JOURNAL OF MICROBIOLOGY & BIOLOGY EDUCATION
DOI: https://doi.org/10.1128/jmbe.v19i1.1399

Science Communication

Communicating Microbiology Concepts from Multiple Contexts through Poster Presentations †

Amy Borello Gruss
Department of Civil and Construction Engineering, Kennesaw State University, Kennesaw, GA 30144

Accredited environmental engineering degrees require graduates to be able to apply their scholarship to concepts of professional practice and design. This transferable skill of relating what you learn in one setting to another situation is vital for all professions, not just engineering. A course project involving designing and presenting a professional poster was implemented to enhance student mastery in Environmental Engineering Microbiology while also developing communication and transferable skills vital for all majors. Students were asked to read a contemporary non-fiction book relating to microbiology and expand upon the book's thesis by integrating course content, news articles, and peer-reviewed journal articles. They then were required to present this information in class using a professional poster. Students felt the project allowed them to synthesize and organize information, analyze ideas, and integrate ideas from various sources. These transferable skills are vital for students and professionals alike to be able to communicate advanced information and master a topic.

INTRODUCTION

When students enter the competitive job market, the ability to communicate and a mastery of their subject are essential. While technical skills are necessary, communication and transferable skills are what set one apart in the hiring pool. Transferable skills allow students to relate contexts from the classroom to their profession upon graduation, or even to topics outside of their field of study. In doing so, better interdisciplinary communication is developed between subjects. Being able to integrate core knowledge from various situations and effectively communicate that information is the primary goal of the course project outlined in this article.

The high-impact practice (HIP) of a class project (1) enhances learning and allows students to apply what they learn in the classroom to multiple disciplines; therefore, a class project was chosen for this exploration. In order to develop mastery, it is important for students to integrate the knowledge they acquire (2). Therefore, the project design used the National Survey of Student Engagement (NSSE) Deep Learning model for students to achieve a deeper understanding. This model includes integrating ideas or information from various sources, analyzing the basic elements of an idea, experience, or theory, and, lastly, synthesizing and organizing ideas, information, or experiences (3). Upon completion of the course, students voluntarily answered a survey on the extent to which the course project helped them develop skills and strengthen their understanding of environmental engineering microbiology. Though this project was applied in an upper-division engineering course, it could be adjusted for use in all types of microbiology and science classes.

PROCEDURE

Students are required to work individually to design and present a professional poster. The poster must be based on a current microbiology book (published within the last 20 years) selected by the student, who must explain how it relates to topics discussed in class. A select list of modern, nonfiction books that qualify is provided in Appendix 1. Selecting a contemporary book allows students to gain experience with non-technical science readings, which can potentially enhance their communication skills with a non-technical audience. It is proposed that exposure to science writing catered to a non-technical audience may allow students to understand the importance of clear and concise communication in appealing to a broad audience.

In addition to the book of their choosing, the following supplementary sources must be incorporated into their project:

1. Course textbook and/or class notes
2. At least two peer-reviewed journal articles
3. At least one current news article.

Corresponding author. Mailing address: 1100 South Marietta Parkway, Building L, Marietta, GA 30060. Phone: 678-915-7262. E-mail: agruss@kennesaw.edu.
Received: 31 July 2017, Accepted: 1 September 2017, Published: 30 March 2018.
†Supplemental materials available at http://asmscience.org/jmbe

The purpose of requiring students to utilize material from different types of sources is to help them develop analytical and communication skills by connecting and explaining the information, respectively. The task of synthesizing information and relating it to classroom lectures is one of the key transferable skills developed in this exercise. For instance, a student could have chosen "I Contain Multitudes," by Ed Yong, a New York Times Notable Book of the Year (www.nytimes.com/2016/11/23/books/review/100-notable-books-of-2016.html), which focuses on the symbiotic relationship between gut microbiomes and animals. The student would then collect supporting information from journals in their field written by researchers working on this topic. Examples may include how engineers can track invasive animals based on the microorganisms located in their fecal matter or how gut bacteria can prevent disease and affect public health, to name a few.

