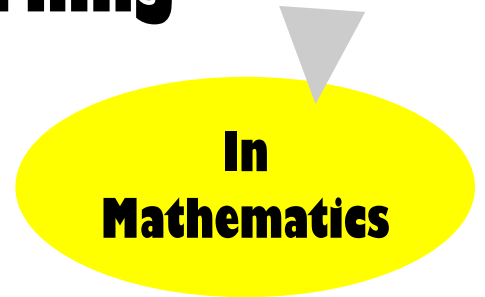


Cooperative Learning



**In
Mathematics**

What is cooperative Learning?

Cooperative learning is a teaching strategy involving students' participation in small group learning activities that promote interaction.

Cooperative learning takes many forms and definition, but all cooperative learning is a special type of group work in which students of all levels of performance work together in small groups toward a common goal on academic content and social skills. Cooperative learning, can be used with any age group and any subject matter.

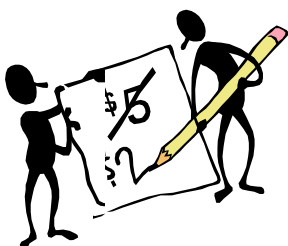
The purpose of cooperative learning group is to make each member a stronger individual.

(Johnson, Johnson & Holubec, 1990, p.14)

In cooperative learning:

- Students learned by talking and working with their group member
- Students have two responsibilities, they learn for themselves and help group member to learn;
- Students work together in small group and they can do the similar task alone. (Johnson, Johnson, & Holubec, 1990).

Three types of Cooperative Learning Groups



- *Informal Cooperative Learning Groups:* Groups are temporary ad-hoc groups that last from a few minutes of one discussion to one class period.
- *Formal Cooperative Learning Groups:* Groups last from one class period to several weeks.
- *Cooperative Base Groups:* Groups are long term permanent, stable and heterogeneous groups.

Why Cooperative learning ?

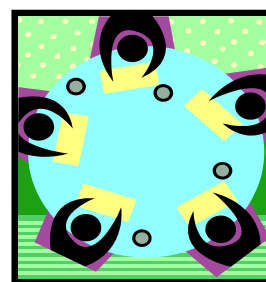
The theoretical basis for the cooperative learning is students learn by interacting with others. The internalize social process that occur in small groups is shaped and reconstructed the student's understanding. The social process shape the students' understanding through talking , helping and working with their group members.

Students' talk in formal or informal talk or chat can help them make the link between their present understanding of a topic or contents and the previous one more meaningful understanding. It is through the talk that learning occurs. Barnes et al. (1969) indicate the talking and listening in learning as follows:

Children learn by talking and listening and should be given more opportunity to talk. Children talking in small groups are taking a more active part in all their work. Tentative and inexplicit talk in small groups is the bridge from partial understanding to confident meaningful statement. Present talking is future thinking. (Barnes et al. 1969, P.126)

Cooperative learning classes offers opportunities for students to learn through oral language: talking and listening process as well as through written language: reading and writing process. Students learn better if they used all the communication skills in *listening, talking, reading* and *writing* while learning (Johnson et.al, 1985).

Cooperative learning empower students talking and working together in mathematics class. As the students talk together they receive an immediate response from their group members. They share their knowledge, exchange ideas, explain, encourage and give support to each other to complete their tasks. When the students talk together they not only construct their knowledge but they also reveal their misunderstanding. As students work together they learn from each other and also teach one another.



Talking in mathematics class occurred in terms of teacher talk and students talk. Based on research finding teacher talked more than 70% of the class time (Amidon & Flanders, 1967).

