CHAPTER 19*

Widening the Threshold:
Using Scholarship as Conversation to Welcome Students to Science

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When thinking about the frames and how I might introduce them to science faculty and students, Scholarship as Conversation was one that seemed easy to understand but unlikely to resonate with them. As I read "… experts understand that a given issue may be characterized by several competing perspectives as part of an ongoing conversation in which information users and creators come together and negotiate meaning,"[1] I imagined it might not be easy to introduce to students of science and engineering, since a rather popular conception is that there are singular answers in science. As Graff and Birkenstein write, "Despite the importance of argument in scientific writing, newcomers to the genre often see it solely as a means for communicating uncontroversial, objective facts."[2] To my surprise, however, after speaking with students and faculty, this concept did resonate well, and I believe it can help us address some critical questions of importance to both scientists and students. In fact, it is a concept that can irreversibly transform how students see scientific research and themselves as participants in it. Seeing themselves as participants helps them through a threshold not only for information literacy but for research education as well.[3]

Anyone who has ever had a conversation about evolution, vaccines, or climate change has probably heard "but it's just a theory!" Expert scientists are comfortable with ambiguity and multiple answers. Thus, the gap between

fact and conversation is not unfamiliar to scientists or students. But how do we bridge the gap between "it's just a theory" and expert comfort with ambiguity? The concept of scholarship as a conversation can help get us there. Moreover, opening the conversation with faculty members by acknowledging this gap can help librarians draw clear connections between their interest in enhancing students' information literacy and science faculty members' interest in scientific literacy. This point of connection can serve as a foundation for further discussion of information literacy.

Moreover, by positing scientific scholarly work as a conversation, something with expected conventions, styles, and approaches, we can help students begin to value their own potential contributions to the conversation and see themselves as contributors to and participants in science, rather than as outsiders looking in at an inhuman process that has always been driven by truth. By positing the scientific scholarship as a conversation, we can make it more vivid to students that science is a product of people. This both encourages students to feel like they could contribute to science—that their questions and unique perspectives have something to add to the conversation—and to feel that it is perhaps less intimidating and more meaningful.

What does Scholarship as a Conversation look like in the sciences?

Perhaps most challenging for many students accustomed to traditional methods of science and engineering is the idea of a lack of a single uncontested answer. While there is an active movement to increase active learning in the sciences and teach science in a way that encourages investigation rather than simple reception of facts, this change will take time to fully permeate the classroom. No matter how science is taught in the classroom, textbooks, the medium through which most students encounter science, also typically present science as an uncontested, non-controversial series of facts.[4] Or, textbooks may highlight occasional controversies as special features, which tends to visually suggest that argument is not a normal part of science but an exceptional one. As well as these aspects of presentation, there are aspects of science that functionally have single uncontested answers. A mouse is a mouse; an ecosystem is usually classifiable; water is a gas, liquid, or solid under knowable conditions. These facts form the foundation from which scientific investigation is conducted, but especially for students who are at the early stages of learning to become scientists, they can be mistaken for science. Thus, for many students understanding that there are complex problems with many possible perspectives is more difficult. But this is a key shift for students who want to join the scientific

community of practice. "Creating and negotiating meaning" is a phrase that is not really commonly used in science, but which accurately describes the attempt to make sense of phenomena on the borders of our knowledge and understanding.[5] So what does it look like when a science or engineering student has grasped the concept that scholarship is a conversation?

Certainly, many of the knowledge practices listed in the Framework are quite directly and easily applicable to the scientific context: citing the contributing work of others, for example, or practicing contributing to the scholarly contribution at an appropriate level via poster sessions, presentations, or lab reports. However, some of the knowledge practices for this frame can be more challenging for students in the sciences to understand. For example, the knowledge practices "identify the contribution that particular articles, books, and other scholarly pieces make to disciplinary knowledge" (in a way more complex than venerating Darwin or Newton), or "summarize the changes in scholarly perspectives over time on a particular topic within a specific discipline," are not necessarily phrased in ways that are particularly resonant with the sciences, and moreover are challenging to students who may even struggle to read and understand complex technical peer-reviewed articles, the sciences' form of primary literature.[6] But thinking about these skills in the context of a literature review or a research proposal explaining how a new question arises out of existing research can help make them clearly relevant to students in the sciences. Similarly, recognizing that the conversation is not just scientists presenting facts to each other but rather a conversation with disputes that may be resolved, may take a field in a new direction, or may never be resolved is very challenging, particularly for students encountering the primary literature for the first time. Another key knowledge practice that students can find challenging is identifying barriers to participation in the conversation. Students may find it quite easy to identify material barriers to participation in the scholarly conversation of science—for example, lack of access to a lab, equipment, or software would be a challenge to participation in the scholarly conversation. But it can be more challenging for students to identify social barriers to participation, such as exclusion due to race, gender, sexual orientation, religion, and socioeconomic status, and yet it is key for students in the sciences to recognize that these barriers exist.

