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Chapter 20

LabWrite: Extensive web-based instruction for helping college students write lab reports and learn science

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Introduction

LabWrite is a free Internet site to help students learn science as they conduct their laboratory experiments and write their lab reports (to Access LabWrite, go to: <http://labwrite.ncsu.edu>). It was developed in 2000 and is sponsored and funded by NSF (award #: DUE-9950405 and DUE-0231086). The immediate purpose of LabWrite is to improve students' lab report writing by filling in the enormous instructional gap related to lab reports; most students are given very little if any instruction in writing lab reports. Typically, all they get is a list of the parts of the report and perhaps a brief description of what goes in each part. LabWrite seeks to fill that gap by providing students extensive instructional materials that help them to understand the genre of the lab report and why they write lab reports and to guide them in the larger process of writing effective reports.

There is also a broader purpose for LabWrite: to enhance students' scientific literacy. More than just the ability to read, write, and visualize science, scientific literacy means understanding science, what it means to be a scientist and to think like a scientist. It means being able to participate in an informed and intelligent way in issues related to science. Since lab reports engage students reflectively in the act of science by encouraging active and participatory scientific thinking, they provide one of the best ways to enhance scientific literacy.

The lab report, then, is a key tool for encouraging scientific literacy, including the ability to think scientifically. It offers students a medium they can use to reflect on and expand their understanding of their lab experiences, a way of thinking that allows them to make inferences, assumptions, and conclusions about the science they are studying.

Achieving scientific literacy should be a basic requirement of any educational experience, whether your students are science majors, and even if yours is the only lab course they will take. It's obviously important for science majors, for whom it is critical to understand and communicate science; but it is important to others as well. They must have the tools for observing, questioning, and evaluating the world around them in a way that allows them to make intelligent decisions about science, decisions that affect their lives and the lives of others. They must become informed consumers of science in newspapers, magazines, and other media.

In a study conducted in an introductory biology course (Carter, Ferzli, Wiebe, 2004), significant differences in scientific understanding, $F(3, 84)=4.9, p<0.003$, and scientific ways of thinking, $F(1, 78)=49.32, p<0.0001$, were found between biology lab students using LabWrite and those engaging in lab without LabWrite. Various students in this study were also interviewed about their perceptions of lab reports in general, without reference to LabWrite. All interviewees mentioned LabWrite as the most important source for learning in their labs. They also acknowledged the lab report as a valuable tool for learning. Although they continued to dislike lab report writing, students using LabWrite understood the role of lab reports in the biology lab, claiming that without them, they would not have learned as much. While studies show that LabWrite can significantly improve students' understanding of the science concepts about which they are writing in their lab reports, implementing LabWrite is not without its challenges. Current studies by the authors at numerous types of institutions and across various scientific disciplines show that LabWrite serves its goal most effectively when fully integrated into the lab course and reinforced by the course professor. LabWrite does not seem to function as effectively when overlaid or pieced into a course with its own system for writing lab reports. Despite these observations, LabWrite offers many guides and examples that fit nicely into any course structure, regardless of its fit with LabWrite.

LabWrite Structure

LabWrite provides the support students need for learning how to approach the lab experience from a process-oriented rather than a product-oriented approach. The core materials and resources guides students through the process of scientific inquiry, teaching them how to actively participate in the community of science by asking the right types of questions, making hypotheses, understanding their findings, using their data to build scientific arguments, and drawing conclusions that relate to the main scientific concept of the lab.

LabWrite is divided into four stages – Pre-Lab, In-Lab, Post-Lab, and LabCheck – each forming an integral part in the lab process and contributing to the writing of lab reports. Throughout each section, there are multiple learning tools that students can use to understand their labs and write their lab reports. There are also ample resources – tutorials, examples, definitions, more help links – that offer additional information and advice. LabWrite is primarily a set of web pages, referred to as the LabWrite “Self-Guide,” but it is also available as an interactive on-line tool, named the LabWrite “Tutor.” In the Tutor mode, students can interact with each stage of LabWrite, answering questions and eventually building their lab report on-line. Resources in LabWrite are available throughout the site, as students need them, or through the Resources Home Page. Although geared mainly towards experimental, hypothesis-driven labs, LabWrite offers a parallel guide for descriptive labs, which are often found in biology courses. LabWrite also offers a “Guide for Writing Partial Lab Reports,” providing the option to write one part of the report at a time, gradually building up to a full lab report. All LabWrite core materials are also available in printable versions.

The LabWrite Approach:

LabWrite is based on an “inside-out” approach to writing lab reports. While the first thing most people think of when starting to write a lab report is the title and the introduction, LabWrite teaches students to start with what they already know—the experiment and findings.

