

# Collaborative learning and problem solving

Coming together is a beginning.  
Keeping together is progress.  
Working together is success.'

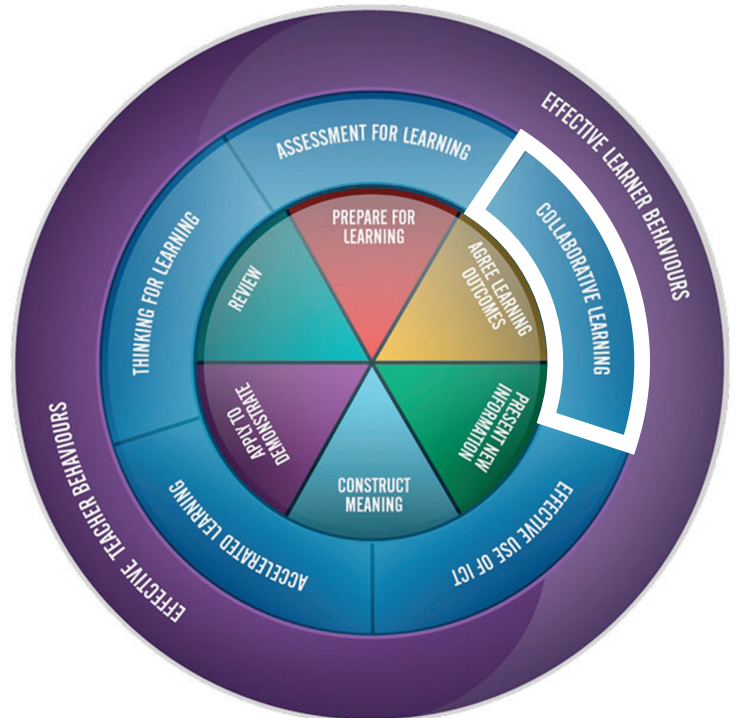
**Henry Ford**

## What is collaborative learning?

It is an approach to teaching and learning that involves groups of students working together to complete a task, solve a problem or create a product.

Collaborative Learning is based on the idea that learning is a naturally social act in which participants talk among themselves. It is based on the following principles:

- Learning is an active process whereby students assimilate the information and relate the new knowledge to a framework of prior knowledge.
- Learning requires a challenge that calls for the learner to engage actively with his/her peers, and to process and synthesise information rather than simply memorise and regurgitate it.
- Learners benefit from exposure to diverse viewpoints from people with varied backgrounds and experiences.
- Learning flourishes in a social environment where conversations between learners take place.
- In the collaborative learning environment the students are challenged both socially and emotionally as they listen to different perspectives and are required to articulate and defend their ideas. In so doing the learner begins to create his own conceptual frameworks and not rely solely on an expert's framework or a textbook.



In a collaborative learning setting learners are given opportunities to converse with peers, present and defend ideas, exchange different beliefs and question other conceptual frameworks.

Collaborative learning can be incorporated into normal lesson periods in a variety of ways: the teacher may simply pose a question and ask students to discuss their ideas with a neighbour, or an activity may be planned to span several lessons and require a number of stages and resources.

Regardless of the approach taken, or the amount of time in a lesson given to collaborative learning, the aim is the same: to shift learning from a teacher-centred to a student-centred model.



## The impact of collaborative learning

Research has shown that the appropriate use of collaborative learning results in improvements in student achievement, an increase in self-esteem, and greater acceptance of special needs students (Slavin R.E. – Cooperative Learning: theory, research and practice. Boston: Allyn and Bacon, 1995).

The positive impact on student achievement is tied to the strategy of establishing targets or goals for the group, while requiring individual accountability. In this way group members are given the incentive and motivation to help one another through the task in hand.

## What is collaborative problem solving?

There is strong evidence that collaborative learning and carefully structured group work are effective learning strategies. Studies have found that working together on a problem and considering each other's ideas led to increased conceptual understanding and problem solving skills (Tao, 2003), as well as increased confidence in problem solving (Seal, 2006).

