Life as a Lab TA

Karli Holman, Chemistry, G2

Rebekah Silva, Chemistry, G6

Objectives: Session participants will become familiar with...

- The responsibilities and benefits of being a lab TA
- How to understand your students and create a welcoming environment
- Running a successful lab by preparing, guiding, and giving feedback on experiments

In this resource, you can find information about the following topics:

1. The responsibilities of a lab TA
2. The benefits of being a lab TA
3. Creating a welcoming environment
4. Understanding your students' backgrounds
5. Preparing your students and yourself for lab
6. Directing progress during lab
7. Office Hours, Grading, and Feedback
8. Tips for grading content and form of lab notebooks and reports

Before anything else, the SAFETY of your students and of yourself is your number one priority

- Make sure students are **informed** of and **follow** all safety rules without exception
- Discuss potential hazards with instructor/students
- Know the emergency procedure
- Immediately report to the instructor if a situation is unsafe

1. The responsibilities of a lab TA

a. Specific responsibilities of a lab TA - a lab TA is in charge of many tasks involving students, including:

i. preparing equipment or reagents before the lab period

ii. overseeing the lab period, including safety and timekeeping

iii. grading pre-labs, notebooks, and reports

iv. holding weekly office hours

v. other duties, such as running recitation sections, ordering chemicals, etc.

b. Differences between lab TA and others - there are many differences between the lab TA role and grading-only or recitation-only TA roles, such as:

You often have more tasks (listed above) than traditional TAs. Additionally, you are your students' main point of contact instead of the professor.

. You interact with students a lot more--you will interact with each student during each class period and generally have smaller class sizes as well.

i. You are in charge of making sure your students complete labs within a given time frame, and are often helping them with materials they have never seen before.

2. The benefits of being a lab TA

a. You help develop your students as the **next generation of scientists**—for majors you are teaching them fundamental skills they will use later on, for non-majors you are making them more well-rounded and helping them think in new ways.
b. You teach them **skills they actually** use! Such as experimental skills, how to use equipment or work up data, and writing/communication.
c. TAing a lab class helps **you become a better researcher**—in class you have to balance the same things you have to balance in your research lab! Like: preparation for experiments, safety, time management.
d. As a lab TA, you spend more time with your students which can help you a more effective **mentor** and **teacher**.
e. It's **fun** and **exciting** – you are always doing something something with your students, usually something completely different from previous weeks.

3. Creating a welcoming environment

a. Students are often afraid to ask questions or talk to their TA because they think their question might be dumb, was already covered, or that they can figure it out later. When students avoid getting help, the often end up wasting valuable lab time. By creating a welcoming environment, specifically an environment that is welcoming to questions and promotes learning, you can help your students' feel more comfortable asking questions. Ultimately, when students ask questions, it can lead to:

   i. improved safety--ex. they may ask how to use equipment properly if they are unsure, they may ask about waste disposal, etc

   ii. improved efficiency--ex. when students reach a problem, they may ask for help sooner instead of spending large amounts of time (that they don't have) troubleshooting

   iii. deeper learning--ex. when students are confused and ask for help, they may learn new things or learn things better by talking to the TA.

   iv. Increased engagement--ex. being in a supportive environment will help a student feel that they belong and feel more invested in the class.

b. As the TA, you can help to create a welcoming environment through simple actions on the first day of class and throughout the term:

   First day of class - on the first day of class, talk to students about how you view your role as their TA. You can tell them why you are there (to be a resource and help them succeed in their experiments, etc), what you want to help them do (explore a new subject, learn new techniques, have fun, etc), and what kinds of interactions you expect (you want them to ask lots of questions, come to office hours, etc.). You

can also tell your students what you expect of them (coming to class on time, doing pre-lab, asking questions when they are confused, etc.)

. Throughout the term - throughout the term, you can maintain a welcoming environment and attitude by staying positive and supportive, being accessible and circulating throughout the class, giving thoughtful responses and feedback to questions, and by being professional and enjoying your time in lab

4. Understanding your students' backgrounds

a. Being a TA can be difficult at times, especially when your students don't understand material that seems very easy or straightforward to you. To empathize with your students, consider the following things:

i. When taking their first lab class, students are learning an incredible amount of new content, skills, and vocabulary all at once! Furthermore, they have to balance all this learning in every class and in their personal lives (since students also tend to grow mentally and emotionally as people during college). Try to recognize that many students are balancing an incredible amount of new ideas and responsibilities, which can make learning harder and slower.

ii. If you are teaching an introductory lab class, your students likely have many different backgrounds and motivations. For instance, you may have students who are freshman and seniors, ones who are majors and non-majors, and people who have taken similar classes before and ones who have never taken a lab in their life. These students will have different life experiences and motivations, both of which can influence their behavior in lab

iii. It is nearly impossible to predict what your students will know coming into a class. This can often be challenging because students will often ask questions that seem basic or straightforward. Our instinct is often to assume the student should have already learned certain materials or should have prepared better for class, and unfortunately we often forget how little we knew when we were in their position. To try to better empathize with your students, ask yourself the following questions:

1. What did you know when you took this class?
2. What experience taught you what you know?
3. Did other information (from additional classes) supplement that knowledge?
4. Would every student reasonably have that same experience or knowledge?

