Teaching Statement 4/2013

I believe that the role of an educator goes far beyond the classroom. As a Lecturer with Security of Employment, my primary goal is to provide high-quality teaching, facilitate research opportunities, and improve the environment for undergraduates. LSOE’s have double the teaching and service load as traditional research tenure-track faculty.

Here, I present accomplishments in teaching, research, and service, as they apply to my goal of enhancing undergraduate education.

Teaching

In my teaching, my goal is to modify my teaching style and techniques to match with the school environment and student learning styles, integrate the latest computer science education research into our curriculum, and provide individual mentoring for students who have the potential to excel.

Throughout my career, I have taught a range of students, levels, and class sizes. As the circumstances have changed, so have my teaching techniques. My career started at Cal Poly, with small class sizes and a personal atmosphere. I found that power-point slides reduced student learning, but students were averse to chalkboard lectures, so I created a set of slides with key parts left out. This allowed students to listen and think rather than write during some parts, but also forced them to write key concepts down so that they could better remember them later. In addition, I gave students extra-credit for participation, encouraging them to allow me to get to know them so that I could write stronger letters of recommendation later. I won the CPE Best Professor award my first year (2003).

At UC Santa Barbara, class sizes were larger, and students had a much different relationship with professors. Students were very unhappy with the partial slides, but they, too, suffered in their learning when provided the full power-point slides. As a result, I now utilize the board for the vast majority of my lectures. At UC Santa Barbara, I won the CS Best Professor award twice (2010, 2011).

I have also led efforts to introduce new curricular techniques into our courses. Pair programming has been shown to improve retention, especially of underrepresented students. The introductory courses now utilize pair programming, which I started with “buddy programming” in 2008, Phill Conrad tested with true pair programming in 2009, and all CS 8 instructors adopted in fall 2009. Also, because of uneven TA quality in introductory courses, Phill and I led a push for labs in all introductory courses (rather than discussions). I developed labs for CS 24 and CS 64 courses. Our anecdotal experience is that pair programming, coupled with in-lab discussions, has improved student learning and reduced the negative impact of weak teaching assistants. Labs are now used throughout the lower division curriculum, and demand for our courses has skyrocketed. Courses that used to have 40 students now have 150 students.

In addition, I created new material for CS 64 (introduction to computer architecture) to strengthen the digital design component. In the follow-on course, ECE 152A (digital
design), students were found to be weak in their digital design knowledge. We moved CS 64 later in the grid to encourage students to take it later, counseled students within the course to take ECE 152A soon afterwards, and significantly strengthened the digital design content. CS students have now become the strongest students in 152A when they were previously the weakest.

Research

In research, my primary goal is to maintain a small but high-impact research program in order to provide opportunities that improve the graduate school prospects of our undergraduates. This high-quality research program is crucial so that I can continue to secure NSF funding that provides opportunities for undergraduate projects, publish in top-tier research venues to improve the records of my students, and maintain credibility in the community to increase the value of my letters of recommendation. In the past 10 years, I have been lead PI on over $2M in NSF funding. I have had a success rate of 63% in NSF proposals that I have led. During those 10 years, I have hired over 30 undergraduates, who have gone on to become PhD students at MIT, Cornell, Northeastern, UCSB, UCSD, and a faculty member at Cal Poly. More than 10 of these students have co-authored scientific papers with me. In addition, over 50% of these students were females and over 15% were minorities.

I have two research programs, one in computer science education and one in computer architecture. My primary research focus, which I started four years ago, is on computer science education, with an emphasis on diversity. This work has resulted in three top-tier publications (SIGCSE)[38, 47, 48] in the areas of computer science education for diverse middle school students, and I have led NSF grants of over $1M. My second research area is computer architecture, for which I received an ITR, CAREER award and SHF from NSF. My current research looks at future multi-core processors and how to reduce the redundancy present when running various forms of parallel programs. This work has resulted in three top-tier publications (2 ISCA & 1 Micro)[29, 37, 53], and prior work produced an ISCA publication[17]. For details on my research, please see my research statement.

Diversity

In everything I do, teaching, research, and service, I bring what I have learned about diversity research to my work. Pair programming has been shown to improve retention rates of females, a major factor in our decision to implement it. I have also simplified the language I use on exams to account for students who are not native English speakers. Finally, I emphasize often in my classes that everyone can succeed, that everyone was accepted because they were capable, and it is all based on what students do. Research on stereotype threat has shown that the belief that success is based on actions, rather than innate intelligence, reduces the negative performance caused by being a member of a minority group that stereotypically does not does as well in a particular field. In addition, emphasizing that unity of the group, as college students, reduces the likelihood a student will identify themselves more with their minority group at a test, further reducing the negative effects of stereotype threat.
In my educational research, tailoring the curriculum to diverse populations is a first-order constraint. During our summer camp, we designed the entire camp around themes that we hoped would attract females and Latina/os – animal conservation and Mayan culture. The curriculum was designed based on these themes. We are taking the same lessons we learned from that project and applying them to our more mainstream elementary school curriculum. The entire purpose of placing computer science in classrooms across the country is to provide equal access to computing jobs for underrepresented minorities – Latina/os, African Americans, Native Americans, and females. In order to accomplish this goal, instead of starting with a small set of high-achieving students, we are interviewing students at a wide variety of schools in order to take examples from diverse students’ daily lives for use in our curriculum.

In our department, I have led or been a part of several initiatives to improve the environment for diverse students. I am the faculty advisor for the new WISH (Women in Software and Hardware) undergraduate club for female computer science and computer engineering students. I also secured a donation from Google to fund ACM tutoring for lower-division classes, ran a short training session for new tutors, and advised the ACM tutoring coordinator. In addition, I have taken a leadership role in the freshman advising pilot, leading the diversity committee to develop a flier of faculty advisor tips to target their advising for students in different situations (with special care to integrate research on how to best interact with diverse students). I developed a new website, http://discover.cs.ucsb.edu, to educate students about academic support and opportunities on campus, spotlight departmental and individual accomplishments in education and diversity, and provide exposure to encourage funding from industry.

My commitment to diversity goes beyond UCSB. I attend the NCWIT (National Consortium for Women in Technology) Summit as the UCSB representative to the Academic Alliance. Here, I learn the latest sociology, psychology, and education research that relates to gender equity in the field, as well as techniques that have worked at different schools. I also volunteer my time with the organization to award grants to schools implementing programs for gender diversity. I help disseminate this information to others, giving talks at UCSB faculty meetings, WICS events, and industry (Raytheon). With what I have learned, and additional research I have performed, I have just completed a book: “The Practical Guide to Gender Equity for CS Faculty.”

As recognition for the contributions I have made to undergraduate research for minority students, I was an inaugural recipient of the NCWIT Faculty Mentor Award. Four awards are given nationally, one in each category of junior/senior faculty and doctoral/non-doctoral emphasis. This year’s awardees include Margaret Martonosi of Princeton, and I feel quite honored to be in her company.