

In Layman's Terms

Teaching Students to Understand the Scientific Literature through Blog-style Writing Assignments

Chadene Z. Tremaglio¹ and Michelle L. Kraczkowski²

¹University of Saint Joseph (ctremaglio@usj.edu)

²Central Connecticut State University (kraczkowski@ccsu.edu)

Abstract

Lay summaries are commonly written by researchers in many disciplines to translate technical scientific concepts into language that can be understood by general audiences. In our first-year introductory biology course, we employed a write-to-learn pedagogy by incorporating a lay summary-style writing assignment that encouraged students to explain the major results of a journal article in their own words, a format we referred to as “blog-style” for our students. We chose to use this format to allow students to focus on understanding, defining and explaining key scientific terminology, without regurgitating technical jargon. Students selected and read a scientific journal article connected to a biotechnology topic at the start of the semester and were given worksheets to complete throughout the semester that guided them in the reading of their article. We also offered in-class workshops that focused on best practices for reading journal articles, how to write for a general audience, and how to avoid plagiarism. Students then composed two-page, lay style summaries highlighting some of the key findings of the articles that they read. This assignment resulted in many students producing engaging, well-written papers that allowed them to demonstrate meaningful understanding of some of the technical terminology and concepts in their articles.

Keywords: Science communication, writing for general audiences, write-to-learn, first year students, introductory biology

Reflective Essay

The ability to effectively communicate is a necessary skill that many college graduates remain deficient in (Kramer & Kusurkar, 2017), and this can have a major impact on their future careers. Increasingly, individuals working in science and medical fields are being called upon to engage in public outreach (e.g., interviews, op-eds, etc.; Brownell et al., 2013a), particularly in the context of the pandemic. Many of the students at our institution are in pre-health professions programs and pursuing careers in patient-facing roles; when they graduate, they will be expected to communicate with patients and the community about complicated medical topics. Thus, we consider the ability to communicate accurately about scientific concepts in a way that can be understood by an inexpert audience an essential skill for our students to develop. However, for many students, learning how to read and write about scientific concepts can be a difficult task that is encumbered by the highly technical nature of these concepts and a lack of familiarity with the associated jargon. As such, when students are asked to interpret scientific writing, they often rely on regurgitating phrases and vocabulary from their sources, thus, never truly demonstrating an understanding of the topic.

To promote students' understanding of complex scientific concepts, we thought it would be beneficial to have them write about such concepts in their own words. This approach to writing has previously been demonstrated to improve student perception of their own understanding of the primary scientific literature as well as their confidence in their writing abilities in an upper-level, undergraduate biology majors course (Brownell et al., 2013b). In the sciences,

prompt
a journal of academic
writing assignments

Volume 8, Issue 1 (2024),
pages 38–44.

DOI: 10.31719/pjaw.v8i1.141
Submitted January 14, 2022; accepted
September 20, 2023; published
February 15, 2024.

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this style of writing is commonly referred to as “lay style” or “lay summary,” where the writer attempts to convey highly technical scientific information to a non-specialist audience. A lay summary focuses on communicating the main findings of a research study in an accessible way, by carefully defining terminology and jargon, and using short sentences to succinctly explain concepts (Tancock, 2018). Given the demonstrated benefits of using this type of writing in the science classroom (Brownell et al., 2013b), we wanted to employ a lay-style writing assignment coupled with reading a scientific journal article in our 100-level biology course, which has heavy enrollment of non-biology, pre-health professions majors. We decided to refer to the writing style we were aiming for as “blog-style” for our students, as blogs are a medium that many students are familiar with, although the analogy to blogging did not extend to publishing the students’ papers online in this version of the assignment. The objectives of this assignment were twofold: first, we aimed to expose them to reading scientific journal articles, a difficult skill that they need to develop as they pursue upper-level coursework, and second, we wanted to give them an opportunity to demonstrate their understanding of the article through writing in a non-technical style. Thus, the overall goal of our Biotechnology Blog Paper assignment was to push students to articulate the key findings of a scientific journal article for a general, non-disciplinary audience.

