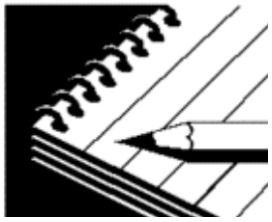

WRITING LAB REPORTS

The undergraduate laboratory report is a useful tool to help students learn the science of the lab and engage in scientific analysis of the physical world: two goals that are important for both science majors and non-majors. Put another way, writing a lab report makes the hands-on experience of the lab also a minds-on experience, thereby enhancing the learning potential of the lab itself.

The lab report adds important cognitive processing to doing a lab by asking students to write about what they did in the lab, reflect upon the lab experience, and try to make sense of it in writing.

The traditional organization of the lab report—introduction, methods, results, discussion—structures scientific thinking: establishing a hypothesis, testing the hypothesis, reporting findings related to the hypothesis, and making a judgment as to the support of the hypothesis.

The feature that is critical to understanding the lab report is its purpose. "We often forget that the lab report is a learning tool," notes Michael Carter of North Carolina State University, "and students need guidance to take full advantage of this important learning opportunity."

USEFUL TIPS

The typical guide to writing lab reports consists of a list of the parts of the lab report and two or three sentences describing each part. For many students, especially those who have not previously had good instruction in writing lab reports, this description is not adequate. Instead, faculty support students when they provide a better guide to writing these reports. Research shows that effective instruction in how to write lab reports not only significantly improves students' knowledge about the science of the lab, but also their ability to use scientific reasoning and even their attitude toward lab reports (Carter, Ferzli, and Wiebe). The following represent some of the best ways to provide that instruction:

- Provide sample lab reports. Create your own or use previous students' lab reports (with their permission, of course). Explain—either in class or by annotating the model report—where the samples meet your expectations and where they do not. For example, you might point out that one has an introduction that clearly states the hypothesis and the reasoning used to arrive at the hypothesis. Another might lack a description of the specific data from the results that led to the judgment about the hypothesis.
- Use a pre-lab questionnaire designed to help students begin thinking scientifically about the lab ahead of time. This can be done ahead of time and sent to the instructor before the lab, or parts or all of it can be done in the first 10 minutes of the lab, followed by a brief discussion of the answers. Such an assignment asks students to do the following:
  - state the scientific concept and write what they already know about the concept
  - list the objectives of the lab
  - describe how achieving the objectives will help them understand the scientific concept
  - establish a hypothesis (in this case, a prediction) for the results of the procedure
  - explain, based on what they know of the concept, the scientific reasoning they used to reach their hypothesis
- Avoid lab report guides that consist of lists of the parts of the report with a brief description of each. Instead, create a guide for lab reports that establishes clear expectations. When students know what you are looking for, they are more likely to meet your expectations.

- Use partial lab reports—good alternatives to fill-in-the-blank reports or workbooks that can limit the learning potential of the lab. Not only do such fill-in-the-blank activities discourage the scientific reasoning that is reflected in the full lab, but they also reduce science to a matter of finding the right answers.
  - In a partial lab report, students write one or more parts of a full report. To help students develop a sense of the logic of the whole report, the students might write a one-sentence summary of each of the sections (as if they were writing an abstract).
  - You can use partial lab reports to build up to a full lab report by the end of the term. Begin with results and add other sections in subsequent reports: methods, introduction, discussion, and abstract.
- Add a conclusion section to the lab after the discussion. In this, students reflect on what they have learned about the scientific concept and also what they have learned from the lab procedures and analysis. Such reflective writing reinforces the lab as a learning experience. In addition, it allows the lab instructor to better evaluate student learning.
- Include a section on limitations of the study. Students can be asked to reflect on whether they met the objectives and why or why not. They can also discuss the technical limitations or sensitivity of the instrumentation, the relative reliability of the data, the margin of error, and errors or departures from the study protocol. After having done the experiment, students might be asked to include limitations of their current understanding of the phenomena observed or of the underlying theoretical constructs.
- Develop and make public a rubric for grading lab reports with grading designations for each criterion. Using an evaluation rubric, which is based on the explicit and implicit criteria in your lab report guide, reinforces your expectations. This rubric can also provide feedback that encourages scientific thinking, not just finding the right answers.
- Direct your students and your lab instructors to LabWrite (http://labwrite.ncsu.edu), a universally available website and tutorial developed by North Carolina State University. In addition to a number of useful tips and teaching materials, the site provides an online tutorial that guides students through writing the lab.

USEFUL SOURCES

We are indebted to Michael Carter of North Carolina State University, who also developed the LabWrite website to help students and TAs learn science through writing better lab reports: http://labwrite.ncsu.edu

Carter, Michael, Ferzli, Miriam, and Wiebe, Eric. "Teaching Genre to English First-Language Adults: A Study of the Laboratory Report." *Research in the Teaching of English* 38 (2004): 395-419.

http://www.writing.eng.vt.edu/