TEACHING STATEMENT

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Teaching is a complex endeavor. Each setting is different, but some things seem to apply everywhere. Perhaps the most fundamental is that, for a class to be effective, students need to be actively engaged. In small classes, this can be achieved by having students discuss ideas and solve problems in groups. In larger lecture classes, perhaps it is enough to simply motivate ideas with interesting examples and occasionally ask students to pause and think. In all cases, it helps to have students asking questions and interacting with the instructor.

I have had the opportunity to teach in a variety of settings. I have been a recitation leader for two semesters at MIT, both times working with first semester freshmen. I have also helped organize two graduate-level seminars at MIT, and several other seminars at the university of Melbourne and at Berkeley. While I was a student at Berkeley I was once lead instructor for a linear algebra class, and I also ran recitation sections for three semesters. I spent the 2005-2006 academic year as a full time eighth grade math teacher at Frick Middle School, an ethnically diverse middle school in Oakland, California. Finally, I have been involved with several enrichment programs for school children, including running a 10-week math circle class for elementary school students.

Teaching middle school had a large effect on my teaching philosophy. It that setting, it was crucial to have predictable structure, but also to have a mix of different activities. A typical 50-minute class involved at least four activities: A warm-up question, a teacher-directed lesson, classwork, and a closing activity. The predictable routine helped keep the class organized and running efficiently, and having a variety of activities helped keep students engaged.

Undergraduate education is very different from middle school, but I have found that building a predictable routine with a mix of activities is still helpful. Classes with an established routine run better, but classes that are always the same get boring. In recitations, I typically begin by answering questions, then I spend about 15 minutes doing an example or two related to recent material, next the students work some problems (either by themselves or in groups), and finally I spend the last 5 minutes or so going over those questions. The predictability makes things easier for students. For instance, they know if they want to ask questions about homework, their chance is in the first few minutes of class, so they should come prepared.

University-level teaching often takes the form of lectures, in many cases with large classes. There the format in fairly fixed, and by "having a routine" I mean simple things, like using a predictable system for introducing new ideas. Personally, I like to do this by starting with some motivating examples, and then moving towards formal definitions and precise explanations. Keeping students engaged is partly a matter of just picking interesting examples. I also try, at least once per class, to pause to ask students to think about a question. I sometimes I do this by getting the class to vote on the answer, allowing more than one student to give input. I also encourage questions, even in larger classes. Questions give me a gauge of how well students are understanding, and a natural opportunity to

explain material from new perspectives. Relying too much on questions can be difficult depending on the environment, so I also watch the class while teaching, judging for myself when more explanation is needed. But it is usually better to have students tell me what is confusing them than to have to guess.

To illustrate some things I do to get students participating, let me discuss the first day of class in the linear algebra course I taught at Berkeley. I began by putting a problem on the board: solve a system of two linear equations in two unknowns. With some prodding, students came up with three different solutions (graph the two lines, solve by substitution, and use a matrix), plus a few variations on those themes. We discussed the different techniques used in these solutions, and I said a few words using this example to motivate linear algebra as a subject. I tried to get as many students as possible to participate in the discussion, calling on new students whenever possible. Students participated well throughout the semester, and I think this activity helped in setting that tone.

Another important theme in my teaching is that techniques and ideas should come up repeatedly and, when possible, "in context" within other problems. It is not enough to teach an idea once, in isolation from other ideas in the course. This will not convince students that the idea is important, and they are likely to forget. For instance, during a unit on applications of integration (volumes, work etc.), I ensure that the more challenging techniques of integration (such as trig integrals and integration by parts) show up. It is tempting to make the integration in these problems easy, and to focus the new idea (i.e. setting up the integral). This is sometimes the right approach, since one does not always want to be distracted by older material. However, the older ideas need to reappear regularly.

Especially in lower division classes, students need regular feedback. In recitations, I can help with this by circulating while students are working problems, but this is not always possible, and in any case more formal feedback is also needed. I like assignments to be graded regularly, and I also like to have at least 2 midterms (in lower division classes). The assignments are important since one can assign some problems that would be too long or challenging for a test, and I think it benefits students to see those questions. The midterms are important because they are the most objective way to find out how students are doing, and to let them know.

Let me also briefly discuss the graduate seminars I have organized. In Spring 2011 I ran a focused seminar on quantum groups at MIT. This ran partly as a course, with me giving a lecture each week building up the subject. Each week a participant (almost always a graduate student) also gave a 1-hour talk on a related topic. In many cases, I helped students select a topic and prepare their talks. In collaboration with the students, we produced a fairly complete set of notes for the seminar, which can be found on my website. I think this format was very successful both in teaching students advanced material, and helping them develop their presentation skills.

I have limited experience as lead instructor of standard undergraduate level courses, having only been in that position once. However, I have quite a bit of experience in front of classes. I have also taken the lead role in teaching in many different contexts, including my time as a middle school teacher, my graduate seminars, and my work with math circles. Teaching has presented me with many challenges. For the most part I believe I have been successful in facing them, and in helping my students learn. I look forward to teaching in my next department, and to continuing to grow as a teacher through working with new colleagues.