Teaching Statement Caitlin D. Wylie

Teaching in a variety of universities has granted me a broad perspective on learning. As a graduate student at Cambridge, I was a “supervisor” for undergraduate science students taking courses on history and social studies of science. Every week I assigned and assessed their essays and led small-group discussions. These elite students brought current scientific knowledge to our debates about, for example, what scientific revolutions are. At the New Jersey Institute of Technology, I taught a 4:4 course load in the field of Science, Technology, and Society (STS) for undergraduates studying science and engineering. My classes ranged from an introductory lecture course for 80 freshmen to an advanced course on social research methods to prepare 30 STS majors to write a senior thesis. Most of my students belonged to groups underrepresented in science and engineering, such as racial and ethnic minorities, immigrants, first-generation college students, and students with disabilities. Their diverse perspectives enriched our discussions about the future of artificial intelligence and the ethics of geoengineering, among many topics. UVA students benefit from my previous teaching experiences and contribute to my ongoing learning. Teaching different populations has helped me identify a few universally successful educational strategies: making classes (1) relevant to students’ professional and personal interests, (2) welcoming and inclusive, and (3) engaging and enjoyable.

As a social scientist in an engineering school, I have the privilege of bridging two ways of understanding the world. To help students gain insight into how the technical and social dimensions of engineering interact, I guide them to think about research, technology, and design through the lenses of social science, history, and ethics. My goal is that, as professionals, they will apply this interdisciplinary mindset to design and achieve engineering work that successfully addresses social problems. However, undergraduate engineers tend to see STS classes as inconvenient requirements for graduation. They are busy learning how to find the right answers to technical problems, but my classes ask them to rethink how they define “problem” as well as “answer.” At the start of my STS courses, students tend to see this broader approach as unnecessary. My challenge as an educator is to address their misconceptions and help them swap their initial resistance for appreciation for thinking about engineering from social perspectives.

The most successful ways I’ve found to challenge students’ assumptions about STS is through discussions of real, relevant examples. For example, I start the fourth-year course sequence (STS 4500-4600) with a reading by MIT anthropologist Sherry Turkle about how children and adults interact with robotic toys. Students remember having robo pets, and they relate to the children’s grief when the toys reset and “die.” They question whether robo pets teach children responsibility, as live pets do. They argue about whether robotics experts should incorporate consideration for children’s emotional well-being into toy design. During that first class, students begin to ask questions about technology’s social impact and how social values shape technology, rather than only focusing on how to build technology. Relatable examples help students discover how and why people matter for technical design.

As students become more comfortable thinking about research and technology in socially-aware ways, I help them design their own STS studies. Proposing a research topic empowers students to investigate an issue they find fascinating, while also improving their motivation to learn. When fourth-year students begin their STS senior thesis, they are excited about their topics but concerned about how to do STS research. To build their confidence, I have them read past students’ theses. To clarify my standards of good work, I give students my grading rubrics before assignments are due, instead of only afterwards with grades as I once did.

Students peer-review each other’s drafts using my rubric, so that they understand what I expect. Peer review also offers important practice for students to give and receive constructive comments. Students also learn to identify admirable and problematic aspects of each other’s papers, which helps improve their own writing. They often offer comments about the rubric, such as what “professional writing” means, and I gladly revise the rubric based on their ideas. This process is a valuable exchange of expectations, in that students improve my assessment of their work. As a result, students write better papers and are more satisfied with their grades because they know the standards. For example, in 2016 my STS colleagues ranked two of my 60 students’ papers as among the best ten papers written by the fourth-year class of 630 students.

As I watched fourth-year students thrive in their research in my first year at UVA, I wondered if they could learn these skills earlier in their journey at SEAS. To find out, I designed a new course: Laboratory Life: Social Research Methods for Studying Science and Engineering (STS 2500). The summer before the course, the Center for Teaching Excellence (CTE) selected me as a fellow for the Ignite program, which includes a one-week Course Design Institute and a year of monthly training. The CTE has taught me strategies to make courses more engaging for students and reinforced my growing trust in students’ ability to guide their own learning. As a result, I designed the Lab Life course around several research projects for which students generate questions, then collect and analyze data (from interviews, observations, and primary- source documents), and draw conclusions from their evidence. My students spanned all SEAS majors and all four years. They told me they were grateful to study research labs in fields they admire and to interview professors whom they want to get to know. By conducting social research in real-world situations that they chose, students embraced the role of a social scientist while also learning about engineering research and careers.

