cooperation:** Cooperation may be extended to the class (by ensuring that everyone in the class has learned the assigned material) and the school (by ensuring that all students in the school are progressing academically) levels.

- **Interaction Pattern:** Students promote each other’s success. Students discuss material with each other, explain how to complete the assignment, listen to each other’s explanation, encourage each other to work hard and provide academic help and assistance. This interaction pattern exists between as well as within groups.

- **Evaluation of Outcomes:** A criteria-referenced assessment and evaluation system is used, the focus is usually on the learning and academic progress of the individual student but may also include the group as whole, the class, and the school.

### 1.5 ESSENTIAL ELEMENTS OF CO-OPERATIVE LEARNING

Cooperative learning has emerged as a leading new approach to classroom instruction. Numerous research studies have revealed that students completing cooperative learning group tasks tend to have higher academic test scores, higher self-esteem, greater number of positive social skills, fewer stereotypes of individuals of other races or ethnic groups and greater comprehension of the content and skills they are studying (Johnson, Johnson and Holubec 1993; Slavin 1991; Stahl and Van Sickle, 1992).

Although Slavin (1990) proposed a three-elements theory of co-operative learning comprising positive interdependence, individual accountability and social skills, yet the five-component theory proposed by Johnson, Johnson and Holubec (1991) is preferred to be used most. According to this conceptualization, the
following five elements are essential for increasing the likelihood of success of a co-
operation learning endeavour:

(a) Positive interdependence
(b) Face-to-face promotive interaction
(c) Individual accountability
(d) Social skills
(e) Group processing

(a) **Positive Interdependence**

Positive interdependence means that a gain for one student is associated with gains for the other students. Students should be guided to understand that: “the success of every team member depends upon the success of other members” and “if one fails, they all do”. (Kagan, 1994)

The discipline using cooperative groups begin with structuring positive interdependence. Group members have to know that they “sink or swim together”. It is positive interdependence that requires group members to roll up their sleeves and work together to accomplish something beyond individual success. It is positive interdependence that creates the realization that members have two responsibilities to learn the assigned material and to ensure that all members of the group learn their respective assigned material. When positive interdependence is clearly understood, it highlights the fact that:

(a) Each group member’s efforts are required and are indispensable for group success (i.e., there can be no social loafing).
(b) Each group member has a unique contribution to make to the joint effort because of his or her resources and/or role and task responsibilities.

There are a number of ways of structuring positive interdependence within a learning group, such as:

1. **Positive Goal Interdependence**: Students perceive that they can achieve their learning goals if and only if all the members of their group also attain their
goals. The group is united around a common goal-- a concrete reason for being a positive learner group.

2. *Positive Reward (Celebrate Interdependence):* Each group member receives the same reward when the group achieves its goals. To supplement goal interdependence, teachers may give students: (i) a group grade for the overall production of their group; (ii) an individual grade resulting from tests; and (iii) bonus points if all members of the group achieve the criterion on tests. Regular celebrations of group efforts and success enhance the quality of cooperation.

3. *Positive Resource Interdependence:*

4. *Positive Role Interdependence:*

5. *Positive Task Interdependence:*

Research indicates that positive interdependence provides the context within which promotive interaction takes place. Group membership and interpersonal interaction among students do not produce higher achievement unless positive interdependence is clearly structured.
(b) **Face-to-Face Promotive Interaction**

It involves students enhancing each other’s goals by using such techniques as supporting, praising, encouraging and scaffolding. The discipline of using cooperative groups includes ensuring that group members meet face-to-face to work together to complete assignments and promote each other’s success. Group members need to do real work together. Promotive interaction exits when individuals encourage and facilitate each other’s efforts to complete tasks in order to reach the group’s goals. Through promoting each other’s success, group members build both an academic and a personal support system for each member.

Promotive interaction is characterized by individuals providing each other with efficient and effective help and assistance, exchanging needed resources such as information and materials, as illustrated below:

- Processing information more efficiently and effectively;
- Providing each other with feedback in order to improve their subsequent performance;
- Challenging each other’s conclusions and reasoning in order to promote higher quality decision making into the problems being considered;
- Advocating the exertion of effort to achieve the group’s goals;
- Acting in trusting and trustworthy ways;
- Being motivated to strive for mutual benefit; and
- Maintaining a moderate level of arousal characterized by low anxiety and stress.

(c) **Individual Accountability**

It involves being responsible for completing one’s share of the work or master the task assigned within the group. In doing so, social loafing is assumed to be minimized. The discipline of using cooperative groups includes structuring group and individual accountability. Group accountability exists when the overall performance of the group is assessed and the results are given back to all group members to compare against a standard of performance. Individual accountability exists when the
performance of each individual member is assessed, the result are given back to the individual and the group to compare against a standard of performance, and the member is held responsible by group-mates for contributing his or her fair share to the group’s success.

What children can do together today, they can do alone tomorrow (Vyotsky, 1962). It is important that the group knows who needs more assistance, support and encouragement in completing the assignment. It is also important that group members know that they cannot ‘hitch-hike’ on the work of others. When it is difficult to identify members’ contributions, when members’ contributions are redundant, and when members’ are not responsible for the final group outcome, they may be seeking a ‘free ride’ (Harkins and Petty 1982; Kerr and Brunn 1981; Williams, Harkins and Latane, 1981).

The purpose of cooperative learning groups is to make each member a stronger individual in his or her own right. Individual accountability is the key to ensuring that all group members are, in fact, strengthened by learning cooperatively.

After participating in a cooperative lesson, group members should be better prepared to complete similar tasks by themselves. Common ways to structure individual accountability include:

- Keeping the size of the group small.
- Giving an individual test to each student.
- Randomly examining students orally by calling on one student to present his or her group’s work to the teacher (in the presence of the group) or to the entire class;
- Observing each group and recording the frequency with which each member contributes to the group’s work;
- Assigning one student in each group the role of the checker who asks other group members to explain, the reasoning and rationale underlying group answers; and
- Having students teach what they have learned to someone else and when all students do this, it is called ‘simultaneous explaining’.
(d) **Social Skills**

It requires a positive interaction among all group members. Skills such as effective communication, building and maintaining trust and constructively resolving conflicts are emphasized. Placing socially unskilled students in a group and telling them to cooperate does not guarantee that they are able to do so effectively. Cooperative learning is inherently more complex than competitive or individualistic learning because students have to engage in task work and teamwork simultaneously. To coordinate efforts that will achieve mutual goals, students must (a) get to know and trust each other, (b) communicate accurately and unambiguously, (c) accept and support each other, and (d) resolve conflicts constructively (Johnson and Johnson 1991).

Placing socially unskilled students in a group and telling them to cooperate does not guarantee that they have the ability to do so effectively. Interpersonal and small group skills do not magically appear when they are needed. Students must be taught the social skills required for high quality collaboration and be motivated to use them for cooperative group to be productive. The whole field of group dynamics is based on the premise that social skills are the key to group productivity (Johnson and Johnson 1991).

The more socially skillful students are and the more attention teachers pay to teaching and rewarding the use of social skills, the higher the achievement that can be expected within cooperative learning groups. Lew et. al. (1986) and Mesch et. al. (1988) investigating on the impact of a reward contingency for academic achievement on performance within cooperative learning groups, indicate that the combination of positive interdependence on academic contingency for high performance by all group members and a social skills contingency promoted the highest achievement.

(e) **Group Processing**

The final phase of the discipline of using cooperative group is structuring group processing. Effective group work is influenced by whether or not groups reflect on how well they are functioning. A process is an identifiable sequence of events taking place over time, and process goals refer to the sequence of events instrumental,
in achieving outcome goals. Group processing may be defined as reflecting on a group session to:

(i) Describe what member actions were helpful and unhelpful; and
(ii) Make decisions about what actions to continue or change.

The purpose of group processing is to clarify and improve the effectiveness of the members in contributing to the collaborative efforts to achieve the group’s goals.

There are five steps in structuring group processing in order to improve continuously the quality of the group’s task, work and teamwork.

• The first step is to access the quality of the interaction among group members as they work to maximize each other’s learning.

• The second step in examining the process by which the group does its work is to give each learning group feedback.

• The third step is for groups to set goals as to how to improve their effectiveness.

• The fourth step is to process how effectively the whole class is functioning.

• The fifth step is to conduct small-group and whole-class celebrations.

Some of the keys to successful small-group processing are allowing sufficient time for it to take place, providing a structure for processing, emphasizing positive feedback, making the processing specific rather than general, maintaining students to use their cooperative skills while they process, and communicating clear expectations as to the purpose of processing.

