Paul Schmitt — Teaching Statement

Research is only one aspect of an academic's career; teaching is a core mission of the university and I have sought to teach and mentor students throughout my time as a graduate student, postdoctoral researcher, and research scholar.

Teaching Approach

My goal as a faculty member is to help each student realize their full capacity as an independent thinker and effective communicator. I work to create settings where students realize that learning concepts and acquiring skills is a natural byproduct of asking questions and exploring solutions for problems that they are interested in. I seek to foster critical, first-principles thinking as the next generation of computer scientists will be tasked with conquering problems of incredible scale and complexity. My teaching philosophy can be summed up in two principles: *(1) learning is an active process*, and *(2) students respond well to high expectations*. While I am constantly learning how to be a better teacher and mentor for students, these principles are fundamental to my approach.

Learning is an active process: Unsurprisingly, cognitive research has definitively shown that students do not learn effectively by passively watching a teacher present slides, or memorizing pre-fabricated questions and answers pulled from a textbook and regurgitating them. Rather, the process of learning is best accomplished by allowing students the space to interact and build their own solutions to problems. The mistakes made along the way lead to deeper understanding of both the problem and the solution space. Fortunately, Computer Science as a discipline lends itself to such exploration as students can prototype software systems and solutions for problems that they encounter in their daily lives. While not all topics and subtopics afford themselves easily to "fun" projects or homework, most can be made relevant. Students are more engaged with material if they can relate to it and see its value.

For example, when I was a teaching assistant for network programming, I noticed the students were not excited by "classic" networking course projects such as FTP servers and client socket programming early in the quarter. In meeting with the students it was clear they wanted to work on real-world, up-to-date network application protocols. Rather than relying on project assignments from previous iterations of the course, I asked the students to create a social network aggregator application for the Android platform using real-world APIs and devices. The response to the assignment was overwhelmingly positive. While there is certainly a place for traditional, fundamental projects, students were excited to work on problems based around "modern" systems.

High expectations: In any given group of students, some will always exceed expectations, but the majority will simply aim to meet the bar that is set for them by the teacher. Therefore, it is critical to set high standards. The most memorable and enjoyable courses during my career as a student were those in which the teacher demanded excellence. Fortunately, in my experience most students do not simply respond to high expectations, they thrive on them. In order to enable the next generation of computer scientists to capably solve complex problems, we must provide them with challenging problems to solve, along with the fundamental tools and techniques to adeptly break complex problems into basic elements.

It is not effective to simply demand hard work. The teacher is responsible for creating a supportive environment where students feel comfortable making mistakes and asking questions. In addition to creating a classroom environment that was open to questions and discussion while working as a lecturer for undergraduate computer networking at the University of St. Thomas, I offered students a means for providing anonymous feedback and to ask questions that would be addressed at the beginning of the next lecture, as I sensed that some students felt more comfortable offering critical feedback and asking questions anonymously. The feedback informed both lectures and class projects, as I was able to tailor the speed and depth to the students in the class. I believe students were also more willing to ask questions that they may not have normally asked in-person, which led to interesting group discussions that, ultimately, allowed the students to understand the concepts more deeply.

When a teacher demands excellence, they must also make themselves widely available for interactions outside of the classroom. When I was a teaching assistant for object oriented design at UC Santa Barbara, I routinely met with students outside of designated office hours. Through one-on-one interactions I could ask and answer questions with the students to learn their view of a problem and provide other perspectives. Allowing the students to drive the discussions led to "Aha!" moments that increased confidence in the topic and a deeper understanding of problems and potential solutions as the students found the answers on their own. Further, I was also able to leverage the insights given by the students explaining their points of view in order to tailor my classroom teaching style to better meet their needs.

Teaching and mentoring is a unique and privileged opportunity, as contributing to students' intellectual growth is deeply satisfying. Teachers and students are codependent: as a teacher, my knowledge and mastery of a subject are deepened by the requirement of clearly communicating with students. I have a responsibility as a faculty member to help students realize their full potential to become the next generation of computer scientists. To maximize their potential, I am committed to remaining agile and responsive to students' needs, while maintaining the principles summarized above, to create an environment conducive to a broad range of learning styles.

Classroom teaching. Over the past ten years I have sought opportunities to teach as I prepare for an academic career. I previously served as an adjunct instructor at the University of St. Thomas for upper-level undergraduate courses on operating systems and networking. While a graduate student at UC Santa Barbara, I was a teaching assistant for advanced undergraduate courses in networking as well as object-oriented design and implementation, an entry-level course. While at UC Santa Barbara I also took courses outside of Computer Science on pedagogy and college instruction in order to hone my skills as a teacher. I learned techniques to make classroom environments more inclusive and accommodating for the wide range of learning styles that students prefer.

As a faculty member, I am interested in teaching both entry-level and advanced courses, as through my experience, I've learned I greatly enjoy teaching both. I view introductory courses as the place to get students excited about a future in Computer Science, while upper-level and graduate courses are rewarding as I can help students become well-rounded as they prepare to embark on careers as computer scientists and engineers. I would be comfortable teaching a range of undergraduate and graduate courses, including core undergraduate courses on networking, operating systems, programming in python or Golang, and network security, and graduate courses on networking, mobile computing, network privacy and security, and a project-based course on Computer Science for social good. Additionally, my research experience enables me to teach a wide variety of seminars within networking and mobile computing, such as: 1) mobile network privacy, security, and architecture; 2) network measurement and performance analysis; 3) machine learning for networking; 4) dynamic spectrum access; 5) a survey of state-of-the-art research in networking or mobile computing; and 6) an interdisciplinary course on information and communication technologies in resource-poor environments. An example course I would create is:

Machine learning for networking: Advances in data science and machine learning have radically changed how we approach network monitoring. Complex tasks such as network failure detection or characterizing application performance are made possible by leveraging modern learning techniques. For students, it is essential to develop the necessary knowledge and abilities to tackle network challenges using these new problem solving methodologies. Following this trend and my research experience, I plan to develop a course that guides students through the process of developing machine learning models that can be used in operational networks. The course would consist of three phases: 1) develop foundational knowledge of how traffic features are collected in networks and at what cost; 2) apply the concepts through a number of use cases; 3) a project carried out using openly available datasets. The course would give students a hands on development experience to demonstrate the inherent trade offs between model accuracy and cost.

Research Mentoring and Advising

The opportunity to advise and mentor students is one of the most important roles I look to take on as a tenure-track faculty member. I see the role as holistic: guiding students through formulating new research questions, expressing their ideas in both academic writing and code, conveying their ideas to colleagues and the broader public, mentoring junior students who might work with them, and more broadly ensuring that their work environment in all its facets is such that they are happy and productive.

During my time as a postdoctoral researcher at Princeton I have worked closely with and mentored several graduate students from both Princeton and USC through research project collaborations. I also mentored junior PhD students during my time as a graduate student at UC Santa Barbara. For each student, I have adapted my advising and mentoring style, as each individual has brought unique skills and perspectives along with different work styles. One tendency that I have noticed—both as a graduate student myself, and as a mentor—is that it is easy to get bogged down in low-level details, particularly for systems research. Certainly, details are important when creating complex systems; however, it can be difficult for students to consider the bigger picture, and focus on the intellectual insights of a given project. To tackle this issue, I routinely return to and discuss the higher-level goals of projects with my students. I believe my role as an advisor and mentor is to reduce barriers to becoming the best researcher one can become, refining the raw talent of the student: to inspire deep thinking and a willingness to challenge conventional wisdom, to instill a desire for rigor in both analysis and engineering, and to develop in the student the ability to organize and communicate ideas clearly.