Learner dispositions for this frame identified in the Framework, too, range widely in their ease of applicability to the sciences. Recognizing that they are entering an unfinished conversation is likely to be challenging to students who perceive science as a series of fact-based, finished projects. Seeking out conversations taking place in a research area is something many undergraduate science students do, although they may struggle as undergraduates to seek out conversations in the peer-reviewed literature, rather than, say, a reputable magazine like *Scientific American* or *ScienceNews*. The emphasis on

the peer-reviewed literature from professors and librarians, too, may make it hard for students to recognize that there are other venues to participate in the conversation, such as data sets, conferences, scholarly blogs, disciplinary listservs, and technical documentation.

But what I think is particularly key for making the conversation more inclusive is for students in the sciences to develop two dispositions in particular, to:

- "see themselves as contributors to scholarship rather than only consumers of it;"
- "recognize that systems privilege authorities and that not having a fluency in the language and process of a discipline disempowers their ability to participate and engage."[7]

The latter is a point students may particularly quickly understand, since their experience engaging with the peer-reviewed literature usually makes that point quite clearly. While students often appreciate and capitalize on the highly structured nature of peer-reviewed scientific articles to read just what they find essential, other aspects of the language and norms of the discipline can be frustrating and opaque. Struggling to cope with dense jargon, decoding graphs, and managing an extensive if precise and technical vocabulary, students are immediately and personally confronted with the challenge of entering a discipline without fluency.

Understanding that mastering the language of science is a key to entering the scientific conversation is a foundational part of students recognizing that they themselves can contribute knowledge, and it is also a way to relate the concept to faculty members who often have vivid memories of the experience of mastering the language of science. As Hope Jahren wrote in *Lab Girl,* reminiscing about learning to write as a faculty member, "I have become proficient at producing a rare species of prose capable of distilling ten years of work by five people into six published pages, written in a language that very few people can read and that no one ever speaks."[8] Instructors can conceptualize this challenge as learning a language to take part in a conversation. Students can then learn that this is a conversation with rules that are constructed by people. Consequently, students can also learn that those rules are therefore changeable if needed, and this can help students understand that their difficulties in joining the conversation, or following the conversations' rules, are not fundamental deficiencies of their own, but rather learned skills that challenge all nascent scientists. Knowing that the rules are changeable means students can perhaps better see a place for themselves in the conversation. Historically, the conversation of science has been shaped by a very narrow sliver of race, class, sexuality, and gender expectations. To know that the conversation is shaped, and that historically only certain participants—or in some cases participants able to present themselves in certain ways—were permitted to enter it, can help student see that the way science is investigated and communicated isn't

inevitable, perfect, or permanent. It can help them see that science could use their voices, and that the questions and concerns they have to add to the conversation can shape and re-create the conversation. Seeing oneself as a contributor to knowledge is a threshold concept not just for information literacy but also for becoming a researcher, and offers another way for librarians to approach this frame in conversation with faculty members.[9]

Consequently, of the practices and dispositions in the frame Scholarship as Conversation, it is the practice of identifying barriers to participation and the dispositions of recognizing the ways systems privilege authority and of recognizing oneself as a contributor that I would like to focus on, both as a way of improving information literacy and as a way of making science more inclusive.

So how has the library community discussed Scholarship as a Conversation?