It can be intimidating for students to explore new ways of thinking. If I want them to venture into an unfamiliar field, such as STS, I must create a space for them to feel included and respected as they explore, try, fail, succeed, and learn. To lessen their fear of being perceived as unprepared or wrong, I ask open-ended questions without correct answers. For example, in Lab Life I often asked students to describe a “good” research community. They drew evidence from our class visits to several engineering labs, where they had talked to faculty and graduate students about the realities of research. Some students recommended ways to foster collaboration, such as social events and shared workspaces. Others described the importance of privacy and quiet for creative thinking. I moderated discussions carefully to welcome various points of view. Sharing these arguments helped students prepare for their final project: to design an ideal physical space and social community for SEAS’ Link Lab. Director Kamin Whitehouse spoke to the class about the Link Lab’s goals, and later he read their best proposals.

I also applied ideas from these discussions to shape our classroom community. For example, thanks to students’ appreciation for quiet thinking, I am learning to create self-guided time in class. Often I ask an open-ended question and give them a few minutes to think. This strategy encourages quieter students and non-native English speakers to talk in class, because they have had a chance to prepare. It’s important to me that all students feel listened to and I regularly invite them by name to share their perspectives, whether they raise their hands or not.

A valuable and unusual aspect of my classes is that they include students from all SEAS majors. Thus my students regularly practice collaborating across disciplines. They get to know each other quickly through these interactions. For example, I place students in groups of different sizes and people to work on assignments. These include class activities, such as responding to and generating discussion questions, and out-of-class projects. For example, in

STS 4600, small groups of students lead discussions of ethical controversies in engineering. With my guidance, each group plans an interactive class about a current ethical dilemma, such as whether and how genetic engineering should be regulated or who is responsible for the lead in Flint’s water supply. To help students think about and achieve the characteristics of good collaboration, I have them confidentially rate each other’s contributions to their group presentation. Students take these peer evaluations seriously, because they form part of each student’s presentation grade and because they respect their classmates and want to work well with them. Communicating evidence-based interpretations is difficult and important work, and so is collaboration. I’ve learned that students are willing to work much harder on these challenges if their teammates are collaborators rather than strangers or competitors.

Choosing topics and working in groups help achieve an important pedagogical goal: making class fun. In my experience, if students expect a class to be enjoyable, they are more likely to participate and think critically and creatively. The CTE also opened my eyes to the important link between enjoyment and engagement. Accordingly, I now incorporate active learning in every class. Activities include analyzing videos together, such as news clips about hamburgers grown in vitro and *The Big Bang Theory*’s portrayal of gender roles in science.

Learning to analyze a variety of sources through the lens of social science equips students to be critical consumers of media. Also, I start every class by showing students a comic strip that addresses the day’s topic. We discuss what the cartoonist is trying to tell us and why it’s funny (or not). These conversations are relaxed and fun, require no preparation from the students, and don’t have right or wrong answers, yet they invite students to think critically and collectively to interpret an often-ambiguous source. Kay Neeley and I presented and published this strategy (Wylie and Neeley 2016). Learning and laughing together builds a sense of community within my class, as a supportive, fun group with the shared goal of understanding the world around us.

I believe that teaching is not just about interacting with students. Learning, researching, and sharing successful pedagogy are important parts of teaching too. Accordingly, I have shared my approach to teaching with colleagues in SEAS, engineering education, and STS. At the 2017 SEAS Education Retreat, I presented my ongoing study of how graduate and undergraduate students learn by working in engineering laboratories and how lab communities create inclusive learning environments for students from underrepresented groups. The NSF and a SEAS Research Innovation Award fund this study. I also reported on a pedagogical innovation my colleagues and I tested last year: an STS qualifying exam for fourth-year students (Wylie, Neeley, and Odumosu 2017). In 2017, I organized a group presentation with three colleagues for a major STS conference to share how we teach STS to undergraduate engineers. Another important aspect of teaching is mentoring students through individual projects, which is a crucial part of STS 4500-4600 and my Lab Life course.1

I look forward to designing more courses and communities where students can develop the skills necessary for lifelong learning. In the near future, I will draw on my research to create a course on diversity and inclusion in lab communities, to strengthen students’ sense of social justice and help them collaborate more effectively in diverse teams. I value research-focused courses like STS 4500 and Lab Life, and I hope to build similar courses for engineering graduate students. They deserve access to the interdisciplinary thinking and methods of argumentation and communication that STS courses offer and from which our undergrads already benefit. Overall, by creating a space of inclusive, fun, collaborative exploration of an unfamiliar field, I hope to empower my students to learn how to learn.

1 For more on my mentorship and support for diversity, please see my Service Statement.