Advances in Biology Laboratory Education, A Publication of the Association for Biology Laboratory Education
Volume 44, Article 35, 2024

Guiding novice students through finding and reading scientific literature.

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Abstract

Reading and extracting relevant information from scientific literature is a skill required in many biology courses. However, students, especially those in lower-level biology courses, struggle with activities involving finding and reading research articles. I designed a multi-week activity to help students in an introductory biology lab course navigate some of the challenging aspects of finding relevant background information from scientific literature. In this activity, students are given a review article and then assigned parts of the article that cover information for one of the background topics needed for a research report. Students work in groups to summarize the information from the review article and find an additional article to summarize from the references cited in their assigned review article. The following week, in lab, each student group presents a short summary of relevant information from both articles to their peers. The goal of the presentations is to provide the class with a short list of articles they can use as resources for the background and significance section of their research report. This activity helps students with the challenge of finding research articles and guides them through the process of determining which parts of an article are relevant to their research project. During the workshop, participants will take on the role of the teaching assistants and discuss how to guide students through this multi-week activity.

Keywords: Scientific literature, Student presentation, Literature review, Novice students

Citation: Mohan S. 2024. Guiding novice students through finding and reading scientific literature. Article 35 In: Boone E and Thuecks S, eds. *Advances in biology laboratory education*. Volume 44. Publication of the 44th Conference of the Association for Biology Laboratory Education (ABLE). DOI: https://doi.org/10.37590/able.v44.art35

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INTRODUCTION

Reading and extracting relevant information from scientific literature is a valuable skill that students should start developing early in their academic career. However, most undergraduate students, especially those in lower-level biology courses, find this to be a daunting task. To make this process less intimidating, I designed a two-week

group activity that helps students find appropriate journal articles and identify information in the articles that is relevant to their research topic. The overall goal of this activity is to generate a list of journal articles for each section that students can use as sources for the background and significance section of their research report. In the first part of the activity, student groups are given a journal article that has sections that are not relevant to their research topic crossed out and are asked to summarize the relevant sections of the article. Students are also asked to select one of the articles that is cited in their initial assigned article and read and summarize the relevant sections of this second article. In the second part of the activity, students present brief summaries of both articles to their peers. The first part of the activity can be completed in one 3-hour lab session or can be split up as a partially in lab (reading and summarizing the first assignment and finding the second article) and partially post lab assignment (reading and summarizing the second article). The second part of the activity (student group presentations) is completed in the following lab session and can take 60 – 90 minutes. For laboratory courses that are led by teaching assistants, reference documents need to be generated to ensure the teaching assistants can help students understand the information in the different journal articles and select an appropriate second article. The reference documents for TAs should provide article summaries and lists of appropriate second articles.

STUDENT OUTLINE

Objectives

Identify appropriate peer reviewed sources for background information for a research report.
Extract information from peer reviewed sources for the background and significance section of a research report.
Present a summary of information from peer reviewed sources to peers.

Introduction

After you have completed the four-week enzyme assay lab exercise, you will write a brief research report describing your experiment and summarizing your results. In the enzyme assay research report, you will also include a background and significance section that focuses on one of the many functions of acid phosphatase. The goal of the background research assignments (the group worksheet and the subsequent group presentation) you will complete in the first two week of the enzyme assay lab exercise is to give you and your peers a list of peer-reviewed journal articles that you can use as sources for the background and significance section of the final research report. For the background research assignments, your group will be assigned a journal article related to one of the functions of acid phosphatase. The journal article will have most of the sections not relevant to the assigned topic (function of acid phosphatase) crossed out. Your group will first read and summarize the relevant sections of the assigned journal article and then find an additional journal article related to your assigned topic. This additional article should be one of the articles that is cited in the initial article that was assigned to your group. You will need to determine which sections of the second journal article are relevant to your assigned topic (use the initial journal article as reference) and then summarize the relevant sections of the second journal article. In the following lab session, your group will present the information from both articles to your peers via a short (5 – 7 minutes) oral PowerPoint presentation. After the presentations, your TA will generate a list of the articles from your section and post the list on Canvas. You will use at least two articles from this list as sources for the background and significance section of your enzyme assay research report.