While some of the notions of who is permitted to join conversations, and the mechanism of the scientific conversation are less familiar to students, the notion of scholarship as a conversation has a long history both within and without the library. Indeed, one of the classic "how to write like a scholar" books is titled *They Say, I Say*, and its central framing device is derived from Kenneth Burke's ideas of scholarship as a conversational parlor.[10] In this conception, Burke presents scholarship as a long-running discussion taking place in a room, which the scholar can enter, then listen, contribute, and, eventually, depart: "Someone answers; you answer him; another comes to your defense…"[11]

Within the library scholarship, the idea of scholarship as a conversation has been explored both since and before the development of the Framework. Much of the pre-Framework conversation, like *They Say, I Say*, has focused on the conversation idea as a way of framing argumentative writing that empowers students and reframes sources as something integral to developing arguments, rather than as decorations added after an argument has been constructed. McMillen and Hill discussed the idea of research as a conversation in the context of a collaboration between the libraries and the composition program at the Oregon State University; they, too, frame the idea of research in terms of the Burkean parlor.[12] Atwood and Crosetto, for example, similarly explore teaching personal voice as part of library instruction in composition.[13] They suggest that librarians and composition instructors share a common goal of students developing a personal voice that yet acknowledges the existence of other arguments and evidence; I would go beyond this and say librarians and any instructor share this goal. Despite the relatively recent establishment of the Framework, the concept of scholarship as a conversation is certainly one familiar in the library world.

How has the scholarly conversation been shaped in science?

The conversational norm in science is rooted in a very particular genre, the peer-reviewed scholarly article. While there are other methods of communicating science, the peer-reviewed article has long established priority and seriousness of investigation. This format did not spring out of nothing; it developed from an epistolary tradition of scholarship, in which savants, scholars, and natural philosophers maintained a written conversation, also known as the invisible college.[14] These letters would have been circulated, broadening their audience beyond one or two, but still remaining relatively limited. Eventually, this tradition grew into a journal format, moving from the communications just of a scholarly society such as the Royal Society. While the journal format broadened the reach and opened the conversation, participants were still limited. Class, race, religion, sexual orientation, and gender presentation all constituted barriers to participation. The journal published the apparently objective word of gentleman, verified by experiment, in the form of the article.

Indeed, while the format of the journal article has changed since the first issue of the *Proceedings of the Royal Society*, the first English-language journal, and one that largely aligns with what we think of as science (though at the time it would have been termed natural philosophy), many of the underlying ideas remain. The veneer of objectivity remains an important part of scientific publishing: today's ideal journal still publishes the word verified by the experiment, pruned as cleanly as possible of any intrusions of the scientist's self.

One might argue that the stripping of the self from the article would allow the broadest possible participation. If scientific articles take no account of the self, then what could be easier to join from the margins? But this is a false premise. The person who writes the article participates in a community of practice, and the article is only the fruit of a long process of growth.

Ultimately, articles are inseparable from their authors, who must do research, process data, and write in the company of other humans and their attendant preconceptions and biases. Underlying the conversation of the article is a deeper daily conversation that does not allow full and equal participation. Scientists who transition genders recount experiences where their work is suddenly evaluated differently after transition. Ben Barres, for example, writes of a situation where he overhead a colleague, unaware of his transition, explain that Ben's work was much better than his sister's.[15] Yet the person who wrote it did not change. From the beginning, then, the journal article grew out of the written conversation of economically privileged white men

who, at a minimum, presented as cisgender, heterosexual, and of the religious tradition most accepted in their home countries. There have always been exceptions and people who paid dearly to join the community, of course. But this is at the root.

Acknowledging that root can make it clear that structures that *still* do not fit a wide swathe of humanity do not fit because of a problem in the structure, rather than a problem with the humans who seek to participate. Understanding these barriers as constructions are essential for making it possible for students likely to be marginalized to see themselves as contributors to the scholarly conversation. So, by making it clear that the participants in the scholarly conversation are privileged in different ways, we can make science more welcoming. But how do we actually make this clear?

