Teaching Statement

Shikha Singh

Teaching Philosophy

Teaching for me goes far beyond the classroom. It is about being able to communicate effectively and being able to inspire interest in ideas, technical or otherwise.

Long before I wanted to be an academic, I was involved in various forms of public speaking such as debates, elocutions, and extempore competitions. I also directed and acted in several award-winning plays in college. These experiences have made me a clear communicator, an engaging narrator, and as a result, a better teacher. They have also heavily influenced my teaching philosophy.

Constructing the narrative. While preparing lectures, I usually think about constructing a stimulating narrative. I arrange and present the concepts so that there is a clear beginning where I set the stage with the problem and assumptions. There is a clear middle where the students learn about the climax—the algorithmic challenges, the performance trade-offs. And finally there is an end, where we overcome the hurdles and end up with the correct clean solution, using the tools and insights gathered along the way.

Cultivating curiosity. My primary teaching goal is to engage and excite my students about the subject. Learning a new topic is a process that starts with genuine interest and curiosity in the material. To cultivate this curiosity, I try to present interesting examples, real-world applications or historical facts about the topic to draw students in. For example, when I taught a lecture on context-free languages to an undergrad theory of computation class, I started with a fun problem about parsing strings, which is easy to state but seems difficult to solve. Then, together with the help of the students, I worked through examples that led us to the rules of the context-free grammar (CFG) for the problem. Students actively participated and contributed example strings and guessed the rules. As a result, I was able to retain their attention throughout the lecture.

Subtext and emphasis. What really distinguishes learning by attending a lecture from learning by reading a book, is the subtext and emphasis that only a teacher provide. For example, when covering topics that are too abstract or complex, I take the time to acknowledge the complexity, and to explain what makes the topic hard to understand. I reassure my students that is okay if they do not get it the first time. Providing such subtext and reassurances is important to make sure that students who are struggling do not give up.

Similarly, when presenting concepts that play a key role in the lecture or the subject at large, I emphasize their importance repeatedly and creatively to make it stick. I learned this from my advisor from whom I will borrow an example: Michael, while teaching a fundamental binomial inequality, calls it the "deathbed" formula, the idea being that even if you are on your deathbed and someone gives you a binomial, you should use it without even thinking. While his exaggeration is silly, it is powerful and sticks with his students.

Teaching to think. As a teacher, I want to teach my students how to think critically. I want them to question every assumption and every method and to come up with alternate solutions. To achieve this, I often ask students to first come up with their own algorithms to solve a problem. Even if their approach is incorrect, I still explore it with them until we figure out why exactly it does not work. From my personal experience, I appreciate and understand the solution more, when I know what does not work and why.

Sometimes in the course of discussions with students, I may pursue interesting tangents and allow myself to make mistakes on the chalkboard. This gives me a teaching opportunity: to identify, with the help of the students, what went wrong and figure out how to fix it. Knowing how to identify and correct mistakes is an important part of learning. As Henri Lebesgue put it, *"the only instruction which a professor can give, in my opinion, is to think in front of his students."*

Teaching Experience

I have taught lectures for both undergraduate and graduate courses on Analysis of Algorithms and Theory of Computation at Stony Brook University. At the undergraduate level, I have also taught several lectures for the honors program, including one which I co-taught with one of my advisors.

While the regular workload of PhD students at Stony Brook only includes teaching assistantships, I have actively sought out these teaching opportunities as I enjoy teaching and I wanted to hone my teaching skills. In total I have taught over 30 hours of lectures at Stony Brook. At the start of my second year of graduate school, I was asked to teach and manage the graduate course on Theory of Computation for a month as the regular instructor was unavailable due to visa issues. Since then, I am frequently asked to lecture for graduate and undergraduate classes by the theory faculty in our department.

During my stay in France, as part of my Chateaubriand Fellowship, I gave an invited lecture at *Université Pierre-et-Marie-Curie*. I have also given several lectures in our algorithms seminar at Stony Brook.

I have been a teaching assistant for undergraduate Analysis of Algorithms and for graduate Theory of Computation, during which I have offered recitals, office hours and designed and executed grading policies.

Diversity and Inclusion

The mission of promoting diversity and inclusion in science is extremely important to me. As a woman in computer science, my personal experiences have made me aware of and sensitive to the multitude of challenges that women and minority groups face in a technical field.

Next, I discuss the steps I have taken to enhance the scientific, professional and personal development of women in STEM fields and what I want to do as a faculty to promote diversity in computer science.

Mentoring and outreach. At Stony Brook University, I have led the Graduate Women in Science and Engineering (GWISE) group in my capacity as its vice president (2016-2017) and then currently as its president. During my tenure as president of GWISE, I, in collaboration with (undergraduate) WISE, and the Center of Inclusive Education, launched a *mentorship program*. The program connects undergraduate women at Stony Brook with graduate women mentors in their discipline who can share with them their unique perspective. It has generated overwhelming interest from the community: currently we have around 50 students signed up and we hope to recruit more.

As president of GWISE, I have organized workshops on salary negotiation, career advancement and talks by distinguished women in science on how to advance and retain women in STEM. Next semester, we are collaborating with WISE and the Alan Alda Center for Communicating Science to run a leadership workshop series for all graduate women in STEM at Stony Brook. The topics covered include socio-psychological considerations related to womens participation and retention in STEM, and managing leadership challenges and work-life balance in STEM fields. We plan to convert the workshop series into a 1-credit graduate course. To do so, I will help write a collaborative grant proposal to fund a tuition waiver for this course. Through this leadership course, I hope to counter the so-called "leaky pipeline" phenomenon: while there are enough graduate women joining the workforce, very few actually stay or move up the ladder.

I am a strong believer that true diversity and inclusion requires allies from the majority white and male community. Under my leadership, we at GWISE (which is open to all genders and departments) shifted our focus to actively engaging men in our conversations about the gender inequality in STEM.

Diversity in computer science. To promote diversity and inclusion in computer science (CS) and my own area of research, I plan to implement the following ideas.

- *Beating imposter syndrome.* Underrepresented groups in any field are more likely to experience imposter syndrome. What has helped me overcome it partly is attending women-only conferences and gatherings in CS which imparted to me a sense of belonging to the field. I will encourage my female students to attend conferences such as Women in Theory, CRA-W Grad Cohort and the Grace Hopper Celebration.
- *Rebranding the community.* Computer science has earned a bad reputation as community of silicon valley "brogrammers". This stereotype by design is unwelcoming to women and minorities. To counter it, I will organize high school outreach programs which showcase the following: (a) the field is collaborative and requires interpersonal skills, (b) computer scientists are people with a wide variety of interests and talents, and (c) computer science has far-reaching impacts on areas such medicine, policy, and social science.

As machine learning and AI pervade our lives, we need the next generation of computer scientists to be a diverse, collaborative workforce that can address the fairness, ethical and legal implications of these developments on society. To get there, we need to rebrand our core community as creative and inclusive.