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Letter Writing as a Service-Learning Project: An Alternative to the Traditional Laboratory Report

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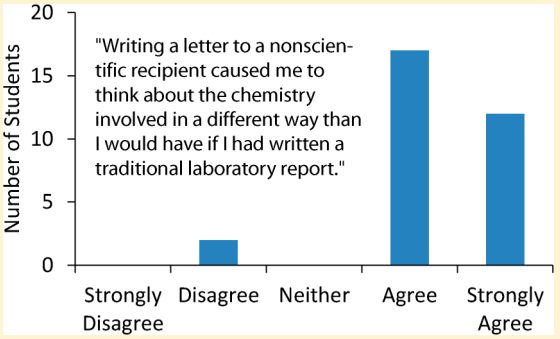
Supporting Information

ABSTRACT: Letter writing as an alternative to a traditional laboratory report was introduced for a general chemistry laboratory project in which students measure lead content in urban soils. Furthermore, this letter-writing activity was conducted within the framework of a service-learning project insomuch as the students' letters were written to the homeowner who provided the samples. The benefits of a letter-writing activity in lieu of a traditional laboratory report are discussed, as well as the benefits of implementing this type of assignment as a service-learning project. A follow-up survey indicated that 94% of the students who completed the letter-writing assignment felt it caused them to "think about the chemistry involved in a different [and we believe deeper] way" compared to writing a traditional laboratory report.



KEYWORDS: *General Public, Laboratory Instruction, Communication/Writing, Atomic Spectroscopy*

INTRODUCTION

One of the key characteristics of an effective scientist is the ability to communicate scientific results to a nonscientific audience.[1,2] This skill is oftentimes not well embodied in the pedagogy of the chemistry teaching laboratory when students are required to report their results in the form of a traditional laboratory report. Laboratory reports are almost certainly submitted to an instructor or teaching assistant; hence, students are not tasked with communicating the results of their laboratory experience to a nonscientific audience. When students are required to convey the same information to a nonscientific audience, it causes the students to: (i) critically analyze the clarity of their results, thus fostering a deeper understanding; and (ii) develop early on the skill of effectively communicating to a general audience. To this end, a laboratory project in which students write a letter in lieu of a traditional laboratory report was created and implemented. Although the idea of a letter as a pathway to deeper understanding has been put forth previously,[2,3] here the idea is fully realized as an alternative to the laboratory report.

THE LETTER-WRITING ASSIGNMENT

Our first-year general chemistry students in the chemistry-majors-only laboratory sections perform an experiment in which they measure the lead content of urban soils using atomic absorption spectroscopy. The students conduct this experiment during the second of their three-term laboratory sequence. As with a traditional laboratory report, the students are responsible for converting their data to the standard measurement of parts per million of lead (by mass) in the soil. With the letter-writing assignment, however, students are aware they must report this result to a general audience—reporting to a homeowner that "the measured lead level was 1080 ± 10 ppm" would be of little use to a reader with no scientific knowledge in this particular area. Students are challenged to explain what "ppm" means, to provide a general explanation of how this value was obtained, and to describe any health and environmental implications of such a level. A straightforward grading scheme was used to assess the letters (see the Supporting Information).

At the simplest, the letter may be written to a hypothetical entity and students need only be told that the audience is nonscientific. The level of student engagement will, however, likely increase significantly if the letter is to be sent to an actual person, making the letter-writing assignment a viable service-learning activity.[4−14]

In our case, soil samples were obtained from two different residences in Corvallis, Oregon. The owner of the residences collected and provided the samples, which were subsequently oven-dried to a constant mass prior to the students' laboratory experience. Upon receipt and evaluation of the students' letters, copies (without the grading mark-up) were sent to the homeowner. In future iterations, we intend to expand this activity to multiple homeowners (ideally one per group of two to four students) and have the students work directly with the homeowners in collecting soil samples. For the case we describe here, however, this was not practical because of time constraints.

If the students' letters are indeed to be sent to the intended recipients, a suitable disclaimer from the instructor should be added to indicate that the analyses were not necessarily conducted under "good laboratory practice" conditions and any

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student results should in no way be considered definitive. Recipients concerned with high levels of lead should have an analysis conducted by a certified analytical laboratory.