One method to enhance collaborative problem solving is through the use of group puzzle games. Students who complete puzzle games that genuinely depend on several people's contribution achieve better than those who take part in a normal lesson, as well as also outperforming those who completed puzzle games alone. Additionally, the use of collaborative puzzle games has shown to lead low-ability students in particular to make the most significant progress as well as building their confidence (Chen et al, 2012).

## Enquiry

Another way to encourage collaborative work is through the use of enquiry. Enquiry can increase student engagement and lead to gains in subject knowledge and academic achievement (Wolf & Fraser, 2008).

You can incorporate collaborative enquiry in to your lessons by getting students to:

- develop and plan investigations
- collect and interpret data
- work together towards a shared goal
- share findings.

## Problem-based learning

Problem-based learning can have positive effects when surface-level knowledge has been acquired, as it enables deeper learning as it places more emphasis on meaning and understanding. Gijbels (2005) outlined 6 core characteristics of problem-based learning:

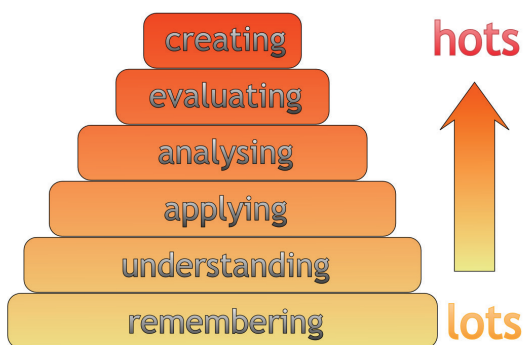
- Learning is student-centred.
- Learning occurs in small groups.
- Teacher is present as a facilitator/guide.
- Authentic problems are presented at the beginning of the learning sequence.
- The problems encountered are used as tools to achieve the required knowledge and the problem solving skills necessary to eventually solve the problem.
- New information is acquired through self directed learning.



## Evidence for the relative effectiveness of teaching methods

Students learn more effectively (i.e. deep learning rather than shallow learning) if they are active rather than passive during the learning process. Learning by doing is generally more effective than learning by listening or reading, and when learning is by doing (using information to solve a problem) students are more likely to remember what they have learned, and are also more likely to process the information they are receiving and reflect on how they learned, especially if there are incentives for them to do this. Incentives include being able to see the relevance of what they are learning so that the information is seen in context and is connected. When students learn actively they are learning several skills at once, for example: finding and digesting information, as well as having to communicate and explain the information to others. Learning is also helped by feedback, which encourages through constant checks telling us we are on the right track, providing input into the trial and error process and reassuring us that we are learning successfully. The motivation – wanting to learn – is not automatic in students. Needing to learn – for example to pass an exam, or learning to drive – can sometimes act as a powerful motivator too.

**As we see in Anderson's taxonomy, we encourage higher order thinking skills (hots) as opposed to lower order thinking skills (lots) when learners are active in learning.**



## What are the key outcomes of learning?

- Knowledge – of things, people, ideas, actions
- Skills – with things, people, ideas and actions
- Feelings and emotions – success, satisfaction, learning from mistakes
- Ideas and strategies about learning
- Motivation to learn more
- A sense of oneself, including oneself as a learner
- A sense of others and how to interact with them
- A sense of membership of a community.

When learners together create a joint product and understanding they develop higher-order thinking skills, interpersonal skills, improved communication skills and management skills. The teacher's role becomes less concerned with mundane tasks and more with higher-level enquiry.

## Effective group work for effective learning

### Enhancing trust

If group work is not designed effectively, students tend to show overdependence on their teachers and lack trust when working with their peers. Encouraging students to build supportive relationships can help increase their attainment, motivation to work with others, and level of communication skills (Kutnick, Ota & Bernondini, 2008).

#### Steps of the 'blind walk' game

- Get students into pairs.
- Blindfold one of the students.
- The other student leads them through an obstacle course.
- The students swap roles.
- Discuss how the activity went.

