TEACHING STATEMENT

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When I teach mathematics, my main goal is to train the students to think about mathematics, not solely to become problem solvers. To be an effective teacher and to reach this important goal is a complicated process that requires much more than simply lecturing. In my teaching, I approach these goals by(a) asking the students to explain their answers, (b) challenging the students with harder problems, and (c) helping the students to ask the right questions (of themselves). I consider my training successful when my students are able to describe their own reasoning for their solution to a problem. I am confident that when students can communicate their knowledge effectively, they have mastered the material.

My approach has developed out of the wide range of courses that I have taught while at Clemson, Fordham, NYU, and Tufts. These courses varied from high school-level to graduate level (see my CV for a complete list). For example, at the high school-level, I was one of the co-creators of the cSplash program at NYU - a one day festival of mathematics for high school students where math outside the typical high-school curriculum is presented. At the undergraduate level, I have taught courses for both majors and non-majors including finite math, courses in the calculus sequence, linear algebra, introduction to proof, elementary number theory, abstract algebra, and topology. At the graduate level, I have taught the graduate abstract algebra sequence as well as special topics courses on toric varieties and smooth manifolds. Additionally, I have developed course materials for several courses, including courses on ethics in mathematics, combinatorics, and a critical thinking component for introduction to proof.

One of the first steps in any successful class is motivating the students to complete the work - if the students don't do their homework well, it is very hard for them to be successful. While grades do provide some motivation, I find that it is much more effective to develop a personal connection with the students. In my classes, I always try to get to know the students both as people and as students. I find that by taking the time to know the students' names, to learn a little about them, and, in general, be curious about their day, the students know that I care about them and they feel more responsible for completing the work. I've found that my personal interest in the students and their lives has increased the time the students devote to the class and increased the proportion of work that is completed.

In my courses, I use the in-class time, homework, and office hours in different ways to try to teach and reinforce different skills. Generally, I use in-class time for presenting the material and discussing how to think about it. I use homework to help the students practice concepts and to express the solutions in their own words. I use office hours to guide the students to the answers by asking leading questions and by helping them to develop questions that they could ask themselves when they get stuck. These three parts of my courses can look very different depending on the level of the course, but across all of the courses I teach, the goal of each part remains consistent.

In the classroom, I constantly ask the students questions about the material, because it makes them active participants, trains them to communicate effectively, and challenges

them to think about the material in new ways. During class, I ask many levels of questions, including computational problems, which engage all of the students, including the weaker ones. I also ask open-ended questions, which are usually answered by explaining the "why" of the problem. For example, I might ask the students to explain why one approach is more appropriate than another for a problem. This type of question helps train the students to communicate their thoughts and to think independently about the problem because they must compare what was done in class to alternate ways they may have been considering to solve the problem.

Recently, I have begun to introduce group work and student presentations in my classes. I find this to be particularly effective in introduction to proof, where I give the students a collection of proofs with errors in them. They must work in groups to identify the errors and then explain their reasoning to the rest of the class. I find this exercise to be particularly effective because the students not only communicate the error in the problem to their classmates in a clear way, but they also often provide suggestions on how the proof with an error could have been improved. This exercise not only improves the students' communication skills, but also leads them to ask the right questions, which they later ask of themselves, as they improve their own proofs.

I typically assign three types of homework in my classes: computational problems, theoretical problems, and challenge problems. The distribution of these different types of problems depends on the level of the class, but the goals remain the same. Each of these types of problems is designed to develop the students' knowledge and understanding in specific ways. For example, I use computational problems to reinforce the computations or definitions discussed in class. Additionally, I find computational problems in first-year, second-year, and non-major undergraduate courses to be particularly effective in improving computational literacy (a common weakness in these students' backgrounds). In such classes, I often use online homework because the online assignments force the students to recall their basic math skills and gives them immediate feedback on problems. I believe that these computational assignments are effective because the students seem to ask the question "How did you get that?" on a computation much less frequently as they had done enough examples to expect the form of the answer on the board. These computational problems allow the students to become more comfortable with computations and allow me to train the students in mathematical thinking by focusing on larger ideas without focusing on the computations themselves.

In addition to the computation problems, I assign both theoretical and challenge problems. The theoretical problems form shorter assignments, but require written explanations for each solution. In these explanations, the students are asked to describe the solution, the choices they made in attempting the problem, and why they made the choices they did. Through these theoretical assignments, I am forcing the students to think about the steps and to take a step back and understand their approach to the problem. Through these written explanations, I am attempting to train the students to not only answer the question correctly, but also to effectively communicate their ideas and begin to master the material.

I also assign additional optional challenge problems. These challenge problems are meant to push the students by asking questions about material that hasn't yet been covered in class, by requiring the students to perform more steps than the previous problems, or by forcing the students to come up with a new approach to solve a problem. I believe that attempting a challenge problem helps all students, even those who don't finish it. For example, the

stronger students may develop their own way of thinking about the problem and become more independent in their work because they cannot rely on the classroom experience for the techniques to solve the problems. By thinking about the problem, weaker students may become a little more familiar with the upcoming material in the class and may become more prepared for those lectures.

In upper-level undergraduate and graduate courses, I think that office hours are one of the best opportunities to train the students. In the classroom, a lot of the material is imparted to the students, but, in office hours, I can work with individual students and train them to ask the questions that we, as mathematicians, ask ourselves. When students have a question with a particular problem, I ask them to work the problem for me, either on paper or at the board. While they're working, I ask leading questions to guide them in the right direction, without giving the answer away. I try to make the questions I ask natural and questions that the students could have come up with by himself/herself. After finishing the problem, I ask the students which questions were most helpful to them in solving the problem. In this way, the students not only have their question answered, but also has learned a few questions that they could ask themselves, independently, the next time they are struck. Additionally, with stronger students, I typically discuss generalizations, other approaches, examples, or counterexamples to extensions of a theorem. Through these discussions, the students are becoming adept and learning the questions they must ask themselves in order to succeed as mathematicians.

I also enjoy fostering mathematical communication outside of my role as an instructor. For example, at NYU, I was a co-creator, leading organizer, and teacher for the cSplash program. cSplash had its first event in Spring 2006 and is now an annual one-day festival of mathematics and computer science for motivated high school students. It is a free program, and the classes are designed to expand the students' view of mathematics beyond the standard high school curriculum. One of the highlights of my day is to encourage students who don't know each other to discover and make friends with others who also enjoy mathematics. At Fordham, I was both the Math Club and Pi-Mu-Epsilon advisor. In this role, I organized several math-related talks from both internal and external speakers, and also arranged for the students to be able to volunteer at math-related events including at the traveling exhibit of math midway and at a mathematics competition at Fordham in 2012. At Clemson, I volunteered at the REU during the summer of 2013 because when I was an undergraduate, the REU's that I attended were instrumental in my decision to become a mathematician, and I wanted to give others the same opportunity. I am continuing to seek out more mathematical service and volunteer opportunities.

Overall, I believe that I am successful in helping the students to reach my goals for them. In fact, I have frequently had students come to me during the following semesters to tell me how useful my class has been for them, both in being able to communicate their solutions and knowing how to approach challenging problems. By combining lectures, homework, and office hours into complimentary approaches which focus on training the students to think mathematically and to communicate well, I feel confident that my students are prepared for the next steps in their mathematical training.