PEER-LED TEAM LEARNING
LEADER TRAINING

PROMOTING METACOGNITIVE BEHAVIOR IN WORKSHOPS

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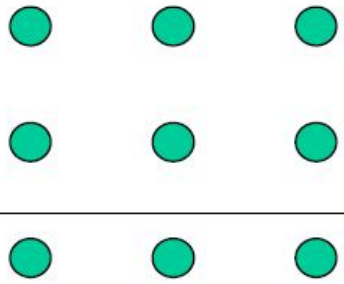
Leader training is one of the Critical Components of the Peer-Led Team Learning (PLTL) approach. Students who are selected as peer leaders have been chosen in part because of their performance in the class and their communication skills. However, without training, peer leaders are not experts in the discipline or experienced in facilitating productive problem- solving discussion. Thus, leader training is important in making problem-solving strategies and issues explicit to the peer leaders and sharing instructional approaches that may be effective in the PLTL workshop. While these strategies may be ones that the peer leaders already use, leader training makes these strategies explicit to the leaders so that they can share these approaches with their students.

The novice-expert paradigm serves as a framework for understanding how students in our classes (novices) compare to experts (professors). The PLTL workshop fits this paradigm where the peer leaders facilitate problem-solving and discussion to help the students become more like experts. Studies of experts and novices solving problems have sought to characterize their behaviors and found that there is a difference in the following areas: knowledge base, problem-solving strategies, and metacognitive behavior. This paper focuses on the latter and discusses some strategies for leader training to promote metacognitive behavior in the PLTL workshop.

What is metacognition? Rickey and Stacy (2000) provide a discussion of metacognition in the chemistry classroom. Briefly, metacognition refers to the ability to reflect upon one's personal knowledge and/or thinking and the ability to act on what one knows. This involves being aware of what one is thinking as well as the ability to regulate one's thinking process. Why is it important to promote this in the classroom? Educational research has demonstrated that it is valuable for the development of conceptual understanding and problem-solving success. Naturally, the question for leader training is: how do we prompt peer leaders to realize the importance of metacognition, and how can they promote its behavior in the PLTL workshop?

In training peer leaders, it is important to share the rationale and context for the exercises and instructional strategies so that the peer leaders can see the purpose in trying them in their workshops. Consider the problem presented in Figure 1.

Figure 1. Draw four straight lines that pass through all nine dots without raising the pencil from the page.



The nine-dot problem can serve to open the discussion in leader training about the importance of being aware of what one is thinking while solving a problem, including what assumptions are made, and being able to "think outside the box." Initial representations can shape the course of our problem-solving. The problem solver may include information that is not in the problem statement or include irrelevant information. Without exhausting all possible permutations for the nine-dot problem, reaching a solution requires the problem solver to evaluate one's problem-solving progress and consider what leads to problem solving failure (e.g., the assumption that the line may not extend beyond the area established by the nine dots). This problem serves as an illustration of the importance of reflecting on what one is thinking while solving a problem. How can peer leaders prompt their students to reflect and monitor their thinking?

One approach to promote metacognition is modeled after Alan Schoenfeld's (1985) question-asking approach. He repeatedly poses the following three questions to prompt his students to reflect upon their problem-solving process: "What are you doing? Why are you doing it? Where do you think it will get you?" As part of the leader training, it may be productive for the peer leaders to brainstorm possible questions to prompt student reflection. Some additional questions may include the following: "Am I done with this problem? How could this have been done another way? How can this be generalized? Is this similar to something we have already seen/ done? What are my assumptions? Are they valid/ reasonable?" Schoenfeld found that his students grew to expect his questions and consequently considered their responses before being asked. In the same way, students in a PLTL workshop can begin to expect such questions and internalize such critical thinking behavior in anticipation of being asked such questions.