The Biology Department curriculum at our institution recognizes the importance of developing students’ critical thinking abilities and communication skills and acknowledges the need for focused coursework to achieve these goals. After completing introductory biology, our biology majors take a dedicated scientific writing course, which aims to fulfill these goals by having students read scientific journal articles organized around a selected topic and conduct a meta-analysis in the form of a lengthy term paper. However, biology majors make up a small percentage of students in our introductory biology courses; nearly 85% of students who take this course are pre-health professions majors who do not go on to take the scientific writing course. Therefore, incorporating a writing assignment based on the primary literature in this introductory course serves not only to help prepare our biology majors for more advanced coursework in later semesters, but also gives non-majors the opportunity to benefit from write-to-learn pedagogy and develop their science communication skills. These skills are important for students to learn, regardless of their major, because having a better understanding of their world will help them make informed decisions, ideally with better outcomes (Brownell et al., 2013a). Further, this strategy is in line with the most recent write-to-learn literature that encourages professors to utilize writing as a means to improve student understanding of content across disciplines, as well as to better engage students and stimulate critical thinking (Bean & Melzer, 2021).

A writing-to-learn approach is an often-underutilized tool in science courses, despite strong evidence demonstrating its effectiveness at improving student learning and increasing engagement (Reynolds et al., 2012). We have tried several ways of incorporating writing assignments into our course over the past several years, with varying levels of success. From 2016–2019, these assignments ranged from papers that compared two journal articles on a biotechnology topic to an entire semester dedicated to writing papers in place of exams. Papers replacing exams were shown to improve student perceptions of learning and increase their critical thinking skills (Guttilla Reed et al., *in press*). Despite the value, these alternative assignments have always required a significant investment of time to help students build their reading and writing skills, which can be difficult to carve out of an already packed curriculum. Therefore, in fall of 2020 we set out to design a writing assignment that would feel less daunting to the students while still encouraging the development of their critical thinking, reading, and writing skills. Thus, the Biotechnology Blog Paper assignment was created.

Over the last three years, approximately 350 students in majors spanning biology, nursing, and health sciences have now completed the Biotechnology Blog Paper assignment in our introductory biology course. The assignment constituted their final course project and was the capstone of our biotechnology unit, the last unit of the semester. Students were given the task of reading a scientific journal article and writing a two-page blog-style paper summarizing the significance, key research findings, and conclusions of their article using accessible language. To start, we randomly assigned students to one of five current topics in biotechnology, which included bioengineering, CRISPR gene editing, the genetics of addiction, gut microbiome, and gene therapy. Although we centered our assignment around the topic of biotechnology and selected papers that fit this theme, this assignment is adaptable to nearly any concept of an instructor's choosing and could be done with as few or as many subtopics as desired. Students were then given a choice between two scientific journal articles per topic, which were carefully selected by the instructors. To try to ensure that all articles were roughly equivalent in terms of readability, we tried to select articles with five or fewer figures containing a variety of biotechnology methods. After students selected a journal article, they participated in workshop sessions that introduced them to best practices for reading the scientific literature, gave them guidance on how to write in a lay/blog style, and instructed them on avoiding plagiarism. When discussing blog-style writing, students were shown examples of different writing styles for various audiences, and we offered the advice that they should write as if they were explaining their paper to their family or friends. After the workshops, the students then had approximately three weeks to read their article and write their blog-style summary paper.

For the paper itself, students were instructed to write a two-page blog-style summary of their article that focused on the significance of the study to the general public. We deliberately limited them to two pages to avoid having students write an overview of an entire article. Students were first tasked with developing a QCC (question, conflict, or concern) as a way to frame the major question being researched in their study. This required them to identify the key findings and major conclusions of the study, and then translate these into their own words. Students were encouraged to think about why the average citizen should care about the research. They were told to imagine trying to explain the article to a relative, for example a grandparent. Given the page constraints, we suggested students focus on one or two pieces of scientific data they felt were most important to the study they read. We explained that we were not looking for a perfect, technical understanding of all of the experiments in the article but rather were looking for students to articulate the connection between what the study was examining and why the average person should care about it. Style and clarity were also important, and students were encouraged to write in an engaging manner. We also offered extra credit to students for creating a piece of artwork or a meme to accompany their paper, which was a popular addition to the assignment.