5. Preparing your students and yourself for lab

a. Preparing yourself:

i. Read the lab manual: know the protocol, what kind of data analysis is expected from the students, and HOW to explain the process of going from raw data to the final plot. Before office hours, run through the data analysis yourself to ensure you understand it before talking to students.

ii. Prepare for experiments by performing the experiments yourself prior to teaching your students. Identify points that might be new or confusing to students or points that might take a large amount of time. You can use this knowledge to help your students navigate through the experiment more effectively.

iii. Some lab classes offer multiple sections led by different TAs, so you may have the opportunity to coordinate with other TAs to let them know if your section struggled with a particular element of the experiment, to find out if a previous section struggled with a particular element of the experiment, or to find out any other useful information that can help you lead your selection effectively.

b. Preparing students:

i. We have a limited capacity to store knowledge in our short term memory. If we can prepare students for lab, then they can focus on the important concepts of the lab instead of devoting attention to just getting through the procedure. They will be safer and more comfortable and therefore will be able to think deeply about the subject matter instead of superficially.

ii. Clearly communicate lab expectations to students – make sure they know what they should get out of the lab and what they are going to be responsible for in your grading

iii. Ideas for lab preparation

1. Prelab assessment
    a. Provides some incentive for students to familiarize themselves with the content of the class
    b. Prelab question focus suggestions:
        i. Safety
        ii. Important lab conceptual knowledge
        iii. Outline of the procedure
        iv. Practice calculations
2. Prelab discussion or mini-lecture
    a. Go over any pertinent material to the lab, especially if it can't be understood very well from prelab documents, but don't explain everything in extreme detail, as the students will then stop preparing for lab and rely on you to tell them what to do.
    b. Try to emphasize "trouble spots" to make the lab run more smoothly
    c. Demonstrate unfamiliar techniques, and observe students while carrying out techniques for the first time to correct improper procedure.
    d. Stimulating and guiding thinking
        . Know where your students are starting from – what knowledge do they have about the experiment? Where are they likely to struggle?
        i. Help students think actively about the important ideas in the lab

ii. Engage with students in the lab: ask them what they just did and what they are doing now, even if they don't seem to be struggling

iii. Strategic questions can help in understanding: "Once you mix these compounds, how are you going to monitor the progress of your reaction?" or "Why do you need to measure the current going both ways through the coils?"

6. Directing Progress during lab

a. Keep students on track by consistently reminding them of the time remaining for each lab period.

b. Have students maintain a detailed notebook. The notebook should be clear and concise and contain any relevant data for the lab as well as notes about the experiment.

c. Interact with all groups in the lab (not just those that seem to need help). This approach will allow you to get a feel for each lab group and also to make sure that everyone is progressing.

d. Check the progress of your students and make sure that the conclusions they are drawing are reasonable based on the data

e. If applicable, have students calculate some results from preliminary data to make sure their result makes sense and prevent them from blindly charging through the procedure.

f. Remember, you are an expert and the students are novices. Some of the language and protocols that come easily to you may be completely new to the students. Be sure to explain things thoroughly (and patiently!) and avoid jargon.

g. Guidelines and methods from addressing student questions

i. Consult with the instructor to find out how questions in lab should be answered.

ii. Your tone of voice can have a huge impact in how your response is received by the students! Be aware of your tone of voice so that you clearly convey that you are trying to help students, not confuse them.

iii. If you choose not to answer a question directly (or have been instructed not to), remind them it is to help them develop expertise and problem-solving skills. Be transparent and clear about your actions or intentions and emphasize that everything you do is to help them learn.

iv. Socratic method – Start with large questions and narrow in on what the true problem is via more specific questions. The Socratic method is useful for helping students think through problem when they are unsure of how to proceed or want to verify that what they are doing is correct. However, the Socratic method can be time-consuming and students can resent when questions seem pedantic.

v. Disparate analogies – Have students consider a situation that parallels the one with which the students are struggling. E.g., when discussing terminal velocities

and the shape of the falling object, the TA might refer to parachutes and the relationship between their size and and how they slow the jumper's descent. Increase the detail in your example until the student makes the connection.

vi. Simplification – Distill down the problem into its key concepts. This strategy is useful when students struggle to connect the idealized knowledge they have learned in class to the "nitty gritty" of the laboratory

vii. Guiding students to the answer – If it isn't helpful for the student to use the above methods, in some cases, you may be able to do give a big hint or clue that will allow the student to still process and reach an "aha" moment. In other cases, such hints will not help and will only frustrate the student.

h. Dealing with group dynamics - For some assignments in some classes, students may be working in groups rather than individually. This situation gives you an opportunity to facilitate group work and teach your students how to work with others on a team.

i. Encourages interaction among people in the group and emphasize that each person is accountable for participating and contributing to group work.

ii. One strategy to facilitate group work is to assign roles to each person in a team that rotate from lab to lab, so that each person has an objective in and outside of lab and contributes to the workload.

iii. If students are unengaged or disinterested, you can try asking questions and that help you understand the situation and how students are interacting with the material. You can also encourage students to participate by encouraging them to share their understanding of the material with the group.

i. Lab wrap-up

i. If possible, you can think about setting aside time at the end of the class period to discuss results and possible problems that could be encountered during data analysis. You can also set aside time during recitation section or office hours for this type of reflection.

ii. If students are working in groups, one point of discussion could be how observations differed among groups and possible explanations for the results.

iii. You and your students may also benefit from reflecting on how the concepts of the lab fit into the big picture of the class or you field of study. Having this context can be be helpful when students analyze data and write lab reports.

