Assisting in Laboratories and Studios

This section provides strategies about two issues that experienced TAs find challenging in these settings:
1. Asking questions as a way of teaching reasoning and independence and
2. Learning how to prepare for a teaching-learning environment where you will be answering a very wide variety of questions.

Perhaps more than other educational settings, labs and studios present situations where students can be overwhelmed by the new environment and the independence typically expected of them. Students may have their hands full (literally) with work and feel some pressure to complete it in the allotted time. Some of the students will not be able to feel comfortable enough to approach you with questions, even when they clearly should be asking for guidance. Others will be so overwhelmed that they may look to you for constant reassurance. A few may be looking for quick answers and approval for shortcuts rather than focusing on learning from the experience.

Lab and studio courses share common pedagogical goals because both settings involve students actively applying their newly acquired knowledge while faculty and/or TAs are available as guides. Among the major goals in this TA role are:

- monitoring students' work-in-progress and asking helpful questions to promote reflection and keep students focused on the objectives
- providing feedback when students ask for it and at other specified times

- highlighting the relevant theory and how the procedures and techniques for a given assignment help students to understand it better
- facilitating the development of the skills, attitudes and habits necessary for professional success, such as keeping an appropriate lab notebook or process journal
- teaching the underlying processes of the scientific method, statistical analysis or the creative process

This section provides strategies about two issues that experienced TAs find challenging in these settings: asking questions as a way of teaching reasoning and independence and learning how to prepare for a teaching-learning environment where you will be answering a very wide variety of questions. The checklist on page 82 summarizes issues that are particularly important in laboratory courses in science and engineering and are also relevant in computer labs in a variety of disciplines.

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Asking Questions and Encouraging Independence

I need to give them the big picture. I need to provide meaning to what they are doing.

Mechanical Engineering, one semester as a TA

The important goals above can be undermined if students are able to take a "cookbook" approach to their work where they simply follow directions without reflection and critical thinking. TAs' activities can keep students focused on learning, not just on getting the work done. In order to help students learn to answer their own questions and develop the independence and confidence they will need as professionals, you need to balance giving answers with asking questions.

Clearly, some students' questions are pragmatic requests for information to help them simply move ahead – these can be answered quickly and directly. At other times, you will have to use your judgment, based on the difficulty of the task and your knowledge of the individual student, about whether to give an answer or ask some questions. For example, if a student's question is stated in an ambiguous form, you might ask the student questions to clarify his or her plan and uncover missing steps or misinterpretations of instructions. Some additional kinds of interactions, discussed below, are especially important to enhance learning in labs and studios.

When teaching a lab, if you approach students and ask if they have any questions, half the time they do. They are just reluctant to approach you. (Chemistry)

Effective TAs make it a point to circulate around the room so that they can make small talk with students ("How are things going so far?") and so that students can easily get their attention as needed for feedback or information ("Should the product be this color at this stage?").

In labs the problem is that they don't know that they don't understand it until they write it up later. I'll ask them questions when I sign their lab book. (Chemistry)

Part of learning about the scientific or creative process is maintaining a notebook properly. For labs, this notebook serves as a record of procedures and results, including explanations of unusual events. For creative work, students may be asked to keep sketches and record notes about breakthroughs in their work. You can use what they have (or haven't) written about to prompt questions that promote further interpretation and integration of their learning.

I think it's very important to offer a lot of positive feedback about the progress (however little) that your students are making. Lab can be very foreign to students and positive reinforcement can help them feel better and therefore do better work. (Biological Sciences)

Lab work can be very discouraging for novices because every new procedure can seem to take an eternity and every error seems like a major setback. Noticing and commenting on progress such as a nice-looking result or improved technique are outstanding motivators for students.

Preparation Advice

I remember being lost when I was new. I remember telling students things that weren't quite right or weren't really answering their question.

