Statement of teaching philosophy

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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 make 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 and, just beginning this semester, at SUNY Stony Brook. My teaching duties have been the following:

- 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
- Spring 2008: Math 185, Linear Algebra for engineers
- Fall 2008 (Stony Brook): Math 203, Calculus in many variables

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. In evaluations, one student said: *"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."*

Math 402 was a small course with 22 students but it presented a different challenge with a mixture of students, from those planning on becoming high school teachers, to those planning on a research career in math. In order to make the course more flexible for this wide spectrum of students, I tried an unusual tactic: making 10% of the student's grade based on a 30 minute oral presentation. 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. Teaching evaluations for this course were very positive. For instance one student wrote *"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!"*

My second year teaching at U of T was very different because both Math 389 and Math 185 were comprised mostly of Engineering Science students, who have a "rambunctious" reputation. Instead of working to make the class more lively, I had to learn how to keep the class quiet! These students were often eager to participate and most of them enjoyed my usual interactive style. Because of the large size of these classes, instead of using homework to keep the students working consistently throughout the semester I gave them 5 quizzes. I often had to reserve a special room for office hours because of the number of students attending before these quizzes. During a typical session there were 10-15 students and we had fun interacting at a more informal level than lecture.

One student from Math 185 recently wrote to me to let me know how my course had impacted his summer project on database design: *"I quickly picked up the necessary theoretical aspects of database design, a feat which I am reasonably certain would not have been so painless without the reasoning ability that I learned in Professor Roeder's linear algebra course. More interestingly, one of the problems to be solved in my data model was solved using the notions of vector spaces and one to one mappings."*

It is only six weeks into my first semester teaching at SUNY Stony Brook, where I continue my interactive style of teaching, as described above. One new twist for this course is that we are using Maple© to plot curves and surfaces in $\mathbb{R}^2$ and $\mathbb{R}^3$. The first homework assignment that required Maple was a hurdle for the students, but they now seem to enjoy it.

Teaching doesn't only happen in the classroom. I really enjoy mentoring students and leading them on research projects. During the summer of 2007 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 guided them in writing their first academic paper, while they helped me with some necessary algebraic number theory. A sim-

ilar mentorship began during the fall semester of 2007 when I led a 4th year undergraduate student, 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.