Strategies for Developing Students' Group Work Skills in the Laboratory Class

Portions adapted from Kerner (2009), Black, Gach, & Kotzian (2007), Chadwich (1989), Winter, Lemons, Bookman, & Hoese (2001)

Your students will do most of their experiments as a member of a team where they will be expected to combine and compare data. Research on learning has shown that students learn better, develop interpersonal skills, and enjoy a course more when they work in a group-learning environment. In addition, teamwork typifies real-world science better than independent learning. Team learning does not mean that students simply work side by side on a problem, or the best student works while the others watch. Rather, a well functioning group has interdependent team members who effectively communicate ideas, interact around questions, analyze data, and problem solve together. Your job as an instructor is to help students learn how to work in a team and to mediate learning difficulties. This section will provide skills specific to the laboratory class. See "Guidelines for Using Groups Effectively" (p. 59) for more information on working with student group work and teams in classroom instruction.

GSI Tip: Students in a team or in a group do not spontaneously develop skills in leadership, time management, communication, and problem solving. Research on managing student teams notes that effective skill development of teamwork and group work requires the instructors to promote individual accountability, the use of interpersonal skills, and chances for self-assessment of personal and team functioning (Woods, Felder, Rugarcia, & Stice, 2000). While this may take time up front, it will save you time in the long run.

Use the following strategies to help you manage group interactions with the goal of developing team cohesion through individual accountability and interpersonal communication skills.

1. Suggestions for supporting groups with individual accountability and collaboration: A successful laboratory team has everyone contributing to get the lab work completed. Walk around and pay attention to group dynamics to see if one team member is doing all of the work or if another student is not participating. Encourage the team to work together by:

- *Deciding ahead of time how you will assign teams*. The most effective lab groups consist of two to four students. The number of students can be determined by the nature of the class or the availability of equipment. There are several ways to assemble teams. (1) Teams can self-select. The advantage of this approach is that students like to work with people they know, and friends will often self-select creating a relaxed classroom atmosphere. The disadvantages are that social teams may focus more on being social than being productive, and you may need to monitor their behavior to ensure that they complete their work. In addition, self-selection may mean that certain students are left out. (2) Teams are randomly assigned. This has the advantage of providing a balanced mix of skills that approximates a real-world work experience. It has the disadvantage of possibly creating a group with conflicting personalities or work styles that will need you to help them work thought their difficulties. (3) Teams are designated by criteria. This has the advantage of ensuring a balance of skills or interests on each team in the class. The downside is that you need to spend time gathering data on your students before you assign the teams.

- *Determine how long teams will be together*. It is important to be clear with the students how long they will be working with their team. In some lab classes, students stay with the same team for several lab sessions; while other labs students change teams more frequently. It is important to note that effective teams need time to learn to work together, and that most teams go through a period of "storming" or negotiating roles and responsibilities before they begin to operate effectively. Switching teams frequently will prevent team members from learning how to work together. If a team does not seem to be able to negotiate their differences, then you should step in help them solve the problem, or suggest how to restructure the group roles or level of participation. If nothing else works, then reorganize the team.

- *Assign team roles to ensure that everyone participates*. Roles might include a manager to organize the activities, a technician to set up equipment, a materials handler to collect all chemicals and supplies, a recorder to collect all measurements and distribute them to the team, and a group process monitor to make sure everyone contributes and gets the work done on time. Support each team role with guidance in your overview at the beginning of the lab. NOTE: Be sure that team members change roles for each new assignment to prevent role repetition.

- *Ask questions to the disinterested student*. This requires the disinterested student to respond to the group and not you: "Hey John, can you share two sources of error in the data with your team?"; "Amelia, what do you think Carlos should do next?"

- *Ask each group member to summarize ideas*. This gets each team member to describe a concept or the progress that they

have made. It encourages them to interact with each other around ideas or to make it clear to them that you are paying attention to each person's contribution.

2. Suggestions for helping groups to develop problem-solving skills: In a laboratory, students are supposed to develop problem-solving skills with their team. Beginning laboratory instructors have been observed making two common mistakes when working with groups: they step in and tell students what to do or how to get the right answer instead of encouraging students to interact with each other, and they spend unequal time supporting group progress in class (Winter, Lemons, Bookman, & Hoese, 2001). You can best help groups by using the following strategies:

- *Don't just tell students if an answer is correct or incorrect*. Instead of a quick answer, encourage the team to tell you how they got their answer first. This provides you a chance to see their thought processes, misunderstandings, or where they are making a mistake. When they tell you their answer, note what was right about it first before prompting them in a new direction.

- *Be sure to cycle around the room*. You should work to make some kind of contact with each group with a simple question like "Is everything going okay with this part of the lab?" If a team is struggling, don't spend all of your time with this group at the expense of other teams. Get them going with a hint or prompt, and then tell them you will check back with them in a few minutes. Do make sure you follow up with them to check on their progress and acknowledge their self-effort.

3. Suggestions for how to use questions to develop interpersonal skills: Good instructor—student interactions promote student-centered learning through the use of effective questioning techniques. The kinds of questions you ask will send a message to students about how you expect them to work together and the depth of learning you expect them to achieve in class:

- *Responding to questions*. When a student in a group asks you a question, don't answer it if you think the group can figure this question out. Respond with phrases like "Does anyone else have an idea what to do next?", "Was anyone else able to work this out?" or to check a student's answer "What did other people get for their calculations?"

- *Vary Question Levels*. You can vary the kind of question to help students learn. Ask "fact level" questions (e.g., how, what where, when) when you need to verify what they know before they attempt the next step or do something dangerous. "What is the voltage on the motor?" or "How will that solvent interact with the gasket?" Ask "higher level" questions, (e.g., evaluation, prediction, and opinions), when you want students to be more aware of their own thinking about the lab concepts. "How would you interpret your results based on the goal of the lab?" "What do you think will happen if you increase the pressure?" or "Aiesha, can you explain to Kirk what figure 1 means in relation to…? or "Why did you all measure the friction in the first part before you moved on…?" (See "Typology of Questions on page 98 for more information on varying levels and types of questions).

References

Black, B., Gach, M., & Kotzian, N. (1996). *Guidebook for teaching labs for University of Michigan Graduate Student Instructors*. Ann Arbor, MI: Center for Research on Learning and Teaching, University of Michigan.

Chadwick, N. (1989). Introduction to lab sections. *Learning to teach, a handbook for Teaching Assistants at U. C. Berkeley*. pp. 28-30. Berkeley, CA: University of California, Berkeley.

Kerner, N. (2009). *Instructor Information: Chem125/126*. Ann Arbor, MI: University of Michigan, Ann Arbor.

Winter, D., Lemons, P., Bookman, J. & Hoese, W. (2001). Novice instructors and student-centered instruction: Identifying and addressing obstacles to learning in the college science laboratory. *The Journal of Scholarship of Teaching and Learning, 2*(1), 15-42.

Woods, D. R., Felder, R. M., Rugarcia, A., & Stice, J. E. (2000). The future of engineering education: Part 3. developing critical skills. *Chemical Engineering Education, 34*(2), 108-117