

ARDON SHORR – TEACHING STATEMENT

Working with hundreds of scientists taught me that sometimes people are hard to understand because they're afraid of being understood. One graduate student confessed, "I secretly hope the audience gets lost because then they won't ask me hard questions." Clear communication is an act of vulnerability – when people see our real work, they also see its real limitations. When students avoid vulnerability, they miss the most important opportunities for learning: checking their understanding, advancing an original argument, committing to an interpretation by virtue of clarity. So as an educator, my goal is to constantly scaffold intellectual vulnerability to create an environment where learning can happen.

Over the last year I've taught workshops in science communication to graduate students at Carnegie Mellon in biology, chemistry, physics, math, mechanical engineering, and machine learning. For three years I've run media training for incoming faculty in computer science. The curriculum is based on five years of workshops I developed with the student group Public Communication for Researchers, and refined by teaching workshops across the country at AAAS, SXSWedu, Indiana University, Harvard, and Stanford. In addition to workshops I meet one-on-one with grad students and faculty to develop grants and public profiles.

I start by establishing motive. Together we work through a close reading from the podcast Radiolab about the Haber process of Nitrogen fixation. The clip starts with a powerful motive – people weren't sure how to feed a growing population. It successively narrows that scope through a series of goals and obstacles to motivate an obscure chemical reaction: to grow more food, we needed more Nitrogen; there's Nitrogen in the air, but it's not deployable; it's not deployable because it's strongly bonded to itself; the Haber process was a new way to distill Nitrogen into a liquid, which led to fertilizer, allowing us to feed billions. Just when students think this much setup is only for podcasts, we turn to an abstract from the New England Journal of Medicine and find the same structure motivating a new form of cancer therapy. Through these activities, students learn to place tractable problems within the context of a larger world problem.

One barrier to learning is that “motive” may be a new concept, or at least newly formalized. But equally important is the psychological barrier: when we ask students to claim their work matters, we are asking them to be vulnerable. One way to build this skill playfully is to ask students to pitch an idea that’s already a success. I give students slips of paper with common objects such as a fork, car, or hammock. The challenge is to imagine a world right before that object was invented, identify what problems it solves, and passionately argue its benefits. With students’ own work, it’s hard to advocate for an idea when they see all the ways it could go wrong. By starting with a guaranteed success they practice building a case for their work.

Students are also vulnerable when they commit to an interpretation. In my workshop on visual communication, we practice interpretation in class: students start with a dataset, select an insight, and write a one-sentence summary. Then they visualize that summary with three colored pencils. The colored pencils encourage students to draw only what’s necessary and separate information into a hierarchy of data (black) background (grey) and emphasis (accent color). We evaluate their work by exchanging visualizations and trying to determine the message they represent. Focused visualizations quickly converge on the intended message, while every additional line generates an off-target interpretation. This lets students preview the diversity of an audience’s interpretations and scaffolds the process of drafting, feedback, and revision. Students directly experience that if they don’t commit to an interpretation, the audience will be left to guess.

Another way students have to commit to an interpretation is at the level of a document. One method to practice clarifying a thesis is by distilling information from a chapter into a page, a paragraph, and a tweet. At each stage we discuss what is lost and what is revealed by the constraint. This distillation helps better-prepared students avoid getting lost in the details, and simultaneously helps less prepared students by highlighting the essential concepts.

The most common way I see students avoid vulnerability is through jargon. Jargon can be a shield to evade criticism and perform what students imagine to be a scholarly conversation. To help students connect more deeply to the meaning behind their words, I occasionally challenge them to use only the 1,000 most common English words. This constraint is based on the book *Thing Explainer* in which Randal Monroe describes tiny bags of water you’re made of (cells), shape checkers (locks), and food-heating radio boxes (microwaves). There is a moment of surprise and delight as students reconsider familiar terms. This helps students

work through their fear of sounding dumb, develop a deeper understanding of concepts, and make more deliberate choices about technical terms.

I try to create an environment for learning not only from what I do in the classroom but also how I do it. Just as I want students to start with motive, I start with a problem that motivates each concept. I show the structure of every presentation and return to the outline between sections to explicitly transition from one concept to the next. I build in moments of wonder, like how sequencing the human genome revealed that we share 50% of our DNA with a banana. I build in moments of humor, like in a biology class on genetic regulation: an interactive game lets students click to lick a rat pup. The animation is endearing and memorable – at the same time, they see genes uncoiling in a landmark experiment in epigenetics. I'm having fun but I'm also deliberately trying to put them in a receptive mood, reward their attention, and build rapport.

Some students come to the classroom with less experience; others are actively told they don't belong. Teaching clear communication has a unique role to play in dismantling psychological barriers to education: when students can explain a concept at several levels, they become more confident in their understanding. When they revisit their relationship to being wrong, they can normalize struggle and promote a growth mindset, emphasizing persistence in the face of difficulty over innate ability. When students formally study communication, they understand how it fails. That provides a new perspective when they get lost: maybe it's not because they're incompetent frauds who don't deserve to be in school – sometimes the speaker omitted the most important information. Imposter syndrome is pervasive in academia, but it's worse for people with less privilege. So addressing the psychological hardship of education isn't just a matter of better learning – it's also a matter of social justice.

Asking questions to reveal our own ignorance can lead to powerful learning opportunities unavailable to students who save face. For me, good pedagogy means taking this vulnerability seriously. I want to move students from a fear of being wrong to curiosity. Curiosity is, after all, the anticipated delight at being wrong, of discovering the world is far more complex than you had ever imagined.