The Synapse: Intercollegiate science magazine

Volume 12 | Issue 1 Article 16

2017

Expanding the Job of a Scientist: A Call for Explicit Writing Instruction in Undergraduate STEM Education

Ally Fulton

Expanding the Job of a Scientist

A Call for Explicit Writing Instruction in Undergraduate STEM Education

Written by Ally Fulton
Illustrated by Sulan Wu

When Joshua Schimel was an Assistant Professor at the University of Alaska, the oil tanker *Exxon Valdez* crashed into Bligh Reef, spilling 10.8 million gallons of crude oil into the sea. Schimel, along with most Alaskan scientists, became part of the damage assessment crew. He was told by lawyers that his job was not to gather data, but to gather evidence. By putting himself in the shoes of lawyers and politicians dealing with the disaster, Schimel came to understand the different set of pressures these executives were under: "Effecting change means working in their world, not expecting them to work in ours."

While it is unrealistic for every scientist to learn the intricate ropes of America's elite political and corporate circles, it is essential for scientists to both see the outcome of their research from the point of view of those implicated by the findings and communicate to them in such a way as to enact change. As the 2016 election made blatantly clear, scientific issues such as climate change are absent from the main concerns of politicians and the general public. Does this mean science communication has failed to convince most Americans of the truths enmeshed in the data?

Not necessarily, for the fabric of American culture is threaded with science-fiction books and movies, science and natural history museums, and countless camps and school programs that highlight the thrills of science. Yet somehow this love for science cannot find a footing in national politics. Why is our science communication failing us?

The roadblocks that inhibit effective scientific communication are twofold. As Schimel speaks to, one reason is that scientists often get caught up writing and speaking only to other scientists; they are stuck in an unpoppable bubble of scientific expertise. The job of the scientist has been established as one that is limited to grant writing, publishing journal articles, getting cited, advising graduate students, and running research labs, condemns Dr. Jonathan Foley, the director of the California Academy of Sciences, in a letter written to fellow scientists. Second, scientists, clouded in an air of expertise, lack an awareness of the needs of the American populace. They beat data over the public's head to convince them of the truth, and the need to enact societal change. Yet scientists do not situate the data within the emotional, needs-based framework that drives the daily life choices of the general public.

The Guardian's Robert P. Grant questions such a move when he asks how many scientists are "willing to step outside their cozy little bubbles and make an effort to reach people where they are, where they are confused and hurting; where they *need*?" And this is our entry point: to learn to attend to the emotions of the people who will be affected and influenced by these scientific discoveries by *listening* to their concerns. It's in these instances where, as difficult as it may be, the facts and the truths must be set aside to allow for a space to understand the compassionate human dimension of science. With this in mind, we can expand the job of the scientist laid out by Dr. Foley to include communicating science to the public in a manner that bridges their interests, commitments, and needs to the facts of the data.

Not only is this part of our "social compact" as scientists, as Dr. Foley suggests, but becoming better communicators actually makes us better scientists because it promotes big picture thinking. With big picture thinking we are better able to understand how each specialized science sector fits into the whole. In effect, we become more creative problem solvers and critical thinkers. Effective communication skills must be recognized as an essential component of the core professional skills for science students. While a few science communication courses are slowly being layered into the curriculum as electives at universities and colleges across the country, a gaping hole in the curriculum remains that needs renewed attention, particularly at the undergraduate level.

One of the biggest hurdles in science education is getting students to root their thinking in concepts, rather than in a pile of facts to be memorized. This becomes a challenge when science communication is absent from the core curriculum. This approach, described in a paper published in "Life Science Education" as *learning-to-write*, should take the back seat to the *writing-to-learn* approach, which uses writing as a tool to develop students' comprehension of broad concepts and to engage students in the transfer of knowledge from one context to another by drawing out core principles and applying them to different situations.

To patch this gaping hole in the curriculum, institutions and science departments must begin to attend to science rhetorically. To do this, all writing and speaking assignments need to be situated in definitive contexts, with an identified audience, purpose, and, most importantly, an objective. Students must also work toward becoming self-regulated learners, meaning they must frequently reflect on their own writing and learning process. To foster this sort of thinking in the classroom, students need to engage in assignments that call for reflection on their beliefs about knowledge and its production and application.

