TEACHING STATEMENT

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My teaching philosophy centers around the simple idea of engagement, both inside and outside the classroom. First, I focus on giving engaging, interactive lectures. During the lectures, I provide structured opportunities to apply the newly learned concepts – teaching is a balance of teacher transmission and the student learning through his or her own experiences. Second, I tightly integrate homework and in-class groupwork. Working together with your peers on homework is a great way to solve challenging problems, and simultaneously foster camaraderie. I’ll elaborate on these ideas by giving examples from my teaching experiences.

Thus far, I’ve been an instructor for undergraduate classes and Putnam problem sessions, and I’ve been a teaching assistant for graduate classes. Of the classes I’ve taught as the primary instructor, the most challenging ones were the summer calculus courses at NYU. The course ran for six weeks, and there were two-hour lectures on four days of the week. In a typical class, I lectured for about an hour, and explained two or three important concepts. It is quite hard to keep a large class attentive: studies have found that students frequently cycle in and out of attention\(^1\). Research has also shown the importance of “active learning”: lapses decreased significantly right after demonstrations and interactive sessions. So I did lots of interactive examples and frequently used Mathematica or Wolfram Alpha to visually illustrate mathematical concepts. Then, just as they were getting bored of listening to me, I’d either give them worksheets or organize a group activity. Finally, to let them wind-down, I’d usually tell them a historical anecdote like the brachistochrone problem, show a video, or do a physical demonstration.

I particularly enjoyed a demonstration I did when teaching calculus students about parametric equations. I hacked together a program that outputs two sine-waves through a computer soundcard. I sent the time-varying \(\sin(\omega_1 t + \phi), \sin(\omega_2 t)\) signal to the \(x\) and \(y\) inputs of an oscilloscope. By varying the frequency and phase-difference, we can visualize the so-called Lissajous shapes, ellipses and space-filling curves. But this isn’t a big deal, since you can see these figures on a computer screen; how is an oscilloscope any different? So while displaying the signals on the oscilloscope, I simultaneously routed the signals into a speaker. By adjusting their frequency in the audible range, we could hear the sine waves and the beats produced by their interaction. This made quite an impression on the students.

Homework has become a significant component of my teaching: I give lots of it and it forms a substantial portion of the grade. However, undergraduates typically take a lot of classes. Simply giving them a lot of homework without giving them the means to handle it is pointless (and cruel). I addressed this by organizing class activities around homework. I divided the class into two-member teams, and let them work on homework for five days. On the day before homework was due, I’d have each of the teams come up to the board and present a homework problem. This way, we’d go over a lot of the challenging problems.

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in class. As an incentive, each problem they got correct would count towards the final. I made the scoring rules complicated enough to involve a lot of strategizing. They got very involved and were fiercely competitive.

While I was fortunate to have some leeway with my course design as a primary instructor, it is difficult to balance student needs against a set curriculum as a teaching assistant. I had an especially insightful experience that highlights this challenge while covering a calculus recitation class for a colleague. I stuck to his lesson plan initially, but quickly noticed that students seemed a little too quiet and unresponsive. After probing them a little bit, it turned out some of them had seen most of the material, and were simply bored. After ensuring that no one would be left behind, we tried working on some more advanced material. The students were much more involved after that.

Group activities and frequent quizzes help me keep track of individual needs. I try to keep myself available outside of class and office hours, and be especially responsive to email. By personally engaging with the students, I try to be more than just an instructor doing a job.

Since I’d like to constantly improve as an instructor, I’ve kept a journal documenting my progress over the last few classes. I learned how to pace myself during a lecture, how hard to make the exams, and improved my use of class-time. The feedback I received through student reviews have also shaped my approach. For example, when I first tried using groupwork to enhance in-class participation, it didn’t go so well. The groups were too large, the model didn’t encourage out-of-class collaboration, and there wasn’t enough incentive for them to solve problems on the board. A student suggested that I decrease the group size, and I tried this on the next course I taught. It turned out to be a great suggestion. As a quantitative measure of my progress, my approval rating increased from 64% in the first class I taught, to 87% on the second, and then finally to 100% (the last one is probably because the class was very small).

In the future, I want to explore more active learning techniques and find more creative ways to engage students in their learning. I’m also looking forward to teaching more advanced classes, especially in areas of my own research.

Mathematics gets a bad rap in our society. While it seems like we’re moving towards a more tolerant culture in general, it’s still completely acceptable to “hate” math. I will continue to do my part to rectify this situation: When teaching, I try to share my love for the subject, and show the students how math can be a creative, engaging and fulfilling pursuit.