1.6 BASIC ASSUMPTIONS OF COOPERATIVE LEARNING

1. The cooperative learning ideology rests in making the teaching-learning process as learner-centered rather than being content or teacher-centered.

2. It advocates the constructivist ideology for better teaching-learning outcomes by encouraging the students to formulate their own constructs and ways of understanding the content material.
3. It believes in redefining the role of a teacher from a lecturer, expert or repository of subject knowledge to capable facilitator for helping his students in their cooperative learning task.

4. It advocates proper teaching-learning environment instead of mere lecturing and demonstration on the part of the teacher. Here, the responsibility for learning is, thus, shifted to the students from the teachers’ efforts for making them to learn by resorting to various tactics.

5. It emphasizes social learning by assuming that learning takes place better in a social situation and group environment rather than in isolation.

6. It assumes that children learn better in a non-competitive anxiety-free cooperative environment rather than in a competitive stressful environment as available in the traditional classroom situations.

7. It believes in group efforts and cooperation among the learners in place of individual efforts and competition.

8. It is of the view that children learn better in a cooperative way from each other on account of the proximity, equality, interdependence and support existing among them instead of the learning thrust upon them by some outside agency, including together.

9. It believes that student’s achievements and performances may be achieved better in term of group achievements in the less threatening group situation rather than the competitive, more threatening individualistic situations.

10. It believes that students learn best when they are totally involved in the learning process by cooperating with each other for attaining the maximum benefit.

11. It advocates that the two necessary elements—group goals and individual accountability should be used together for the evaluation of group achievements in cooperative learning.

12. It believes in providing the students the opportunity to learn and work cooperatively in a group in order to develop them into a cooperative and
responsible social being on the very assumption that students who cooperate with each other in learning learn to like each other in real life.

1.7 BASIC RULES OF CO-OPERATIVE LEARNING

One member of each group places the name of the group and names of its members on an index card for teacher. He then creates a handout that lists the names of each group and its members in alphabetical order. This handout is distributed to the class, along with a list of cooperative learning rules.

- Every member of each group is responsible for all work.
- Be open to other members’ ideas and encourage their participation. Make sure no one is left out.
- Every day one member of each group is designated as facilitator. The facilitator is not in-charge of the group, but simply keeps the group organized on the particular day.

1.8 TYPES OF COOPERATIVE LEARNING GROUPS

Johnson et. al. (1988) describe three types of Cooperative learning groups as given by - formal cooperative learning groups; informal cooperative learning groups; and cooperative base groups. Within cooperative learning groups, students discuss the material to be learned with each other’s help and assist each other to understand it, and encourage each other to work hard. Cooperative learning groups may be used to teach specific content (formal cooperative learning groups) to ensure active cognitive processing of information during a lecture or demonstration (informal cooperative learning groups) and to provide long-term support and assistance for academic progress (cooperative base groups) (ibid). Any assignment in any curriculum for any age student can be done cooperatively.

1.8.1 Formal Cooperative Learning Groups

Formal is structured, facilitated and monitored by the educator over time and is used to achieve group goals in task work (e.g. completing a unit). Any course material or assignment can be adapted to this type of learning, and groups can vary
from 2-6 people with discussions lasting from a few minutes up to a period. Types of formal cooperative learning strategies include jigsaw, assignments that involve group problem solving and decision making, laboratory or experiment assignments, and peer review work (e.g. editing, writing assignments). Having experience and developing skill with this type of learning often facilitates informal and base learning.

Formal cooperative learning groups last from one class period to several weeks. We can structure any academic assignment or course requirement for formal cooperative learning. It ensures that students are actively involved in the intellectual work of organizing material, explaining it, summarizing it and integrating it into exiting conceptual structures.

Any course requirement or assignment may be reformulated to be cooperative. In formal cooperative learning groups, teachers:

- **Specify the objectives for the lesson.** In every lesson there should be an academic objective specifying the concepts and strategies to be learned and a social skills objective specifying the interpersonal or small group skills to be used and mastered during the lesson.

- **Make a number of pre-instructional decisions.** The concerned teacher decides on the size of the groups, the method of assigning students to groups, the roles to the students will be assigned, the materials needed to conduct the lesson, and the way the room will be arranged.

- **Explain the task and the positive interdependence.** The respective teacher clearly defines the assignment, teaches the required concepts and strategies, specifies the positive interdependence and individual accountability, gives the criteria for success and explains the expected social skills to be engaged in.

- **Monitor students’ learning and intervene within the groups to provide task assistance or to increase student interpersonal and group skills.** The class teacher systematically observes and collects data on each group as it works.
When it is needed, the teacher intervenes to assist students in completing the task accurately and in working together effectively.

- Assess students’ learning and helping students process how well their groups functioned. Students’ learning is carefully assessed and their performances are evaluated. Members of the learning groups then process how effectively they have been working together.

### 1.8.2 Informal Cooperative Learning Groups

Informal incorporates group learning with passive teaching by drawing attention to material through small groups throughout the lesson or by discussion at the end of a lesson, and typically involves groups of two (e.g. turn-to-your-partner discussions). These groups are often temporary and can change from lesson to lesson (very much unlike formal learning where 2 students may be lab partners throughout the entire semester contributing to one another’s knowledge of science). Discussions typically have four components that include formulating a response to questions asked by the educator, sharing responses to the questions asked with a partner, listening to a partner’s responses to the same question, and creating a new well-developed answer. This type of learning enables the student to process, consolidate, and retain more information learned.

Informal cooperative learning groups consist of having students work together to achieve a joint learning goal in temporary, ad-hoc groups that last from a few minutes to one class period (Johnson, Johnson and Smith, 1991). We use them during direct teaching (lectures, demonstrations, films, videos) to focus student attention on the material they are to learn, set a mood conducive to learning, help set expectations as to what class will cover, ensure that students cognitively process the material we are teaching and provide closure to an instructional session. During direct teaching, the instructional challenge for the teacher is to ensure that students do the intellectual work of organizing material, explaining it, summarizing it, and integrating it into existing conceptual structures. Informal cooperative learning groups are often organized so that students engaged in three-to-five minute focussed discussions
before and after a lecture and two-to-three minute turn-to-your-partner discussions interspersed throughout a lecture session.

1.8.3 Cooperative Base Groups

Cooperative base groups are long-term (lasting for at least a year), heterogeneous groups with stable membership whose primary purpose is for members to give each other the support, help, encouragement and assistance each needs to progress academically. Base groups provide students with long-term, committed relationship.

These peer groups gather together over the long term (e.g. over the course of a year, or several years such as in high school or post-secondary studies) to develop and contribute to one another’s knowledge mastery on a topic by regularly discussing material, encouraging one another and supporting the academic and personal success of group members. Base group learning is effective for learning complex subject matter over the course or semester and establishes caring, supportive peer relationships, which in turn motivates and strengthens the student’s commitment to the group’s education while increasing self-esteem and self worth. Base group approaches also make the students accountable to educating their peer group in the event that a member was absent for a lesson. This is effective both for individual learning as well as social support.

1.9 THEORIES OF COOPERATIVE LEARNING

Three principle theoretical perspectives have guided research on cooperative learning Social interdependence; Cognitive development; and Behavioral perspective rendered in terms of respective theories of cooperative learning.

1.9.1 Social Interdependence Theory

In an educational setting, social interdependence refers to students’ effort to achieve, develop positive relationships, adjust psychologically and show social competence. The social interdependence perspective of cooperative learning presupposes that the way social interdependence is structured determines the way persons interact with each other.
Moreover, outcomes are the consequences of persons’ interaction. Therefore, one of the cooperative elements that have to be structured in the classroom is positive interdependence or cooperation. When this is done, cooperation results in promotive as group members encourage and ease each other’s efforts to learn (Johnson, Johnson and Holubec 1998).

1.9.2 Cognitive Development Theory

The cognitive development perspective is grounded in the work of Piaget and Vygotsky. Piagetian perspective suggests that when individuals work together, socio-cognitive conflict occurs and creates cognitive disequilibrium that stimulates perspectives, talking ability and reasoning.

1.9.3 Behavioural Learning Theory

Cooperative efforts are fueled by extrinsic motivation to achieve group rewards — academic and/or non-academic.

1.10 WHERE TO USE COOPERATIVE LEARNING

- To learn facts and concepts
- Problem solving
- Group assignments
- Conducting experiment
- Assemble a collage
- Prepare a research report
- Prepare a biographical report
- Group investigation
- For providing drill work to a group.

1.11 COOPERATIVE LEARNING METHODS

Replacing the traditional classroom learning and setting up a cooperative learning system is not an easy task. One may have to face so much opposition and
resistance from the fellow teachers, students, authorities and parents in doing so. However, much depends upon the teacher who is convinced about the fruitful outcomes of co-operative learning in doing so, he may try a number of typical cooperative learning set-ups.

