Inquiry based learning improves scientific literacy in first year biology students.

Ana Medrano and Ann Cheek

University of Houston, Department of Biology and Biochemistry, 3455 Cullen Blvd, room 342, Houston, TX, 77204-5001, USA.
(aimedrano@uh.edu; aocheek@uh.edu)

To test the idea that course-based mini research experiences would improve scientific literacy, we developed inquiry-based learning modules for both Introductory Biology laboratory courses. In each 4-week module, students learn a measurement technique, analyze published experiments, design their own experiments, collect data, and present their results. The summary written or oral presentations are designed to build students’ graphing, analytical, and data presentation skills. Students improve at some skills after one 3-module course shown by paired pre- and post-test scores on the validated Test of Scientific Literacy Skills (TOSLS), Gormally et al. (2012); but they improve at all nine assessed skills after completing 5 modules over two courses.

Figure 1. Student performance in the TOSLS. Panel A) Students entering their first laboratory course were proficient at skills: evaluating appropriate use of scientific information (A), identifying valid scientific arguments (B), reading and interpreting graphs (C), and solving problems using quantitative skills (D). Panel B) Students presented developing scores in these skills: making a graph (E), understanding research design (F), understanding, and interpreting basic statistics (G), ability to conduct an effective literature search (H), and ability to justify inferences and predictions based on quantitative data (I). Completing the inquiry modules across two semesters had a significantly positive effect on their developing skills.

Analyzing and discussing experimental design in a scientific paper was the most challenging activity for teaching assistants to lead and for undergraduate students to complete. The purpose of guided paper discussions is for students to identify the authors' hypothesis, explain their experimental design, to practice verbally summarizing results shown in a figure or table, identify the authors' inferences, and evaluate whether the results support these. This activity is intended to provide students an example of how to design
their own experiments. Participants in the mini workshop engaged in a role-play activity illustrating the discussion of primary literature in a laboratory session and discussed options to improve this type of activity.

**Keywords:** inquiry-based learning, scientific literacy

### Cited References


### Mission, Review Process & Disclaimer

The Association for Biology Laboratory Education (ABLE) was founded in 1979 to promote information exchange among university and college educators actively concerned with teaching biology in a laboratory setting. The focus of ABLE is to improve the undergraduate biology laboratory experience by promoting the development and dissemination of interesting, innovative, and reliable laboratory exercises. For more information about ABLE, please visit [http://www.ableweb.org/](http://www.ableweb.org/).

Papers published in *Advances in Biology Laboratory Education: Peer-Reviewed Publication of the Conference of the Association for Biology Laboratory Education* are evaluated and selected by a committee prior to presentation at the conference, peer-reviewed by participants at the conference, and edited by members of the ABLE Editorial Board.

### Citing This Article


https://doi.org/10.37590/able.v43.extabs33

Compilation © 2023 by the Association for Biology Laboratory Education, ISSN 2769-1810. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the copyright owner. ABLE strongly encourages individuals to use the exercises in this volume in their teaching program. If this exercise is used solely at one’s own institution with no intent for profit, it is excluded from the preceding copyright restriction, unless otherwise noted on the copyright notice of the individual chapter in this volume. Proper credit to this publication must be included in your laboratory outline for each use; a sample citation is given above.