Statement of Teaching Philosophy

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As a mathematics educator, I have **two goals**, and everything I do when teaching aims to advance one or both. The first goal is **to communicate the specific content of the course** I'm teaching. Whether I'm teaching a graduate-level seminar or pre-calculus, my students should develop an understanding of the material and an ability to apply knowledge and techniques from my class in their further academic pursuits. The second goal is **to help my students become effective writers** and communicators of technical and mathematical ideas. Math is a language—a precise way of communicating—as much as it is a specific body of facts, and I guide my students to develop clearer and more effective mathematical communication.

In fact, although I enjoy the explicit subject matter of math, the clarity of thinking and writing that comes along with it is more important to me, and **I'd love to teach a writing-intensive math class**. I want my students to be able to make clear arguments, and to analyze the arguments of others. These thinking and writing skills are particularly important for non-math majors: ten years after college, anyone working in a math-heavy field will need some particular facts, but most of my students won't need to remember the definition of a vector space, or the proof of the Class Number formula, or the definition of "cosecant." They will, however, continue to draw on the thinking, writing, and communication skills that come with a good mathematical education.

My most important tool for effective teaching is fostering an **open and interactive classroom environment**. I've had a couple professors who spent class talking to the blackboard; neither they nor I could tell if I understood the material. But more often, I was blessed with talented and passionate teachers who got me, and all of their students, involved and invested in the material they were discussing. These engaging teachers got me excited about math as an undergraduate, and I try to pass this excitement on to my own students when I teach.

Interactivity helps maintain student interest, but it also makes my teaching more effective in two ways. First, it allows me to **calibrate my teaching** to my students' current level of mastery. When my students are answering questions and working problems with me, I have a much better sense of what they understand and what material I need to spend more time reinforcing. Second, my teaching style gives me many **opportunities to provide feedback** to my students, on both their grasp of course material and the clarity of their communication. I praise aspects of student answers that are especially well thought out or well-phrased, and work with my students to improve parts of their answers that are incorrect or poorly expressed.

Because student-teacher and student-student interaction are so crucial to my teaching style, it is important to **ensure that all students can participate** in the classroom dynamic; it is especially important to create a **space where students from marginalized demographics and disadvantaged backgrounds are not excluded or silenced**. In a small class or lab environment I can work with each student individually or in small groups, answering questions and helping them find the right thought process to approach problems they find difficult.

In a large lecture hall it is more difficult, and more important, to prevent the loudest and most enthusiastic students from drowning out the quieter ones. I do this directly by encouraging everyone to participate and **actively calling on my more reticent students** (while quieting the most boisterous), but also use a number of indirect techniques. I like to ask a question and give

30 seconds or so for **my students to each answer for themselves**: while doing word problems, for example, I might ask my students to each draw their own diagram before I draw mine. This allows my class to catch up, think about the problem, and then get feedback when they compare their answer to mine. I pair this with **regular flash polling**, where I ask everyone in the class to vote on an answer; this forces my students to think about the problem and helps me determine how well my students grasp the material.

Another important aspect of my teaching style is **publicly modelling my thought processes**. Students learn how to approach and solve problems by watching their teachers. I make sure to always show complete, organized work on the blackboard, presenting answers of the quality and style I expect, so my students are exposed to good mathematical writing and reasoning. I make my reasoning about problems explicit, **explaining my approach through explicit steps**, and providing rules of thumb and heuristics my students can use to be more effective problem-solvers.

I begin my class planning by identifying **specific skills and concepts** I want my students to develop. I organize my teaching around these concepts and emphasize to my students which skills are especially important; my students find it extremely helpful to know which aspects of the course they should focus on. I write assignments to further aid in mastery of these specific concepts: some easy problems to practice the basics, and some more challenging ones to develop and extend expertise. Through all this I prioritize giving **prompt and regular feedback**.

In proof-based courses, I also **assign problems specifically to improve proof-writing skills**. In particular, I have assigned a few problems over the term that could be resubmitted repeatedly, with detailed feedback on each draft; **this edit-revise-and-resubmit cycle develops writing skills** and gives my students guidance on how to write good mathematical proofs.

A vital part of mathematical reasoning is the ability to view a topic or mathematical object from multiple perspectives. Similarly, **each student comes to my class with their own perspective and experiences**. My own approach to math and to teaching is shaped by my background: my participation in high school debate, **my education at a liberal arts college**, and my active amateur interest in disciplines from philosophy to music to economics have all shaped my approach to math and to my classes. My students will have varied backgrounds as idiosyncratic as my own, and will have more, or less, or simply different preparation for the material. I want every student to get full value from my classes, and will enthusiastically do review sessions and extra one-on-one work sessions to help the least prepared catch up, and to enable the most enthusiastic to excel.

As a mathematics educator, I am particularly troubled by the belief many students hold that they are "bad at math". I firmly believe that **all students can learn math**. I've made a special effort to tutor troubled students, and while teaching at Caltech I took the opportunity to **teach a course for incoming Caltech students with weak or disadvantaged math backgrounds**, one of the only graduate-student-taught classes at Caltech. At Occidental College I have continued to work closely with student groups on campus that assist struggling students with math, and I will always work to create a helpful and supportive environment that makes all students feel welcome, and capable, and excited to learn math.