Slavin (1995) summarized the most extensively researched and widely used cooperative learning techniques as:

### Cooperative Learning Methods

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<td>Student-Teams Achievement Divisions (STAD)</td>
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<td>Team Assisted Individualization (TAI)</td>
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<td>Cooperative Integrated Reading and Composition (CIRC)</td>
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![Figure 1.1](image)

1.11.1 **Student-Team Learning**

Student-team learning techniques involving cooperative learning developed and studied at John Hopkins University stipulate, among others, that all cooperative learning, based primarily on the idea that students work together to learn and are responsible for one another’s learning methods, emphasize on the use of team goals and team success which can only be achieved if all members of the team learn the objectives being taught. In student-team learning, the students’ tasks are to learn something as a team. Three concepts are central to all student-team learning methods ‘team rewards’; ‘individual accountability’; and ‘equal opportunity for success’. In
these techniques, teams may earn team rewards if they achieve at or above a designated standard. Individual accountability means that the team's success depends on the individual learning of all team members. Thus, the activity of the team members is focused on tutoring one another and making sure that everyone in the team is ready for quiz or for any other type of assessment expected to complete, without team-mate’s help. Equal opportunity for success means that all students contribute to their teams by improving upon their own past performance. This ensures that high, average and low achievers are equally challenged to do their best and that the contributions of all team members are equally valued.

It may be not enough simply to tell students to work together. They must have a reason to take one another’s achievement seriously. Research seems to indicate that if students are rewarded for doing better than they did in the past, they will be motivated more to achieve than if they are rewarded, based on their performance in comparison to others, because rewards for improvement makes success neither too difficult nor too easy for students to achieve (Slavin, 1980).

There are four principal student-team learning methods that have been extensively developed and researched.

I. **Student-Teams Achievement Divisions (STAD)**

Student-Teams Achievement Divisions (STAD) method was founded by DeVries and Slavin in 1978. In STAD (Slavin 1986), students are assigned to four-member learning teams heterogeneously mixed along performance level, ability, sex and ethnicity. It has five components:

(a) **Class Presentation:** The material to be learnt is initially presented by the teacher to the whole class or in an audio-visual presentation.

(b) **Teams:** Teams composed of 4 or 5 students are carefully selected to represent a cross-section of the class. The teams are as heterogeneous as possible with regard to sex, ethnic background and ability level of students. The team members’ work together is a peer-tutoring format to master the material of the learning unit. Most often, the team
members quiz each other, working from worksheets and consist of problem and/or information to be mastered.

(c) **Quizzes:** The students are evaluated via individual quizzes that assess individual achievement on the material presented in the class and practised in the teams.

(d) **Individual Improvement Scoring System:** A detailed scoring system that allows the students to earn points for their teams based on their improvement over a running average of already existing past scores. The scoring system is based on a periodically readjusted "base score" for each student; each student earns points for his/her team based in improvement over past performances.

(e) **Team Recognition:** The teachers use newsletters, bulletin boards or other forms of social recognition and rewards for teams showing high individual weekly performance and/or high cumulative standings. Recognition is provided for individuals who perform exceptionally well or who are the most improved.

This method has been used in a wide variety of subjects, from Mathematics to language, arts to social studies, from grade 2 through college. It is most appropriate for teaching well-defined objectives with single right answers, such as mathematical computations and applications, language usage and mechanics, geography and map skills, and science facts and concepts.

II. **Student-Team Games Tournament (TGT)**

This method is founded by Slavin and Lazarowitz. This method (DeVries and Slavin, 1978; Slavin, 1986) uses the same teacher presentations and team work as in STAD, but replaces the quizzes with weekly tournaments in which students compete with members of other teams to contribute points to their team scores. The winner at each tournament table brings the same number of points to his or her team, regardless of which the table it is. Thus, low achievers (competing with other low achievers) and
high achievers (competing with other high achievers) have equal opportunity for success. As in STAD, high performance teams earn rewards.

III. **Teams Assisted Individualization (TAI)**

Teams Assisted Individualization (TAI) (Slavin et. al., 1986) combines cooperative learning with individualized instruction. It shares with STAD and TGT the use of four-member mixed ability learning teams and rewards for high performing games. TAI is specifically designed to teach mathematics or students in Grades 3-6. In TAI, a student enters an individualized sequence according to a placement test and then proceeds at his/her rate.

In general, team members work on different units. Team-mates check each other's work against answer-sheets and help one another to address their problems. Final unit tests are, however, taken without team-mates’ help and are scored by student monitors. Each week, teachers total the number of units completed by all team members and give certificates or other team rewards to teams which exceed a criterion score based on the number of final tests passed.

IV. **Cooperative Integrated Reading and Composition (CIRC)**

In CIRC, groups are also of heterogeneous type. As students are with different capabilities, they co-operate with each other in reading to each other, summarizing to each other, practising spellings and vocabulary, etc. Evaluation is also done on the basis of performance of the whole group. Certificates are given to team according to average performance of all team members.

1.11.2 **Jigsaw**

Jigsaw method was founded by Aronson, Stephan, Sikes, Blaney and Snapp in 1978. In the originally designed Jigsaw method, students are assigned to six-member team to work on academic material, broken down into sections, each team member reading his or her assigned section. Members of different teams who have studied the same sections meet in 'Expert groups’ to discuss their sections.
**Jigsaw II**

This modification was developed by Robert Slavin (1980b). In it, competition occurs between learning teams who compete for specific group rewards which are based on individual performance. Points are earned for the team by each student improving his/her performance relative to his/her performance on previous quizzes. Also, all students read a common narrative and then each is assigned a topic upon which to become an expert. This version saves the teacher from having to prepare different sets of reading materials.

**Jigsaw III**

This method, developed by Kagan, is for use in bilingual classrooms. Cooperative groups consist of one English speaker, one non-English speaker, and one bilingual student.

1.11.3 Learning Together

‘Learning Together’ method (founded by Johnson in 1975) of cooperative learning involves students working in four-or-five member heterogeneous groups on assignments. The groups complete a single assignment and receive praise and rewards based on the group product. This method emphasizes team building activities before students begin working together and engage in regular discussions within groups about how well they are working together.

1.11.4 Group Investigation

Group Investigation method (developed by Sholmo Sharan in1992 at the University of Tel-Aviv) is structured to emphasize higher order thinking skills such as analysis and evaluation in a general classroom. In its organization plan, students work in small groups using cooperative inquiry, group discussion and cooperative planning projects. In this method, students choose their own two to six member groups. After choosing sub-topics from a unit being studied by the entire class, the groups further break their sub-topics into individual tasks and carry out activities necessary to prepare group reports. Each group then makes a presentation or display to communicate its findings to the entire class.
1.12 SOME OTHER IMPORTANT TECHNIQUES

1.12.1 Listen-Think-Pair-Share Model

This model is basically a tool adapted from F.T. Lyman, Jr. comprising a multimode discussion cycle in which students listen to a question or presentation, have time to think individually, talk with each other in pairs and finally, share responses with the larger group. The teacher signals students to switch from listening to think, to pair, and to share by using clues. The benefits of this method include longer and more elaborate answers, inferences supported by evidence and logical argument, increased student participation and improved achievement. Students individually or in pairs may write or diagram their thoughts. Teachers may cue them to reach consensus, engage in problem solving or assume the role of a devil's advocate. The overall effect of these co-ordinated elements is a concrete, valid and practical system, made manageable and thereby acceptable to teachers. The steps in using Think-Pair-Share tool involve:

1. **Listen** - students listen to the question.
2. **Think** - (wait time I)
3. **Pair**
4. **Share** - (followed by presentation of finding in front of the class) Teacher - (wait time II)

This method can be used effectively in schools as well as in colleges.

1.12.2 Partners

The class is divided into teams of four. Partners move to one side of the room. Half of each team is given an assignment to master to be able to teach the other half. Partners work to learn and can consult with other partners working on the same material. Teams go back together with each set of partners teaching the other set Partners quiz and tutor team mates. Team reviews how well they learned and taught and how they might improve the process.
1.12.3 Three-Steps Interview

Each member of a team chooses another member to be a partner. During the first step individuals interview their partners by asking clarifying questions. During the second step, partners reverse the roles. For the final step, members share their partner's response with the team.

1.12.4 Round Robin Style Brain Storming

Class is divided into small groups (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 the team share responses with another 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.

