INTRODUCTION

Writing science requires critical thinking and analytical skills. We are surrounded by high-stakes testing, which makes learning iterative thinking more valuable than ever (1). A solid understanding of the structure of a scientific laboratory report, systematically taught and practiced during introductory courses, teaches synthesis and provides the foundation for improvement during more advanced courses.

Unfortunately, due to the large number of students in classes, mandatory responsibilities of faculty outside of their teaching load, and limited or nonexistent teaching assistant support, instructors often are unable to read a large volume of lab reports and provide feedback. Hence, the number of required lab reports is reduced to one or two per semester, or reports are subject to severe style simplification. By the time students enroll in advanced courses, they are still likely novice science writers.

Various approaches to teaching science writing have been used successfully (2–5). We used online low-stakes writing (6) as a method to engage students in scientific writing and critical thinking without too much pressure. It is suitable for all students, including those not majoring in biology. It also eliminates the illusion produced by a high-stakes assignment that there will always be someone reading the students’ drafts to fix all the mistakes. We also requested that students evaluate the work of their peers (7). The instructor’s role is thus concentrated on guiding the writing and evaluation processes.

PROCEDURE

The online platform Blackboard (Bb) with discussion boards was used to assign, collect, and grade assignments. The course was divided into three main parts. The first part focused on teaching students the format and grammar of lab reports by using a modified version of How to write a laboratory report (8). We simplified the original text to adapt it to our course content and excluded detailed grammar and language requirements (students were simply advised to write in complete sentences using their best grammar). Each week for the first five weeks, students had to complete one or two tasks based on readings from How to write a laboratory report or their own lab findings. All scientific writing activities were worth 15% of the course grade.

During the first four weeks of the semester, discussion boards were used as a method of instruction (detailed instructions provided in discussion boards are provided in Appendices 1 to 4). The students were asked to read short paragraphs posted on the discussion board and leave

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two comments in total, one comment to the faculty post and one comment to their peer. The paragraphs presented two versions of sections of a lab report, and students were to explain in the comments which was more appropriate and why. Examples of “poor” writing were inspired by real student work. They were then asked to compose short written pieces on their own on which others commented. For Week 5, students were assigned an online quiz on proper citation and references (Appendix 5). During Weeks 6 to 12, students submitted a high-stakes complete original lab report (Appendix 6). All online activities, including discussion boards, were graded using the online Bb rubrics (provided in appendices), affording students immediate feedback.

CONCLUSIONS

Through feedback surveys, our students related the positive impact of this approach to writing scientific lab reports (Table 2). Ninety percent of students reported they prefer online submission of lab reports over traditional printed reports. Over 70% felt online discussion board and related tasks helped to improve their writing. Furthermore, over 80% agreed that the online grading rubric and the How to write a laboratory report source were helpful. Approximately 75% of students achieved average lab report scores (which included all low- and high-stakes assignments) in the range of A, B, and C grades. We found that all students participated at least to some degree in a number of discussion board writing tasks, even if they did not fully complete every assignment. This observation was in stark contrast to what we see when teaching these same courses in the traditional manner with no scaffolding.

Our scaffolding method could be used in studies of the efficiency of remote instruction or research on active collaborative learning. The method could be used in experimental groups of students while control groups would use a classical method of submitting reports without scaffolding, with the average grades for reports compared. More research could also be conducted to study students’ attitudes toward technology in the classroom (such as discussion boards); for instance, students could be surveyed about their thoughts concerning whether online communication between peers helps their writing or helps them with time management, or they could be asked for suggestions on how to improve the method.

In summary, our scaffolded low-stakes writing assignment works progressively to walk students step-by-step through a multisection formal lab report. In a short amount of time on a weekly basis, students build on their initial writing attempts. Their peer review discussion board comments monitored by the faculty ensure a venue where they receive instant feedback, which can generate confidence. In a matter of weeks, we found most students who participated were writing more and at a quality level. This work requires minimal time on the part of the instructor, who simply uses

| Week | Topic | Activity | Reference |
|------|-------|----------|-----------|
| 1    | Introduction to Assignments and Materials and Methods | Task 1. Discussion board Task 2. Personal writing assignment | Appendix 1 |
| 2    | Results section of a lab report | Task 1. Discussion board Task 2. Personal writing assignment | Appendix 2 |
| 3    | Introduction section of a lab report | Task 1. Discussion board Task 2. Personal writing assignment | Appendix 3 |
| 4    | Discussion and Conclusions sections of a lab report | Task 1. Discussion board Task 2. Personal writing assignment | Appendix 4 |
| 5    | References | Quiz | Appendix 5 |
| 6–12 | Complete lab reports | Complete lab reports | Appendix 6 |

TABLE 2.
Sample excerpts from student feedback survey.

| Quotation | Response |
|-----------|----------|
| “It is easier to do the work online, and submit it once it’s done.” | |
| “I like it when I can go back and look at what I have done and flow to improve. I can learn and improve at my own pace.” | |
| “Doing the reports online was easier and saved me time versus writing them out.” | |
| “It was very helpful for time management.” | |
| “It was much easier this way. [This is the first time I have used this way to submit a lab. I actually like it and I hope each of my remain[ing] science class reports are as such!” | |

Quotations represent a majority of student responses regarding their thoughts on the use of the online low-stakes assignments to support writing in college biology courses.
online tools to ensure quick turnaround of input and grading. The method can be reduced (without discussion board) to fit course needs. The approach was appreciated by the students, who demonstrated significant improvement in their formal scientific writing skills.

SUPPLEMENTAL MATERIALS

Appendix 1  Week 1: Introduction to assignments and materials and methods
Appendix 2  Week 2: Results
Appendix 3  Week 3: Introduction
Appendix 4  Week 4: Discussion and conclusion
Appendix 5  Week 5: References
Appendix 6  Weeks 6 to 12: Complete lab reports

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