#### Steps of the 'mirroring' game

- Get students into pairs.
- Instruct one of the students to do some actions e.g. raise their arm slowly.
- The other student then copies their movements exactly.
- The students swap roles.
- Discuss how the activity went.

### Small group discussions

The use of small group discussions has been found to significantly enhance students' understanding when students in the group held diverse views and understanding (Bennett et al, 2004). However, these discussions need to be structured. It is suggested that group discussion tasks should:

- include 2-6 students
- have a specific stimulus
- involve a substantive discussion task of at least 2 minutes
- have a specific purpose.

It is important to prepare students for working together. To do this, you can:

- teach them listening skills
- encourage students to make critical arguments both for and against different cases
- model how you want students to talk to each other
- ask them 'why'
- ask students to give reasons for their answers
- encourage students to ask others what they think
- elicit group work ground rules from the students (CUREE, 2006).

## Structure of groups

There has been much research on the composition of groups. One study found that similar groupings - based on gender or ability - led to an increased amount of collaborative, constructive dialogue, with those in mixed ability groups feeling either left out or that others hadn't pulled their weight (Seal, 2006). However, other research has suggested that the best group composition may not be the same for all children (van der Laan Smith & Spindle, 2007), as higher ability students can prefer homogenous groups, whereas lower ability tend to prefer heterogeneous groups.

Research suggests that students in structured groups were more willing to work with others than those in unstructured groups (Gillie, 2004). Additionally, those in structured groups had a higher level of group cohesion. To do this, you could structure your class in to groups in the following ways:

- Gender
- Ability level
- Personality type



# Effective teaching for effective collaboration

## Characteristics of a collaborative classroom

### Shared authority and knowledge among teachers and students.

Teachers share authority and responsibility with pupils in very specific ways. Pupils are invited to set specific goals for the group and for themselves within the framework of what is being learned. The teacher also provides options for activities, challenges and tasks that capture different interests and learning strategies, treat others respectfully, and focus on high levels of understanding for all.

Pupils are encouraged to listen to others, support opinions and knowledge claims with evidence, engage in critical and creative thinking and participate in open and meaningful dialogues.

The teacher is not the only knowledge giver. Although the teacher has vital knowledge about the content and skills needed, and still provides that to students, she also values the knowledge, personal experiences and culture that the students bring to the activity. The whole learning experience is enriched, as pupils are encouraged to learn from each other.

## Strategies

- Setting challenges with clear success criteria.
- Timed group tasks.
- Think, pair share.
- Peer assessment and feedback.
- Self-assessment.
- Group target-setting.
- Problem-solving activities.
- Personal learning plans.
- Explicitly teaching the features and attributes of effective collaboration, time-management, communication, etc.

## Teachers are mediators

The teacher mediates through facilitating, coaching, mentoring and modelling. Most teachers engage in these practices from time to time, but in a collaborative classroom it drives the instruction and has specific purposes. Facilitating involves the creation of an appropriate, safe physical and emotional environment. It involves creating opportunities and tasks that link new information to prior knowledge. Coaching involves asking questions to help the student make meaning for himself. Modelling involves sharing what one is thinking about, the content to be learned and the processes involved in achieving this. The teacher does not simply tell the student, but challenges the student to think things out for himself.

## Strategies: thinking aloud

- Asking pupils to justify views and opinions, or asking them to argue the opposite viewpoint.
- Helping the groups make explicit the process used in tackling the problem or challenge.
- Investing time in making explicit the environment we want to learn in and agreeing expectations regarding classroom procedures.
- Spending sufficient time debriefing the process of learning, both with small groups and with the whole class.

Collaborative learning involves students collaborating on meaningful tasks and responses to questions. While the teacher uses strategies to establish an atmosphere of collaboration and cooperation, (such as cooperative learning strategies and strategy selection of groups) the focus is on meaningful learning. Students actively participate in the negotiation of roles, responsibilities and outcomes. Such collaboration may be shown in small group activities, but may also involve a whole class focus on a project, such as an environmental project, a community survey, or an enterprise event, for example.