STUDENTS' RESPONSES TO THE ASSIGNMENT

A written follow-up survey was conducted for the students who completed this letter-writing project. Students had the option to remain anonymous; 31 of the 32 enrolled students completed the survey. Students were asked whether they agreed with the following statement: "Writing a letter to a nonscientific recipient caused me to think about the chemistry involved in a different way than I would have if I had written a traditional laboratory report." Of the respondents, 29 students (94%) indicated either "agree" or "strongly agree". Students were also given the option to provide additional comments; one student wrote:

> *Writing a letter made me think of the practical applications of chemistry, not just the "find the answer" [type of] chemistry. I felt that it was a good learning experience.*

On this survey, students were also asked about their agreement with the following statement: "I worked harder knowing my letter would be delivered to an actual recipient (not just my TA or instructor)." Of the respondents, 19 students (61%) indicated either "agree" or "strongly agree" (10 students indicated "neither" and only two students indicated "disagree" or "strongly disagree"). One student wrote:

> *It was nice to do hands-on research and actually have it be immediately applicable to someone other than us. It was overall exciting, and I hope to do more experiments like this in the future.*

Another student wrote:

> *To me, the lab was especially interesting because it applies to real world problems, where there are actual people/problems involved.*

A third student simply wrote: "It was nice to have a *real* purpose."

CONCLUSIONS

A traditional laboratory report certainly has pedagogical value; we do not advocate that every laboratory report be replaced with a letter (our students are still required to write several traditional laboratory reports throughout the three-term laboratory sequence). It is clear, however, that letter writing, used occasionally, provides a unique and rich academic experience for students. Not only does it help students think about chemistry from the perspective of the nonscientist as they create the framework of their letter, but it also can be easily adapted to a service-learning project that will likely increase their level of engagement.

The letter-writing assignment described here could easily be adapted to many different types of laboratory activities; furthermore, it would be applicable to many levels of chemistry laboratory education ranging from high school to upper-division undergraduate students.

ASSOCIATED CONTENT

Supporting Information

Laboratory activity handout; grading scheme; example of a student's letter (used with permission); student survey form; student survey results. This material is available via the Internet at http://pubs.acs.org.

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Notes

The authors declare no competing financial interest.

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REFERENCES

(1) Anderson, C. P. Explaining Chemical Issues to the Nonscientist. *J. Chem. Educ.* **1985**, *62* (9), 768.

(2) Ritter, M. Bringing Science to the People: The Aunt Gladys Letter. *J. Chem. Educ.* **1988**, *65* (12), 1054.

(3) Kirms, L. M. Students as Letter Writers: How Letters Inform Instructors. *J. Chem. Educ.* **2004**, *81* (7), 982−984.

(4) Cartwright, A. Science Service Learning. *J. Chem. Educ.* **2010**, *87* (10), 1009−1010.

(5) Kesner, L.; Eyring, E. M. Service-Learning General Chemistry: Lead Paint Analyses. *J. Chem. Educ.* **1999**, *76* (7), 920−923.

(6) Sheardy, R. D., Ed. *Science Education and Civic Engagement: The SENCER Approach*; ACS Symposium Series 1037; American Chemical Society: Washington, DC, 2010.

(7) Grover, N. *Lessons from Local and International Service Learning in Science*. Perlman Center for Learning and Teaching lecture presented at Carleton College, Northfield, Minnesota, April 8, 2010.

(8) Donaghy, K. J.; Saxton, K. J. Service Learning Track in General Chemistry: Giving Students a Choice. *J. Chem. Educ.* **2012**, *89* (11), 1378−1383.

(9) Wiegand, D.; Strait, M. What Is Service Learning? *J. Chem. Educ.* **2000**, *77* (12), 1538−1539.

(10) Kalivas, J. H. A Service-Learning Project Based on a Research Supportive Curriculum Format in the General Chemistry Laboratory. *J. Chem. Educ.* **2008**, *85* (10), 1410−1415.

(11) National Service Learning Clearinghouse. http://www.servicelearning.org/ (accessed Sep 2013).

(12) Draper, A. J. Integrating Project-Based Service-Learning into an Advanced Environmental Chemistry Course. *J. Chem. Educ.* **2004**, *81* (2), 221−224.

(13) LaRiviere, F. J.; Miller, L. M.; Millard, J. T. Showing the True Face of Chemistry in a Service-Learning Outreach Course. *J. Chem. Educ.* **2007**, *84* (10), 1636−1639.

(14) Glover, S. R.; Sewry, J. D.; Bromley, C. L.; Davies-Coleman, M. T.; Hlengwa, A. The Implementation of a Service-Learning Component in an Organic Chemistry Laboratory Course. *J. Chem. Educ.* **2013**, *90* (5), 578−583.