7. **Office Hours, Grading, and Feedback**: You may be expected to hold office hours or a recitation section to review material and/or address students' questions regarding assignments. In addition to interacting with students in person, you will be interacting with their work when you grade. Grading is a crucial aspect of laboratory courses and provides a means for assessing a student's understanding of the purpose and technical knowledge that should result from performing an experiment. It is imperative that you methodically and holistically grade a student's

work, and the more feedback you provide, the more a student will grow and learn from their mistakes and successes. Below we have provided some ideas for how handle your responsibilities as a Lab TA that are usually expected to be completed outside of lab. For more details, see online materials for the “Grading and Feedback” and “Office Hours” sessions.

a. Before you hold office hours, consult with the instructor about how much information is acceptable to share with students about the assignment. For the topics you can discuss, the methods of addressing student’s questions outlined above can be applied during office hours. And if applicable, coordinate as much as possible with other TAs to make sure that you are all giving consistent advice to you students.

b. Consult the instructor to receive guidance about grading expectations and the late policy.

c. Do your best to use (or develop if necessary) a standardized rubric that assigns grades based on specific metrics. Having a rubric helps you minimize ambiguous grading and gives you more time to focus on the commentary you provide each student on their work.

d. When grading, distinguish as much as possible between content (experiment completion, accuracy of the analysis, etc.) and form (writing style, formatting, etc.).

i. Students may have strengths in performing experiments, analyzing results, and/or presenting data, or they may need to develop skills in a multitude of categories.

ii. You can help scaffold learning for students through giving thoughtful feedback by categorizing your comments. This will help students realize where they meeting expectations, focus on the steps they need to take to improve their scores, and minimize how much student focus on “getting the right answer”.

iii. If you have the discretion, you can also consider awarding points to students have not obtained the desired result but have given an explanation of why they got that result and what they can do differently in the future.

e. Consider reading through several labs before making comments or scores. This gives you a baseline idea of how the class is doing overall and also can give you an idea if there is broad misunderstanding of some concept, formatting expectation, etc.

f. Give constructive and prompt feedback to students!

Tips for grading content and form of lab notebooks and reports - As always, consult with the instructor of the class about grading, rubrics, and feedback.

Grading Lab Notebooks:

1. Is the lab notebook neat?

a. Are ideas, pre-lab, data, and other materials organized in a logical and concise manner?

b. Is the handwriting and organizational style legible?

2. Has the student completed experiments according to the lab manual?
    a. Did the student obtain and complete every section of the experiment?
    b. Were proper procedures and safety instructions followed?
3. Were appropriate details recorded?
    a. Are all pieces of data recorded?
    b. Are all observations recorded and written in a thoughtful manner?
    c. Is the experiment described in the notebook reproducible?
    d. Could you follow the details in the notebook and perform the experiment without referring to the lab manual?

Grading Lab Reports:

1. Abstract
    a. Does the student give relevant values with error (if required) obtained during the experiment?
    b. Does the student emphasize one or two important conclusions from the experiment?
    c. In other words, could you read this paragraph and determine the main ideas behind the experiment?
2. Introduction
    a. Does the student discuss important, previous work in the field?
    b. Does the student give relevant background theory that relates to the reason the experiment is being performed?
3. Experimental
    a. Is the procedure followed for the experiment concise and sequential?
    b. Does the student use specific values obtained during their carrying out of the procedure?
4. Data Analysis
    a. Has the data been worked up correctly?
    b. Does the student use theory, approximations, and equations appropriately to analyze the raw data obtained in the experiment?
5. Discussion of Results
    a. Is the theory used to correctly and thoughtfully describe the results of the experiment?
    b. EVEN if their results are incorrect, do they discuss why their results are wrong and how they could perform the experiment to improve the data they have obtained?
6. Conclusion

a. Does the student recapitulate the most important take-aways from the experiment?
b. Does the student discuss future directions or other “next steps” that could be taken based on their conclusions?

7. Formatting - Different disciplines have very different formatting conventions, so communicating and giving examples of your expectations can really help prevent students from losing points unnecessarily. It is also imperative that you or the instructor emphasize the weighting assigned to formatting.
   a. Is proper formatting used based on guidelines given in the class?
   b. Do figures have appropriately labeled legends, captions, units, and axes?
   c. Did the student include citations appropriately?
   d. Is the information presented in the appropriate sections?
   e. Do the grammar, syntax, mechanics, paragraph structure, and transitions of the report contain minimal errors?

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