Dimension of Classroom Environment

Comparison Between Cooperative Learning Class and Traditional Whole Class Instruction

Dimension	Cooperative Learning Class	Traditional Whole-Class Instruction
Classroom Arrangement	<ul style="list-style-type: none"> • Students sit at clusters of desk facing another members in one group • Teacher's desk located at the corner or behind the classroom 	<ul style="list-style-type: none"> • Desks are arranged in rows facing the blackboard • Teacher's desk always in front of the class
Classroom Instruction	<ul style="list-style-type: none"> • Group of groups • Classroom divided into mix abilities groups of four-five students • Students interact and communicate in groups • Student-centred 	<ul style="list-style-type: none"> • One big group • Whole class instruction • Students do seatwork • Teacher explains in front of class • Teacher-centred
Classroom Talk	<ul style="list-style-type: none"> • Students talking in groups or in pairs • Students discussion • Talking is encouraged • Students ask, answer questions and share their knowledge 	<ul style="list-style-type: none"> • Talking is misbehave, no one can talk • No discussion • Teacher talking only • Teacher led recitation, discussion, question and answer
Classroom Activity	<ul style="list-style-type: none"> • Students work individual, in pairs and in small groups • Students work, explain and help each other to complete their assignment • Students checking work, do active learning • Students move to work with a other group such as Jigsaw method. 	<ul style="list-style-type: none"> • Students working at their own desk, and try their own pace • Teacher talking explaining, giving directions, lecture... • Teacher checking work, correct paper • Walking, leave his/her desk is misbehave • Students need permission to leave their desk
Classroom Climate	<ul style="list-style-type: none"> • Informal • Enjoyment • Friendly, helping 	<ul style="list-style-type: none"> • Formal • Serious • Competition

Cooperative learning is group work, but not all group work is Cooperative Learning!

What is the Different?

Cooperative Learning Group	Traditional Learning Group
<ul style="list-style-type: none"> • Mix ability membership; • Positive Interdependence is structured; • Individual accountability for self and group members; • Team building activities promote trust, commitment, and group cohesion; • Member responsibility for each others' learning; • Group member cannot complete task independently; • Shared leadership; • Social skills are directly taught, practiced and processed; • Academic task and social skills emphasized; • Teacher observe and intervenes; • Group processing to evaluate functioning of group. 	<ul style="list-style-type: none"> • Group member are homogeneous membership; • No interdependence; • No individual accountability • No team building activities; • Members are responsible for their own learning; • One member is appointed leader; • Social skills are assumed and ignored; • Only academics emphasized; • Teacher is less likely to monitor; • No group processing.



**In cooperative learning group
We sink or swim together.**

Advantage of using cooperative learning:

- Students' achievement higher;
- Possess positive attitudes toward mathematics and school;
- Increased students' motivation;
- Improved social skills, and knew how to work with others;
- Greater retention of material presented;
- Engage in more and higher quality on-task, academic; and
- Reduced the number of disruptive behaviours;



Cooperative Learning model

The components of Cooperative Learning model

□□ 1. Principles of cooperative learning:

- Positive interdependence
- Individual accountability
- Social skills and communication skills;
- Group reward;



2. Cooperative learning methods:

- Conceptual Approach
- Students Team Learning approaches
- Investigation Approach
- Structure approaches

