REFLECTING ON CITATIONAL PRACTICE IN BIOLOGY WRITING ASSESSMENTS

ASHLEY B. HEIM

This teaching resource is an assessment in which biology undergraduates engage in self-reflection (and potentially peer reflection, if time allows) on their process of finding sources and generating citations in preparing a literature review for a scientific writing assignment. I originally envisioned it for undergraduate biology courses (introductory or advanced) that include scientific writing assignments with a literature review component. This learner-centered resource would be most effective for an iterative writing assignment in which students have multiple opportunities to receive feedback and revise their writing based on peer and instructor comments. Additionally, this resource is heavily focused on inclusive pedagogy. Here, I adopt Bryan Dewsbury's (2017) definition of inclusive pedagogy as "a philosophy of teaching that provides equal opportunities for all students to have a successful learning experience" (p. 2). Ultimately, the goal of inclusive pedagogy in academia is to improve the retention of underrepresented and underserved undergraduates (Florian & Black-Hawkins, 2011), particularly in science, technology, engineering, and mathematics (STEM) fields (Dewsbury, 2017).

By completing this exercise, students will be able to:

1. Recognize patterns in how they find sources and generate citations within biology, including which search terms they use and which digital pathways they follow.
2. Reflect on how these patterns determine the diversity and breadth of their search results.
3. Search for relevant sources from data repositories, journals, and other publishing venues supporting researchers with underrepresented identities and/or early-career scholars in biology.
4. Discuss how making academia more diverse, equitable, and inclusive will benefit scientific writing (and learning) in biology.

I would also anticipate that students could apply and transfer these aforementioned learning objectives beyond this reflective exercise to other courses and research experiences in biology and other scientific disciplines.

Context

My ideas for this teaching resource draw from my personal experiences as a first-generation undergraduate biology instructor and researcher in biology education. At the time of resource development, I was a postdoctoral associate studying biology education research at Cornell University. I completed a Ph.D. in Biological Education from the University of Northern Colorado in 2020, where I was trained as a discipline-based education researcher. During my time as a Ph.D. student, I had the opportunity to teach a variety of undergraduate courses, from introductory biology lectures and labs for both majors and non-majors to pedagogy-based workshops focused on biology curriculum development.

These ideas were further catalyzed by discussions in the Fall 2021 CIRTL workshop, "Teaching Citational Practice: A Critical Feminist Approach." One journal article I read during this workshop was by Jane Goodman et al. (2014), in which the authors eloquently state,

> Citational practices attribute utterances to distinct speakers, beings, or texts. They also connect temporalities, joining past, present, and future discourses, documents, and performance practices. In so doing, citational practices play a pivotal role in linking particular articulations of subjectivity to wider formations of cultural knowledge and authority. (p. 449)

As instructors, we often require students to include citations in their writing assessments to "give credit where credit is due," and when the information they are including is not "common knowledge." In biology courses, these scientific writing assessments may come in the form of research papers, literature reviews, lab reports, and discussion boards, among others (Armstrong et al., 2008; Brownell et al., 2013; Cronje et al., 2013; Mynlieff et al., 2014). While the importance of citation and avoiding plagiarism is often briefly mentioned on the first day of class and/or in the syllabus across undergraduate science curricula, students are generally not further exposed to the topic of citational practice throughout their courses (Power, 2009). Despite the dearth of research on citational practices in biology fields, training students in proper citational practice and plagiarism avoidance in class has been found to be a valuable and successful teaching approach (Holt, 2012).

Further, we are rarely challenged to critique our citational search practices in biology—whether as students, instructors, or researchers—particularly as these practices relate to inclusive pedagogy and issues of diversity, equity, and inclusion (DEI). While strides have recently been made to improve DEI efforts across academia, white supremacy is still upheld in the biology classroom in our valuing of and bias towards the knowledge and discoveries of white scientists (e.g., through departments' choices of textbooks and teaching materials focusing almost exclusively on the contributions of white scientists), and particularly white men (Nardi, 2021). Additionally, when challenged to reflect on their inclusive pedagogy in the classroom, many instructors argue that active learning is synonymous with inclusive teaching, though Chelsey Nardi (2021) reports that active learning does not inherently account for students' different identities and learning preferences in biology education.

