

Sarah Ritchey Patterson

Teaching Statement

As a teacher of mathematics, my goal is to get students to appreciate the beauty and power of mathematics and revel in the struggle. Mathematics is hard. Often times students look at a challenging problem and feel discouraged if they do not immediately know how to solve it. Instead, this struggle and eventual success is something to be celebrated. I believe students should be actively engaged, challenged, and supported.

Classroom Atmosphere

At Duke University, I have taught a variety of [introductory calculus courses](#) in which I implemented a combination of lecture, discussion, and group work. These courses had about 20 freshmen who were not math majors. One unique aspect of calculus at Duke is that each class has a weekly lab where groups of students use techniques from the class to analyze data. I find that my research background enables me to relate these concepts to students effectively. For example, when teaching Euler's method, I talk about how I use numerical methods to create models of [blood flow](#).

Learning is most likely to occur when students are actively engaged in the material. Therefore, student participation is a key aspect of my classroom. Students will often work in small groups to solve problems or explain unfamiliar concepts. I find that students are more willing to answer questions if they discuss with a partner first. This has increased participation from quieter students since students who have not participated yet are given priority to answer.

In order to determine if students are on track, I often use formative assessments of student comprehension. For example, I will conduct informal class polls where students can express what they think is the correct answer or their comfortability with a subject or class pace. I found that almost all students will participate in these assessments because they are less intimidating than vocalizing answers.

Although mathematics courses should be challenging, I believe all students can succeed with the proper support. Therefore, I make myself available outside of the classroom and encourage students to capitalize on the wealth of resources available to them. For example, I allow students to [replace their lowest quiz score](#) with the number of times they visit the math tutoring center. In addition to traditional office hours, students can ask questions in an online class forum. This affords students the opportunity to explain class concepts to their peers, and for students to benefit from the questions of others.

Course Development

As an applied mathematician, I am interested in many fields of mathematics. I have completed research projects in [mathematical modeling](#), [numerical analysis](#), [biomath](#), [machine learning](#), [number theory](#), and [computer science](#). These diverse research experiences have enabled me to develop mathematics courses for the Duke Talent Identification Program ([TIP](#)), an enrichment program for academically gifted students in grades 4 through 12.

One of these courses that I developed and taught was for the TIP Field Studies summer program called "[From Startups to World Hunger: A Mathematical Perspective](#)." In this course, students discovered several mathematical modeling techniques by engaging in inquiry-based learning. For example, on the first day of class, students were asked to calculate how long it would take to get to the top of the Empire State Building. This activity helped students to jump right into the modeling process and to foster a cooperative group-work mentality. [Open-ended problems](#) would often be posed in the beginning of a class, and students would work to discover viable solutions. This structure allowed students to experience productive struggle. This format is typical for my Duke TIP classes.

The Duke TIP classes I taught had a diverse population of students both in mathematical and cultural background. To account for the gaps in student knowledge, lectures were followed by remediation and group

work. For both my modeling and [machine learning course](#), students were encouraged to create their own topic for the final projects. This allowed them to pursue their wide range of personal interests.

Advising and Mentoring

As an undergraduate, my professors focused on undergraduate students. I would like to give that same experience to a new generation of mathematicians. In my courses on [machine learning and mathematical modeling](#), I was able to advise bright students on their projects and presentations. This experience will help me to develop research projects and advise student research. I also work with undergraduate mathematics majors outside of the classroom. I started a department-wide [mentoring program](#) which formed mentoring groups comprised of faculty, graduate students, and undergraduate students. In this program, I mentor several undergraduate mathematics majors. This program aims to retain and increase diversity in the department and foster a culture of mentoring.

Reflections

I feel that the practice of teaching can always be improved. To this end, I attend many professional development programs. I am a member of the Duke Certificate in College Teaching ([CCT](#)) Program and the North Carolina Council of Teachers of Mathematics ([NCCTM](#)). In order to improve my teaching, I gather feedback from both students and colleagues.

As part of the CCT, I participated in a program called [teaching triangles](#) where groups of three graduate students from different disciplines observed each other's classroom. Observing others made me more conscious of my own board presentation and nonverbal communications. By both observing others and being observed, I am able to reflect on my own teaching so that I can grow as an educator. I believe my reflective habits have helped me to make many improvements.

Additionally, my students fill out anonymous surveys midway through the semester, and I try to adjust my teaching style to students preference and heed reasonable requests. For example, after collecting student feedback in my Math 106 class at Duke, I started to write out more steps when solving problems. My teaching evaluations from Duke have increased on my most [recent class](#) compared to the [first class](#) I taught.