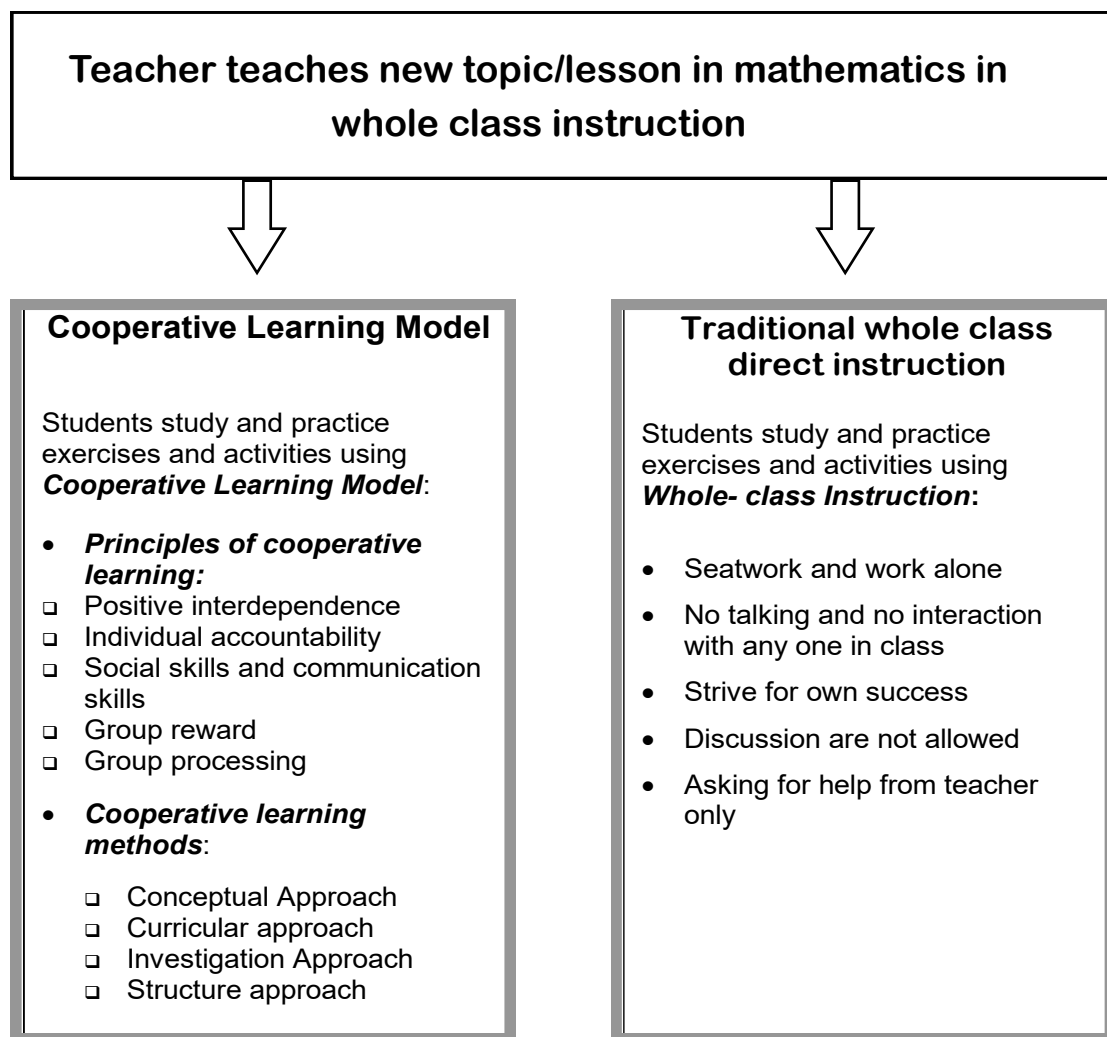
Cooperative learning usually supplements the teacher's instruction by giving students an opportunity to discuss information or practice skills originally presented by the teacher; sometimes cooperative methods require students to find or discover information on their own.

(Slavin, 1991, p.88)

Cooperative learning model can be implemented in mathematics class using the same number of hour as the traditional direct instruction mathematics class, if the teachers carefully prepared, well planned, and monitor mathematics lesson.

The implementation of cooperative learning lesson begins with teacher presents new topic/lesson in the whole class using directed instruction, after that students practice mathematics tasks/exercises in small group using cooperative learning model. The figure below displays how cooperative learning can be incorporated in mathematics class.

Teaching and Learning process in Mathematics class using traditional whole class direct instruction compare to cooperative learning



Essential Principle of Cooperative Learning

In order to implement cooperative learning model effectively, teacher have to implement essential principles of cooperative learning in their mathematics classes. The essential principles of cooperative learning are based on the theoretical perspectives of the authors:

David W. Johnson and Roger T. Johnson (1994) who explained that for cooperation to work well, teachers explicitly have to structure 5 essential principles in each lesson namely:

- Positive interdependence;
- Individual accountability;
- Group processing;
- Social skills, and
- Face-to-Face interaction.

Robert Slavin (1990) and his colleagues at Johns Hopkins University created and researched on cooperative learning: Students Teams Learning which emphasizes centred-concepts namely:

- Individual accountability
- Equal opportunity to success, and
- Group reward.