Exploring the conversation of science

When teaching, I approach these questions in several ways, depending on the amount of time available and the scope of a class session. In situations with repeated, long-term contact, one approach that has been successful is using an activity inspired by the BEAM method, which asks students to assess how citations are used, fitting them into one of four categories (Background, Exhibit, Argument, and Method).[16] I explored this approach in a biology course that is team taught with a colleague, where we had three sessions with upper division undergraduates. Our underlying approach is inspired by BEAM, although we modified the form greatly. Our goal is that at the end of the session students understand why a particular citation has been chosen. Rather than asking students to categorize citations into one of four categories, we simply asked small groups of students to look at particular sections of an article and identify why articles have been cited in each section. Because there is a fairly significant barrier to reading an entire article in class, we have typically sought to use an article students have already read and split the class up into at least four sections that each take responsibility for a section: the introduction, methods, results, and conclusion. Depending on the article and class, one might choose to swap the results section for the literature review. While each section has a set of tailored questions, there are one or two that are consistent throughout the exercise, asking students the general purpose of citations in that paragraph and asking them to select one citation and explore in depth why it might have been selected. By using a carefully selected article, one can elicit questions and conversations that give rise to reflection about who is participating in the conversation and how. For example, students notice when a particular person is repeatedly cited or when the author cites themselves frequently.

These observations serve as introductions to discussion about participation in the conversation of scholarship and how particular voices come be rendered important. For example, discussing self-citation prompted a conversation about how self-citation can lead to more citation by others and the way that particular behavior is gendered.[17] I asked students why self-citation might happen, and they identified several reasons, ranging from a narrow specialization in which there are no other experts, a research project building on past experiments, and also gendered behavior. Students reflected on issues of who is permitted to brag, to claim their own authority, and establish themselves as experts. Other questions raised by this citation analysis touched on status and class access to the conversation. For example, in a discussion about standard techniques for affixing motion-trackers to turtles, students wondered about laboratory technicians and their ability to participate in the conversation, when they noticed that in their experience it is lab techs who do much of this kind of work but are rarely credited as authors or invited to participate in larger conversations. This was an opportunity for students to reflect on how people might choose research collaborators, and indeed who counts as a collaborator. It sparked their beginning to think about how authorship credit is impacted by social expectations and biases. This, in turn, can help students see that citation and collaboration are not markers solely of virtue but of social forces.

Another activity that has worked well begins by exploring a controversy or question that is influenced by whose voice is privileged in science as a case study. Students might be given a short description of a scholarly scenario in which issues of identity are interwoven and a set of questions including:

- What is the current state of knowledge around the question?
- Who are the participants in investigating the question?
    - What stake do they have in it?
    - What perspectives and background do the participants bring to the question at hand?
    - How do they interact with each other?
- How do these perspectives and backgrounds enrich the conversation? How might they facilitate or obstruct entry into the scholarly conversation?
- What related questions remain unasked?

These scenarios might be current or they might take a more historical approach. Examples might include any of the following:

- the field of animal behavior, and how long it took to acknowledge, record, and investigate widespread and behaviorally important same-sex sexual behaviors in animals;[18]
- the field of Arctic ecology, and how long it is taking to integrate indigenous perspectives and what has consequently been missed when, for example, university climate change scholars assert that

indigenous populations have "little understanding of the history of the earth;"[19]

- human biology, exercise science,[20] and medical research,[21] in which typical subjects have until recently been male, to avoid the confusion that female hormones might add to research, ignoring the fact that male hormones exist and affect the body, and that half of most drug recipients will, in fact, not be male, leading to a limited understanding of male hormonal processes, and medications that may not work as expected in women;
- in medicine, where members of minority racial groups have long received subpar pain treatment.[22]

These activities are very structured and take place in a course where we have several sessions and a relatively free hand with content.

What can one do in one-shots or sessions where most of the content is fixed and pre-determined? A few well-placed discussion questions can at least raise awareness of the issues and is a method I commonly employ. Graff and Birkenstein suggest simply asking questions that frame a question in terms of a conversation; they suggest asking who an author is responding to, rather than what the author's argument is, for example.[23] They found that when phrased this way, students were able to participate in a more lively conversation where they intelligently questioned the author's point of view, discovered other alternative points of view, or developed their own unique views rather than painfully summarizing.[24] This method of foregrounding the academic conversation forces students to engage with the idea of authors as part of something larger, rather than isolated pieces. Librarians can take advantage of this approach. Discussing forward citation tracking is already a frequent part of my instruction in the sciences, given the emphasis on currency in the sciences, and it offers an opportunity to clearly raise questions about who is responding to whom and why. Making the approach more explicit helps highlight the idea of scholarship as a conversation. Using these small opportunities, we can intertwine conversations about why certain voices might be listened to above others in a standard discussion of forward and backward citation chaining. Why is someone's contribution to the conversation enshrined in a citation while others are not? Beyond relevance and currency, what other factors are brought to bear on who can participate? Understanding and identifying these factors can be a struggle for students when there is only time for short discussions, so it is important to have some guiding questions to elicit these points in the classroom. For students, once grasped, this point can encourage them to seek out additional points of view, searching beyond simply citation chaining backward and forward. Indeed, in my own practice as an author, I find thinking about these questions makes me more mindful of who I am citing and encourages me to search for more perspectives.