1.12.5 Team Pair Solo

Students do problems first as a team, then with a partner and finally their own. It is designed to motivate students to tackle and succeed at problems, which initially are beyond their ability. It is based on mediated learning. Students can do more things with mediation than they can do alone. By allowing them to work on problems, they could not do alone, first as a team and then with a partner, they progress to a point they can do alone what which at first they could do only with help.

Certain cognitive tools, which seem to be simple and will bring excellent results in cooperative learning and can also be easily used in the class for conducting cooperative learning are also available. A few of them are mentioned below:

1.12.6 Questioning/Discussion Strategies Book Mark

Teachers can use a Questioning/discussion Book mark in their daily activities in the classroom which features question starters, on the one side, and discussion strategies, on the other. During classroom discussion, the book mark reminds teachers to use these promising strategies. On one side of the book mark, there are questions for quality thinking through which expected objectives can be achieved is written.
The strategies include wait time I and II, THINK-PAIR-SHARE, follow ups, ask for summary etc.

1.12.7 Thinktrix

The thinktrix is a device to help students and teachers in generating questions and responses. It is a game board type device, containing vertical axis and horizontal axis. The vertical axis of the matrix contains symbols of types of thought and horizontal axis lists categories that give points of departure for inquiry. Using this board, teachers can make up their own questions, teach question design to students, show students how to respond to information using different thinking types and point out possible visual representative. Thinking matrix helps in shared meta-cognition in which teacher and students have a common framework for generating and organizing thought as well as for reflecting upon it.

1.13 ADVANTAGES OF CO-OPERATIVE LEARNING

Cooperative learning techniques have numerous benefits both for the teacher and the learner.

According to Glasser (1986), children's motivation to work in elementary school is dependent on the extent to which their basic psychological needs are met. Cooperative learning increases students’ motivation by providing peer support. As part of a learning team, students can achieve success by working well with others. Students are also encouraged to learn the learning material in a greater depth than they might otherwise have done, and to think of creative ways to convince the teacher that they have mastered the required material.

Cooperative learning helps students feel successful at every academic level. In cooperative learning teams, low-achieving students can make contributions to a group and experience success, and all students can increase their understanding of ideas by explaining them to others (Featherstone, 1986).

Components of the cooperative learning process as described by Johnson and Johnson (1984) are complimentary to the goals of early childhood education. For example, well-constructed cooperative learning tasks involve positive
interdependence on others and individual accountability. To work successfully in a cooperative learning team, however, students must also master interpersonal skills needed for the group to accomplish its tasks.

Cooperative learning has also been shown to improve relationships among students from different ethnic backgrounds. Slavin (1980) notes: "Cooperative learning methods [sanctioned by the school] embody the requirements of a cooperative, equal status interaction between students of different ethnic backgrounds..." For older students, teaching has traditionally stressed competition and individual learning. When students are given cooperative tasks, however, learning is assessed individually, and rewards are given on the basis of the group's performance (Featherstone, 1986). When children are taught the skills needed for group participation when they first enter a structured setting, the foundation is laid for later school success.

✓ Thus, it can be said that cooperative learning helps to:
✓ promote students' learning and academic achievement.
✓ increase students’ retention.
✓ enhance students’ satisfaction with their learning experience.
✓ help students’ to develop skills in oral communication.
✓ develop students' social skills.
✓ increase their liking of the school.
✓ promote tolerance for individual differences.

Cooperative learning offers a platform as well as a teaching-learning strategy to bring a desirable reform in the present day teaching-learning system or the strategy adopted in the traditional classroom settings.

1.14 LIMITATIONS

The different factors that are coming in the way of cooperative learning methods’ acceptance and introduction as a teaching-learning strategy in the system of education may be like the following:
• Teachers’ reluctance to change and innovate.

• Teachers themselves have not been taught through cooperative learning strategy at their school or college level and they have not got any orientation and training for the use of cooperative learning strategy in D.Ed. or B.Ed. courses.

• Teachers fear that they will have to give up their control of the class and their authority, if they give more responsibility to the students for their learning.

• Teachers feel that students will waste their time in a cooperative learning set up.

• It is feared by the teachers that it would not be possible to teach effectively by adopting cooperative learning technique.

• Students are habituated to seeing the teacher in his authoritarian expert role, presenting each and every type of information and skill before them.

• Students feel that lecture method is a proper method of teacher's training and they resent any type of responsibility handed over to them in terms of interactive and cooperative learning.

• It becomes quite difficult for the students to feel their utmost individual responsibilities for the greater cause of group work and cooperative learning.

• Learning to facilitate cooperative learning expertly requires training, experience, and perseverance. It may take 2 to 3 years before a instructor can use these techniques routinely.

• Groups finish work at different times. Sometimes learners argue or refuse to do the work. Some learners do not know how to get along with others and settle their differences. Some learners want to work alone.

• Initially, the teaching of collaborative/social skills takes up a great deal of class time, affecting the amount of content covered.
• Some learners do not like to work in groups. If individual accountability is not in place, some learners do all of the work and the other group members let them.

• Cooperative learning does not work well in easy lessons.

• Processing skills take time to learn and to carry out in the classroom. Conflicts may arise for which the instructor may not be prepared.

• Working in cooperative groups creates a level of "noise" that may be uncomfortable for some instructors.

In this way, number of hurdles, fears and resentments we seen to be standing in the way of introducing cooperative learning in the education system. Maybe, the results of this study prove it to be otherwise: all these fears and resentments absolutely erroneous and baseless, if that be so, the cooperative learning could be profitably used to promote the educational academic and social development needs of students in a more tangible way.

1.15 CAN TEACHERS USE COOPERATIVE LEARNING STRATEGIES?

Foyle and Lyman (1988) identify ten basic steps involved in successful implementation of cooperative learning activities:

1. The content to be taught is identified, and criteria for mastery are determined by the teacher.

2. The most useful cooperative learning technique is identified, and the group size is determined by the teacher.

3. Students are assigned to groups.

4. The classroom is arranged to facilitate group interaction.

5. Group processes are taught or reviewed as needed to assure that the groups run smoothly.

6. The teacher develops expectations for group learning and makes sure that students understand the purpose of the learning that will take place. A time line for activities is made clear to students.
7. The teacher presents initial material as appropriate, using whatever techniques she or he chooses.

8. The teacher monitors student interaction in the groups, and provides assistance and clarification as needed. The teacher reviews group skills and facilitates problem-solving when necessary.

9. Students’ outcomes are evaluated. Students must individually demonstrate mastery of important skills or concepts of learning. Evaluation is based on observations of student performance or oral responses to questions; paper and pencil need not be used.

10. Groups are rewarded for success. Verbal praise by the teacher or recognition in the class newsletter or on the bulletin board can be used to reward high-achieving groups.

1.16 USE OF JIGSAW METHOD AS A TOOL OF STUDY

It is a cooperative learning technique that reduces racial conflict among school children, promotes better learning, improves student motivation and increases enjoyment of the learning experience. It was first developed in the early 1970’s by Elliot Aronson and his students at the University of Texas & the University of California. It is a remarkably efficient way to learn the material; but even more importantly, the Jigsaw process encourages listening and engagement by giving each member of the group an essential part to play in the academic activity. Group members must work together as a team to accomplish a common goal; each person depends on all others. No student can succeed completely unless everyone works well together as a team. This ‘cooperation by design’ facilitates interaction among all students in the class, leading them to value each other as contributes to their common task.

To follow the Jigsaw procedure, first assign students to cooperative groups, give all groups the same topic, and take the material and divide it into parts like a jigsaw puzzle so that each student has part of the materials needed to complete the assignment. Give each member one unique section of the topic to learn and then teach
to the other members of the group. Members study the topic and teach their part to the
rest of the group. The group synthesizes the presentations of the members into the
whole picture. Group members, therefore, cannot learn in totality unless all members
teach their parts. In a jigsaw each student then has to participate actively in order for
his or her group to be successful. The task for students is to learn all the assigned
material. The cooperative goal is for each member to ensure that everyone in their
group learn all the assigned material.

Structure of Jigsaw Classroom

As with any learning process with independence and interdependence as the
goals, effective use of the Jigsaw technique begins with teacher modeling. Explain to
the students that they will be working in different cooperative groups to learn content:
a jigsaw or home group, made up of students who have read different texts and expert
group that all reads the same text. First assign students to cooperative groups (usually
use groups of four named as 1,2,3,4 or A, B, C, D etc., but may be jigsaw materials
for groups of any size). After naming the team members as said above, divide the
content or text into four parts. Number each part (Part 1, Part 2, Part 3 etc.).
Distribute a set of materials to each group so that each group member gets one part of the materials. Ask students to form a preparation pair with a member of another group who has the same part they do (a pair of Part 1’s, a pair of Part 2’s, a pair of Part 3’s). Here students have moved from ‘Home Group’ to the ‘Expert Group’ and have two tasks: (a) Learning and becoming an expert on their part of the lesson materials and (b) Planning how to teach their part of the material to the other members of their groups.

