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Enhancing Scientific Communication Through an Undergraduate Biology and Journalism Partnership †

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Scientific terminology presents an obstacle to effective communication with nonscientific audiences. To overcome this obstacle, biology majors in a general microbiology elective completed a project involving two different audiences: a scientific audience of their peers and a general, nonscientific audience. First, students presented an overview of a primary research paper and the significance of its findings to a general, nonscientific audience in an elevator-type talk. This was followed by a peer interview with a student in a journalism course, in which the biology students needed to comprehend the article to effectively communicate it to the journalism students, and the journalism students needed to ask questions about an unfamiliar, technical topic. Next, the biology students wrote a summary of their article for a scientific audience. Finally, the students presented a figure from the article to their peers in a scientific, Bio-Minute format. The biology-journalism partnership allowed biology students to develop their ability to communicate scientific information and journalism students their ability to ask appropriate questions and establish a base of knowledge from which to write.

INTRODUCTION

Effective science communication can be difficult when scientific terminology provides an obstacle to nonscientific audiences, including journalists conveying information to the public (1). Undergraduates often have little experience discussing the significance of scientific topics with their nonscientific peers (2). Ineffective communication skills transfer into clinical settings as well, with patient experience scores and compliance suffering as a result (3, 4). A biology-journalism partnership allowed biology students to develop their communication skills and journalism students to ask probing questions to improve their understanding before reporting.

PROCEDURE

Selection of primary research article

Students in a general microbiology course (junior/senior-level elective for biology or biochemistry majors) chose a peer-reviewed, primary research article focusing on various applications of microbiology. Students read the primary article to develop an understanding and discussed technique and analysis questions with the instructor.

Communication to a nonscientific audience

Students need to be mindful of the terminology they use to illustrate a primary research article's significance for a nonscientific audience (5). To challenge their awareness of the terminology they use, students presented two-and-a-half-minute elevator-type talks (only aided by a whiteboard) (6). Students (i) stated the problem or idea addressed by the article, (ii) provided a brief context for the topic, and (iii) explained the importance of a single finding from the article. Students were encouraged to use analogies, define terminology, and/or draw pictures as part of their presentation. Faculty members from nonscientific disciplines participated as general audience members and assessed student performance by completing a grading scoresheet (Appendix 1).

To further emphasize how language and explanations vary between scientific and nonscientific audiences, biology students collaborated with peers in a Journalists' Workshop course offered through our Jandoli School of Communication. The Journalists' Workshop provides journalism majors with the opportunity to report (using written and audiovisual methods) local news shared on an online news site. Instead of observing the press interview of a scientist and critiquing the subsequent article, as done by Renaud et al. (6), biology students served as the "experts" being interviewed on their selected primary articles. As experts, students needed to explain the study goals, how the goals were met, and the overall significance of the study. The

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interviewing journalism students, often unfamiliar with the subject, needed to ask pointed and exploratory questions to deepen their understanding before writing an article. The interaction between the biology and journalism students provided each with immediate feedback, allowing for repeated attempts to convey the scientific information or ask the probing questions necessary to understand the scientific problem. Several articles written by journalism students were published on https://www.tapinto.net/towns/greater-olean (search "SBU Bio Report"), a student-staffed, hyperlocal, online newspaper serving the surrounding community (see examples in Appendix 2).

If a journalism class is not available for collaboration, partnerships could instead be established with English, communications, or public policy classes to allow for interaction among students from different disciplines. An alternative to establishing an interdisciplinary partnership includes having biology students prepare their own brief newspaper article or infographic. While biology students would not benefit from receiving the immediate feedback from their journalism peers, students would still need to evaluate their word choice and describe the science in an approachable way. To allow for nonscience audiences to benefit, biology students' articles could be distributed throughout campus to improve science literacy.

Communication to a scientific audience

To demonstrate a scientific understanding of their selected primary article, students prepared a brief written summary of the article and provided scientific support and background for conclusions presented in the article. Here, students were encouraged to use technical words or terminology discussed in class. This "scientific audience" was expected to have background knowledge similar to that of the writer, thus reducing the need to define terms and concepts.

Students also conveyed their understanding of the primary paper's scientific importance in a modified Bio-Minute presentation (J. A. Oliver, presented at the 22nd Annual American Society for Microbiology Conference for Undergraduate Educators (ASMCUE), Austin, TX, 28 to 31 May 2015 and A. M. Hoskinson, presented at the 16th Annual ASMCUE, Colorado State University, Ft Collins, CO, 28 to 31 May 2009.). In a Bio-Minute presentation, students select the table, graph, or figure they believe best highlights the overall significance of the selected primary article. This figure is placed on a single PowerPoint slide containing (i) a memorable and creative title, (ii) a single-sentence description of the question the article attempts to answer (overall hypothesis), (iii) a brief caption and methodology for the selected image, (iv) up to five bullet points addressing the article's significance and the student's thoughts and conclusions, and (v) an article citation (see sample slides in Appendix 3). Students could annotate or draw on the figure to aid their presentation. The Bio-Minute presentation was designed to present one figure from an article in one minute; however, after using this type of presentation for several years, three minutes was deemed a more appropriate amount of time for students to provide a detailed analysis and presentation of the selected figure.

ASSESSMENT

Biology students were evaluated on their two presentations and written scientific summary based on guidelines provided to them (Appendix 1). To evaluate the success of this biology-journalism partnership, biology students were asked some pre- and post-activity questions (Appendix 4) regarding perceptions of communicating science. Using a Likert scale, 38% of biology students disagreed or strongly disagreed with the statement, "Discussing biology related material with peers not in biology related majors is easy" prior to participating in this interdisciplinary partnership. After interacting with a journalist, 80% of biology students expressed disagreement with the same statement. While the change in attitude after the activity was not statistically significant (Wilcoxon Signed Rank test, $p > 0.05$, $n = 10$), student comments trended toward awareness of the difficulties that arise when communicating science to nonscientists. In addition to qualitative student comments supporting such an awareness, 80% of biology students agreed with the statement, "This project made me think differently in how I need to approach communicating science." For example, one student commented: "Analogies are really helpful for taking something you are familiar with and applying them to something new. I needed to keep in mind when I was using terms that have been familiar to me, they might not have been to someone else."

CONCLUSION

Whether their audience is a patient, a politician, or the press, scientists need to point out the significance and relevance of their work in an abbreviated format that avoids the technical terms used within that scientific field (5). This project provided biology students with the opportunity to develop their skills in communicating with different audiences. When speaking to a nonscientific audience, biology students had limited time to convey a scientific finding using non-technical terms. Journalism students involved in active dialogue with the biology students were exposed to reporting on, and asking questions about, an unfamiliar scientific topic. Limited to just one PowerPoint slide and three minutes for the scientific, Bio-Minute presentations, biology students needed to be focused in both content and delivery.

Communicating scientific content, no matter the audience, is necessary in most science-based careers. Given the ubiquitous nature of the future communication

responsibilities of biology majors, raising awareness of the different skills required to convey scientific information to varied groups, and providing students with opportunities to practice communication skills, is warranted at the undergraduate level.

SUPPLEMENTAL MATERIALS

Appendix 1: Evaluation guidelines and scoresheet
Appendix 2: Example articles
Appendix 3: Bio-Minute slide student examples
Appendix 4: Pre- and post-activity questions

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