Assessment

I have found that more informal assessments work well to assess whether students are developing dispositions and knowledge practices that align with these ideas. Think-pair-share has been a particularly effective approach for formative assessment, since it gives students scope to explore their ideas. In this technique, students are asked to think about a question, discuss it with a partner, and then join a larger, full group conversation. Because this classroom assessment technique lets all the students engage and share their insights, and is especially well suited when a range of potential opinions and insights can be shared, it is a good fit for these courses.[25] Because students exchange and discuss opinions, it allows them to refine their thoughts and explore others' points of views, and in the sharing phase, it allows the librarian to hear student perspectives, assess the overall grasp of key ideas, address anything missing or misunderstood, and use the current conversation to segue into the next topic.[26] For this activity, I would expect to hear students identify both material and immaterial barriers to participation in science, in particular how language and stylistic conventions are useful both to present complex ideas concisely, but also function to exclude many participants from the conversation. Any of the questions used in the activities described above would be potentially applicable here, and librarians might also choose to ask students to take a moment at the end of a session to ask what, in particular, they can add to the conversation. What unique perspectives do they bring to science? In this case, I would hope to hear students reflect on how their experiences and concerns can bring a useful perspective to science and potentially address new questions.

If the context is one where the librarian has more time with the class, perhaps a credit course or a recurring session, another classroom assessment option that could work well is the invented dialogue. In this technique, described by Bowles-Terry and Kvenild, students are asked to create dialogues with an imagined partner in order to explain a challenging concept.[27] One might ask students, for example, to imagine they are explaining the habits and practices of participation in the scientific scholarly conversation to a newer student. If students have crossed or begun to cross this threshold, I would hope to see students identifying barriers, both material and immaterial, to participating in the scholarly conversation and explaining that scientists must learn particular language and conversational conventions to participate in the scholarly debate. This assessment demands time from the student and time from the teaching librarian to read, assess, and follow up with feedback, so it may be difficult to stage in one-shots or other short engagements.[28]

Conclusion

By explicitly discussing who participates in the scientific scholarly conversation, and how the conversation developed in a way that privileges certain voices, we can help students understand both how to work better within the system as it is, and how to think about possibilities for change and why there is an urgent need to broaden the pool of voices. While this is a narrow aspect of the frame Scholarship as Conversation, it is an aspect that can have a significant effect on students and is deeply transformative. Crossing the threshold of seeing themselves as participants in research is a transition for both nascent scientists developing their identity as a research and for students becoming information literate. Moreover, crossing this threshold can lead to a greater sense of inclusion and, consequently, increased retention of underrepresented students in the sciences. This retention can lead to wider pool of voices that will increase the scope of questions in the sciences, enhance the quality of work done, and simply make sure that more students have the opportunity to explore their interests in full.

