Teaching Statement

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One of the most enjoyable aspects of being a professor is the ability to teach. I look forward towards sharing with students my passion and curiosity for learning, innovating, and engineering solutions to interesting problems. In general, my teaching philosophy is centered on three main objectives: conveying the big picture and its associated ramifications, providing real world projects that encapsulate the complexity of a problem, and actively listening to students to ensure their engagement in the material.

I first became aware of the importance of the big picture as an undergraduate at UC Berkeley, while studying for an introductory course in device physics. The professor, while meaning well, essentially lectured the class as a brain dump, providing as many equations and operating conditions for devices as possible. With this manner of teaching, the class goals were seemingly to memorize the relevant equations and to know which ones to use in problem sets and exams. I decided later as a teaching assistant for a digital design class at Berkeley that I would try to emphasize more on the big picture and less on equation implementation. While giving recitations and supervising group projects, I felt it was important to explain clearly the relevance of the material first, and then describe the equations and procedures that formed the solutions of the problem. In this manner, the objective of class was not to copy frantically in a notebook everything which is lectured upon, but instead to give intuition about class material.

After understanding the big picture relevancy of particular concepts, students can then understand practical solutions by working on immersive projects that encapsulate the engineering process better than relying only on the traditional method of problem sets and exam questions. I have seen the benefits of immersive projects twice while serving as the head teaching assistant for my advisor Professor Dally's graduate level classes on digital systems engineering. This class, about creating and connecting various components to create computer systems, is a difficult class, as the course material varies widely, from the noise behavior of transmission lines to power supply dissipation of router microchips to circuit design of signaling parts. With such diverse material that may not build upon previously taught concepts, the only way to grasp the entire system design is to provide interesting projects that can bring everything together. Professor Dally's open ended projects, such as the system design of a switch fabric in a high-end internet router, are able to address the large amount of material and make it relevant. As the head teaching assistant for this class, I supervised class projects, provided feedback on design tradeoffs, and graded final project reports. I was able to apply my first-hand experience in building working experimental prototypes towards helping them make design decisions. From these student interactions, I observed that while some students do get frustrated by the open-ended nature of these projects, the benefits of such an approach are many. First, real engineering work, whether industrial or academic, requires working with team members, collaborating and dividing work as efficiently as possible. Second, real engineering projects are also open ended, and require solutions that do not have exact answers. For example, in building a backplane system board for a project, students went to the web and chose different components from different suppliers that satisfied their respective performance requirements, similar to what an engineer in industry would do. By the end of these classes, these comprehensive projects allowed the students to see the relevance of the material and also gain important group work experience.

While an instructor may spend many hours perfecting lectures, projects, problem sets, and exams, actively listening to students and proactively obtaining feedback is essential in ensuring the quality of one's teaching. Teaching is a difficult endeavor and requires constant improvement and adaptability upon the part of the lecturer. Without feedback to determine whether the material is clear and relevant, the class slowly diverges into a lecture with students scrambling to copy everything down, left only to decipher their cryptic information later. As a teaching assistant I often heard students' perplexity with complex questions. Instead of simply providing the solution which often does not provide much insight, I always tried to frame the explanations in a manner that made sense conceptually and logically, often times providing real-world examples to bring practical context to the problem.. For example, while describing the differences between a pleisochronous and a mesochronous clocking methodology, I described the reasons for the existence of these two methodologies and how most systems in backplane routers use pleisochronous clocking due to their simplicity in system requirements. I learned that listening and interacting not only allows the students to learn more thoroughly, but also enables me to understand the material deeper, possibly providing new insights to research questions and understanding the engineering ramifications from untainted viewpoints and different experiences.

Finally, I feel that life as an academic is a privileged position that should not be taken for granted, and considerable effort should be made to give back to the community at every level, from the university to the elementary school levels. Instilling the concepts and foundations of science and engineering into children are important endeavors, especially in the increasingly competitive global workforce. As a graduate student, I volunteered as a mentor for an after-school science fair project at a low-income elementary school (East Palo Alto Charter School). Interacting with grade school children made me realize how fortunate my life and career have been, and the difference we can make by instilling the curiosity of science in children. As academics, we need to continue to strive in educating and encouraging our youth to pursue science and engineering.

Classes that can be taught:

<u>Undergraduate Level</u>
Digital design
Analog circuit design
Digital circuit design
Analog RF design
Introduction to electronics
Computer architecture

<u>Graduate Level</u>
Digital systems engineering
High speed serial links
Clock synthesis/phase locked loops
Advanced VLSI design