Since its debut in Fall 2020, the Biotechnology Blog Paper assignment has steadily evolved each semester. In our first iteration, we tried introducing the whole assignment during our final unit of the course, which took place during the last four weeks of class. While students were enthusiastic about the informal writing style, many still reported feeling rushed and overwhelmed by trying to understand their journal articles. So, for the Fall 2021 semester, we revamped the assignment by having students start it much earlier in the semester, introducing the assignment in the first week of class, and holding the workshops on reading scientific literature earlier as well. We also provided additional scaffolding to better support students with reading and translating their articles. We created worksheets designed to help students summarize the major sections of their articles, and we made these due throughout the semester to keep them consistently immersed in the assignment. These worksheets tasked students

with defining important jargon, identifying the hypothesis and purpose statements in the introduction, summarizing some of the data in the figures, pointing out the major conclusions of the work, and articulating the significance of the research for a non-disciplinary audience. The final worksheet was an activity on blog-style writing. Students were given timely feedback on the worksheets that focused on clarifying their understanding of each section of their papers.

Adjusting the timeline of the workshops and adding the guiding worksheets seem to have eliminated the student feedback regarding feeling rushed, and we noticed that overall, students had fewer questions regarding the expectations of the assignment. A representative example of an evaluation we received at the end of the semester stated, “The blog paper worksheet assignments in particular were very helpful when it came to writing the final blog paper. All methods and assignments were appropriate, useful, and structured to meet the different learning needs of those in the class.” However, although the worksheets did seem to accomplish the goal of guiding students through a closer reading of their journal articles, some students still reported that they found the articles very challenging to understand, and others continued to struggle with writing the paper.

To identify potential solutions to remaining barriers, this assignment was workshopped in a Universal Design for Learning (UDL) faculty institute before the Fall 2022 semester. For students, journal articles can appear very technical and dry, and we have found that they often approach this task with trepidation and a preconceived sense of defeat. Borrowing from principles of UDL, students were assigned to read articles in groups, rather than on their own, to foster a sense of collaboration and community and provide them with a built-in support network throughout the semester as they worked to understand their articles (CAST, 2018). An in-class peer review session for the papers was also held before the final papers were due, giving students the chance to receive feedback on their writing. Students reviewed each other’s work for clarity and organization on a provided worksheet and students were instructed to use this feedback in revising their paper. A final piece of this activity asked students to compose a brief reflection (~250 words) on the usefulness of the feedback they received to their final paper, and most students reported they found the peer review very helpful. This was unsurprising, as the benefits of peer review for both readers and writers are well-documented across disciplines (Cartney, 2010; Cho & Cho, 2011) and have been shown to be especially successful when guided rubrics are given (Kelly, 2015). The peer review session also gave students valuable insight into different writing styles as they read and explored each other’s work.

Over the course of the many semesters that we have given this assignment, we have observed a majority of students presenting their ideas in a clear and well-organized fashion. However, we have also noted a few common pitfalls that continue to hinder student success. For those that struggled with the assignment, there was a tendency to include too much information or too little. For example, some students continued to use jargon without defining technical terms, while others struggled to find the right amount of experimental details to include, usually erring on the side of including too much. There were also cases of students including a lot of irrelevant information without actually summarizing the key findings of their article and attempts to oversimplify a topic too much. For example, one student described CRISPR as “a DNA sequence” and did not elaborate beyond this point, which is not sufficient to explain what CRISPR is for a non-disciplinary audience. These are issues that could be addressed by the inclusion of a focused paper outlining activity that would help students determine what their paper needs to define and explain in order to accurately demonstrate their understanding of the article they read.

Our overall goal was to create a writing assignment that would help first year students learn to read the scientific literature and allow them to demonstrate critical thinking about

complex scientific topics, without overwhelming them with a lengthy term paper. Our hope was that by interrupting the student impulse to repeat technical phrases from their articles and forcing them to rephrase in their own words, we would help them better understand what they were reading. This assignment also gave students the opportunity to develop science communication skills that many will go on to use in their careers as health-care professionals. Given that blogging is a culturally relevant and familiar medium to this generation of students, the use of a blog-style format seemed like a good fit for our assignment, and we can envision enhancing it in future semesters by having students post their work to a course blog for public dissemination. This would align with recent studies showing that the use of writing and reading blogs in the science classroom improves student perceptions of learning (Garcia et al., 2019), enables students to develop critical thinking skills (Conde-Caballero et al., 2019), and increases self-motivation (Kramer & Kusurkar, 2017). We feel this assignment could be adapted and implemented in virtually any science course to provide students with an opportunity to learn this valuable skill.

