Teaching Statement

As a member of the academic community, I feel an imperative to strive both to be an effective teacher and to contribute to the project of mathematics education. As a teacher, my principles are simple: Mathematics is a hands on discipline, let students get their hands dirty. Show students your interest in the subject, and be interested in passing your knowledge on. Finally, tell a clear story, one with a beginning a middle and an end. These principles made me an award winning teacher at Northeastern University, and they continue to guide my engagement with undergraduate education.

As a part of the project of mathematical education, contributing means engaging in the issues of discipline: How do students actually learn mathematics? How do we engage with other disciplines and departments? How do we understand and address the lack of diversity in our discipline? These are not questions with easy answers, but I feel that my role as a teacher requires me to become an active participant in the shaping of mathematical pedagogy.

Class Structure

I run my classes as combination of mathematics lecture and lab. Every theorem should be immediately tested; we should immediately see through examples both where it applies and where it fails. Each new idea starts as a problem we cannot yet solve and ends as a new suite of tools and ideas. However, it is important to me that this process is interactive: I often toss out small pieces of theorems, questions or computations and tell students to take a few minutes and talk among themselves about the answer. When we arrive at a solution we immediately try to apply it both to standard cases and then to pathological ones. The importance here is for students to get their hands dirty with the math, to apply a theorem and see where it breaks and see where it holds.

For example, in my course on mathematical computing for beginning math majors, I eschewed the computer lab for personal machines so that they would feel ownership over their tools. By the end of the first semester, over half of the students in the class had come to me to show me their progress applying the method of the course to content they had found elsewhere. To me that is the best expression of active learning, when students take the tools we give them and see how they can be applied in their own projects.

Curriculum Development

When I teach a class, I think it is important to tell a large story across each semester and a smaller story during each lecture. At the beginning of each semester, I explain to my class the suite of tools we are going to develop and the kinds of problems they will be able to solve. Each lecture, I start with a problem we cannot yet solve and a reason to solve it. I then go through the steps both of finding a solution and the intuition for the method of solution. I have found this is particularly effective in interdisciplinary courses where being able to tie a fast moving and fairly advanced topics back to problems the students already want to solve allows many of my students to get excited about the work instead of intimidated.

In the last few years I have designed the curricula for a host of courses in both traditional mathematics and mathematical computing. In my courses, I decided to only use examples and projects that could be realized from start to finish, both mathematically and programmatically, by the students. I brought the methodology that I had developed with me, trying to give the students the tools to solve problems but allowing them to forge their own route to the solution.

My goal as a teacher is to make students excited enough about the material that they find their own interests, their own applications, or their own love of the structure. With the Boston Public
Schools, I developed a curriculum to teach mathematical computing to 30 high school students with intermediate math skills. At the end of the course, I gave them a list of projects to work on and present but told them they could pick their own if they were interested. On the last day of class there were presentations simulating the solar system, drawing DNA, producing fractals and playing simple games. Only two of the ten projects came off my list. A curriculum designed to empower students as mathematicians finds use outside of the classroom and brings students into the discipline, it is my goal in each of the courses I design for the students to leave feeling like they have a new tool to engage with the world.

**Addressing Diversity In Mathematics**

Through my conversations and research it has become clear to me that part of fixing the problem of diversity in the STEM fields is seeking out and mentoring interested students who are not traditionally seen as successful. That is why I chose to work with intermediate students in the Boston Public Schools. It is why I fought for nearly doubling the size of the PRISM undergraduate research program and put pressure on the admissions committee to bring in nontraditional students regardless of their academic standing. We cannot expect that every student will go to college, or stay in STEM, but I believe that opening up the discipline takes planting the seed to interest in new minds. It is misguided to put in no effort and then blame potential students when they do not invent a love of mathematics.

College mathematics is a gateway to many jobs and fields of study, and the success of failure of inclusivity within our courses reverberate throughout the sciences and engineering. For that reason, it is important for us to design our beginning math classes to be safe havens for students underrepresented not only in mathematics but in all of STEM. We need instructors who see beginning math education as a primary mission of the discipline and we need to give them the training to bring students into STEM majors. Finally, we need to reach out to students and faculty that have left STEM and students that never joined and take seriously the answers they give us when we ask what is holding them out of our discipline.

Mathematics is a discipline that should know no boundary of gender, race or socioeconomic status. I strongly believe that with dialogue, hard work, and a willingness to study ourselves as we study math that we can open the discipline and create one of the most diverse and inclusive branches of academia.

**Education Research**

Being a good mathematics educator requires engaging with the hard questions of student understanding and mathematical pedagogy. For example, at The University of British Columbia, I have had the opportunity to engage in research projects that attempt to rigorously address some of the issues of how and what students learning in our courses. One such project is in the understanding of student study habits and how they contribute to success or failure in introductory courses. I collected grade correlated data on changing student study habits and I intend to construct a compendium for both students and faculty to give concrete, data driven answers to the old question what should I be doing to improve my grade.

During my mathematical career I have had the opportunity to teach at many levels, to many different populations. I have consistently seen that a students academic success and intellectual reward is directly tied to their ownership over the course material. By teaching mathematics as a tool to be used, and allowing students to apply the coursework to interesting problems, I have found that students are able to achieve both an ownership and an understanding of the structures and methods of modern mathematics. I look forward to continuing to develop myself as a teacher, and to guiding future students from passive learners to competent and interested professionals and academics.