Deliverables for this project include a digital copy of the poster created and an oral presentation of the poster. Professional posters were required in order for students to develop their communication skills by orally presenting a great deal of information in a condensed form (4, 5). Additionally, students who create their own poster feel they improve their communication skills and develop mastery

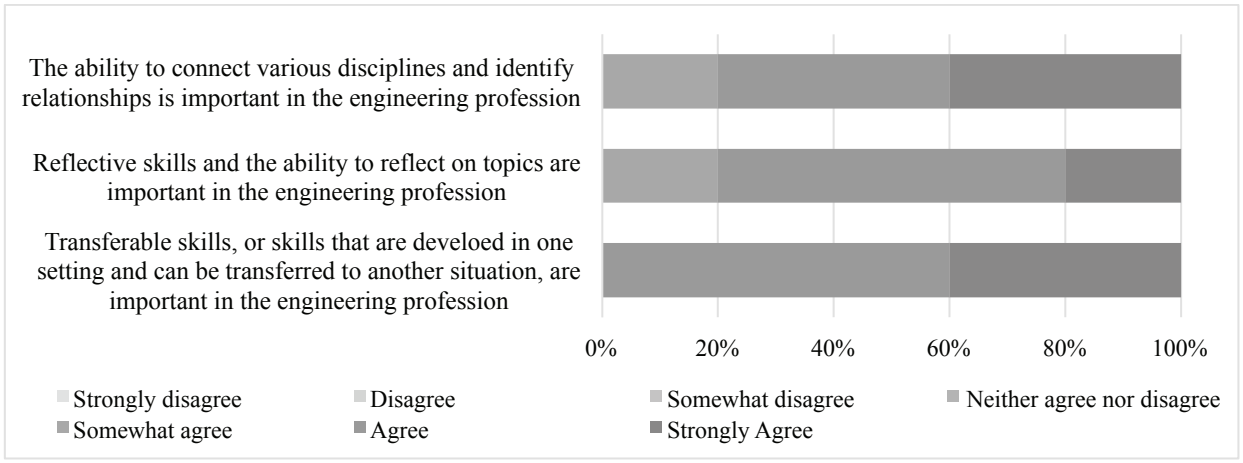

FIGURE 1. Evaluation responses indicating students' views (n=5) on skills in their respective profession.

