

PEER-LED TEAM LEARNING LEADER TRAINING

PAIR PROBLEM-SOLVING: AN EFFECTIVE MODEL FOR LEARNING

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Pair problem-solving seeks to maximize on task behavior by students, and affords the greatest opportunity for learning by *all* members of the cooperative learning group. The model for the pair problem-solving method comes from Whimbey and Lochhead (1986, 1981), which is itself modeled after the clinical interviews used by Piaget. These texts also provide an excellent source of problems to train students in the pair problem-solving technique.

Research indicates that the problems that students solve to develop conceptual understanding of content are not always, in themselves, sufficient for learning. The various relationships between concepts and ideas, which comprise a conceptual web of understanding, are best discerned through problemsolving *discussed* in a social context (Von Glasersfeld, 1988). Though knowledge is constructed individually, it is corroborated largely through consensus, and consensus-achieving is a social activity.

By encouraging students to verbalize their thoughts, they are forced to examine their ideas as they communicate. They must evaluate those ideas in the light of another person's interpretation of what they are saying. Requests for clarification and repetition often help students to catch and correct their errors as well as helping to reinforce ideas that they may have held only tentatively.

Pair problem-solving incorporates two key notions: constructivism; the idea that students must construct knowledge for themselves (not to be confused with making scientific discoveries *a la* Newton, Einstein, Maxwell, etc.) and metacognition; the supposition that the vehicle for the construction of knowledge is self-reflection, or in Piagetian terms, reflective abstraction. Pair problem-solving promotes metacognitive activity through the use of questioning strategies, which require students to reflect on their thought processes. Four such strategies are (Confrey, 1985): 1) ask students to discuss their interpretation of the problem, 2) ask students to describe precisely their methods of solution, 3) ask students to defend their answer and their solution, 4) ask students to retrace the steps in their solution so as to review the process they engaged in to solve the problem.

The pair problem-solving process forces students to articulate their ideas to one another in a manner that causes them to explore their own understandings. In their attempt to explain their solutions, and to defend against argument, students develop representations, analogies, extreme instances, contradictory evidence, etc. In pair problem-solving, the conceptual web of understanding grows as students engage in an interactive, reflective process.

Directions to Start

Students in the workshop session are divided into pairs: one is the *problem solver*, and the other is the *listener*. Each pair is given a problem.

Instructions to the Problem Solver

The student designated as the *problem solver* begins by reading the problem aloud to the other student (the *listener*) and verbalizes all thoughts on how to solve the problem. The problem solver does all the talking and all of the writing about the problem. The problem solver is responsible for articulating all ideas as they occur, whereas the listener has an opposite task.

Instructions to the Listener

The role of listener is quite difficult. The listener must:

1. *Listen carefully*. Ask the speaker to repeat statements if needed, or to slow down.
2. *Encourage vocalization*. Ask, "What are you thinking?" and "Can you explain what you are writing?"
3. *Ask for clarification*, for example, "What do you mean?" and "Can you say more about that?"
4. *Check for accuracy* by asking, "Are you sure about that?"

Yet there are also "do not's" for the listener:

1. Do not give hints
2. Do not solve the problem
3. Do not tell the solver how to correct an error.

As the problem solver is talking, the listener must suspend solving the problem him/herself so that complete concentration and attention is devoted toward understanding the problem solver's solution.

The pair's interaction is characterized by the focus on language used by the problem solver and by the listener's acceptance of the solver's vision of a solution path.

Instructions for Peer Leaders

Every two or three minutes the peer leader moves from working with one pair of students to assist another pair, serving as a coach.

After first identifying who is the problem solver and who the listener, the peer leader should direct all questions to the listener and *not* to the problem solver. If the listener cannot explain the *problem solver's* solution, then the listener must be directed to ask the problem solver to repeat the solution. The peer leader should agree to return after the listener feels confident that they both understand the solution and that the listener can communicate it effectively. Upon listening to the solution, the peer leader should probe for any uncertainties or confusions, and state agreement when and where it occurs. A student's answer is not acknowledged as either right or wrong.

The peer leader continuously manages the workshop through constant and proximal observation, feedback, and when necessary, direction.

What Pair Problem-solving Looks Like

Upon entering the room an observer would notice students seated haphazardly in pairs, conversing and sometimes arguing with one another. The students may seem oblivious to the peer leader, who may be difficult to locate since she/he is not at the front of the workshop group. There may be more than one group of students working at the board simultaneously. The noise level in the room is such that the door to the hallway may need to be closed. Occasionally a hand goes up in the air, waving for the peer leader's attention. There are loud exclamations of "I got it!" intermixed with groans of frustration. The scene is active. It appears anarchic because no one person seems to be directing the activity.

Instructional Extensions

1. By *exchanging roles of problem solver and listener*, students have the opportunity to learn the related skills of problem-solving aloud and listening for meaning.
2. If time permits listeners should *present their partner's solution to the group*. In this manner the pair problem-solving roles of problem solver and listener will be reinforced.
3. In addition to listening to students, *leaders should model expert problem-solving* for the group. Students rarely see experts solve problems, much less hear them solve problems aloud. By describing one's thought processes aloud, peer leaders demonstrate the process of thinking with all of the dead ends, mistakes, and corrections that characterize real problem-solving.

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