Based on my own experiences, students and scholars in biology have historically found sources and generated citations for their works based on the "status quo" researchers that serve as foundational research pillars within one's field. Rarely are biologists asked to reflect on *why* we select certain sources to support our own ideas and research findings, or *what processes* we use to search for these sources. When we cite the "go-to" authors in our respective fields from the most common resource venues and journals, who or what information are we excluding, and who or what information are we discriminating against? Whose voices and ideas are not being heard because we as academics feel an expectation to always cite the "leading researchers" (i.e., the most well-known researchers whose articles have the most downloads and citations) in our disciplines, or because we have never been asked to reflect on the pathways we use to search for relevant sources? Sometimes, these research pathways may dictate or delimit our knowledge production by narrowing our awareness of all available sources for citation. Mott and Cockayne (2017) beautifully summarize this far-reaching issue: "Careful and conscientious citation is important because the choices we make about whom to cite – and who is then left out of the conversation – directly impact the cultivation of a rich and diverse discipline… " (p. 955).

This is why I've chosen the literature review as a place for students to learn about and intervene in the production of scholarly discourse and community formation in the sciences. Literature reviews are commonly used as stand-alone writing assignments or included as part of a larger writing assignment—e.g., a scientific journal article or lab report—in biology (Colton & Surasinghe, 2014). The literature review serves as an integrated analysis of resources on a

certain topic, and generally provides the reader with a background of relevant research that has been conducted; connections, disagreements, or gaps of knowledge among prior studies; and the significance of the topic in question (University of West Florida University Libraries). While some undergraduate biology course curricula may include class sessions or offer resources dedicated to writing literature reviews, instructors often assume students have this skill upon enrolling in their course and thus spend limited time, if any, discussing how to conduct an effective literature review.

Thus, I have developed a resource for teaching students both the practice and the politics of conducting literature reviews: one that is broad enough to be used across undergraduate biology courses, regardless of topic or level.

Implementation

Ideally, as scaffolding for this exercise, students would already have a foundational knowledge of how to format in-text and end-of-text citations in biology—instructors, particularly those teaching introductory courses, would likely need to provide this instruction themselves. Further, the instructor should dedicate some in-class time to the topic of writing literature reviews (the amount of time dedicated may be dependent on the academic level of the students and their familiarity with literature reviews and scientific research), and what this in-class time looks like may differ across instructors and institutions. For example, instructors could invite science-focused librarians from their institution to discuss and lead activities on the process of writing literature reviews, or alternately, could ask students to read through self-guided learning tutorials and resources focused on how to write literature reviews in biology, such as those provided on the Literature Reviews webpage of the New Jersey Institute of Technology. Whichever format the instructor chooses, discussion of the literature review process in biology should preface students' completion of the self-reflection assignment to more directly address common practices and problem areas of citational practice in the discipline.

Students would then be briefly introduced to the significance of citational practice as well as the importance of diversity, equity, and inclusion in biology. Following that, students can complete the exercise itself, in which they respond to both open- and close-ended prompts that encourage them to reflect on their research pathways when searching for relevant sources to be included in a literature review (e.g., In what venues/data repositories/journals did you initially search for relevant sources? Why did you choose these

venues/data repositories/journals?). I would recommend students first answer the prompts individually in a reflective writing assignment, after which they could share their responses in a paired peer discussion. After responding to these prompts, students are instructed to develop a first draft of a literature review for the writing assignment in question and to potentially add and/or revise a certain number of citations based on their self-reflections; they would then submit both the literature review draft and revised citation list to the instructor. The instructor could provide feedback on the literature reviews and reflective prompts for each individual, including offering suggestions for additional venues/data repositories/journals the student could use to broaden their research pathway(s).

