

# Statement of Teaching Philosophy

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After one particularly lengthy session with four or five students, one of my combinatorics students impulsively complimented me on my “fun” office hours. In this class I had been running office hours as if we (with myself as one of the students) were collaborating on a research problem. This approach helps me observe how my students assimilate the material, while interacting with them in a mathematical discussion. I think these sessions are so enjoyable because the students actively engage with the problems rather than just “slogging through” the homework. While this format is not always appropriate for office hours and other settings, I try to structure my teaching so that as they develop mathematical skills, students learn to participate in and identify with a larger mathematical community. This statement outlines some of the techniques I use in helping students learn to talk, write, and explore mathematics.

I find that most people (math majors and English majors, alike) become more engaged with a subject if they perceive some broader relevance, whether or not it addresses their interests directly. As an instructor, I therefore consider it important to share some of the many compelling applications that are often difficult for students to pinpoint on their own. I prefer to focus on a few well-developed applications, such as describing Google’s use of eigenvectors to rank searches in my linear algebra class or discussing mixing times in card shuffling in my representation theory class. This in-depth approach seems to energize students at all levels of experience while avoiding the “word-problem” stigma. My students at Stanford have responded especially well to this strategy, often introducing to me additional applications of the class material that they see in their own programs. Several students have even visited me long after their course is over to describe ongoing projects that use the mathematics developed in my course, which has allowed me, in turn, to recycle these ideas into future courses. So sketching a broader relevance not only acts as incentive for students to delve into a subject, but it frequently begins a dialogue that far surpasses the initial bounds of the course.

Verbal communication skills are essential to lively mathematical discussions, and I have found that group work, in particular, can help students learn to articulate their thoughts. I first learned about using group work in the Wisconsin Emerging Scholars (WES) program, an intensive, workshop-based program for calculus students. As the students worked together on challenging problems, my role as a teaching assistant was to observe their progress, giving hints when necessary and coordinating productive group dynamics. Over the course of the semester, I watched my classes transform from a scattered ensemble of students desperately avoiding thought to what might be described as a junior community of mathematicians. These profound results have inspired me to incorporate some of the ideas behind group dynamics and student-led discussions into my courses.

Of course, energetic mathematical discussions often lead to ideas and results that necessitate transcription into clear and rigorous exposition. To help students develop these skills, I try to include assignments that emphasize exposition in addition to mathematics in each class. I use a range of formats – smaller assignments focus on the structure focus on the structure of definitions, results and proofs, while larger projects that helps students learn to synthesize their ideas. For example, in more advanced undergraduate classes I supplement larger writing projects with weekly vocabulary quizzes to hone definition-writing skills. Students are often skeptical initially, but they soon realize that revisiting definitions helps them keep track of all the new ideas and understand lectures. My returning students have even requested these quizzes. In all forms, writing assignments give me more detailed feedback on students’ progress, while also helping students develop a rigorous mathematical voice.

My ultimate goal as an instructor is to introduce students to the excitement of working on new mathematical ideas. From exploratory assignments in courses to independent undergraduate research, there is a full range of possibilities that can give all undergraduates a taste of mathematical research. My own REU experience at Davidson College inspired me to continue mathematics in graduate school. But even for those students not committed to mathematical careers, research fosters an enduring appreciation and respect for the subject. In my work with Stanford undergraduates Eric Marberg and Vidya Venkateswaran, I have also discovered the benefits of mentoring emerging researchers. Their fresh insights and enthusiasm have pushed our research in new and unexpected directions.

These ideas represent some of the tools I use to help students to grow mathematically. Lectures lay a strong foundation by drawing a broader context, group work and larger class discussions develop verbal communication skills, and writing assignments promote rigorous thought and help crystallize ideas. Meanwhile, I encourage students to explore beyond the boundaries of individual courses through ongoing discussions that can produce a variety of contributions to the growing field of mathematics.