Students are to read their part of the material together, using the pair reading procedure of (a) both students silently read each paragraph (or "chunk"), (b) one student summarizes its meaning while the other student checks the summary for accuracy and (c) the students reverse roles after each paragraph. In doing so pair members should list the major points they wish to teach, list practical advice related to major points, prepare a visual aid to help them teach the content and prepare procedures to make the other members of their group active, not passive learners. The cooperative goal is to create one teaching plan for the members that each member is able to teach. Each member needs their individual copy of the plan. The tasks are for the members to practice teaching their part of the assigned material, listen carefully to their partner's practice and incorporate the best ideas from the other's presentation into their own. The cooperative goal is to ensure that each member is practiced and ready to teach.

After practicing the content in the ‘Expert Group’, students return to their home groups, named as ‘Re-Group’. Their tasks are to: (a) Teach their area of expertise to the other group members and (b) Learn the material being taught by the other members. The cooperative goal is to ensure that members master all parts of the assigned material.

While the pairs and the cooperative groups work, teacher systematically moves from group to group and assists students in following the procedures. Assess students' degree of mastery of all the material by giving a test on all the material that students take individually. You may wish to give members of groups whose members all score 90 per cent or above five bonus points.
1.16.1 Steps in Jigsaw Method

According to Aronson (2008), there are ten steps as considered important in the implementation of the jigsaw classroom:

1. Students are divided into a 5 or 6 person jigsaw group. The group should be diverse in terms of ethnicity, gender, ability, and race.

2. One student should be appointed as the group leader. This person should initially be the most mature student in the group.

3. The day’s lesson is divided into 5–6 segments (one for each member)

4. Each student is assigned one segment to learn. Each student should only have direct access to its own segment.

5. Students should be given time to read over their segment at least twice to become familiar with it. Students do not need to memorize it.

6. Temporary expert groups should be formed in which one student from each jigsaw group joins other students assigned to the same segment. Students in this expert group should be given time to discuss the main points of their segment and rehearse the presentation they are going to make to their jigsaw group.

7. Students come back to their jigsaw group.

8. Students present their segment to the group. Other members are encouraged to ask question for clarification.

9. The teacher needs to float from group to group in order to observe the process. Intervene if any group is having trouble such as a member being dominating or disruptive. There will come a point that the group leader should handle this task. Teachers can whisper to the group leader as to how to intervene until the group leaders can effectively do it themselves.

10. A quiz on the material should be given at the end so students realize that the sessions are not just for fun and games, but that they really count.
1.16.2 Problems during Implementation of Jigsaw

There are several advantages of the jigsaw method. Teachers find it easy to learn, enjoy working with it, it can be used in conjunction with other teaching strategies and can be effective even if used for just an hour per day.

There can be some obstacles while using the jigsaw method. One common problem is a dominant student. In order to reduce this problem, each jigsaw group has an appointed leader. The leader is responsible for being fair and spreading participation evenly. Students realize that the group is more effective if each student is allowed to present his or her own material before questions and comments are made. Dominance is eventually reduced because students realize it is not in the best interest of the group.

Another problem is a slow student in the group. It is important that each group member presents the best possible report to the group, as it is important that individuals with poor study skills do not present inferior reports to their jigsaw group. In order to reduce this problem, the jigsaw technique relies on "expert" groups. Students work with other individuals from other groups working on the same segment of the report. In this "expert" group, they are given a chance to discuss their reports and gather suggestions from other students to modify their reports as needed. Another issue is that of bright students becoming bored. Research suggests that there is less boredom of bright students in the jigsaw classroom than in the traditional classroom. Bright students should be encouraged to develop the mindset of a teacher. By being a teacher, a boring task can be changed into an exciting challenge.

Dealing with students that have been trained to compete can also cause difficulties. A goal of the jigsaw classroom is to decrease competition and increase cooperation and so competitive students can create difficulties. Research on the jigsaw classroom suggests that it has its strongest effect when introduced in elementary school. If there is exposure to the jigsaw classroom at an early age, only an hour a day is needed to maintain the impact of cooperative learning in later
schooling. If Jigsaw is first introduced in the later years of the schooling it can often be an uphill battle. Old habits can be hard to break but, over time, students participating in the jigsaw classroom in high school can benefit from the cooperative structure.

1.17 EFFECT OF SMALL GROUP INSTRUCTIONAL STRATEGY JIGSAW ON THE ACADEMIC PROFILE OF SEVENTH GRADERS IN MATHEMATICS

1.17.1.1 Mathematics: Its Place and Importance in Life

Mathematics as a branch of knowledge has been an inevitable ingredient of core curriculum at basic stages in every society since ancient times. It is so essential in our life that we cannot expect our existence without it. According to Oxford dictionary, Mathematics is the science of numbers, quantities and shapes. Being a leading logical system, Mathematics is considered inevitable for social life as well as exploration of the Universe.

Mathematics and its knowledge is very important in our day-to-day work. Mathematics is a leading logical science. It involves typical logical argumentations which require specific learning methodology. If mathematical aid is not called for calculation and measurement, there would be wastage of time, wastage of money, wastage of everything. Without the use and intervention of mathematics and mathematical knowledge so would life in all our movements and all its dimensions and all calculations would cease. There would be nothing like measure the dose, the blood pressure, the beats of pulse, the body temperature etc. all are to be studied on mathematical line. Without mathematics, the whole civilization would at once collapse. The need and importance of mathematics in a civilized age would can never be set aside.

Mathematics is universally commended as a compulsory subject for students at school level. The Education commission (1964-66) pointed out, that in the teaching of mathematics, emphasis should be more on the mechanical teaching of mathematical computations. Mathematics has always been a compulsory subject in
school curriculum because of its multi-factor values for individuals as well as for the society.

Mathematics is widely used in various fields, covering a wide range of activities. However, decline in mathematics achievement at school level is of concern. Among the reasons of the decline in Mathematics achievement in schools is that students are most to believe and consider Mathematics as a difficult and boring subject.

The phenomenon of frustration among teachers and students needs to be overcome in order to achieve excellence in Mathematics. Therefore, teachers should take note of the needs of individual students. According to O’Keefe (1997), the individual needs of students should be treated in such a way that the teaching and learning of mathematics becomes effective.

Mathematics can be described as a tool especially suited for dealing with abstract concepts as there is no limit to its power in this field. Indeed the whole modern civilization owes its peculiar stamp indirectly to Mathematics. Study of Mathematics increases the power of concentration, develops constructive imagination, increases self-reliance, and inculcates systematic and orderly habits as well as truthfulness and honesty. Mathematics helps in developing proper moral attitudes as there is no place for prejudiced feeling, biased outlook, doubts and half-truth, unreasonableness and irrationality in learning of this subject. The study of Mathematics prepares us for various vocations like Engineering, Accountancy, Taxation, Banking, Designing, Teaching Financing, Quality control, Budget construction, Computer Appliances and applications. Mathematics develops the quality of hard work and attitude of discovery.

Mathematics is the subject which is highly correlated with all other fields of study as it provides fundamental aspects to utilize in the other fields of knowledge. Mathematics can be recognized as the central stream for all the day-to-day human intellectual exercise. A good teacher of mathematics is the one who facilitates the learning of mathematics in an effective and easy manner. No doubt, mathematics works as a tool for all the science, commerce and industry.
1.17.1.2 Historical Development of Mathematics

In the early days the need for mathematics and the motivation for its development were rather limited. The farmer and the ordinary worker needed little beyond the ability to add and subtract. One who aspired to enter some form of trade experience needed to know something of simple computation, and have a sight of knowledge of common measure and a few very simple fractions.

The most ancient mathematical texts available are in Babylonian mathematics (1900 B.C.) and Egyptian mathematics (2000-1800 B.C.). All of these texts concern the so-called Pythagorean theorem, which seems to be the most ancient and widespread mathematical development after basic arithmetic and geometry.

The Greek and Hellenistic contribution greatly refined the methods and expanded the subject matter of mathematics. The study of mathematics as a subject in its own right begins in the 6th century BC with the Pythagoreans, who coined the term “Mathematics” from the ancient Greek mathematic, meaning “subject of instruction.” The Hindu-Arabic numeral system and the rules for the use of its operations, in use throughout the world today, seems likely to have evolved over the course of the first millennium AD in India and was transmitted to the west via Islamic mathematics. Many Greek and Arabic texts on mathematics were then translated into Latin, which led to further development of mathematics in the medieval Europe.