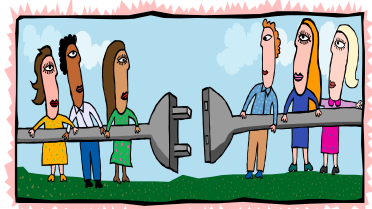
Spencer Kagan's principles of Cooperative learning (1992):

- **Positive interdependence**
 - Is help necessary?
 - Is a gain for one, a gain for all?
 - Is my gain, your gain?
- **Individual accountability**
 - Is there required individual performance?
- **Equal participation**
 - How equal is the participation?
- **Simultaneous Interaction**
 - What percentage are active at once?



Positive interdependence

Positive interdependence is the perception that you are linked with others in a way so that you can not succeed unless they do (and vice versa) that is, their work benefits you and your work benefits them (Johnson & Johnson, 1991). Positive interdependence exists when group members realize that they need to work together to achieve their goal. Students clearly understand that their success depends on the success of their group.



When Positive Interdependence is carefully structured, You tend to see students:	When Positive Interdependence is not carefully structured, you may see students:
<ul style="list-style-type: none"> • Putting their heads close together over the work. • Drilling each other on the material being learned. • Talking about their work assignment. • Sharing answers and materials. • Encouraging each other to learn. • Helping and explaining the work assignment to all members in group. 	<ul style="list-style-type: none"> • Leaving the group impulsively; • Doing their own work while ignoring other students. • Talking about topics other than the work assignment. • Not sharing answers or materials • Not checking to see if others have learned the material. • Poor helping and giving answers without explaining each other how to get the answers.



How to create Positive Interdependence

Goal Interdependence:

- **One product:** group has only one worksheet, group produce only one completed assignment, all members must agree on the answers and all members must be able to explain how to solve the problem.
- **Improvement scores:** all members improve their performance over their previous scores
- **Group goal:** all group members understand *how to do long division with remainders.*



Reward interdependence

- All members receive the same reward if every member in the group succeeds.
- Teachers give **academic rewards** such as bonus points.

“If all group members score more than 80 percent on the test, each of you will receive 5 bonus points.”
 - Teachers give **non-academic awards** such as extra free time, extra recess time, stars or sticker to all group members when every group member improvement scores reach criteria.

Role Interdependence

Working Roles:

- Reader
- Writer
- Time-keeper
- Summarizer
- Checker
- Recorder

Social Roles:

- Encourager
- Observer
- Noise monitor
- Support Giver

Simply placing students in groups and telling them to work together does not mean that they know how to cooperate or that they will do so even if they know.

(Johnson, Johnson & Holubec, 1990)

Individual Accountability

Individual accountability means that group success depend on the individual learning of all members in the group. Accountability focus the activities of the group on explaining concept to one another and making sure that everyone in the group is ready for a quiz or any other activities that students have to take without any help from other members in the group.

Individual accountability exists when the quality and quantity of each member's contribution are assessed and the results given back to the group and individual. It is important that the group knows who need more assistance, support, and encouragement in completing the assignment. Individual accountability is the key to ensure that learning cooperatively in fact strengthens all group members (Slavin, 1990; Johnson & Johnson, 1990).

How to create Individual Accountability

- Each group member having a role/job in the group
- Each group member have to contribute part of the work;
- Each group member have to contribute bonus point or score to the group;
- Each group member having to encourage and help each other
- Each group member know that the success of the group depend on all member in the group;
- Randomly select one member to explain answer and how to solve the problem for the group; and
- Keeping group size in a small number of members.



Social Skills

Groups cannot function effectively if students do not have and never use the needed social skills. Placing socially unskilled students in a group and telling them to cooperate does not guarantee that they are able to do so effectively. Students must be taught the social skills for high quality cooperation and be motivated to use them. Students should be required to practice social and cooperative skills within their group members.

Cooperative skills are those social skills commonly use in group activities. After determining what skills are needed by students, teachers should provide social-skill instruction by defining the skills, explaining its importance, demonstrating the skill, setting up the practice situations in the groups, and giving students feedback on how well they are using the skill. Cooperative skills included leadership, decision-making, trust-building, communication and conflict-management skills. (Johnson & Johnson, 1991).

Sample of Social skills: What you can add?