- I. Making sense of the lab procedure & data:
 - A. Materials & Methods:
 - B. Results
- II. Setting the context for the lab report
 - A. Introduction
- III. Explaining the results within the context of the lab
 - A. Discussion
- IV. Wrapping it up...
 - A. Conclusion
 - B. Abstract
 - C. Title
 - D. References

LabWrite Stages:

PreLab

An opportunity for students to actually understand what the lab is all about before they do it.

InLab

Shows students how to set up your experiment, take notes on protocol and instrumentation, organize and record data that you collect in lab, and how to display your data in meaningful tables and graphs.

PostLab

Once students have collected the data and have a good idea about what the lab is supposed to be teaching, the next step is to write the lab report. The PostLab offers students a systematic approach for reflecting, organizing, and communicating what they have done in any given lab. PostLab brings the PreLab and InLab experiences together to help students create a complete and effective lab report through a step-by-step process.

LabCheck

Finally, in the LabCheck section, LabWrite gives students an opportunity to review their work and make sure that they have everything they need before they turn in their final reports. When students get their graded lab reports back from their instructors, LabCheck can also help them interpret their grades and improve their skills for the next lab reports they write.

LabWrite Resources

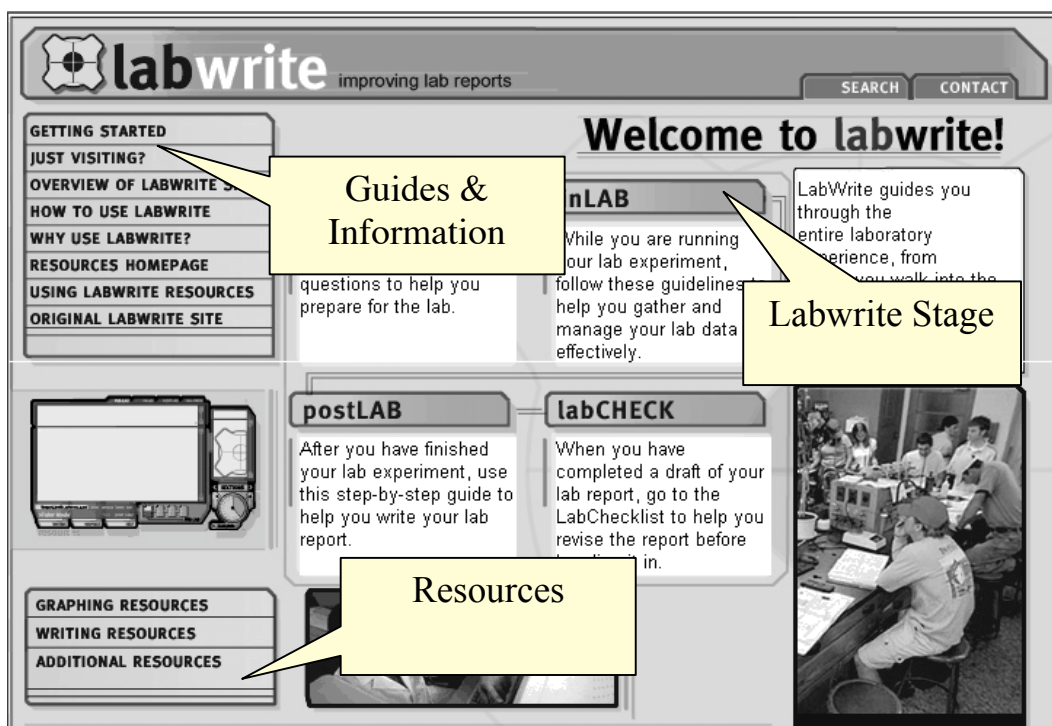
LabWrite provides a collection of resources tailored to provide help to meet specific needs. For example, students can access the resources to learn how to enter data into an Excel™ spreadsheet, how to create different types of graphs and tables, check the formatting for citations and references. LabWrite resources are organized in three categories: Graphing, Writing, and Additional Resources.

Graphing Resources provide help for working on data, particularly for putting data into a visual format such as a table or graph. Here you will find resources for entering data into Excel, creating tables, and creating many kinds of graphs.

Writing Resources provide quick access to pages used frequently, such as the LabChecklist and the Evaluation Guide, as well as useful information, such as correct use of citations and references and online writing labs.

Additional Resources include a variety of other pages to help students. These include sample lab reports, an introduction to the scientific method, a guide to designing lab experiments, and a glossary of terms used in LabWrite.

The LabWrite Home Page: (Sections are highlighted to show main components):



The Tutor

The Tutor allows students to work on-line using an interactive interface. Students can use PostLab in Tutor to build and save a draft of their lab report on-line. Tutor may be accessed from each LabWrite stage home page.