From ancient times to the modern age, Mathematics has passed through many developments and interacting with new scientific discoveries, it is growing with an increasing pace that continues through the present day.

The origin of mathematic thought lies in the concepts of number, magnitude and form. Modern studies of animal cognition have shown that these concepts are not unique to humans. Such concepts would also have been part of everyday life in hunter-gatherer societies, as well.

Babylonian mathematics refers to any mathematics of the people of Mesopotamia (Modern Iraq) from the days of the early Sumerians through the Hellenistic period almost to the dawn of Christianity. It is named Babylonian
mathematics due to the central role of Babylon as a place of study. The earliest evidence of written mathematics dates back to the ancient Sumerians, who built the earliest civilization in Mesopotamia. They developed a complex system of metrology from 3000 B.C. and from around 2500 B.C. onwards, the Sumerians wrote multiplication tables on clay tablets and dealt with geometrical exercises and division problems. They further covered the topics which include fractions, algebra, quadratic and cubic equations and the calculation of regular reciprocal parts.

Egyptian mathematics refers to mathematical texts in Egyptian language. The most extensive Egyptian mathematical text is the Rhind Papyrus (1650 B.C.). It is an instruction manual for students in arithmetic and geometry. In addition to giving formulas and methods for multiplications, division and working with unit fractions, it also contains evidence of other mathematical knowledge, including composite and prime numbers, arithmetic, geometric and harmonic means etc.

Greek mathematics (600 BC to 800 AD) was much more sophisticated than the mathematics that had been developed by earlier cultures. Greek mathematicians used deductive reasoning in contrast to the inductive reasoning. Thales used geometry to solve problems such as calculating the height of pyramids and distance of ships from the shore. He is credited with the first use of deductive reasoning applied to geometry. Pythagoras established the Pythagorean school, those are credited with the first proof the Pythagorean theorem and with the proof of the existence of irrational numbers.

Indoxus (408-355 BC) developed the method of exhaustion, a precursor of modern integration. Aristotle (384-322 BC) first wrote down the laws of logic. Euclid (300 BC) is the earliest example of the format still used in mathematics today, definition, axiom, theorem and proof. He also studied conics. Archimedes (287-212 BC) of Syracuse used the method of exhaustion to calculate the area under the arc of a parabola with the summation of an infinite series, and gave remarkably accurate approximation of Pi.

Indian mathematicians like Aryabhata, in the 5th century used calculation in astronomy and mathematical mensuration. In the 7th century, Brahmagupta identified,
for the first time, the Brahma-Sphuta-Siddhanta and lucidly explained the use of zero both as a placeholder and decimal digit and expounded the Hindu-Arabic numeral system.

The 17th century saw an unprecedented explosion of mathematical and scientific ideas across Europe. Galileo, an Italian, observed the moons of Jupiter in orbit about that planet. In 18th century, Leonhar Eules, contributed a lot to standardizing many modern mathematical terms and notations. For example, he popularized the use of Greek letter $\pi$ to stand for the ratio of a circle’s circumference to its diameter.

The 19th century saw the development of non-Euclidean geometry and abstract algebra. German mathematician Bernard Riemann developed Riemannian geometry, which unifies and vastly generalizes the three types of geometry and ideas of curves and surfaces. William Rowan Hamilton in Ireland developed non-commutation algebra. The British mathematician George Boole devised algebra that soon evolved into what is now called Boolean algebra, in which the only numbers were 0 and 1 and in which, $1+1=1$. Boolean algebra the starting point of mathematical logic and has important applications in computer science. George Cantor established the first foundations of the set theory.

A number of mathematical societies were founded in the 19th century like the London Mathematical Society in 1865, the Circolo Mathematico Di Paelmno in 1884, the Edinburgh Mathematical Society in 1883 and the American Mathematical Society in 1888. The first international, special interest society, the Quternion Society, was formed in 1899, in the context of a Vector controversy.

In 20th century, Srinivasa Riyanga Ramanujan (1887-1920), who proved over 3000 theorems, including properties of highly composite numbers, the partition function and its asymptotic and mock functions, also made major investigations series, hypergeometric series and prime number theory.

Now most mathematical journals have online versions as well as print versions.
1.17.1.3 Nature of Mathematics

The nature of mathematics has always been of interest not only to mathematicians but also to all those who have been using mathematics as a tool for their investigations. Physicists and engineers have all along been interested in mathematics and its nature.

What is mathematics and how does it grow are the basic questions which all the students of mathematics must understand. Each and every part of the school curriculum must have certain aims and objectives which are decided by its nature. In comparison to other school subjects, mathematics holds a stronger position.

(A) What is Mathematics?

A large number of definitions of mathematics have been given from time to time. Some of these are:

1. Mathematics is the science of numbers and space.
2. Mathematics is the science of measurement, quantity and magnitude.
3. Mathematics is the science which draws necessary conclusions.
4. Mathematics in general, is fundamentally the science of self-evident things.
5. Mathematics is nothing more than a game played according to certain simple rules with meaningless marks on paper.
6. Mathematics does not study objects, but the relations between them. Mathematics does not engage their attention. They are interested in form alone.
7. A mathematical system is any set of strings of recognizable marks in which some of the strings are taken initially and the remainder derived from these by operations performed according to rules, which are independent of any meaning assigned to the marks.
8. Mathematics includes computation with natural numbers and everything that can be founded on it, but nothing else.
9. Mathematics in its widest significance is the development of all types of formal deductive reasoning.
10. Mathematics is engaged, in fact, in the profound study of art and expression of beauty.

Mathematics, therefore, is not only ‘number work’ or ‘computation’, but is more about forming generalization, seeing relationships and developing logical, thinking and reasoning.

The National Policy on Education (NPE, 1986) stated, “Mathematics should be visualized as the vehicle to train a child to think, reason, analyze and to articulate logically”. Mathematics should be shown as a way of thinking, an art or form of beauty and as human achievement.

(B) Mathematics is a Science of Discovery

Mathematics is the discovery of relationships and expression of those relationships in symbolic form in words, in numbers, in letters, by diagrams or by graphs.

According to A.N. Whitehead (1912) and E.E. Biggs (1913), “Every child should experience the joy of discovery.” Initially a child is very curious about things to happen and child’s discoveries may be observations. But later, when power of abstraction is once developed, it will create the ability to draw conclusions. This will give the joy of discovering mathematical truths and concepts. Mathematics gives an easy and early opportunity to make independent discoveries.

Mathematics is a dynamic intellectual game. Mathematics is growing at a very fast, almost exponential rate. Mathematics can be treated as an intellectual game with its own rules and without any relation to external criteria. From this viewpoint, mathematics is mainly a matter of puzzles, paradoxes, and problem solving, a sort of healthy mental exercise. Mathematics clicks the mental exercise to think, analyze, interpret and draw necessary conclusion. Mathematics is highest order intellectual activity. It stimulates and enhances the capacity to reason.

(C) Mathematics is a Logic-based Activity

According to Mathematicians like Russell and Whitehead, mathematic is logic. One says that mathematics is the science of logical reasoning. In fact the
concept of logic and the concept of mathematics go hand in hand. No one points out that logic and mathematics are complimentary to each other.

Polya remarked that Mathematics actually has two faces. One face is a systematic deductive science. This has resulted in presenting mathematics as an axiomatic body of definitions, undefined terms, axioms and theorems. Marie Pierce stated, ‘Mathematics is a hypothetico-deductive system’. This statement means that mathematics is a system of logical processes whereby conclusions are deduced from certain fundamental assumptions and definitions that have been hypothesized. This is reinforced by Benjamin Pierce, when he defined mathematics as ‘The science which draws necessary conclusion.’

Polya described the second face of mathematics by saying “Mathematics in the making appears as an experimental, inductive science.” It is based on the principle that holds good for some particular cases, it holds good for the similar case and hence, the relationship can be generalized. This process is known as inductive reasoning. For example, Sum of the angles in a triangle is 180°. Rule can be generalized by observing the fact in a number of triangles of different shapes, sizes and angles.

In mathematics, many rules and definitions can be generated through the process of induction. Here, role of teacher is important that he has to produce number of examples before the student to observe and find the explicit relationships and leading to generalization.

1.17.1.4 Mathematics is a Science of Space and Quantity

Mathematics is a science of space and quantity that helps us in solving the problems of life needing numeration and calculations.

Courant and Robbins (1941) defined mathematics as an expression of the human mind that rejects the active will, the contemplative reason and the desire for aesthetic perfection. Its basic elements are logic and intuition, analysis and construction, generality and individuality.
Mathematics involves man’s high cognitive powers. It develops the power of thinking and reasoning and gives mental exercises best fitted for strengthening the facilities of the mind. It helps the child develop speed, precision, brevity, accuracy and neatness in the computation and calculation work. The child develops ability to perform calculations mentally, to estimate and check results.