Stanford University is actively working toward incorporating this sort of explicit writing instruction into their science

curriculum. The Immunology Program in the School of Medicine at the University implemented a neuroimmunology course for undergraduate and graduate students that gave students the opportunity to develop skills for writing to a general audience. The course asked students to attend expert-taught lectures in the field of neuroimmunology, read primary scientific papers that described critical advances in the field, and write *New York Times* "Science Tuesday" styled articles directed at a general audience that would summarize key aspects of the primary source and the implications of its findings. All assignments were subject to feedback from teaching assistants, peers, and "general audience" members (students who hadn't taken college level biology), and revision was mandatory to normalize the reflexive process of writing.

Like Stanford, the University of Wisconsin Madison (UWM) is committed to making writing a primary focus in the science curriculum, though through an outside avenue: a strong partnership with the University's Writing Center. The Writing Center is uniquely positioned to access the student body through multiple levels, from workshops to individual sessions, so they train their staff on how to work with scientific writing. While there are many stories of fruitful writing center sessions, one partnership stands out. Described in a blog post by UWM Writing Center tutor Amber Meneses-Hall, the partnership was between Zachary Marshall, a Writing Center tutor, and Tara Davenport, an Environmental Studies graduate student working on her dissertation. When Tara thought about her science education, she came to the conclusion that "Often in science, the emphasis is on the presentation and analysis of the data rather than making sure the document itself is structured and written in a way that makes sense." With her dissertation, she appreciated the Writing Center's help in organizing her ideas so that they flowed logically, what she deemed "science with structure".

As these examples highlight, there are many avenues to incorporating writing into the science curriculum at the undergraduate level. Though both of these initiatives are from large research universities, liberal arts colleges like Oberlin and Denison are uniquely situated to adopt a writing attentive curriculum in the sciences. The curriculum needs to do two things. The first is that communication must be taught in the context of introductory science courses. Second, it needs to be impressed upon students that practice will not make for "perfect" writing, but it will develop their writing and revision skills. Moreover, it will allow students to grapple with complex ideas from primary literature or course lectures for longer periods of times, which deepens understanding and increases opportunities for the transfer of knowledge to occur.

In addition, faculty must implement written and oral communication assignments with real-world applications to inspire student creativity. For written work, this could take the form of *New York Times* style articles (to mimic the assignment at Stanford), but could be adopted to an Oberlin or Denison setting: establishing a science section for *The Oberlin Review* or *The Denisonian*, submitting creative nonfiction pieces to *The Wilder Voice* or *Exile*, crafting a class blog or newsletter, or partnering with *The Synapse* itself, potentially to create smaller offshoot publications or zines. Lastly, oral communication needs to be recognized as an essential component of science communication. This requirement should extend beyond formal research presentations into the realm of authentic communication experiences, such as devising a minute-long presentation that answers the question: *Why do you love what you study and why is it important?* Encompassing these curricular requirements should be a renewed attention to peer feedback and support, specifically in the form of collaboration between the Oberlin Writing Associates Program and the CLEAR center. If we foster stronger relationships between these three departments, we will provide science students with non-scientific readers to offer advice on the effectiveness of their communication. This will forge and strengthen connections between science and non-science students with the goal of making science topics important to the campus community.

> Often, emphasis is on the presentation and analysis of the data rather than making sure the document itself is structured and written in a way that makes sense.

These sorts of curricular revisions are necessary to implement because if we are to solve nation-wide science issues, we need to tackle them as a national community. Margaret Wertheim, the director of the Institute for Figuring in Los Angeles, is dedicated to crafting new methods for captivating public interest in science and technology by situating communities at the core of issues. Wertheim's Crochet Coral Reef project, which encompasses math, science, craft, and community art practice, allows millions of people worldwide to visualize complex mathematics and science in beautifully colorful, dynamic crocheted coral forms. This project literally embodies ideas so that communities can play with them, and hopefully come to understand them. What makes Wertheim's project so special is that she has the foresight to see that communities flourish when they care about and act around similar principles. Thus, as young scientists, we need to not only learn to explain our answers, but to embody them. To do so, we need to go back to the beginning and hone in on our initial questions and why those questions matter. We are obliged to become empathetic communicators if we want the public to find worth in caring about the complex scientific and technological issues presently at hand.