TEACHING STATEMENT

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I have found that for many mathematics students, it is very easy to miss the forest for the trees. They may get caught in the trap of memorizing formulas without understanding the contexts in which it is appropriate to use them, or they may read proofs line by line without understanding the motivation behind them. I believe that as an instructor, it is my job to give them a motivation and context for the details they are learning as well as to explain and reinforce the details.

General approach to teaching. When I teach lower-division courses, I distribute surveys on the first day. Apart from the immediate benefit of helping me learn their names more quickly, this allows me to tailor the course to that particular group of students. This does not mean that the material or goals of the course will change, but that I will choose my approach in response to my students' attitudes. For instance, when teaching calculus for humanities students, it is useful to know whether most of the students are afraid of math or whether they see the course as an easy A because they have taken calculus before. In addition, knowing my students' majors allows me to select my examples so my course is more relevant to them. If I have several future biologists in a calculus class, I can talk about modeling population growth with a logistic growth function; if I have more sociologists, the same function can be used to model the spread of a rumor. In the future, my surveys for required courses will include the question "Why do you think this course is required for your major?" I hope to make them think about why my course might benefit them from the start.

When I lecture, I emphasize the terminology the students will have to know to improve their understanding of the underlying concepts. In a logic course, this may be the difference between a valid argument and a sound argument; in a calculus course, this may be a concept such as marginal cost. When I do examples, I take care to explain each step and emphasize the importance of checking the answers. For instance, if I am doing an optimization problem, I always check that the final answer satisfies the constraints of the problem. In doing this, I hope to give them a set of tools to evaluate their own work as well as the right techniques to do it in the first place.

When I teach an upper-division course, however, my approach changes somewhat. I am able to assume that the students are interested in the course material, and I am able to assume a certain amount of mathematical maturity on their parts, such as the ability to understand how one step follows from another in a proof. However, I cannot assume that they will understand the general theme of a proof on their own. For instance, the proof that the cardinality of the set of functions from $\mathbb{N}$ to $\{0, 1, 2\}$ is the same as the cardinality of the set of functions from $\mathbb{N}$ to $\{0, 1\}$ requires the construction of an injection from the former to the latter. If the injection is simply presented without an explanation, it is possible for a student to follow the proof but not understand why the chosen injection works except on a line-by-line level. Therefore, while I go through the proofs rigorously, I try to make sure that they understand why we choose to use a particular function or proof technique.

In every class I have taught, I have worked to get feedback from the students over the course of the semester to determine whether they are learning effectively. Neither Berkeley nor NUS has official midterm student evaluations, but around the midpoint of the semester, I stop class a few minutes early one day and ask my students to write down their thoughts about the course. Generally, their responses indicate that the course is going well. For instance, almost every semester, approximately equal numbers of students tell me that I am going too quickly and too slowly. I have found that if I tell my students what the distribution of responses is, they understand my classroom approach much better and are more content. However, sometimes I incorporate some of their suggestions. Once, when I was a TA for a logic course, several students asked that we do more group work. Although the material we were covering at that point did not lend itself easily to this, I promised them that when we began to write proofs in first-order logic, we would try it. It worked very well.

Teaching in the US and overseas. Teaching abroad has presented me with a new set of challenges. While my Singaporean students are very much like their American counterparts in many ways, there are some key areas in which I have had to adapt to be an effective teacher.

The primary difference I have found is that my students at Berkeley were much more comfortable speaking up in class than my students at NUS. This means that I have had to develop new strategies to encourage classroom participation. For instance, when a question is met with a long silence, I tell the students to break up into groups of three and discuss the problem for five minutes. During those five minutes, I circulate among the groups, and afterwards, I choose a group at random and ask for their thoughts. This has two important benefits. The shyer ones feel more comfortable asking me for clarification when the entire class is engaged in group work, and when I call on a group, the students feel more comfortable reporting on the group's ideas than their own.

Teaching in Singapore has made me better prepared to teach in the US. Not only have I learned new techniques for encouraging student participation, I have more experience with students who have varying linguistic and cultural backgrounds. This background will help me when I teach international students or ESL students in the United States.

Technology. I have found that, while software can help students learn, it should be evaluated carefully. In an introductory logic class I was a TA for, an educational theorem-proving program accompanying the textbook was quite useful. It allowed the students to build counterexample "worlds," and it helped to solidify their understanding of topics like universal generalization and instantiation. However, in other cases, I believe that software is less effective than traditional methods. For instance, I have seen software bundled with a calculus textbook that provided so many hints that it almost seemed to discourage independent work.

I have also found it useful to have a private online forum for each class as a space for my students to discuss the course material. I typically do not post on the forum myself unless a question is directly addressed to me or unless all of the students are on the wrong track after 24 hours. I look forward to trying the same approach with the large lecture I will teach this spring.

Conclusion. I have developed these teaching techniques through my work with many different courses. Clearly, not every technique works with every class. The students I have taught at an academic summer camp for advanced middle-school students are very different from my calculus students, and they, in turn, are very different from my students in upper-division courses. However, I have enjoyed the challenge of teaching different subjects to different student populations, and I enjoy using my creativity to give my students the best classroom experience possible.