Advances in Biology Laboratory Education
Publication of the Association for Biology Laboratory Education
Volume 43, Extended abstract 33, 2023

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

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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.

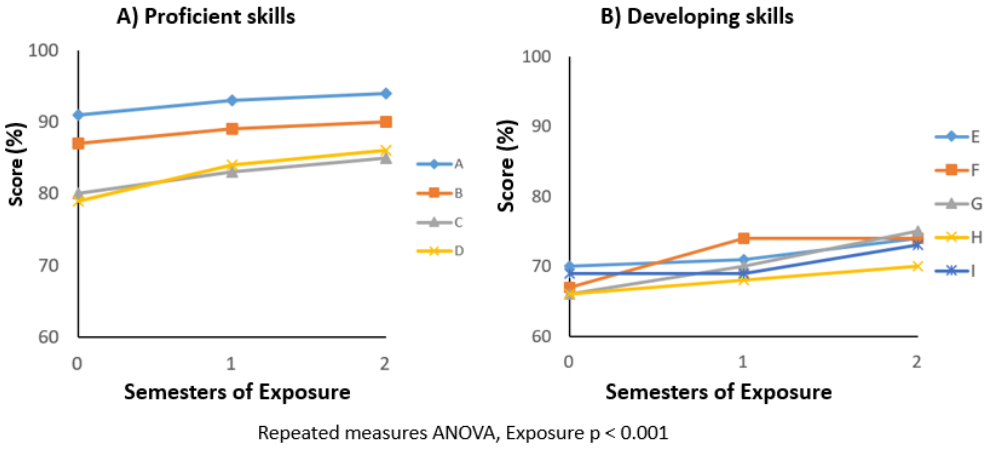

Figure 1. Student performance in the TOSLS. Panel A) Students entering their first laboratory course were proficient at skills: evaluating appropriate use of scientific information (A), identifying valid scientific arguments (B), reading and interpreting graphs (C), and solving problems using quantitative 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

Gormally, C., Brickman, P. and M. Lutz. Developing a Test of Scientific Literacy Skills (TOSLS): Measuring Undergraduates' Evaluation of Scientific Information and Arguments. *CBE Life Sciences Education. Vol 11, No. 4, 364-377 (2012).*

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Citing This Article

Medrano A and Cheek A 2023. Inquiry based learning improves scientific literacy in first year biology students. Extended abstract 33 In: Boone E and Thuecks S, eds. *Advances in biology laboratory education*. Volume 43. Publication of the 43rd Conference of the Association for Biology Laboratory Education (ABLE). https://doi.org/10.37590/able.v43.extabs33