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My teaching experiences at Berkeley have varied widely. In the more usual realm, I have taught introductory calculus, honors linear algebra, and upper-division linear algebra. But I have also acted as a classroom observer for new graduate student instructors, as well as led the class that all new mathematics instructors take, in order to give them the necessary teaching tools.

Every semester of teaching has required a different skill set, and each has posed its own unique challenges and rewards. I was recognized as an “Outstanding Graduate Student Instructor” by the University in 2007, partly, I think, because of the abilities I have gained at different aspects of teaching through my breadth of experience.

This experience actually goes back further than my Berkeley teaching career – I taught mathematics in some capacity for eleven years of my life, including being a Course Assistant for many courses while an undergraduate, teaching high school students in India for a year, and tutoring prisoners in the San Quentin College Program. I have always loved teaching, even though, or perhaps because, every teaching position poses new problems and presents new obstacles that I have to overcome to succeed at it. Each phase of my teaching career has given me new thrills and new challenges.

After graduating from college, I spent a year teaching mathematics in India on a public service fellowship. I was teaching high school students, which was not entirely new for me – I had taught high school students in afterschool programs while I was in college. However, the students in India, most from impoverished circumstances, had very little mathematical background. Thus, the curriculum I had planned, focusing on more advanced topics like probability and basic logic, could not be attempted without a huge amount of remedial work.

The situation was frustrating, of course, but it also taught me how to deal with the problem of inadequate knowledge. Students often do not want to admit that they do not know something, especially when they know that they should. Understanding why a student thought that multiplication by 0 was not allowed, and showing them the physical meaning of multiplication in this case, was necessary before I could do anything else with them.

At Berkeley, my challenges have been of many types – both seen before and totally new. As a graduate student instructor for a normal class, a large part of my job is helping with homework problems. However, since I am also the main point of contact that my students have with the class, it is also my job to make sure that students understand the material being learned. Often, the difficulties students have with homework are precisely because they do not understand a concept in the class.

This increased responsibility for my students’ understanding makes my task much trickier. How much time can I spend going over the underlying concepts? Will doing Gram-Schmidt orthonormalization show a student what the dot product is supposed to mean, or should I review the concept of orthogonal projections first?

The difficulty is compounded because the students must be engaged, and convinced that they want to know the background material – that the background is as important as the answer. I motivate such discussions through asking questions. What are we actually doing? What would happen if the vectors that we started with were not a basis? Why does this procedure work? Making students think about what they are doing, as opposed to just helping them do it, arouses their interest.

In the fall of 2007, I was the only graduate student instructor for six different lectures, all being taught at different speeds, and several from different texts. The greatest difficulty was that, because my interaction with students was entirely in the form of office hours, I had much less of an idea how the students are doing. I might not see individual students for weeks. I did not see any of their written work. During my office hours, I usually had upwards of ten students, and I had to know how much time I needed to give each of them: is a hint enough for this problem, or did I have to do a walk-through of all the steps, or is a mini-lecture on the concepts required?

The skills necessary to do this were similar to those I needed in India – hearing students' confusions and understanding where their questions actually lay, but in addition I also needed patience – explaining the same problem repeatedly for five hours, and remaining engaged, and attentive to each student, to make sure that I understood their problems.

Very different skills were necessary for the other type of instructing that I have done at Berkeley – observing and teaching new graduate student instructors. As an observer, I videotaped new instructors' classes, and then met with them one-on-one and in pairs to go over their teaching. As a teacher, I met with new instructors weekly, to discuss their classes and also general pedagogical techniques. In observation, my most difficult task was analyzing what had gone wrong in the class, and thinking about what I would have done differently. Sometimes, the answer was as simple as using the blackboard more effectively. In other cases, discussing the issue with the instructor afterwards would lead to a solution that neither of us had thought of before, such as seeing which student wrote what in groupwork by giving each of them a different-colored piece of chalk. In still others, I learned new techniques from instructors, like having every problem worked out in front of the class entirely by students; that instructor's students were terrified of section, but also did better on the exams than any other section.

Being an observer meant that I had to decide whether a classroom technique bothered me because it was different from mine, or because it produced bad results, and whether one that I could think of would do better. It forced me to re-examine notions of being a good teacher. Some attributes are constant – listening to students, asking questions, speaking clearly. But others vary widely. How much focus on homework? Should students do groupwork or be shown how to do problems by the instructor? Should students on the wrong track be corrected immediately, or allowed to discover mistakes on their own? Good teachers, I have found, make their methods work for them, whatever they are. That, of course, makes it even harder to tell people how to be good teachers, because there is no right answer, and not even that many wrong ones.

When I led the class for new instructors, I had to analyze my teaching philosophy on a deeper level. Often, as an observer, my comments were mainly functional – remember to pause for five seconds after you ask a question, don't erase what you have just written, make sure you look at the entire class when answering a

question. While such suggestions remain useful, more is needed for a class for first-time instructors. It is easy to be caught up in the minutiae when teaching, and not to grasp a bigger picture of what the class is designed to do, and what the overall goals should be. First-year students are not required to take calculus because achieving their life goals requires integration by parts. And first-year students do not do worse in calculus in college as opposed to high school because the material is harder. The reason for both of these is that college calculus is taught with the idea of teaching students how to think abstractly, and how to manipulate symbols to correspond to their abstract thinking. Thus, it can turn out that time spent on complicated trig integrals is less useful than going into detail on a simple rewriting of a summation, because the latter actually involves knowing what the sum *means* and how it can be manipulated.

While I led discussions, it was also important for me not to unduly push my own philosophy of teaching. I lean heavily towards an active classroom, in which I call on students and cajole them to participate. I believe that teaching students how to think is more important than the precise facts they know, even though sometimes the students disagree. More generally, I often distrust what students want from a section – it is much easier for them to listen to me lecture, and think that they are learning, than it is for them to solve problems themselves, even though often, that is where the greater benefit lies. However, my views, based in my experience, are not universally held, nor should they be. Explaining my views, and why I held them, while leaving space for others to develop theirs, forced me to re-examine, and sometimes voice for the first time, policies that I had taken for granted, while also solidifying certain ways that I did things.

The experience I had gained in teaching new instructors was truly tested in my final semester of teaching at Berkeley, when I was the graduate student instructor for a class designed to prepare high school math teachers. The focus of the class was on teaching techniques, yet in many cases I had to also teach the mathematics itself to the students, since the presentation of concepts was mathematically rigorous and unfamiliar, despite being intuitive. This was the first time that I had to simultaneously teach both a subject and how to teach that subject, and it was a very challenging class, not least because of the frustration students felt when dealing with concepts, like fractions, that they found familiar, and yet couldn't use rigorously. Introducing students to a completely new way of thinking about a subject was a struggle, but I was impressed as they eventually learned to think and speak in the new framework.

Each teaching task I have been faced with has presented its own unique set of challenges, but also its own rewards. The high of a successful section, in which the whole class is engaged and interested, and every group solves the assigned problems, is a feeling worth aiming for every time, even if it is a difficult objective. Helping a student in office hours is a smaller individual accomplishment, but it has the advantage of knowing that the student has really understood the problem, and has written down a solution that they, working with you, came up with. Observing and teaching new instructors gives me new perspective on teaching, new possibilities as well as confirmation of old views. I look forward to encountering new teaching situations, allowing me to apply what I have already learned while growing as a teacher.