

An Approach to Asynchronous Virtual Scientific Paper Discussions[†]

Kari Debbink

Department of Natural Sciences, Bowie State University, Bowie, MD 20715

Effectively reading and interpreting scientific literature are fundamental skills for students pursuing degrees in STEM fields. In-person classes allow for real-time discussion and dissection of scientific literature; however, with increasing focus on virtual learning environments, alternative approaches are needed to promote student development of these skills. This manuscript presents suggestions for conducting paper discussions in asynchronous environments via learning management system (LMS) message boards. Modifications of this paper discussion activity for different class sizes, educational levels, and assignment goals are included.

INTRODUCTION

Reading scientific papers is a fundamental skill for students in STEM fields (1). Discussion of scientific literature has traditionally been done in person; however, the increase in demand for virtual learning options necessitates alternative approaches to engaging with scientific papers. The coronavirus pandemic has forced most students to transition to online learning environments, which can pose a variety of equity issues that may not allow all learners to participate synchronously in their classes. Different life situations students face that can interfere with synchronous class participation may include caring for family members, unreliable or inconsistent access to technology, and altered work hours.

Synchronous virtual sessions allow for the use of breakout rooms or other group interactions that are compatible with frequently used approaches to undergraduate literature discussions like CREATE (2), Annotation (3), and Figure Facts (4). Figure Facts is most similar to the described approach, which takes a figure-focused approach and requires that students read and fill out a template describing the paper's figures prior to the discussion. However, the discussion part of Figure Facts relies on in-person/synchronous discussion and analysis of the paper, while the approach described here proposes a way to undertake the discussion portion in an asynchronous, online forum, providing greater flexibility for student participation.

This asynchronous, virtual paper discussion activity was designed for use in an undergraduate introductory-level microbiology class that typically has 24 to 35 students, but it could be adapted for any course that reads scientific literature. Students in this class have little previous experience reading scientific literature, so the focus is on developing beginner literature analysis skills. The aims of this activity are to (i) develop students' individual abilities to discern and articulate what they do and do not understand in a scientific article, (ii) facilitate peer–peer discussion that enhances the group's understanding of a scientific paper, and (iii) increase students' self-efficacy in reading scientific literature. To accomplish these aims, students participate in a paper analysis activity using learning management system (LMS) discussion boards in combination with individual pre- and post-discussion analysis and reflection.

PROCEDURE

The course instructor should choose a scientific paper that can be divided according to the class size (individual figures, figure panels, topics, etc...). In an LMS discussion board, a discussion forum for the paper should be created and then a separate thread within the forum for each figure, figure panel, or topic (Fig. 1).

Students should be given access to the paper and the pre-assignment worksheet (Appendix 1). The goal of the pre-assignment worksheet is to allow students to work through the paper individually before entering the discussion with their peers. Using this worksheet, students summarize the aims of the paper, explain each figure, and formulate questions for parts they do not understand. It is important to stress that it is not necessary for students to understand everything in the paper, but that they need to write down specific questions that will facilitate their understanding of

Corresponding author: Mailing address: Department of Natural Sciences, Bowie State University, 14000 Jericho Park Rd., Bowie, MD 20715. Phone: 301-860-3341. E-mail: kdebbink@bowiestate.edu.

Received: 28 September 2020, Accepted: 10 January 2021, Published: 31 March 2021

[†]Supplemental materials available at <http://asmscience.org/jmbe>

confusing figures. This holds them accountable for putting in mental work toward addressing their difficulties. Students submit a copy of their completed pre-assignment worksheet prior to the discussion.

For the discussion, students should be assigned an individual figure or figure panel on which they become the expert (e.g., 1A, 1B, 1C, 2A). Students have two responsibilities within the discussion: to help facilitate peer understanding of the paper and to help facilitate their own understanding of the paper. In order to help their peers understand the paper more thoroughly, each student is instructed to post an explanation that covers the “what/why/how” of their figure for other students (the results of what the researchers did, why they did it, and how they did it). The student is then expected to answer any questions that are posted about their figure within that figure thread. In order to facilitate their own understanding of the paper, students are expected to read through the figure threads, especially for the figures that they did not understand fully and about which they wrote questions during the pre-assignment. Students then post questions on their peers’ figure threads about what they still do not understand. Students are not required to post on all of the threads, but to ensure that everyone participates, the grading rubric (Appendix 2) specifies a certain number of posts that students need to make for answering questions and asking questions about other students’ figures. Since some figures are more challenging than others and elicit more questions, the instructor can ask questions in threads that are not getting student questions so that everyone has an opportunity to answer a question.