A second approach to promote metacognitive behavior is the pair problem-solving approach developed by Whimbey and Lochhead (1986). (For another description of the pair problem-solving approach, see Narode, 2000, *Progressions*, Vol. 1, Issue 3.) In this approach, students work in pairs where one student is the "problem solver" and the other student is the "listener." The "problem solver" is asked to read the problem aloud and to verbalize while solving the problem. The "listener" is instructed to listen carefully and remain quiet except to pose questions that encourage the problem solver to verbalize, e.g., "Can you explain what you're doing?" or ask for clarification, e.g., "Can you explain what you mean by that?" Students then switch roles for the next problem.

Figures 2 and 3 present two possible problems to use as training exercises for peer leaders. However, it may be more productive to implement the pair problem solving approach with problems from an upcoming workshop.

Figure 2. Water and Wine Problem (from Herron, 1996).
You have a glass of water and a glass of wine. Assume that both are pure, homogeneous substances. Transfer one teaspoon of water to the glass of wine and mix thoroughly. Transfer one teaspoon of the contaminated wine to the water. Now both the water and the wine are contaminated.

Consider the amount of contaminant in each container. Which of the following is true?

A) The amount (volume) of water contaminating the wine is greater than the amount (volume) of wine contaminating the water.

B) The amount (volume) of wine contaminating the water is greater than the amount (volume) of water contaminating the wine.

C) The amount (volume) of water contaminating the wine is equal to the amount (volume) of wine contaminating the water.

Figure 3. Jose and Arthur are two friends who decide to run in opposite directions around a track.. Jose takes 40 minutes to complete one circuit. Jose and Arthur pass each other every 15 minutes. How long does it take Arthur to complete one circuit? (from Whimbey & Lochhead, 1986)

Using the pair problem-solving approach during leader training also has value. (For reflections on the pair problem-solving approach from the peer leader perspective, see Burg, 1999, *Progressions*, Vol. 1, Issue 1.) The peer leaders have an opportunity to develop their listening skills and practice possible responses to prompt students to reflect on their problem-solving process. From these experiences, peer leaders also have a sense of the pitfalls and potential drawbacks to the method and can be sensitive to that in the PLTL workshop.

Participants in the conference on *Training Peer Leaders* at the University of Rochester (June 18-20, 2000) were asked to try the pair problem-solving approach using the problems in Figures 2 and 3 and provided the following feedback. First, participants found that the roles of the problem solver and listener can easily break down. For instance, the listener may be tempted to share thoughts about the solution process such that both individuals end up solving the problem. While the PLTL workshop encourages such collaboration, the leader may need to remind the students that the purpose of the pair problem-solving approach is to develop critical thinking and listening skills rather than collaborative skills. Second, the problem solver may find it overwhelming to verbalize his/her thoughts while solving the problem. One suggestion is to adapt the pair problem-solving approach by allowing the problem solver to think through the problem prior to verbalizing his/her thinking

process. Third, the listener needs some guidelines in what questions to ask and when to pose them. One suggestion is to have the listener only ask questions from a short list of possibilities such as the reflection prompts discussed earlier. Fourth, the problems selected for the purpose of training peer leaders should not be too difficult such that the students cannot practice the skills associated with being the problem solver or the listener (e.g., some participants found the problem in Figure 3 to be too math intensive). Such issues can be addressed in leader training so that peer leaders have an idea of not only what to expect when implementing the approach in the workshop but also how to make the method a meaningful learning experience as students articulate their ideas and learn to reflect on their problem-solving process.

Peer leaders serve an important role in helping students become more proficient in the discipline and more successful problem solvers. Leader training should include means to equip peer leaders in promoting metacognitive behavior. Reflective questioning and the pair problem-solving approach are two such methods that can be used to promote critical thinking behavior in the PLTL workshop.

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References

Herron, J.D. (1996). *The Chemistry Classroom*. Washington, D.C.: American Chemical Society.

Rickey, D. & Stacy, A.M. (2000). The Role of Metacognition in Learning Chemistry. *Journal of Chemical Education*, 77, 7, 915-920.

Schoenfeld, A.H. (1985). *Mathematical Problem Solving*. New York: Academic Press.

Whimbey, A. & Lochhead, J. (1986). *Problem Solving and Comprehension*. Hillsdale, NJ: Lawrence Erlbaum Associates.

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