Mathematics helps the child in the development of correct attitudes by

- Analyzing the problem
- Discovering the facts and solving the problems with his own independent efforts.
- Expressing his opinions precisely, systematically and logically without biases and prejudices.

For applying all the skills mentioned above in the classroom, a conducive learning environment is needed to be created.

Mathematics equips children with a uniquely powerful set of tools to understand and change the world. These tools include logical reasoning, problem-solving skills and the ability to think in abstract ways. As such, mathematics is a creative discipline. It can stimulate moments of happiness and wonder when a child solves a problem for the first time, discovers a more efficient solution to a problem or suddenly sees hidden connections.

Throughout history, mathematics has shaped the way we view the world. The early study of astronomy demanded the expansion of our understanding of mathematics and made possible such realizations as the size and weight of the earth, our distance from the sun, the fact that we revolve around it, and other discoveries that allowed us to move forward in our body of knowledge without which we would not have any of our modern marvels of technology.

Mathematics remains as important today. Many life stages and skills require a solid grasp of mathematics, from entering university to balancing a household budget, applying for a home loan, or assessing a possible business opportunity. When
children eventually leave education and seek out a career, they will inevitably need to call upon the mathematical skills and strategies they have learnt at school. They will soon realise that many careers require a solid understanding of mathematics. Doctors, lawyers, accountants and other professionals use mathematics on a daily basis, as do builders, plumbers, engineers and managers. Mathematics is a critical skill for many professions and opens a world of opportunity for children.

In this context Kothari Commission (1964-66) suggested that “Science and Mathematics should be taught on a compulsory basis to all pupils as a part of general education during first ten years of schooling.” This statement itself describes the importance of mathematics in our life.

Lau et al. (2009) explains that "The Mathematics skills required for youth of today and adults of tomorrow to function in the workplace are different from that for youth and adults of yesterday". Mathematics cannot be made more effective without effective teaching. There are so many devices for effective teaching. Any effective teaching technique can ensure effective learning. At present, the educators of different societies are evaluating different teaching learning techniques.

Learning outcomes signify accomplishment or gains carried out successfully by an individual or group on the completion of a task whether it be academic, personal or social. Academic Achievement encompasses many aspects of students’ accomplishments in schools, including progress in core academic subjects e.g. mathematics, science, language, arts and social studies.

1.17.2 Cooperative Learning and Academic Achievement in Mathematics

Achievement tests are used to measure the attainments of the students (Ebel, 1972). The purpose of achievement testing is to measure some aspects of the intellectual competence of human beings.

The most widely used model for identifying the cognitive processes used by the examinees to solve test items is the Taxonomy of Educational objectives: Cognitive Domain (Bloom, Englehart, Furst, Hill & Krathwohl 1956). The taxonomy provides a systematic outline of six different levels of thinking. It begins with the
simplest level, knowledge, (i.e., recall of specific information), and ends with the
most complex level, evaluation, (i.e., the ability of judge the value of materials and
methods for given purposes).

Gierl, M.J. (1997) developed Mathematics Achievement Sub-test (MAS)
based on achievement testing program in Canada, 1991, after grade 6. The MAS was
used to assess knowledge, comprehension and application of the same cognitive skills
measured with 1991 provincial test. The definitions used by the provincial test
developers to describe cognitive skills closely resembled the first three levels of
Bloom’ s taxonomy.

Knowledge was operationally defined as recalling the mathematics solution.

Comprehension was operationally defined as performing the mathematics
operation required the question and generating a solution.

Application was operationally defined as performing the mathematics
operations required in the question, generating an intermediate solution, and then
applying the intermediate solution to reach the final answer.

Peterson, Swing, Braverman and Buss (1982) found that students reported
understanding of mathematics lesson content and use of specific cognitive strategies
were significantly related to achievement.

Dusen and Cherrington (1992) reported that 7th and 8th grade pre-algebra
students who used cooperative techniques not only scored higher than the control
group but retained the information for a longer period of time.

Hamilton (1995) found computer assisted instructed resulted in significant
achievement difference for elementary and secondary students crossing all ability
levels in mathematics.

Doyle (1997) found a significant difference in achievement between the
treatment groups and control group. The treatments were ranked using post-test
achievement scores in the order: alignment – cooperative norms, alignment mastery
learning – cooperative norms, alignment – master learning, alignment and control
groups.
Barbato (2000) reported that the class of 10th grade, taught cooperatively had significantly higher mathematics achievement than traditional group.

Von Secker (2002) found that greater emphasis an inquiry-based teaching is associated with overall higher sciences achievements but are likely to contribute to greater inequities among more or less advantages students as they are to close persistent achievement gaps.

Kalaiyarasan and Krishnaraj (2007), found that STAD with reward approach process to be more effective than the group investigation approach and traditional approach in enhancing self esteem of learners.

Johnson& Johnson (1990) and Slavin (1991) found that co-operative learning facilitates the acquisition of problems solving strategies, verbal abilities, meta-cognitive knowledge and curriculum content.

Ahuja (1994) found that the use of co-operative learning instructional strategy resulted in greater academic achievement of VII grade science students than traditional method and better attitudes towards science, makes science learning more fun and improved their learning.

Qin Zhining, Johnson and Johnson (1995) studied co-operative efforts versus competitive efforts and problem solving. Results revealed that co-operative efforts are more effective than any competitive efforts for completing lower level tasks.

Brandt (1995) found a significant difference in favour of co-operative learning classes than traditional classes on academic achievement of students of grade IX- XII with learning disabilities but no significant difference was found between both the groups self-esteem.

Whicker, Bol and Nunnery (1997) found that Mathematics students of secondary class in the co-operative learning groups had increasingly higher test scores than students in the comparison groups. Survey results revealed primarily favourable responses towards the cooperative learning procedure. Most students indicated that they lined working in groups and appreciated getting help from other students, especially for learning difficult concepts.
Ponnusamy and Sudarsan (2001) conducted a study on students’ achievement and cooperative learning method in Mathematics at upper primary level. The study found that cooperative learning contributes a lot to improve the academic performance of the students in VII and VIII standards in learning mathematics. The standard and gender have no effect on the performance of experimental group students and so the effectiveness of cooperative learning can be generalized.

William Devon (2004) studied on improving race relations in higher education in small group instructional settings. He suggested that by implementing a cooperative learning technique on campus known as the Jigsaw classroom, it has the potential to reduce social discrimination.

Krol Karen, Jansen Jeroen, Veenman, Simon & Vanderlinden, Jos (2004) conducted a study on the effect of a cooperative learning program on the elaborations of students working in Dyads. They found that treatment dyads were found to exchange significantly more high-level elaborations during the language task than the control dyads and the treatment dyads produce higher performance scores on the tasks.

Blair Benjamin F. & Millea Meghan (2004) conducted a study on the student academic performance and compensation as the impact of cooperative education. Results show that cooperative education programs have significant effects on all these measures.

Veenman Simon, Denessen Eddie, Van den Akker, Anneriet & Van der Rijt, Janine (2005) viewed the effects of a cooperative learning program on the elaborations of students during help seeking and help giving. The program showed moderately the effects on use of elaborations among the treatment dyads. Dyads with experience in cooperative learning achieved more than dyads without such experience.

Siegel Christine (2005) studied on implanting a research based model of cooperative learning and inferred that while the teacher implanted a research based model of cooperative learning instruction, he adapted the model for use in his
classroom. Results also identified the teacher’s prior experience and teaching context as factors that influenced his implantation of cooperative learning instruction.

Hemant Lata Sharma and Savita Sharma (2008) reported that cooperative learning can help in the ‘Learning to Live Together’ as the principal goal of education.

Mehra Vandana and Thakur Kalpana (2008) viewed the effect of cooperative learning on achievement and retention in Mathematics of seventh grades with different cognitive styles and compared the effect of cooperative learning and conventional group learning on achievement and retention in Mathematics of VII graders with different cognitive styles. It was found that students when exposed to cooperative learning yielded better mean gains on achievement scores as compared to those taught through conventional group. Field independent and field dependent students yielded better mean gains on achievement and retention scores through cooperative learning than the conventional group learning.

Meixia Ding (2009) examined the extent to which teacher interventions focused on students' mathematical thinking in naturalistic cooperative-learning mathematics classroom settings and suggested detailed techniques to address students' thinking, such as identify, diversify and deepen their thinking.