The final part of the assignment is a post-assignment reflection (Appendix 3) and is crucial to ensuring that students used the discussion board to further their own understanding of the paper. There are several options for having students reflect on their learning. One option is to have students return to their pre-assignment worksheet and update it with new information and understanding they gleaned from the discussion. Another approach is to have each student write a reflection about the points they struggled with initially and how they came to a better understanding of the paper. Either way, the idea is to encourage students to communicate their own learning process and witness their own growth in understanding difficult material.

In my course, this activity takes 9 to 11 days, divided into several steps. Students are typically given the paper to read at the beginning of the module and are reminded about the pre-assignment a few days before it is due. On the day the pre-assignment is due, students are assigned a figure from the paper. They then have two days to post their figure explanation in the discussion forum thread, another two days to read over the discussion forum and ask questions in the different figure threads, and a further two days to answer questions posted about their figure. Finally, the post-discussion reflection is due two days after questions have been answered. Students are graded as complete/incomplete for doing the pre-assignment worksheet, assigned a percentage grade

based on the rubric for doing the discussion board posts (posting explanation of figure, asking questions, responding to questions), and again graded as complete/incomplete for the post-discussion reflection. The time schedule for different parts of the assignment or the grading scheme could be adjusted based on class schedule and structure.

CONCLUSION

This activity was conducted in a relatively small class, 24 to 35 students. For a larger class, instructors could choose multiple papers and assign students to different paper groups, students could work in groups on a single figure, or students could be given the chance to participate in the asynchronous discussion only if they could not attend a planned synchronous discussion. This activity could also work well with review papers if students are divided into topics within the review rather than by figures. For classes with more experience analyzing primary literature, the grading criteria could be altered to focus more on mastering the scientific concepts or proposing next steps in the research.

Versions of this activity have been used in my microbiology course several times since our university moved to virtual learning in spring 2020. Notably, the first time I did an asynchronous discussion, I did not have students do the pre-assignment. I found that the depth of explanation students provided for the figures and the quality of the questions asked were not meeting my expectations. When I discussed this with my class, students reported feeling overwhelmed by the paper and that they did not know what to ask in the discussion. They mostly focused on their own section and did not make much effort to understand the paper as a whole. To address this, I created the pre-assignment, with the intention of breaking it down into pieces to seem less overwhelming, encouraging students to think more specifically about what their difficulties were, and ensuring that students read the paper in its entirety. After the pre-assignment was implemented, there was a notable increase in quality of discussion board posts and post-assignment responses.

In relation to the aims of the assignment, the pre-assignment and questions posed during the discussion demonstrated that most students were able to articulate the points they did and did not understand in the paper. In addition, students generally did a good job of explaining their figures and answering peer questions in the online forum, helping their peers understand the paper more fully. Finally, students reported that, although doing the pre-assignment was more work, it helped them feel like the paper was more manageable. They also felt less pressure to understand everything in the paper immediately. This, coupled with good discussion board posts, suggests that the activity did help increase self-efficacy for reading and understanding scientific literature. Overall, this assignment helped students develop skills in reading and analyzing papers using an approach that

prioritizes flexibility in participation in order to provide a more equitable learning environment.

SUPPLEMENTAL MATERIALS

- Appendix 1 Figure 1: LMS asynchronous paper discussion organization
- Appendix 2 Pre-assignment worksheet for asynchronous discussions
- Appendix 3 Asynchronous paper discussion rubric
- Appendix 4 Post-discussion reflection assignment options

ACKNOWLEDGMENTS

The author has no conflicts of interest to declare.

REFERENCES

1. Coil D, Wenderoth MP, Cunningham M, Dirks C. 2010. Teaching the process of science: faculty perceptions and an effective methodology. *CBE Life Sci Educ* 9:524–535.
2. Hoskins SG, Lopatto D, Stevens LM. 2011. The C.R.E.A.T.E. approach to primary literature shifts undergraduates' self-assessed ability to read and analyze journal articles, attitudes about science, and epistemological beliefs. *CBE Life Sci Educ* 10:368–378.
3. Kararo M, McCartney M. 2019. Annotated primary scientific literature: a pedagogical tool for undergraduate courses. *PLOS Biol* 17:e3000103.
4. Round JE, Campbell AM. 2013. Figure facts: encouraging undergraduates to take a data-centered approach to reading primary literature. *CBE Life Sci Educ* 12:39–46.