TAs in the Sciences: Best Practices for Labs

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Facilitating lab sessions can be a very rewarding experience. This is the moment where students finally get to carry out the very processes that they are studying and becoming acquainted with. Through the completion of the lab exercises, group discussion and interaction with the lab demonstrators, students are becoming practitioners of science.

While rewarding, the tasks associated with managing a lab session can be quite complex. TAs are often responsible for the preparation and delivery of content and procedural protocol, the stimulation of student thinking and reflection, and student safety.

In today's academic environment lab sessions range from one hour statistical analyses in psychology courses to full-day wet lab experiments in biology. Taking this into consideration, this document may not align perfectly with your specific context; however, the suggestions, thoughts and questions outlined throughout should serve as a helpful guide and useful resource to encourage reflection and inspire new ideas.

When responsible for lab sessions, the three main phases to consider are the Preparation phase, the Facilitation phase and the Evaluation phase.

One: Preparation

A paramount contributor to an efficiently run and engaging lab session is preparation. Giving some thought to the format, content, interaction, support, resources, and possible questions and difficulties that may come up is arguably the most important step in teaching or managing laboratory sessions. To ensure a rigorous and engaging lab experience, planning for your lab should include consideration of the following:

- Know exactly what the students are supposed to learn and why they have to learn these things. This will come in

handy when your students start to wonder why they're doing what they're doing.

- Perform the entire experiment in advance. There is no guarantee it's going to work as advertised in the lab manual. By going through the lab yourself, you'll be familiar with some of the stumbling blocks that your students may confront and you'll know the subtler points of the process you are demonstrating.
- If this isn't possible, at least read through the procedure as though you were doing it. And familiarize yourself with the equipment that your students will be using. Also, obtain some sample data and work the calculations and answer the questions (without using the key).
- Read and study the theory on which the experiment(s) are based. Your understanding of the theoretical aspect of the lab should be useful to you in handling most student questions which don't deal with concrete parts of the experiment(s).
- Research the relevance of the experiment, both the technique being taught and the applications of the theory being demonstrated.
- Talk to experienced instructors. They will often have very useful tips about things you are teaching.
- Decide how to introduce the lab most effectively. Your initial introduction to the lab or the day's first activity can set the tone and provide motivation during the rest of the activity.
- Plan how you will guide students in preparing their lab reports. - Indiana University Bloomington (2011)

Other elements to consider when preparing your lab session include finding a mentor, ensuring clear communication within your TA team, and having a backup if things don't go as planned.

In order to inform yourself about probable questions and potential difficulties that may arise in your lab session, approach a fellow TA that has taught or is currently teaching the same lab at a time earlier in the week. Based on their insight you may be better able to prepare how and what you will communicate to your students.

To reduce confusion and potential conflict within your TA team, ensure that the roles and responsibilities of each TA are clear. The following are questions that may help you set your expectations: Who will play a role in introducing the lab to the students? What will they be responsible for doing? Who will facilitate the lab and how? Who will grade the lab and how? What information have you agreed to share or not share with students? Independently or as part of a TA team you should also take the time to get informed about the policies concerning the submission of late assignments and the protocol for completing missed lab sessions so that all members of your team are on the same page. Consider reminding your students of these policies at the outset of the semester.

Lastly, come up with a backup plan in the event that all or parts of your experiment don't work. Perhaps you won't have time to start over, but at least you'll have something productive planned to carry you through the remainder of the lab session.

Reflection

The following are some questions to help guide you in your planning:

- Will I be able to do the lab myself before class?
- Am I familiar with the materials and equipment?
- What are the safety considerations?
- Would it help if I gave my students a handout highlighting key theoretical, procedural, and safety points?
- How can I link this lab to the professor's lecture?
- How can I clearly communicate the criteria used in grading the lab reports?
- What kind of preparation should my students do before they come to lab?
- What tips can I give my students, so they can complete the lab successfully within the time allotted?
- Would it be helpful if I demonstrated new techniques to the students?
- How will I monitor student progress in the lab?
- Where might my students run into difficulty completing the experiment?
- What kinds of questions should I ask my students to stimulate their thinking and to encourage deeper understanding of the experiment?
- How can I help the lab pairs/groups to work together well?

