Teaching Statement

The most enduring lesson I’ve learned in my experiences as a graduate student instructor is that teaching is inherently dynamic. This description applies both to the evolution of a given section as well as to overall teaching style. I’ve had the opportunity to lead several quarters of calculus and linear algebra sections, and each successive iteration has further affected and molded my teaching philosophy.

My first teaching assignments were courses in single-variable calculus. I walked into my first section naïve and over-prepared, with notes so detailed as to distinguish material to be spoken from material to be written on the board. It was scarcely a minute into that first section before I realized the fantasy of such a rigid blueprint. During those initial missteps, I relied heavily on my energy and enthusiasm to carry me through, as well as my ability to bring humor into the classroom. This inadvertently led me to my first real discovery: most students could find success in calculus if they could first find enjoyment in the subject. Early on I made it a primary focus to help them find it.

My initial quarters teaching calculus certainly served as formative teaching experiences and helped bolster my confidence, but it wasn’t until I began teaching linear algebra that I first began to see the art required for good teaching. I view my calculus quarters much like first learning to swim: with enough energy and flailing, I was able to stay afloat, and perhaps even paddle about. My linear algebra students are the ones who taught me to swim.

Those later sections marked my first encounter with self-motivated students. I was unaware of how great an asset this would be. It allowed me to redirect my energies from simply getting (and holding) their attention to presenting abstract mathematical ideas in the clearest possible way. It was then that I began to view teaching not as a necessary burden but instead as an exciting opportunity. It gave me a chance to present alternate viewpoints on the material, to move away from the purely computational aspects and move towards the more theoretical underpinnings. It was also at this time I first noticed weaknesses of certain approaches of presentation. I discovered, for instance, students had enormous difficulties with the concept of “change of basis.” Time and again it would stump all but my strongest students. I felt that the order in which the concepts were presented was the underlying cause for their confusion, since it didn’t fully prepare them for the new viewpoint needed to properly understand systems of coordinates. With each explanation, I found myself more frustrated by the organizational structure of the course.
As a section leader, I had no choice but to follow the order of material presented in lecture, but internally I began to form a personal philosophy on how best to teach the subject.

I was allowed to test my theories in the summer of 2006, when I was assigned full teaching responsibilities for the linear algebra course. Although it ultimately entailed more work than I had imagined (perhaps again a sign of my naiveté), it was also remarkably freeing. I had begun to suspect that concepts such as change of basis were stumbling blocks for students partly because they appeared too late in the quarter, after students had become accustomed to associating vectors with their standard coordinates. In my summer course, I attempted to appeal to the coordinate-free picture early and often. I didn’t force a purely abstract approach; rather, I continually reminded them of the geometry lurking in the background, ever-present but often hidden. When we officially came to the lecture on change of basis, I found noticeably less confusion.

Teaching linear algebra also served as my first attempt to integrate technology into the coursework. Working with fellow graduate student Andrew Schultz, I designed and wrote a series of MatLab assignments focused on various linear algebra concepts. These assignments first taught the students the basics of MatLab, and then proceeded to give them real-world examples using linear algebra. These varied from curve-fitting to the Google PageRank method. These assignments are now integrated as part of the standard course curriculum, and a series of assignments for the course sequel are currently underway.

Such assignments only hint at the possibilities of using technology as an instructional tool. Too often, especially in courses like linear algebra, a great obstacle to student understanding is simply a lack of visualization. With the prevalence of computers, it is possible to remove this obstacle. It is one of my current goals to use computer animations and models to aide in the presentation of new concepts and examples. This applies not only to basic subjects like linear algebra, but also to more advanced fields of study, like algebraic geometry. From the perspective of a student myself, I appreciate lectures in which algebraic and theoretical precision are illustrated with abundant geometric examples and visualizations, and I find I learn best from such an approach.

I look forward to my post-doctoral career, in which I will continue to strike a balance between research and teaching. By combining student input with my own experiences as a student, I will further develop my teaching style. Throughout this process, my ultimate goal will always be to make mathematics – at any level – accessible to as many students as possible.