Background Research Worksheet

During lab, your group will be assigned a topic (one function of acid phosphatase) and a journal article related to your assigned topic. Parts of the journal article that are not directly relevant to your assigned topic will be crossed out; you do not need to read the sections that are crossed out. As a group you will summarize the information in the assigned article in the Background Research Worksheet. For each relevant section in your journal article, write a 2 – 4 sentence summary, in your own words, of the information given in that section. After reading and summarizing all of the relevant (not crossed out) sections in your assigned article, select one article that was cited in your assigned article (from the references/literature cited section of your assigned article). This additional article must be relevant to the background topic assigned to your group. Using PubMed or Google Scholar search for the article your group selected and download a pdf of the article. You must be able to download the full text of the additional article you selected. If the full text is not available, then select a different article. Check with your TA to ensure the article you have selected is appropriate for the assigned topic. You will present information from both articles to your peers during the next lab session.

Background Research Presentation

The purpose of your presentation is to provide your peers with a brief background about the function of acid phosphatase that was assigned to your group. Additionally, the goal of these presentations is to provide your peers with at least two articles they can use as sources if they choose to discuss the function of acid phosphatase assigned to your group in their Background and Significance section of the Enzyme Assay Research Report.

Your presentation slides must include:

- Title slide with your assigned topic and group member names
- For each article you must include:
    - A slide that lists the name of the article, the authors, the publication year, and the journal it was

published in (this does not need to be in the form of a citation, it can simply be a list of all necessary items).
- The overall goal(s) of the article
- 1 - 2 summary slides that describe the information in the article that is relevant to the topic assigned.
    - Each summary slide should be a bulleted list (4 - 5 bullets) of the relevant information from the article. Do not write paragraphs of text in your summary slides.

Note: You do not need to present all of the information in each of the articles. Instead, you should only present a brief summary of the information that is relevant to the assigned topic.

MATERIALS

Depending on the number of students (and student groups) in your course, you will need 4 – 8 journal articles, one article per group. A computer with Internet access is required for each student group to complete the background research assignment during the first lab session. A projector and computer are required for the in-lab student presentations.

NOTES FOR THE INSTRUCTOR

One of our big challenges for this activity was providing the teaching assistants (TAs) with adequate training and preparation so that they could help their students summarize the articles and find an additional article. Our introductory laboratory course is a large enrollment course with 700 – 900 students enrolled each semester. Due to the size of the course, the laboratory sections are run by teaching assistants. Additionally, the TAs for our course can be either graduate students or undergraduate students. The preparation we provided had to address TAs with various levels of familiarity and comfort with reading journal articles. Additionally, it was not reasonable to expect our TAs to thoroughly read six different journal articles in preparation for this activity. Instead, we used a think-pair-share type activity during the TA prep meeting to generate resources that TAs can use to guide their students in lab. During this activity, TAs will read one or two of the selected articles and write a summary of the relevant information in the article. They will also make a list 4 – 5 articles cited in the original article that would be appropriate choices for the additional article that their students will select. Then TAs will pair up with another TA who read and summarized the same article(s), compare, and consolidate their summaries and articles list. At the end of the prep meeting, I will consolidate all of the summaries and the article lists and share the consolidated document with all of the TAs. When TAs are teaching their lab sections, they can refer to the consolidated document for guidance on appropriate articles that students can select and for general information presented in each initial article assigned to the students.

The other challenge we faced was finding appropriate articles for students to read. Since our course is an introductory course with novice students, we needed to find articles that did not have complicated techniques or data analyses that our students would not be familiar with. We decided to use review articles as the initial assigned article as they are typically not focused on techniques and have a more comprehensive references section that students can use to find their second article.

ACKNOWLEDGEMENTS

Thank you very much to all of the BSCI171 students and teaching assistants who have helped improve this laboratory exercise.

About the Authors

Swarna Mohan has been a lecturer at the University of Maryland College Park since 2019, where she is the lab coordinator for a large enrollment (>700 students per semester) introductory biology laboratory course and teaches the introductory cell and molecular biology lecture course

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