Teaching Statement

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I have always admired the contributions to society made by doctors who can cure a patient, and manufacturers who can build machines, and I've realized that I can make my own contribution through the abilities I have developed as a teacher. I hope to be an outstanding teacher, and I can thank my experiences at Emory University for giving me excellent training, experience and guidance toward this goal. In particular, I was very strongly influenced by the teaching example of the excellent professors I met there, from whom I learned some very important things.

First of all, I believe the best professors have an ability to consider complicated material and come up with a vivid image or straightforward point of view that opens the minds of students. Because the goal of mathematics is so often abstraction, students need a connection to their own experiences. For instance, I found after a while that, when I had to present mathematical induction, simply repeating the definitions didn't help puzzled students; instead, I asked them to imagine a line of side-by-side bicycles, and then tell me what would happen if someone pushed the first one over. Another roadblock came when I was demonstrating the Chain Rule for differentiation of e^{x^2}, but no one was getting it. I finally was able to get them to think it through by stressing "this is not e to **the** x **itself**, it is e to **a function** of x", after which the confusion seemed to disappear. While clear and vivid speaking is important, I saw from the example of professor Shanshuang Yang how important it was to use the blackboard not just for the current topic, but also to indicate the development of ideas throughout the lecture; he often had three boards in use, the current one in the middle, while the second and third boards displayed information covered earlier that was still being referred to, so that instead of viewing the lecture through a letter-box, so to speak, the student was encouraged to see the new ideas in relation to the entire previous discussion.

Because students come to class having forgotten the previous lecture, and have a tendency to focus on the current moment without trying to see the larger pattern, I start my lectures by recalling previous material on which I will build, and then outline the goal we are going to cover, and the steps we will take to reach it. I also rely on frequent "reminders" such as quizzes and weekly reviews to discourage the student from assuming that once a topic has been covered it can be safely forgotten!

The second important aspect of teaching is motivation; again, mathematics classes often have a tradition of simply presenting material in isolation, to be appreciated for its consistency and logic. But I have found that students are repelled by abstraction; they are attracted when they see how abstraction allows a mathematical theory to come alive in a particular application. Thanks to my background in computational mathematics, I can draw on examples from cardiac therapy planning, fluid dynamics, and climate modeling to make the point to the students that **Mathematicians can save your life!** Seeing connections between theory and application makes them much more willing to try to look for the meaning behind all the symbols.

A great way to facilitate this kind of understanding of mathematics in action is to have the students work with MATHEMATICA and MATLAB. Using computing on examples can help students comprehend and enjoy theoretical concepts through visualization, and to experiment and play with ideas. Aside from helping directly with the course, familiarity with mathematical software is a skill that will benefit them in other classes and throughout their lives.

There is also a personal factor in motivation. Students are very conscious of whether their instructor knows their name, and I do my best to learn everyone's name in the first weeks, and to regularly call on students by name during class, and to give students individual praise or feedback when it is earned. I have found this an effective way to keep students involved and invested in the course.

Finally, I totally agree with Marie Jameson, who said "Great professors challenge their students without demoralizing them; they find the sweet spot of difficulty where students are pushed to accomplish and encouraged to take an active participation in the learning process." This comment makes me think of Professor Ken Ono, who won the NSF Director's Distinguished Teaching Scholar Award because of his effective teaching style. In the beginning of his course, he would distribute a bunch of projects, whose difficulties covered a large range. Students were free to choose a project, and after a while, the students took turns reporting to others about their own projects. The variation in difficulty corresponded to the variation in educational background, ability, and ambition of the students. But Professor Ono always encouraged students who picked easy projects to move on next to more challenging ones. During the presentations, he always questioned the student, making sure the deeper ideas were discussed in a way that made it clear to the audience. I also learned a lot about effective teaching from Professor Ernesto Estrada, in his course on "Complex Network" at Emory. At the end of the course, each group of us reported an interesting project, and wrote up a report in a format suitable for publication.

During my five years at Emory University, I had classes from many great and inspiring professors, and because I knew I wanted to be a good teacher myself, I tried very hard to observe and learn from their examples. Since I myself was also a teaching assistant and then an instructor, I had the chance to experiment in my classes with the teaching insights I had picked up. I learned how helpful it was to move from a pure lecture-based presentation to one that included discussions and projects. In my classes on Calculus, Probability and Statistics, and (Partial) Differential Equations, I also learned to carefully regulate tests and project outlines to something like 40% easy problems, 50% problems of medium difficulty, 10% moderately hard problems, and 5% hard bonus problems; students found this mix fair and challenging.

Another aspect of teaching involves training students to do research; here I learned a great lesson from my PhD advisor Alessandro Veneziani. He inspired me to give up the idea that one can only do research after one has become fully prepared on all related topics. Now I agree that students should not hesitate to begin a project, expecting to learn some skills as they go, and that everyone has the ability to contribute something to a given task. Alessandro has attracted many seniors to put aside their natural caution and get involved; this has resulted in many awards for students, and led a number of them to pursue a graduate degree that they hadn't previously thought they were capable of. From my experiences with Alessandro, I think I have a good idea of the best ways to supervise great undergraduate research, and I look forward to serving in this capacity.

I can summarize by saying that I feel that teaching is my best chance to change lives. I have tried very hard, while at Emory, to learn from the best teachers I met, and to practice and develop the skills they suggested to me. I am eager to have the chance, as a young mathematician, to work closely with students, to excel as an instructor, and as an advisor for seniors interested in beginning research.