Statement of teaching philosophy

Roland K.W. Roeder

Many of us have heard the statement "I hate math" or "I'm bad at math!" I think that these feelings often result from a lack of communication between the instructor and the students combined with feelings of guilt and inadequacy that arise in the student from not understanding a concept. (At some point or another most of us have encountered the embarrassing instance of feeling pressured to act as if we understand something that we do not.) In this way the lack of communication, and the feelings arising from a lack of comprehension form a cycle with each problem exacerbating the other.

My job as a teacher of mathematics is to break this cycle—I try to make the class as fun and as interactive as possible, while still covering the necessary material.

I will often work a problem in the class, asking the students for their input for what to try next at each step. (e.g. "So, which row or column do we want to expand upon first when computing this determinant?") This helps the students to understand the many types of decisions that are made when solving a problem, allows me to better determine whether the students understand, and breaks up the monotony of the lecture. The students find it particularly interesting to hear suggestions made by their classmates about a given problem, and it definitely makes the lecture more interesting for me.

And why should the course be interesting for the instructor? Well, if the instructor is bored, there is no doubt that the students will be bored. However, if the instructor finds the material interesting and the interaction with students fun, so will the students.

Another way that I make the class more interactive is to write a statement on the chalkboard and ask the students to vote whether they think it is true. One must of course add the requisite joke about the 30-40% of students that don't vote, but this just livens things up further.

I tell occasional jokes, ask questions of the students, and even occasionally make an obvious mistake in order to see if the class follows me. In the case that the obvious mistake is not intentional this provides a moment for me to express my humility to the students, and to illustrate that perfection is not expected.

For me, teaching provides a pleasant level of human interaction and also a stable complement to the inevitable ups and downs of mathematical research. Every time that I teach I feel a bit of success, I know that I have made a difference, and I enjoy it. When the students see how I enjoy lecturing it has an enormous positive feedback—they enjoy the class much more, too. This pleasure in listening carries over to happiness working with the material building confidence, skills and satisfaction.

Let me provide examples of my teaching techniques. During my final year of graduate school at Cornell University I taught first and second semester calculus to a small group of students (roughly 25). While I had some of the common difficulties experienced by first time teachers, I consistently made jokes and did everything that I could to make the classes fun and interactive for the students. In fact, one of the students later told me that he always enjoyed coming to class because he was never sure what kind of funny things would happen.

Since leaving Cornell, I have been a postdoctoral fellow at the University of Toronto with the following teaching duties:

- Spring 2007: Math 223, Linear Algebra for Arts and Sciences students.
- Spring 2007: Math 402, Classical Geometries
- Fall 2007: Math 389, Complex variables for Engineers (teaching currently).
- Spring 2008: Math 185, Linear Algebra for Engineers (next semester).

Each of these courses presented different types of challenges. For instance, Math 223 was my first large course with about 90 students, but the organization of course was entirely prepared for me by a course coordinator. I did my best to keep the course fun, and the students appreciated it.

Math 402 was a small course with 22 students but it still presented challenges. One challenge is that I developed the course myself, based solely on the catalog description. The other challenge was the mixture of students, ranging from rather weak students to four or five extremely strong students (who were taking other courses at the graduate level.) Despite the broad spectrum of students and despite the non-traditional lecture time of 6-9PM one night a week, I was able to keep the students coming to lecture, interested, and asking questions. As in my other courses, one of the key ways to do this was to routinely ask the students for input in how to solve a problem, or how to prove a given statement. It slowed the class down, but I think it was very worthwhile.

In this small class I tried an unusual tactic for a math course: making 10% of the student's grade based on a 30 minute oral presentation given outside of class during the last 2 weeks of the semester. This allowed the students perhaps their only chance as an undergraduate to work on their oral presentation skills, while learning a topic of their choice from geometry. Stronger students could do more advanced topics while weaker students could choose appropriate topics as well. I feel that this was well received, and that the opportunity was quite appreciated by the students.

My course this term is Math 389—complex variables for engineers. There are roughly 150 students in one big lecture. This combines the difficulty of a large class with the fact that I have entirely redesigned the course myself, placing emphasis on my favorite four applications of complex variables to the "real world": use of the complex physical quantity known as *impedance* in electrical circuits, computation of indefinite integrals using contours, solution of Laplace's equation via conformal mappings, and the Fourier transform. I was given this class by the teaching coordinator Mike Lorimer, because of my strong teaching record from previous courses. (Mike has written a letter of reference about my teaching.) So far, the students love the course, and I have already received a number of positive comments about my interactive style and my emphasis on applications.

Let me finally mention that I really enjoy mentoring students and leading them on research projects. During this past summer I enlisted two graduate students, Omar Antolín and Greg Maloney, for a project in computational hyperbolic geometry. I taught them the ins and outs of hyperbolic geometry and writing their first academic paper, while they helped me with some necessary algebraic number theory. A similar mentorship is beginning

this semester as I lead a 4th year undergraduate George Han in a reading course about complex dynamics.

A large part of doing mathematics consists of communicating mathematics. Whether with students or with colleagues, I think that it is important to do this in a clear, interesting, and, as much as possible, interactive way.

Comments from student evaluations:

"Professor R. Roeder is an excellent U of T teacher. Always helpful and attends to student needs. Outstanding teaching methods with lots of fun and jokes. He approaches hard material with lots of great examples. Give him a raise and keep him at U of T."

"I've seen all of UT's math profs, trust me, Mr. Roeder is the best... Bring some new/fresh profs like Mr. Roeder into the faculty plz!"