Integrating Science Communication Into a Large STEM Classroom

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The communication of scientific findings through writing is an important skill for undergraduate science majors to develop as they move through their respective degree programs. Seeing the importance of science communication skill development, we brought a science communication blog written by graduate students on the same campus to the attention of a large undergraduate organic chemistry lecture in collaboration with their professor. These undergraduate students were then given an assignment in which they would write their own blogs, go through a process of peer review, and then have the opportunity for their blog to be published on a website for high school students. The undergraduate students were able to consider the role that science communication will play in their future careers and practice the basics in a low-stakes, brief assignment. Overall, the learning goals we set for the assignment were met with a positive impact on the students. While there were several small challenges associated with the first implementation of this assignment, we were pleased to learn of the high level of value that students placed on this assignment.

The communication of scientific findings through writing is an important skill for undergraduate science majors to develop as they move through their respective degree programs. While improving their scientific writing skills, students concomitantly develop their level of conceptual understanding and overall confidence in regards to subject matter knowledge (Pelger & Nilsson, 2015). Besides becoming proficient in the academic style of scientific writing, undergraduate students should also aim to use their newfound science verbiage to communicate science to diverse audiences of laypeople. Students can strengthen both their writing and communication skills by presenting science concepts to different target audiences (Pelger & Nilsson, 2015; Smith, 2016). In contrast to the more traditional style of scientific or academic writing used in lab reports or formal research papers, science communication focuses on presenting ideas clearly and placing science within a broader context (Treise & Weigold, 2002). While scientific writing is also vital to those embarking on a possible career in the sciences, knowledge and experience engaging with the public is a skill that is becoming more desirable and necessary (Brownell et al., 2013). Furthermore, these skills may help future researchers consider how to design broader impact statements that highlight both scientific and societal merit as they move forward in scientific career fields (Treise & Weigold, 2002; Smith, 2016). In this study, we focused on the communication skills of peer review, both as an author and a reviewer, and on writing for a target audience while discussing majoring in the sciences and the college experience.

Treise and Weigold (2002) speak of science communication as placing “scientific activity within a broader context” when reporting the latest findings in science, while Mercer-Mapstone and Kuchel (2015) address science communication as an exchange between scientists and laypeople, rather than the deficit model that is quickly becoming outdated. The challenge for instructors, then, is how to fit science communication into an already packed curriculum and formulate assignments that properly teach this skill. Mercer-Mapstone and Kuchel (2016) found that by embedding explicit science communication skill development within the curriculum, gains could be made on student learning with small class sizes. However, this was not as successful with larger classes. As discussed by Train and Miyamoto (2017), explicitly teaching popular science writing may lead to more gains in conceptual understanding of a student’s respective content area while simultaneously serving their development for the job market. Additionally, the authors found that graduate assistants play an important role in the success of scaffolding science communication skills in larger classes, especially within the realm of implementation and assessment.

Peer review of science writing was shown to be a positive experience and an effective method of improving students’ writing and collaborative skills, whether they were working on grant proposals or popular science writing.
begin to develop the skills for writing about the science that interests them. The choice of major is relevant for a science communication topic, as many laypeople do not necessarily understand the differences between all the science, technology, engineering, and math (STEM) tracks. For instance, majors such as chemistry, biochemistry or biology, and microbiology may sometimes blend together, as can the career paths available within each major. Also, by focusing on students’ choice of major, we saw this as a unique opportunity for the undergraduates to work on writing for a target audience: high school students trying to decide on a college major track. A target audience is an important part of science communication, as keeping in mind the needs of the reader is critical when conveying new information. High school students are a target audience with which undergraduate students could easily identify, as they had recently needed to make the same decision. The undergraduate students thus had a specific purpose in mind while completing this low-stakes assignment, and the blog posts, when published, could help high school students learn about the variety of STEM career paths as well as gain an understanding of the diversity of STEM students.

**Potential Impact and Scalability**

This assignment, titled “What’s Your Major? Blog Assignment,” was designed for a larger science class (more than 100 students), keeping in mind that a small number of teaching assistants would be available. We had two main goals for the project: improving students’ writing and editing skills and communicating to high school students about what attracted the college students to science and their respective majors. We decided that a creative assignment focused on the choice of major was a simple way to meet both goals and for students to begin to develop the skills for writing about the science that interests them. The blog post was intended to be a self-reflection on the major they chose, any surprises regarding the major, and any unique opportunities they experienced that helped solidify their choice (e.g., research experiences). Students were then placed in groups of six, and each group chose the two “best” blogs to continue with toward the peer review portion of the assignment. At this point, two group members became authors and the other four became the peer reviewers (two reviewers per blog post), with the reviewers expected to provide constructive feedback for their respective author. The class was given general guidelines for the process (email the author for supplemental material), including how to give comments on flow, clarifications, and grammar. The authors would then have an opportunity to edit their pieces and send them back to the group. Once the group received the edited blogs, one was chosen by the full group for submission to the faculty member to be considered for publication.
ered for publication on the blog. All students in the class had the chance to submit their posts for publication, even if their blog was not chosen by their group.