University of Washington (2003)

Two: Facilitation

The effective facilitation of lab sessions is just as much about creating a comfortable and engaging learning environment as it is about ensuring that your students successfully complete the assigned activities. In pursuit of these objectives, it is important to consider your approach at the beginning, throughout and at the end of your lab sessions.

At the beginning of the lab session:

- Give a short pre-lab talk to explain the lab organization, timing, management issues, safety precautions, relevance to the course, etc. Pre-lab talks are not meant to be a lecture (i.e. give new material) but can highlight important concepts on a practical basis.
- Establish the specific goals of the lab (write them on the board).
- Prepare an outline (on the board) of the lab activities.
- Provide clear and complete instruction at the very beginning of the lab session.
- Try to break down the demonstration (of equipment, the experiment process or both) into several meaningful steps.
- Review safety issues for the lab.

During the lab session:

- Treat your students with respect and be approachable.
- Create and maintain a jovial and collegial atmosphere that fosters student curiosity, all while maintaining an appropriate amount of structure.
- In case of difficulties, avoid jumping in and completing the task for the students. Use process questions to help students identify their own problems and solve them. This is of particular importance to the development of skills in scientific inquiry among the students.
- Do not hesitate to explain things more than once or answer questions that you may consider simple (this will likely save you from headaches later on).
- If you don't know or are unsure of an answer to a student's question, say you will find out for them. Don't bluff.
- Visit with each student individually during the lab.
- Ask specific questions of the students in order to monitor their progress during the lab.
- Provide positive and constructive feedback to students as they complete the lab exercises.

Reflection

When students encounter difficulties during the lab session, you may ask process related questions such as:

- How did you begin?
- Where did you first experience difficulty?
- Are there other options available to you?

Hong Kong University of Science and Technology (2011)

At the end of the lab session:

- Finish with a short post-lab talk to summarize the important results of any experiments. Summarize what the students have said and highlight major learning points.
- Ensure students leave the lab clean and that the equipment is put away properly.
- Do a routine check at the end of the lab: turn off lights, lock up equipment; check air, gas, and steam taps. Lock up the laboratory. Does the department/course have a checklist for ending labs?

Adapted from University of Victoria (2008)

Three: Evaluation

Often the work of a TA does not end with the completion of a given lab session. TAs are frequently responsible for the marking of lab assignments. To effectively and efficiently complete this task, consider the following:

- Ensure that you have established a grading scheme and that it is consistent with the course objectives. Does the course instructor have an existing rubric? How are you going to ensure consistent marking across assignments? Consider discussing the grading scheme with your students before the submission of each assignment.
- Assess whether many students missed a critical concept. Perhaps you may want to bring this to the attention of the course instructor, or provide a recap during the next lab session.
- Evaluate whether students drew reasonable conclusions from the data they collected.

- Read, evaluate and return lab reports in a timely manner with cogent feedback.
  - Help students improve by telling them how they could have done better.
  - Focus comments in specific areas rather than on the report as a whole.
  - Jot down notes for future improvement and share them with the course instructor(s), technicians and other demonstrators.

Levin (2007) and Vanderbilt University (2011)

Common challenges

Beyond the general challenges you may encounter in most classrooms, challenges specific to your lab sessions may include:

- Teaching material you feel is unimportant, unrelated, or just plain boring.
- Safety concerns (students behaving in an unsafe way).
- Plagiarism and session disruptions (computers, cell phones, socializing, etc.)

Monitor your attitude toward the content; ensure you have done your best to understand the relevance of the material by speaking with the course instructor. Make the best of it.

Many challenges can be avoided simply by setting and discussing clear expectations with your students at the beginning of the semester. What is appropriate and inappropriate in your lab context and why?

Being responsible for lab sessions can be a very rewarding part of your graduate experience. The “light bulb moments” that students have when discovering something new based on your effective preparation and facilitation is quite impressive to see. Even more exciting are instances when students go beyond a lab’s expected objectives by making connections with previous lab exercises, course content or even content not yet covered by the course or program.

Use the suggestions, thoughts and ideas in this resource to help guide the preparation, facilitation and evaluation of your labs. Even if some of these items don’t fit your particular discipline or lab context, they may at least inspire you to reflect on your teaching and give you some ideas about strategies to consider when making your lab experience a successful one.

Further Reading

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This publication is also available in English.

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