Notes

1. Association of College and Research Libraries (ACRL), *Framework for Information Literacy for Higher Education*, February 2, 2015, http://www.ala.org/acrl/standards/ilframework.
2. Gerald Graff and Cathy Birkenstein, *They Say, I Say: The Moves That Matter in Academic Writing*, 2nd ed. (New York: W. W. Norton & Company, 2009), 158.
3. Kristine Alpi and Chad Hoggan, "Recognizing the Value of Threshold Concepts: Application of a Conceptual Tool to Professional Students Learning to Be Researchers," *The Reference Librarian* 57, no. 2 (April 2, 2016): 121–122, doi:10.1080/02763877.2016.1121070.
4. Graff and Birkenstein, *They Say, I Say*, 158.
5. ACRL, *Framework for Information Literacy for Higher Education*.
6. Ibid.
7. Ibid.
8. Hope Jahren, *Lab Girl* (New York: Alfred A. Knopf, 2016), 63.
9. Alpi and Hoggan, "Recognizing the Value of Threshold Concepts"; Margaret Kiley and Gina Wisker, "Threshold Concepts in Research Education and Evidence of Threshold Crossing," *Higher Education Research & Development* 28, no. 4 (August 1, 2009): 431–41, doi:10.1080/07294360903067930.
10. Graff and Birkenstein, *They Say, I Say*; Kenneth Burke, *The Philosophy of Literary Form: Studies in Symbolic Action* (Baton Rouge: Louisiana State University Press, 1941).
11. Burke, *The Philosophy of Literary Form*, 110.
12. Paula S. McMillen and Eric Hill, "Why Teach 'Research as a Conversation' in Freshman Composition Courses? A Metaphor to Help Librarians and Composition

Instructors Develop a Shared Model," *Research Strategies* 20, no. 1–2 (2004): 3–22, doi:10.1016/j.resstr.2005.07.005.
13. Thomas A. Atwood and Alice Crosetto, "How to Address 'I've Already Written My Paper, Now I Just Need to Find Some Sources': Teaching Personal Voice through Library Instruction," *College & Undergraduate Libraries* 16, no. 4 (2009): 322–28.
14. David A. Kronick, "The Commerce of Letters: Networks and 'Invisible Colleges' in Seventeenth- and Eighteenth-Century Europe," *The Library Quarterly: Information, Community, Policy* 71, no. 1 (2001): 28–43.
15. Ben A. Barres, "Does Gender Matter?," *Nature* 442, no. 7099 (July 13, 2006): 134, doi:10.1038/442133a.
16. Kate Rubick, "Flashlight: Using Bizup's BEAM to Illuminate the Rhetoric of Research," *Reference Services Review* 43, no. 1 (February 5, 2015): 98–111, doi:10.1108/RSR-10-2014-0047.
17. Robin Wilson, "Lowered Cites," *The Chronicle of Higher Education*, March 17, 2014, http://www.chronicle.com/article/New-Gender-Gap-in-Scholarship/145311.
18. Joan Roughgarden, *Evolution's Rainbow: Diversity, Gender, and Sexuality in Nature and People* (University of California Press, 2013).
19. Elaine Bielawski, "Inuit Indigenous Knowledge and Science in the Arctic," in *Naked Science: Anthropological Inquiry into Boundaries, Power and Knowledge*, ed. Laura Nader (New York: Routledge, 1996), 224.
20. Bethany Brookshire, "Women in Sports Are Often Underrepresented in Science," *Science News*, accessed June 18, 2016, https://www.sciencenews.org/blog/scicurious?mode=blog&context=131; Joseph T. Costello, Francois Bieuzen, and Chris M. Bleakley, "Where Are All the Female Participants in Sports and Exercise Medicine Research?," *European Journal of Sport Science* 14, no. 8 (November 17, 2014): 847–51, doi:10.1080/17461391.2014.911354.
21. Paula Johnson, Therese Fitzgerald, Alina Salganicoff, Susan F. Wood, and Jill M. Goldstein, *Sex-Specific Medical Research: Why Women's Health Can't Wait: A Report of the Mary Horrigan Connors Center for Women's Health & Gender Biology at Brigham and Women's Hospital* (Brigham and Women's Hospital, 2014), http://www.wisdombog.com/pdf/11200415250.pdf.
22. Vence L. Bonham, "Race, Ethnicity, and Pain Treatment: Striving to Understand the Causes and Solutions to the Disparities in Pain Treatment," *The Journal of Law, Medicine & Ethics* 28 (March 1, 2001): 52–68, doi:10.1111/j.1748-720X.2001.tb00039.x.
23. Graff and Birkenstein, *They Say, I Say*, 145–46.
24. Ibid.
25. Melissa Bowles-Terry and Cassandra Kvenild, *Classroom Assessment Techniques for Librarians* (Chicago, Illinois: Association of College and Research Libraries, 2015), 32.
26. Ibid., 34.
27. Ibid., 54.
28. Ibid., 56.