Chemistry, three semesters as a TA

Even though you may not be getting up in front of the class to give a long presentation, working as a lab or studio TA requires significant preparation in order to make the learning meaningful and to answer the diverse types of student questions. You may need to give a very short pre-lab introduction to focus students' attention on the most important issues and procedures. You may have to answer questions at many levels of detail and need to think both quickly and flexibly to decide what level of detail your response should have. For example, a student may ask about a "picky" procedural detail in a way that might reflect misconceptions about the purpose of the assignment. Or, a student may describe his or her understanding in imprecise language, but point out an important methodological problem in the process. In both cases, the nature of your preparation could determine whether the student gets a "quick fix" response or something deeper. The following priorities in preparation are offered by experienced TAs.

It is important to know your way around the lab.
(Mechanical Engineering)

Students' questions can vary from basic facts like where to find supplies and how to use a new tool to more subtle questions about what to do if a computer or equipment isn't working.

It is important to do the experiment yourself.
(Mechanical Engineering)

Many TAs have trouble making time to do all of the experiments themselves, but there are many benefits to making this a priority. Most importantly, doing the experiments yourself is the best way to identify the kinds of pitfalls students may encounter such as misreading the manual, rushing a particular procedure inappropriately, or not being able to detect when a specified condition has been reached. Completing the experiment yourself is the best way to be thoroughly familiar with the students' options and likely difficulties.

In the computer labs I've had to prepare, I went into a lot of detail so that, if you follow step by step, the handout tells you what you'll type in. This lets students understand the concept but not be bogged down in mechanics. It gets them to the conceptual stage.
(Tepper School of Business)

Computer labs can require extensive preparation to ensure that the instructions are up-to-date and working with frequently changing hardware and software. For introductory-level students, the instructions might include some questions designed to check that students understand the purpose and significance of various steps. If students are unable to answer these "checkpoint" questions, that prompts them to ask you questions. For upper-level students who have a clear professional need for learning particular software or analytical techniques, a few key questions can be discussed informally with individuals or pairs while they work.

If you're a TA in lab and there are multiple sections, talk to the TAs for the earlier sections and listen to where students are going to mess things up. Then you can address those issues before lab starts.
(Electrical and Computer Engineering)

Other possible goals for an introduction to the lab include reminding students of the purpose of the assignment in conceptual terms, clarifying any deviations from the assignment or manual, and highlighting the steps where they may need to spend the most time so that they can plan accordingly.

Checklist: Being Proactive in Lab

✓ **Walk around the room.**
A TA who watches from the corner of the room doesn't seem very approachable or enthusiastic to students. Especially in a computer lab, you can only monitor students' work at a fairly close proximity.

✓ **Compliment good work.**
Noticing nice results or improved technique helps keep students motivated in an environment that can be intimidating.

✓ **Ask students questions like "How is it going?" as an innocuous opener.**
They may answer that things are fine, but they often have a question or something they'd like to double-check with you.

✓ **If you do a quick demonstration, be sure to let students practice, too.**
If possible, coach students while they try something new themselves rather than showing them how right away.

✓ **If you don't know the answer to a question, talk to the professor or an experienced TA to find out.**
If you give a student the wrong information, it undermines your credibility very quickly.

✓ **Make sure you know where the relevant equipment and supplies are.**
Whether or not you are the person responsible for setting up the lab, students expect you to be able to answer questions about the materials they need.

✓ **Give students tips to make them more efficient.**
Students in lab often work under time pressure. Saying something like "You should go ahead to step 4 now because there's a long line for the instrument you need in step 3" can help students to cope and plan more effectively.

✓ **Ask enough questions to help students understand how to deal with mistakes.**
A short sequence of questions (e.g., "What's the purpose of the procedure?" "Does the mistake matter for that purpose?" "Why would excess solvent matter in general?") can model systematic critical thinking. But don't ask too many probing questions if the student must rush to recover from a major error without falling behind.

✓ **Help students avoid errors that may cost lots of time.**
You may need to repeat an announcement a few times and check on students' progress more frequently if everyone must get to a certain stage in an experiment or project on a given day.

✓ **Know how to handle emergencies.**
Safety is always a top priority and, while major accidents are rare, errors with minor injuries are fairly common.

✓ **Enjoy the one-on-one interaction.**
Take advantage of the time to get to know students. Many will view you as a potential mentor.