- Move quietly to and from groups
- Stay with your group
- Use each other's names
- Organize materials
- Clean up materials
- Share materials
- Include each other
- Listen to one another
- Ask questions
- Follow directions
- Ask for help
- Give help when asked
- Share your opinion
- Give reasons for your opinion
- Give accurate directions/information
- Extend others' ideas
- Make a plan
- Disagree in a constructive way
- Use a variety of ways to decide
- Combine ideas to get a new idea
- Get many ideas before deciding
- Show respect for minority views
- Summarize all ideas or alternatives before deciding
- Work until you reach consensus



How to Teach Social skills

The teachers have to teach social skills before implement cooperative learning methods in their classes. Teachers cannot assume that students have the skills necessary for working cooperatively with others. Students must have a clear idea of what the skill is and how to perform it. Every students needs to know what to say or to do to perform the skill.

To ensure that students understand and know how to use cooperative skills while they work together in group and when it should be used, the teacher have to explain exactly what they are to do. The simple technique in building a cooperative skill is engaging students in building a cooperative skills T-chart poster. A *T-chart* poster of cooperative skills consist of two columns: *What students can do* and *What students can say* as shown in the figure below.

T-Chart Skill: Using Quiet Voices

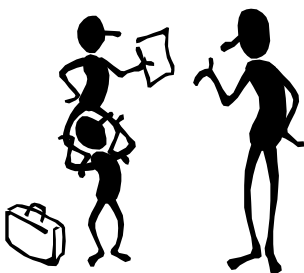
What students can do	What students can say
<ul style="list-style-type: none">• All students facing each other• Making eye contact• Only one person talking at a time• The listeners are looking at the speaker• Whisper• Nodding heads• Quiet talking• Attentive Listening• Using quiet signal: Put finger-to-lip to indicate <i>quieter please</i>.	<ul style="list-style-type: none">• Speak softly, please!• Let turn down our voices• I don't understand. How did you get that answer?• I don't get it. Would you please explain?• Uh Huh! Great ideas• Good idea! Thank you• I agree with• May I ask a question now?

T-Chart Skill: Encouraging

What students can do	What students can say
<ul style="list-style-type: none"> • Giving thumbs up • Shaking hands • Patting on the back • Smiling and nodding interacting • Having arms unfolded or open 	<ul style="list-style-type: none"> • That is a good ideas • Great ideas. That helps! • I hadn't thought of that. That is a good point. • I like the way you explain to me. • You helped us a lot when you... • I like working with this group. • We haven't heard from.....? • How do you feel,.....? • This is fun. • We can do it. Let's go! • Let's keeping going. We're almost there... • Let's all share our idea!

T-Chart Skill: Helping

What students can do	What students can say
<ul style="list-style-type: none"> • Passing things • Taking turns • Using positive body language • Showing smiling faces • Making good eye contact • Giving thumbs up • Shaking hands • Patting on the back • Smiling and nodding interacting • Having arms unfolded or open 	<ul style="list-style-type: none"> • Let me show you this problem. • I'll help you with that... • Could you help me with ...? • Could you explain that to me again please? • I'd like some light shed on problem#, can you help me with.... • Here's the way I came to that conclusion. • I don't understand how you come to that conclusion, would you please explain that to me? • Great ideas. That helps! • missed his/her turn, • You helped us a lot when you... • Do you want me to help you? • We haven't heard from.... yet. • How do you feel,.....?



Group Reward

Group reward is a joint reward given to successful group work. Everyone is rewarded or no one is rewarded. Each group computes their total group scores or mean group score by using the improvement score or bonus points of all members. The mean group score can be used when the members in each group are not of equal number. Group may earn certificate or other group rewards if their group score achieved at or above designated criteria (Slavin,1991).



Group processing

Group processing is the discussion of how well group members are learning mathematics and maintaining effective working relationships among members. Group members need to reflect on how well the group is functioning. They need to describe which members' actions are helpful or unhelpful, and make decisions about what behaviors to change or continue. In essence, group processing is an assessment about the functioning of the group. Group processing enables learning group to focus on group maintenance, facilitates the practice and learning of social skills, and ensures that students received feedback on their participation in the group . Some of the keys to successful processing are by allowing sufficient time for it to take place, making it specific rather than vague, and reminding students to use their social skills while they process (Johnson, Johnson & Holubec , 1994).