Further, to emphasize to students that citational practice is an iterative and progressive practice, I would recommend that the instructor also compile common limitations or citational patterns they notice across all students' literature reviews and accompanying self-reflections, and that the instructor share these observations with the class as a whole. Ideally, this step would incorporate small-group discussions among students to discuss how to improve the limitations or citational patterns mentioned by the instructor, after which the instructor could offer their own recommendations. Depending on the logistics of the writing assignment, students could also be required to review their peers' writing assignments and provide feedback regarding citational practice using the same questions they answered during the self-reflection task; this step could take place after the whole class discussion, after the instructor reviews each writing assignment, or really at any point in the iterative writing process after students have made revisions. To underscore the learner-centeredness of the assignment, the instructor could also (1) assign multiple peer reviews to each student so that individuals could both compare and provide feedback on their peers' citational practices more broadly, and (2) incorporate more frequent small-group discussions among these peer reviewers in and out of the classroom to discuss feedback in more detail.

Another extension of learner-centeredness could be for instructors to engage students in communal, reflective discussion about how their takeaways from this exercise inform their sense of their own position, identity, and belonging in the biology classroom and scientific community. The instructor could also contribute to the discussion with reflection on their own position in the classroom, modeling this kind of self-reflexivity for students.

Reflective Questions for Instructors

1. What does citational practice look like in your discipline? Did you receive formal training in citational practice and/or plagiarism avoidance in the classroom? Have you incorporated citational practice and/or plagiarism avoidance in the classes you teach? Should more discussion regarding plagiarism be included as part of this activity?
2. What issues related to citational practice and/or inclusive pedagogy have you observed and/or heard about in your discipline? How might you make students more cognizant of these issues?
3. What writing assignments would this activity best align with in your class? What revisions could you make to current writing assignments to more effectively implement this activity in your class (e.g., extending the duration of the assignment, including more revision rounds)?
4. Are there questions that you could add to the activity and/or revise based on your course learning objectives and discipline-specific citational practices?
5. Would your responses to the self-reflection assessment be similar to or different from those of your students? Have you reflected on your own citational practices, and are you conscious of the processes you use to search for relevant citations and your reasons for doing so?

TEACHING RESOURCE

Student-facing Instructions

[Could be presented as PowerPoint slides and/or handouts, depending on the needs and logistics of your course. Instructor-specific notes are included in brackets.]

What is citational practice, and why is it important in biology?

Goodman et al. (2014) define *citational practice* as follows:

> Citational practices attribute utterances to distinct speakers, beings, or texts. They also connect temporalities, joining past, present, and future discourses, documents, and performance practices. In so doing, citational practices play a pivotal role in linking particular articulations of subjectivity to wider formations of cultural knowledge and authority. (p. 449)

In other words, citational practice can be thought of as the norms or expectations of how we cite various sources in our own discipline—for the purposes of this class, we'll focus on citational practice in biology. When we engage in scientific writing, citing allows us to acknowledge the concepts and research findings of others that we use to support our own ideas. Further, proper citational practice allows us to avoid plagiarism of others' resources and intellectual property.

Why are diversity, equity, and inclusion (DEI) important in biology, and how does DEI benefit the field of biology?

As in all scientific disciplines, a diverse, equitable, and inclusive community allows a broader range of voices to be heard, a multitude of perspectives to be shared, and greater accessibility to teaching, learning, and research. Unfortunately, while current DEI efforts are gaining traction across scientific fields—including transformative social change in light of race, ethnicity, class, sexuality, and ability—we fall far short of where we should be.

But how does this relate to citational practices? Well, as Mott and Cockayne (2017) explain, we must be more aware of "the continued underrepresentation and marginalization of women, people of color, and those othered through white heteromasculin[ity]… by focusing on the politics of knowledge and how particular voices and bodies are persistently left out of the conversation altogether" (p. 955). In biology, we are rarely asked to reflect on *why* we select certain citations to support our own ideas and research findings, or *what processes* we use to search for these citations.

By citing the "go-to" authors in our respective fields from the most common resource venues and journals, who and what information are we excluding, and who or what information are we discriminating against? Whose voices and ideas are not being heard because we feel an expectation to always cite the "leading researchers" in our disciplines, or because we have never been asked to reflect on the pathways we use to search for relevant citations? Sometimes, these research pathways may dictate or delimit our knowledge production by narrowing our awareness of all available sources for citation.

For more information regarding diversity in biology, consider visiting the Project Biodiversify website and exploring their numerous teaching and learning resources: https://projectbiodiversify.org/.

