

Teaching Statement

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I strive to engage students in meaningful reflection of course material, meet students at their level, and make math feel accessible rather than intimidating. I realize that most of my students are required by their departments to take math in order to learn to solve specific types of problems and I have prioritized developing these practical skills. I also think that math classes provide us with a unique opportunity to encourage the development of deeper skills that students can apply to all aspects of their lives and I have particularly emphasized the development of study habits and self assessment, along with critical thinking and problem solving. I have actively sought out opportunities to improve my teaching by consulting with experts who study mathematics education, conducting my own original research on the comparative efficacy of various types of homework, and taking on additional teaching responsibilities as an associate instructor.

I've always enjoyed teaching and found ways to incorporate it into the work that I do. In high school, I volunteered in an elementary school classroom for students that spoke English as a second language and volunteered in an after school program for middle school students especially interested in math. In college, since my department did not have teaching opportunities for undergraduates, I worked as a high school and college math tutor with an organization that partnered with libraries to provide tutoring services at no cost to the students. After graduating, I worked at a special needs elementary school in Nicaragua where I taught all levels of math and eventually served as the third grade teacher for several months. At the same time, I volunteered in a college preparatory course for high school students that needed to improve their math scores on university entrance exams. As a graduate student at UCSD, I have had the opportunity to work as a teaching assistant or course instructor during each quarter of my studies and have taught graduate algebra, introduction to proofs, abstract algebra, mathematics for secondary teachers, and all levels of calculus.

I want teaching to be a meaningful component of my future work. As a result, I have sought out opportunities at UCSD to experience teaching at a different level than I do as a teaching assistant and to learn how to be a more effective educator. Last winter, I was the instructor for a pre-calculus class with about 80 students. Last year I also was fortunate enough to be selected as a summer graduate teaching scholar. As part of this program, participants took a 10 week course over the winter that covered teaching pedagogy, with topics such as metacognition, creating opportunities for active learning, and the development of expertise and meaningfully connecting related concepts. This program also provided me with an opportunity to conduct a formal study of interest in math education and to teach another large lecture course over the summer, this time multivariable calculus for non-science majors.

As I learned more about how students best acquire information, I was gratified to find that much of my intuition about teaching methods is supported by research in the field and that what I do naturally as both a teaching assistant and an instructor facilitates students' learning. For example, even in a large lecture classroom, I like to ask students to provide ideas on what steps we should try next as we work through examples together. An observer from the program noticed that I solicited feedback from students 37 times in a 50 minute lecture. These questions slow down the pace of lecture, encourage students to reflect on their understanding of key concepts, and keep students engaged. Even students who prefer not to volunteer answers have specifically mentioned to me that my questions are extremely helpful, that my process allows them to formulate questions on material they don't fully understand, and that it makes them feel comfortable asking these questions. As a teaching assistant with smaller sections, my style is similar. I've found that with the proper guidance, students have a very good intuition for pacing; they do a good job of taking turns answering questions and leave enough time for their peers to think about the question before providing an answer. In section especially, I also frequently give students time to reflect on a multiple choice question before asking them to vote on

what they think the answer should be. While I've found that students at UCSD are initially hesitant to vote, I'm careful to explain the benefits of participation. The advantage of holding these polls in smaller classes is that I can repeat the vote until every student participates and create an environment where being wrong is a natural and comfortable part of the process, but being silent is not.

Another area that I've been very conscientious about as a teacher is helping students to develop good study and reflection skills. For example, before tests I encouraged students to check that they could solve problems on the first attempt and without help, consistent with their goals on a test. While this seems obvious to us, many of my students believed that they should expect to do well on tests if they did the homework, even if they had to attempt the homework several times or ask for help on it before they finally got the correct answer. After giving the first test, I asked my students to reflect on their study habits, evaluating both whether the time they were investing in the course was appropriate given their personal goals and which of the things they did helped them learn best and made the most productive use of their time.

As part of the summer scholars program I also received support to conduct a study evaluating the relative efficacy of online homework compared to more traditional written assignments. As more and more departments, mine included, gradually transition towards greater use of online homework, the question of which system better promotes student learning, and how we can adapt each system to be of even greater use, becomes an especially timely and relevant point of inquiry. I randomly divided my students into two groups. One group did written homework for the first half of the quarter while the other group did online homework, and then everyone took the first midterm. The students then switched which type of homework they completed before taking the second midterm. The students that first completed written homework beat the class average on the first midterm by just under 10%. On the second exam, this same group, completing online homework, beat the class average but by only 2%. This strongly indicates a need for follow up study to see if the original results can be duplicated, and I have had several fruitful conversations with senior lecturers who are intrigued by the results and intend to conduct similar studies. It also may suggest that we can improve the effectiveness of online homework by training students to use the tool properly. One of the great potential strengths of online homework, the ability for students to receive feedback on their attempted solutions and revise their answers, is also one of its greatest weaknesses as the system often encourages guessing. I hypothesize that the second group was less inclined to guess because they had been correctly trained on how to approach problems in their written homework assignments. I am in the process of analyzing data that will help me evaluate the accuracy of this hypothesis and am interested in continuing to explore how both written and online homework can best be utilized to promote student learning.

I am also open to changing the way I teach when I learn there is a better method. In my summer class, based on feedback from the summer scholars program, I frequently had students work in small groups in order to get additional practice with a new concept we had learned. This worked well; most students were engaged in the process and found that it helped them to understand concepts better. However, some groups were frustrated because they couldn't figure out how to start a problem (or what the second step was, after I was able to address their initial questions). I also was hesitant to use group work when I had a lot of content since we were able to cover far fewer examples using this method. I am interested in continuing to experiment with the use of group work as a tool to actively engage students in the material, and have had success with it in abstract algebra this quarter, but I also want to learn more about how best to implement group work and overcome some of the obstacles I have encountered. As another example, I like to occasionally assign homework exercises that require students to critically apply conceptual understanding in original ways unlike any examples we've covered. In evaluations, students have complained that homework is much harder than anything we do in lecture and unrelated to important concepts. I see two key areas for improvement here. First, I can do a better job of framing these questions; I need to explicitly address the fact that I am asking students to do something we haven't covered together and motivate the importance of developing problem

solving as a skill and also the practical benefits that deep conceptual understanding provides in solving other problems. Second, I need to better evaluate which of these questions are actually of practical use to students who will not go on to study science, shorten the rest of the assignment to give students the time they deserve to carefully work on these difficult exercises, and teach students how to approach problems that can't quickly be solved by applying an algorithm we've covered. I appreciate the insight that I get from student feedback and am continuously revising my teaching style as I learn more about what works well and what doesn't.

For most mathematicians in academia, teaching is one of the requirements of employment. For me, teaching is something that I sincerely enjoy, am good at, and spend time reflecting on. In their comments, my students have noticed that my strengths include explaining problems in easy to understand steps, highlighting important concepts and connecting these to other concepts we've learned, anticipating and explaining common mistakes or misunderstandings, and creating a comfortable environment where students are encouraged to ask questions until they understand everything. I take pride in making math accessible to my students and providing them with the direction they need to grow and succeed.