Strategies for Managing Discussions with Groups in the Laboratory Class

Adapted from Allen, O'Connell, Percha, Erickson, Nord, Harper, Bialek, & Nam (2009)

GSI TIP: Experienced GSIs noted that an important skill for new instructors to learn is how to manage 20-40 students and how to encourage participation in the laboratory sessions. As an instructor in a laboratory class you have to play an active role in managing and encouraging effective participation.

You'll spend most of your class time talking to students in groups of two or three. In order to facilitate this, you should constantly walk around the room—students won't ask you questions if you're sitting behind your desk in the front of the room. In addition, students won't always ask questions when they have problems, or even realize they've drifted off track. In these cases you may want to intervene and ask a provocative question or two. Keep in mind, though, that a student is far more likely to be interested in what you say if he or she is the one who asked the question! This period of the class time is much like tutoring, but there are subtle and important differences. The GSI has an opportunity to rediscover the course material or course concepts with the student (sometimes through his/her eyes), while growing into a mentor. It is essential for the learning process that students are not given the answers to the questions that lie at the heart of the experiment. Exercise your patience, keeping in mind that the goal is for the student to learn or create, rather than merely draw directly from your knowledge. Below we present several different methods for answering questions. The idea is not for you to pick your favorite and master it; you will have opportunities to use all of them, often during a single class period! It is as important to use the right approach, as it is to say the right thing.

Socratic Method: To help students develop their own analysis methods and establish confidence in their own intuition, we may ask questions that break down problems into smaller, more manageable parts. When students request help, we may lead them through a series of questions, so that they eventually solve their own problems. You may find that this mirrors your own approach to solving problems. For the willing student who tends to learn best through discussion-oriented lessons, this method proves useful; for other students, it may appear pedantic, incur resentment, and result in damaged lines of communication between the instructor and student. The GSI may attempt this with each student and with less obviously procedural questions until it is clear that the student is unhappy. Socratic discussions often start with broad questions, meant to establish common ground with the student. Once you know where you're starting, you can ask more specific questions to help students find their way to the answer. A sequence of questions might resemble:

1. "Where is the current flowing in this system?"
2. "Does more current flow through resistor A or resistor B?"
3. "What would happen if we replaced resistor B with a wire?"

While this approach leads to deeper understanding and can be quite empowering for the student, it can also be a useful strategy when the student is not taking responsibility for his/her work and is, instead, merely asking you if it is correct. It is also helpful in addressing more fundamentally challenging concepts that require the student to carry out more logical steps to connect the phenomena with the explanation. Keep in mind, though, that asking guiding questions can be time-consuming and you need to spend time questioning all lab groups.

Disparate Analogies: Some concepts lend themselves more readily to discussion by example. With students who have more visual or kinesthetic inclinations, offer to draw pictures and develop analogies to phenomena with which they will be more familiar. One of the keys here is to establish a picture that is fundamentally, but not obviously, the same as the one with which the students are struggling. It should be significantly removed from the current context, so that the students must again create their own understanding or draw their own conclusions. For example, when discussing terminal velocities and the shape of the falling object, the GSI might refer to parachutes and the relationship between their size and how they slow the jumper's descent. Also, the presentation of the analogy makes the difference between helping the student think in a new way and giving away the answer. Begin with an oblique reference; as in "Consider the scenario where..." Increase the detail in your example until the student makes the connection.

Hints, Clues, and Cliff-hangers: These approaches are especially useful when there is less time (when there are many hands up around the room), when the problems are not as difficult or involved, and when the students are on the verge of understanding. It may be most useful to merely give a one-sentence hint at the solution. In this case, you should assure the students that you will be back to check on them shortly.

Oversimplification: Useful when seeking to connect a student's present knowledge to a concept that he/she finds difficult to grasp. Try and simplify the concept into a representation that is useful and holds the important elements of the more difficult concept, but without the complexity that might make the idea too difficult for a novice to grasp. Remember that every situation the students encounter in lecture is idealized. They are seeing this material for the first time, so it may not be worthwhile to focus too heavily on the details.

Full/Complete Answers. For scenarios where questions are not as useful for learning, or when the student apparently has a grasp of the material, we can save time by answering straightforwardly. This is particularly useful when one minor problem is preventing the student from finishing the rest of the lab, or when class time is winding down and there is much more work to be done. Bear in mind, though, that our goal is to let students learn for themselves. If we just give them all the answers to the more interesting questions, it's less likely that they'll ever learn that material.

Reference

Allen, D., O'Connell, R., Percha, B., Erickson, B., Nord, B., Harper, D., Bialek, J., & Nam E. (2009). *University of Michigan Physics Department: GSI training course*. Ann Arbor, MI: University of Michigan Physics Department.