**Evidence of Impact**

A pre- and post-assignment survey were given to each student to gauge how students perceived this assignment in terms of both relevance and their growth as a science student, as well as to gather feedback that would allow us to modify and/or improve this activity. The 22-question surveys, which included both short-answer and Likert-scale questions, were identical, with the exception of three questions on the post-assignment survey that asked for feedback regarding the activity itself (email the author for sample surveys).

The survey results showed that the majority of the 239 respondents had no experience in writing a blog post or short article about any topic in science but considered learning how to be a science communicator as valuable to their future goals (Figure 2). Additionally, they believed peer review to be important while revealing that they were neutral in terms of their comfort with the peer review process. The post-assignment survey showed that the overall range of comfort level with the peer review process increased as a result of this assignment. Also shown in the post-survey was an increase in students’ overall confidence as writers.

When students were asked if they felt that science communication should be taught in an undergraduate science classroom, 81% said yes and 16% said maybe. Students were then asked to share what they liked and disliked about the assignment, along with suggestions for what could be improved upon and why. The majority of responses were positive:

“It’s interesting to see how writing is important in science because it gives me a glimpse of what my career might be like.”

“I liked getting to read about why other people chose their majors. It was interesting to me to see what other people’s career paths are because it helped me to understand mine more clearly.”

“I also like that this assignment gives a basic introduction to the peer review process, which will be essential if students move forward in the field of science and scientific research.”

“I like the cooperation that was needed. My peers helped me write a very well thought out response to the prompt.”

“I liked the democratic portion of
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Beyond the students’ perceptions of the assignment, we observed improvements in the blog posts submitted on the LMS (Figure 3). The peer review feedback was generally clear and constructive, with corresponding improvements in the final edited posts. The published blog was also able to take advantage of the posts submitted, and many are available on the blog. These were only minimally edited by graduate students before publication.

The biggest challenge that students shared with us was that group communication was sometimes difficult, so point values should be adjusted to reflect who completes work and who does not. Challenges with group work are not a new issue in education, so instructors should take steps to mitigate these challenges wherever possible. We offer several suggestions in the next section specific to this assignment.

Lessons Learned
While we were pleased with the feedback from students and the blogs they produced, we were able to identify areas for improvement. One student, for example, said, “Overall I liked the assignment; however, my group was pretty disorganized. I think it would’ve been better if there was a set way to communicate.”

FIGURE 4
Blog assignment goals and workflow.

The main issue that came up in several ways was the timeline we set up for the assignment, which took place almost over the entirety of the semester. First, students were put into groups before the drop deadline for the course, which completely changed the makeup of several of the individual groups once that deadline passed. Second, we believed that students would be able to get together on campus or through the online collaborative pages we set up for them in the LMS. However, we did hear that students would have preferred some class time to work on the assignment. Looking at the feedback, we find it key that students are given at least a brief opportunity to meet with their partners face-to-face so they can plan where to go from there, especially in large classes. Students also suggested that their groups, which were predetermined by the instructor, should include only students from the same lab or recitation to give them more opportunities for face-to-face meetings. Due to the perceived challenging nature of the course, students recommended more reminders of when work was due. Even though they enjoyed and found value in the assignment, they were heavily focused on learning the material for their exams.
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and did not always remember the due dates for this assignment. We agree with the feedback and have shortened the timeline of the overall assignment, made due dates consistent (e.g., having sections due each Wednesday), and started posting reminders and alerts in the LMS. Finally, the majority of students knew how to work within the LMS, but for the few who did not, the LMS created extra stress. Therefore, a page of instructions on how to use the LMS for this assignment should be made accessible to all students. These logistical issues are easily modified so this assignment can work more effectively in a large science course.

Conclusions

While there were several small challenges associated with the first implementation of this assignment, we were pleased to learn of the high level of value that students placed on the work. Students discussed that peer review was sometimes awkward but an important process for them to practice as they plan on career paths in the sciences. The fact that students were given a tangible target audience helped provide them with motivation, relevancy, and practice in one of the two most essential science communication skills, as described by Mercer-Mapstone and Kuchel (2015): “[T]o identify and understand a suitable target audience” (p. 193). They also gained experience with the second essential skill: “[U]se language that is appropriate for your target audience” (p.193). The undergraduate students were able to consider the role that science communication will play in their future careers and practice the basics in a low-stakes, brief assignment. Overall, the learning goals we set for the assignment resulted in a positive impact on the students (Figure 2). While there may be barriers to implementing science communication skills development in a large undergraduate science classroom, we believe that short assignments focused on one or two skills can lead to positive outcomes for student development while not affecting the overall amount of topic-specific content that needs to be covered in a course. Additionally, science communication may better serve the students in terms of learning these skills as they become more relevant to their area of study when part of a content course rather than outside of the realm of science (Conte, 2010; Mercer-Mapstone & Kuchel, 2015). Because it is important to speak the language of science in terms of being an effective educator and having the ability to identify the broader impacts of one’s scientific endeavors for successful grant application, undergraduate science students would benefit from an introduction to science communication skills, including writing, while taking a content course (Treise & Weigold, 2002; Smith, 2016).

References

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