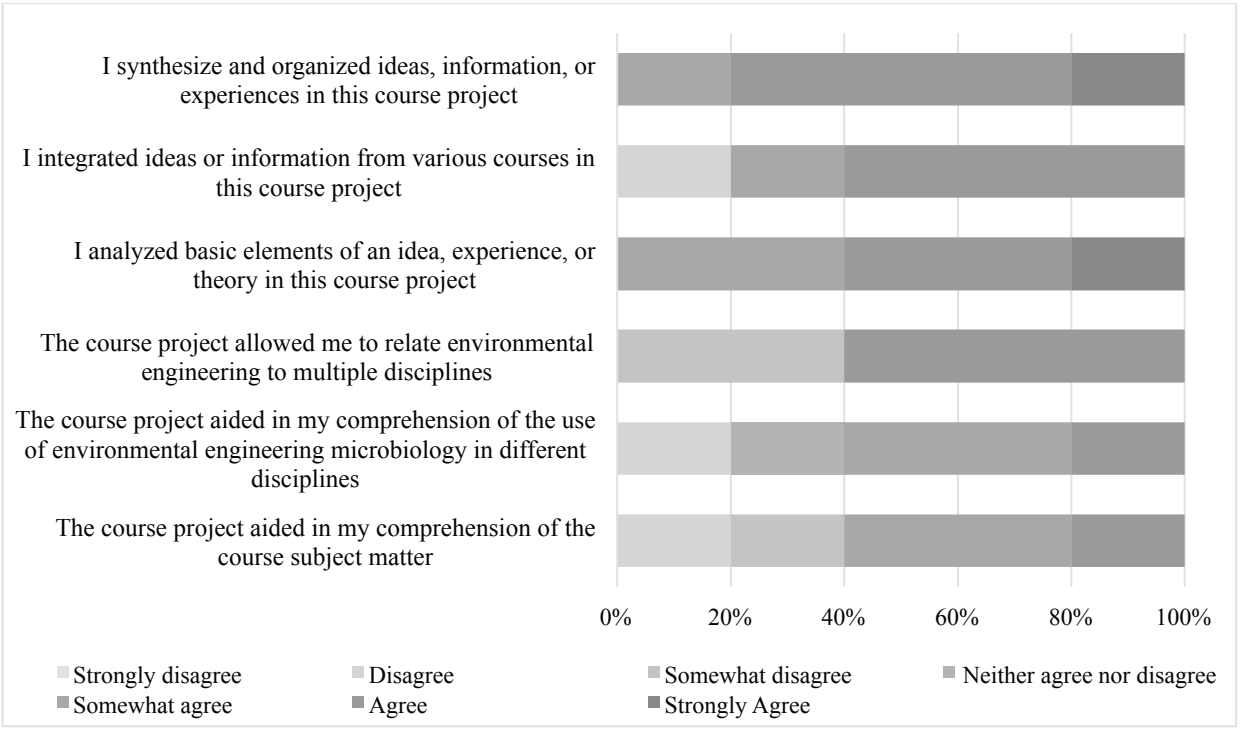

FIGURE 2. Evaluation responses indicating students' perceptions (n=5) of how the course project helped broaden their understanding of the subject.

of the subject matter (6). Students were given access to sample posters typically seen at conferences or summits in their field and were provided a basic template; however, they were given creative freedom on layout, figures, graphs, charts, and how much text they wanted to display on their poster. The oral presentation was to be ten minutes long. This project was worth 25% of the students' overall grades, and a rubric for the project and oral presentation can be found in Appendix 2.

RESULTS

Upon completion of the poster and the in-class presentation, the students voluntarily completed a survey evaluating their perception of the extent to which the course project helped broaden their understanding of environmental engineering microbiology. Since Environmental Engineering is a new degree at the university and this was the first time the course was offered, the class size was small. Consequently, the sample size for the evaluation was limited to one section consisting of six students, though the demographics can be considered representative of the department.

As a whole, the students agree upon the importance of identifying relationships, reflecting upon topics, and transferring skills from one setting to another. Figure 1 indicates that every student at least "Somewhat Agreed" that these abilities are important for their field. Therefore, it is valuable for the project to focus on these skills. Additionally, 80% to 100% of the students at least "Somewhat Agreed" that the course project allowed them to meet the various NSSE Deep Learning components of integrating, analyzing, and synthesizing information that the project set out to accomplish (Fig. 2).

Although the students felt that they accomplished the elements of higher-order learning (relating what you learn to real life situations) and integrative learning (relating what you learn to other scenarios), they did not agree that this aided in their understanding of course material. Figure 2 shows 40% of students at least "Somewhat Disagreed" when asked if the project aided in their comprehension of how their subject matter relates to other disciplines. Since deep learning does not focus on memorizing information for an exam but instead focuses on *why* the information is important, students may not fully understand the benefit of deep learning-driven projects until they are in their profession, where they commonly practice transferable skills.

The course project accomplished the goal of improving students' ability to analyze and communicate information. A variety of students within the biology and microbiology disciplines could benefit from this project by relating a chosen book from the provided reading list or another of their choosing to their field (e.g., a Virology student could tie "I Contain Multitudes" to the impact that various bacteriophages have on the human microbiome). Professors can incorporate this project to expose students to tasks and skills that they will use throughout their career.

SUPPLEMENTAL MATERIALS

Appendix 1: Suggested reading list: microbiology-oriented books
Appendix 2: Course project rubric

ACKNOWLEDGMENTS

The author would like to thank Esther Jordan for her support and the suggestion of implementing an oral poster presentation and the students in this course who voluntarily provided their feedback. The Kennesaw State University Institutional Review Board approved this study (Study #17-529). The author declares that there are no conflicts of interest.

REFERENCES

1. Kuh GD. 2008. *In* LEAP (ed), High-impact educational practices: what they are, who has access to them, and why they matter, 1st ed. Association of American Colleges and Universities, Washington, DC.
2. Ambrose SA, Bridges MW, DiPietro M, Lovett MC, Norman MK. 2010. How learning works: seven research-based principles for smart teaching, 1st ed. Jossey-Bass, San Francisco, CA.
3. Laird TFN, Shoup R, Kuh GD, Schwarz MJ. 2008. The effects of discipline on deep approaches to student learning and college outcomes. Res Higher Educ 49(6):469–494.
4. Gabriel SE. 2014. A modified challenge-based learning approach in a capstone course to improve student satisfaction and engagement. J Microbiol Biol Educ 15(2):316–318.
5. Chan V. 2011. Teaching oral communication in undergraduate science: are we doing enough and doing it right? J Learn Des 4(3):71–79.
6. Stanton JD. 2013. A poster-session review to reinforce course concepts and improve scientific communication skills. J Microbiol Biol Educ 14(1):116–117.