ASSIGNMENT

Biotechnology Blog Paper

Throughout the semester you have been working to read and understand a scientific journal article. Now it's time to write about it! For this paper, you will identify a major question, conflict or concern (a "QCC") within your assigned topic and write a focused and engaging blog-style paper explaining how your chosen article attempts to address this question.

What is a blog, and why should you learn how to write one?

Over the past decade, blogs have become increasingly popular sources for science news and analysis because so many of them are written for an "inexpert audience"—non-scientist, everyday folks who are interested in learning more about science! While journal articles are one of the main ways that scientists share their research, they are intended to be read by other scientists and are not written for a general audience. But because so much of research funding comes from Federal tax dollars (like the National Institutes of Health and the National Science Foundation) the general public are entitled to hear about the results, and we have a responsibility as scientists to share them! Learning to communicate about science or any complicated topic in a clear and engaging way will have enormous benefits for your future career, whether that career is in science, education, healthcare, politics, business, etc.

Guidelines

1. Your paper should be ~2 pages, paragraph format only, double-spaced, 12 pt font.
2. Review your Biotech Blog Paper worksheet assignments that you've completed throughout this semester, and re-read your scientific journal article again. These assignments were designed to help you understand the paper and summarize each section individually. Your goal with this blog paper will be to give a high-level summary of the whole paper, so use what you've done so far as a starting point.
3. Develop a 'QCC'—this is a question, conflict, or concern to focus your paper around. For example, if my assigned topic was "Covid-19" and I chose a paper that looked at the sequence of the SARS-CoV-2 virus, I might formulate a question such as, "should we be concerned about the virus mutating?"

4. Write in “Blog Style”. A few tips:

- Think of this as almost investigative reporting work: Who did the research? What did they do? Why/How did they do it?
- Engage the reader: Why should they care about this topic? How might it help them?
- Avoid listing the information that was in the journal article: Interpret, hit the reader with key important information and explain what it means.
- Inform your audience: You should incorporate other sources of information to clarify the knowledge introduced because this is intended for a non-expert audience

5. No quotations. Put everything in your own words by paraphrasing and properly cite the sources in-text and with a reference list.

6. In addition to citing your journal article, you should also be using and citing your textbook (additional *academic* references are welcome). If you incorporate additional information, it should be academic sources only (textbooks, journal articles, agency reports...) DO NOT cite popular websites or Wikipedia (although you are welcome to look these up to help you understand the topic).

7. Have a look at these science blog posts for some inspiration:

- [To Protect an Endangered Snake, First Protect a Venomous One](#)
- [Deadly Spread of Some Cancers may be Driven by a Common Mouth Microbe](#)
- [Chocolate as Poison](#)
- [Tomorrow’s Catch](#)

Extra Credit

Many science bloggers include fun little drawings or comics, or even memes, to illustrate the concepts they are presenting. Create a science meme (check out <https://imgflip.com/memegenerator>) or include your own piece of science art to accompany your piece and earn up to 3 extra credit points on your paper! Keep it relevant to the topic and professional, please!

Grading

Your blog paper will be graded on the following categories:

- **QCC Development (20%):** ‘A’—QCC is clear and easily identifiable, ‘B’—QCC is somewhat clear, ‘C’—QCC is present but weak, ‘D’—QCC is illogical or difficult to identify, ‘F’—No QCC present
- **Understanding of the Topic (45%):** ‘A’—Understanding is clearly demonstrated, ‘B’—Only minor issues with demonstration of understanding, ‘C’—Major issues with demonstration of understanding, ‘D’—Information presented is irrelevant or poorly organized, ‘F’—No understanding of the topic is demonstrated
- **Style and Clarity (25%):** ‘A’—Information is well-organized and style is engaging and fun to read, ‘B’—Information is organized but it is not very engaging, ‘C’—Information is disorganized, and/or style is inappropriate for assignment, ‘D’—Paper is difficult to read, ideas are presented in illogical order, ‘F’—Information is not organized and paper is difficult to read
- **Formatting and Citations (10%):** ‘A’—Citations are present and correctly formatted, ‘B’—Minor issues with citations, ‘C’—Consistent issues with citations, ‘D’—Major issues with citations, ‘F’—No citations

Supplementary Material

For supplementary material accompanying this paper, including a PDF facsimile of the assignment description formatted as the author(s) presented it to students, please visit <https://doi.org/10.31719/pjaw.v8i1.141>.

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