Self-Reflection Guidelines

Now that you have completed the first version of your literature review [or other course-specific writing assignment], you are ready to reflect on your citational practice in more detail! The purpose of this exercise is to provide you an opportunity to assess the research pathways that you use to search for sources and generate citations while writing a scientific literature review. Respond to the prompts below in as few or as many words as needed to effectively answer the question.

1. At first glance, do you notice any patterns in the sources you found and/or the citations you generated? Please elaborate.

2. Now, check out the journals or other sources you have cited. Did you cite from a broad range or a limited selection of sources? How recent are the sources that you cited?

3. What did your search process look like?
    a. What search terms did you use to find relevant sources for your literature review?
    b. In what venues/data repositories/journals did you initially search for relevant sources? Why did you choose these venues/data repositories/journals? What digital steps did you follow to access these venues/data repositories/journals?
    c. In what venues/data repositories/journals did you search for relevant sources after your initial search? Why did you choose these venues/data repositories/journals?
    d. Have you engaged in this citational search process before?
        i. If so, in what context? Please explain.
        ii. If not, did your current search process align with your expectations? Please explain.

4. Based on your findings and your answers to the preceding questions, whose voices need to be represented more in biology research citations, and why? Are there other people beyond the "go-to" researchers (e.g., citing Darwin when discussing evolutionary theory) that should be recognized for their contributions to the topic you are focusing on in your writing assignment?

5. How will you use this self-reflection citational activity in future courses or research experiences? How do you envision improving your citational search process over time?

Now that you've had time to reflect on your citational practice, the next step is to potentially make some revisions!

1. Based on the pathway(s) you took to search for relevant sources, what venues/data repositories/journals would you like to incorporate more in your citational research process? Why?
    a. Using these new venues/data repositories/journals, search for additional sources to include in your literature review. What new sources did you find that are relevant to your topic? How do these sources improve your literature review?

2. What new search terms might you use to find relevant sources that you did not use during your initial citational search process?
    a. Using these search terms, search for additional sources to include in your literature review. In which venues/data repositories/journals did you use these new search terms? What new sources did you find that are relevant to your topic? How do these sources improve your literature review?

3. Support diverse research in biology! Try to find a source to include in your literature review that was published in a venue/data repository/journal which highlights research conducted by biologists with underrepresented identities, and/or those who are early-career scholars (e.g., grad students and postdocs!).

    For example, you could focus on one of the biologists featured on Project Biodiversify (https://projectbiodiversify.org/), which highlights the work of researchers with underrepresented identities in biology. How did this new source improve your literature review and overall citational search process?

[The following text pertains to the peer review portion of this activity, which you can include in the student handout if time and logistics permit. Peer review could be incorporated before or after the self-reflection portion of the activity, depending on the goals of the writing assignment. Questions can be added, removed, or revised to better align with the learning objectives of your course writing assignment.]

Peer Review Guidelines

Now that you have reflected on your own citational practice, it's time to offer feedback on the citational practice of a peer! Respond to the prompts below in as few or as many words as needed to effectively answer the question.

1. At first glance, do you notice any patterns in your peer's citational practice? Please elaborate.
2. Now, check out the venues/data repositories/journals they cited from. Did they cite from a broad range or a limited selection of sources? How recent are the sources that they cited?
3. Name one to two venues/data repositories/journals that your peer might find helpful in writing their literature review based on your own citational search process. Why did you choose these venues?
4. List at least five search terms that your peer might find helpful in searching for sources to include, based on the topic of their literature review.
5. What is one thing you learned from your own citational search process that may help your peer broaden or improve their research pathway for this literature review?

[Students could then share their reviews with their assigned peer, who would have the option to revise their writing assignment based on the feedback they received.]

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ASHLEY B. HEIM was a postdoctoral associate in the Department of Ecology and Evolutionary Biology at Cornell University when she developed this resource. Her primary research focuses on the development of an instrument to measure undergraduates' critical thinking in ecology courses, known as the Biology Lab Inventory of Critical Thinking in Ecology (Eco-BLIC). She is also involved in collaborations exploring social networks in physics classrooms, studying how faculty use open education resources, and developing learner-centered curriculum materials for both in-person and virtual biology courses, among others.