## Collaborative learning and problem solving is demonstrated by teachers:

- arranging their classrooms in such a way as to maximise engagement and interaction through collaborative discussion (e.g. groups of tables)
- regularly setting group tasks and establishing ground rules about how the groups will operate
- explicitly teaching students to work as a team by assigning different roles within groups to make students responsible for particular aspects of tasks
- assigning tasks that require the sharing of expertise and ensuring that students' contributions are valued by other students
- providing opportunities for students to make individual and collaborative decisions about how they will undertake learning tasks
- encouraging students to set goals for their learning, to self-monitor their progress and provide evidence to the teacher when they believe they have achieved their goals
- establishing in consultation with students clear assessment criteria before a task is begun.

## Collaborative learning and problem-solving is NOT demonstrated when:

- students mainly work individually, with little opportunity for whole-class or small group discussion
- class discussion is dominated by the teacher's voice
- minimal opportunity is given for students to interact with and support each other
- acquisition of knowledge is valued above skills and dispositions and effective learning behaviours
- decisions relating to all tasks, projects, research and investigations are made by the teacher
- all student targets and goals are set by the teacher.

## Comparing traditional teaching and student centred collaborative learning

Traditional teaching:	Collaborative learning:
A teacher centred environment	A student centred environment
Teacher in control	Students are in control of their learning
Power and responsibility are primarily teacher centred	Power and responsibility are primarily student centred
The teacher is the instructor and the decision-maker	The students are the decision makers – the teacher is facilitator and guide
The learning experience is often competitive in nature. The competition is usually between students. Students resent others using their ideas.	Learning may be co-operative, collaborative or independent as needed. Students work together towards a common goal. They willingly help each other, sharing ideas and skills. They compete against their own previous performance, not other students.
The teacher defines a series of tasks organised within subject disciplines	Authentic, interdisciplinary problems and tasks
Learning takes place within the classroom	Learning extends beyond the classroom
The content is most important	Content, skills and dispositions are all valued
Students master knowledge through drill and practice	Students evaluate, make decisions and are responsible for their own learning. They master knowledge by constructing it.
Content is not necessarily learning in context	Content is learned in a relevant context.

### References and further reading

Bennett, J. (2004) A systematic review of the use of small-groups discussions in science teaching with students aged 11-18, and their effects on students' understanding in science or attitude to science. EPPI-Centre: London.

Clarke, G., Quill, M. (2003) Researching sport education in action: a case study. *European Physical Education Review* 9(3), 253-266.

Gijbels, D., Dochy, F., Van den Bossche, P. & Segers, M. (2005) Effects of problem-based learning: A meta-analysis from the angle of assessment. *Review of Educational Research* 75, (1) 27-61.

Gillies, R.M. (2004) The effects of cooperative learning on junior high school students during small group learning. *Learning and Instruction* 14, (2) 197-213.

Kutnick, P., Ota, C. & Bernondini, L. (2008) Improving group work among primary pupils: facilitating attainment, interaction and classroom activity. *Learning and Instruction* 18, 83-95.

CUREE (2006) Raising achievement through group work: GTC research for teachers summary. London: Teaching and Learning Academy [Online] Available at <http://tinyurl.com/q2bfy67>

Seal, C. (2006) How can we encourage pupil dialogue in collaborative group work? Paper presented at: Teacher Research Conference 2006.

Swann, M. (2006) Collaborative learning in mathematics. A challenge to our beliefs and practices. NRDC & NIACE.

Van der Laan Smith, J. & Spindle, R.M. (2007) The impact of group formation in a cooperative learning environment *Journal of Accounting Education* 25, 153-167.

Wolf, S.J. & Fraser, B.J. (2008) Learning environment, attitudes and achievement among middle school science students using inquiry-based laboratory activities. *Research in Science Education* 38, 321-341.

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