Pushpanjali and Satyaprakasha (2010) studied the effect of cooperative learning on achievement, motivation and anxiety and found out the effectiveness of cooperative learning strategy on achievement, motivation and anxiety of class eight students. Cooperative learning was found to be superior to the conventional in significantly promoting achievement motivation and anxiety. Cooperative learning strategy was effective in significantly reducing the anxiety.

1.18 COOPERATIVE LEARNING AND SELF-CONCEPT

Achievement is not only an important outcome of schooling, schools also play a critical part in the personality development and socialization of students to appropriate adult roles and behaviour. The personality pattern is composed of a core or centre of gravity called the “concept of the self”. The importance of self-concept in
the personality pattern is evidenced by labels usually given to it. It is referred to as the core, the centre of gravity, the “keystone of personality” (Brekenridge and Vincent, 1965). Its importance stems from its influence over the quality of a person’s behaviour and his methods of adjustment to life situations. As Lewin points out, it gives “consistency to the personality”. Stagner emphasized on the stability it contributes to personality.

According to James (1902), Self-concept stands for ‘an awareness of oneself as a human being’ and ‘the importance or significance of oneself in the role of life’.

The concept of self is today found in number of theories as the central unit of personality, for example, those of Carl Rogers (1951), Abraham Maslow (1954) and Kurt Goldstein (1939). In these theories, the person is described and understood in terms of how he conceives of himself, that is, on the basis of his “self-concept” which causes him to act and react as he does.

According to Allport (1961), the self is something of which we are immediately aware. We think of it as the warm, central, private region of our life. As such it plays a crucial part in our consciousness (a concept broader than self) in our personality (a concept broader than consciousness) and in our organism (a concept broader than personality). Thus, it is some kind of a core in our being. How broad and all inclusive the concept of self is has been emphasized by Jersild (1965) and many other scholars like him.

All the different aspects of self form the Self-concept, which includes all the views a person holds about himself. Self-esteem refers to the individual’s personal judgment of his own work (Coopersmith, 1967).

Self-esteem is such an important aspect of the self-concept that the two terms are often used synonymously (Coopersmith, 1967). Self-concept involves an objective or cognitive appraisal of the self, while self-esteem involves an emotional appraisal of the self, reflecting self-confidence.

Karl Smith (1984) however, cautioned that ‘cooperative learning’ is not merely having students sit side by side at the same table with one another as they do
their individual assignments. Cooperative learning is much more than students discussing material with other students, or sharing material among students, although each of these is important in cooperative learning. Cognitive activities and interpersonal dynamics go together hand in hand.

Ames (1984) and Nichols and Miller (1994) found that students’ self perceptions of ability (Self-efficiency) are positively related to achievement.

Students with greater self-esteem are more likely to be successful academically in school (Marsh, 1990).

Self-set attainment of goals, improvement over past performance or measuring up to one’s own standards, all contribute to the consolidation of self-concept. The degree to which one’s body and mind is found to be serviceable and reliable to one self as well as attractive to others, influences the content of self-concept. The self is composed of an organized set of identities (Burke 1980). Self-concept and self-esteem are of crucial importance in understanding an individual’s attitude to the world around him and the people in it (Bagley et.al. 1979).

Self can be conceptualized as a process that consists of two distinct but simultaneous aspects: the ‘I’ and the ‘ME’ (Mead 1976).

Agnihotri (1987) defined self-concept as a composite of person’s thoughts and feelings, fears and fantasies, his attitudes pertaining to his worth. The most important attitude each person holds is his attitude about self (James 1890). The sense of personal worth, we associate with our self-concept, is self-esteem (Alwater 1983).

Blaney et. al. (1977) and DeVries et. al. (1979) found positive effects of cooperative learning approach on self-esteem of learners. Lazarowitz et. al. (1982), Madden And Slavin (1979) Minte (1990), Coleen (1991), Judith Rae (1992) arrived at similar conclusions.

1.18.1 Components of Self-Concept

The concept of self has three major components: the perceptual, the conceptual, and the attitudinal.
The perceptual component is the image the person has of the appearance of his body and of the impression he makes on others. The perceptual component is often called “physical self-concept”.

The conceptual component is the person’s conception of his distinctive characteristics, his abilities and disabilities, his background and origin, and is composed of such life adjustment qualities as honesty, self-confidence, independence, courage and their opposites.

Attitudinal components are the feelings a person has about himself, his attitudes about his present status and future prospects, his feelings about worthiness, and his attitudes of self-esteem, self-approach, pride and shame.

1.18.2 Kinds of Self-Concept

James was the first to suggest that a person has many “selves”. The four categories of the Self-concept are: the basic, the transitory, the social and the ideal.

The Basic Self-Concept: The Basic Self-Concept corresponds to James concept of the ‘real-self’. It is the person’s concept of what he really is. It includes his perception of his appearance, his recognition of his abilities and disabilities and of his role and status in life, his values, his beliefs and aspirations.

The Transitory Self-Concept: The transitory Self-concept may be favourable or unfavourable, depending, largely upon the situation in which the person finds himself momentarily. It is influenced by some passing mood or emotional state or by a recent experience. It is transitory and unstable because it lacks the perspective found in the basic self-concept.

The Social Self-Concept: Social self-concepts are derived from social interactions. People build up different social self-concepts, depending on the kinds of social groups — home, peers, or community with which they are most often associated. In adolescence, the social self-concept is derived from the opinions of the peer group as a whole the “generalized others”.

The Ideal Self-Concept: The Ideal Self-Concept is made up of perceptions of what a person aspires to be and what he believes he ought to be. It may be related to
the physical self-image, the psychological self-image, or both. It may be unrealistic that it can never be achieved in real life. Towards adolescence, the discrepancy between ideal and basic self-concept normally diminishes as the self-concept becomes stronger and plays a larger role in determining the person’s image of himself.

Mwamwenda and Mwamwenda (1987) examined the relationship between 1517 female and 1042 male students; age 12-14, self-concept and their performance on the Botswana primary school leaving examination. Subject with high school self-concept scored significantly better than subjects with low confidence in their overall performance as well as in Mathematics, English, Social Studies and Science.

Walker and Crogan, in 1998, looked at the effects of a cooperative learning environment and a Jigsaw classroom on academic performance, self-esteem, liking of school, liking of peers, and racial prejudice. They looked at and observed at 103 students in grades 4–6 at two separate schools. Cooperative learning was used as a baseline measure for the effects of cooperation and there was an improvement seen in academic performance and in self-esteem for those in the Jigsaw group.

Bratt (2008) presented two studies on Jigsaw, one with children in grade 6 (Study 1), one with adolescents in grades 8 to 10 (Study 2), both using pre- and post-measurements. Bratt focused on the claimed effectiveness of Jigsaw to reduce prejudice, assuming that his research would support Jigsaw. The first study gave similar findings as Walker and Crogan’s study (1998), but contrary to Walker and Crogan, Bratt stressed that data could not be interpreted as giving support to positive effects by the Jigsaw classroom.

1.19 EMERGENCE OF THE PROBLEM AND ITS RATIONALE

Research on student thought processes is based on the belief that teaching is mediated by the student thought processes 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 instructions 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 is not 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 student. It is an easy technique to implement in the classroom, particularly in a block or a scheduled time table. The rationale for using cooperative learning techniques is that the principles on which they 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) questions continue to surface about students’ performance in a small group setting. It seems not that all students receive the same benefits from participation in heterogeneous cooperative groups.

Throughout the world, Mathematics is taught as one the subjects in Schools, Colleges and Universities. 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. Also, majority of the Mathematics teachers follow the traditional methods of instructions in School. For effective instruction and learning, there is a need to create effective learning strategies (settings) in the classroom that enable learners to actively participate in the instructional process, rather than be passive listeners.

Co-operative learning is one strategy that can enable all learners in the classroom to learn or work together. This can contribute to intellectual, social and psychological development of learners unlike other methods of instruction. It improves academic achievement, improves behaviour and attendance, increases self-confidence and motivation and increases the liking of school and classmates. Moreover, cooperative learning focuses on preventing and treating a wide variety of
society problems such as 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.

In cooperative learning settings, group of students of mixed abilities help each other to learn by discussing the things which include 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 and social psychological literature for more than three decades, which poses an obvious problem for an intensive study. Hence, the statement of the problem:

**1.19.1 Statement of the Problem**

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

**1.20 OBJECTIVES OF THE STUDY**

The main objective of the present study was 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.

1.21 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.
H₂ 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.

H₃ There exists significant difference between STAD and Jigsaw methods on achievement of students.

H₄ 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.

H₅ 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.

H₆ There exists significant difference between STAD and Jigsaw methods in developing self-concept of students.

1.22 METHODS OF TEACHING 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.

1.23 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)

### 1.24 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.