TEACHING STATEMENT (Written November 2012)
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Three qualities define me as instructor: my emphasis on challenging problems, my attention to student thinking, and my commitment to personal growth as a teacher. I’ve developed these views from my own experiences as a student, my experiences as a teacher, and communication with other instructors and researchers.

I strongly believe mathematical understanding is built through active engagement with challenging problems. Learning happens through the entire, sometimes zigzagged, process of solving a problem. The false starts and partial solutions we stumble over in the process are integral to building our overall understanding of a mathematical topic. If my students don’t experience the challenge of stumbling in the problem-solving process, then the problem hasn’t challenged them enough and I haven’t presented them with a chance to learn, only a chance to demonstrate that which they already know. In addition to affording learning experiences through productive struggle, challenging problems provide a motivation to participate and a significant sense of accomplishment when completed. Routine problems provide none of these.

My commitment to problem-centered curricula stems from my own experience as a student. Nothing ever “clicked” for me in lectures. It was only when I went home and struggled through homework that I understood new concepts and how they connected. In fact, my favorite class was one in which the professor’s lecture accidentally lagged behind his problem sets. For this class I worked at my own pace by myself and with peers, working hard on the pre-emptive problem sets, and came to lecture able to enjoy and think contextually about the professor’s big-picture insights. This has influenced my teaching ever since. I’ve applied this wisdom to almost course I’ve taught, starting in summer of 2007 when I taught advanced high schools students at Canada/USA Mathcamp and designed several Moore-method-like problem sequences before I’d ever heard of the term “Moore-method.” I knew that problems in themselves were learning experiences and labored over building logical sequences of instructional problems in the areas of proof techniques, metric spaces, euclidean constructions, measure theory, and more. Later, I was excited to see how effectively I could use a problem-based approach when I started teaching another population—future elementary school teachers. Students were immediately motivated by classic tractable problems like the “hand-shake” problem, which (surprisingly) none of them had never seen before. Through one-on-one conversations in class and in office hours, and detailed written homework assignments, I have observed their mathematical understanding improve greatly by working on problems for which they have no formulaic approaches. I’m enthusiastic about these particular students’ receptiveness to these kinds of problems and the learning experiences they engender because I hope they will bring them into their own practice as classroom teachers.
I strive to create a classroom climate that supports this view of mathematics-learning through problem-solving and struggle. Unlike a traditional mathematics classroom, where many students feel ashamed of not understanding something, I make it clear to my students that “not understanding” is an important step on the way to understanding. My students feel comfortable asking questions and making their thinking public. My goal is that they don’t fear judgment from me or their peers, but rather see public thinking as productive. I foster this climate by requiring all students to participate (often cold-calling for answers to questions), and by taking the time to point out productive components within incomplete or incorrect solutions or ideas. In an evaluative focus group held with my students (in my absence), the students expressed to the evaluator that they feel very comfortable talking in my class and know that it’s OK to share their thinking, even if its not completely correct.

“Public thinking” in my classroom is not just an aspect of the classroom climate, but is itself a way to help my students learn. It’s not surprising that a student explaining something to the class may find an error in her own thinking, which benefits not only her, but the listeners as well. If students only see perfect solutions, they may not recognize what they’re not understanding. One example from my work with future teachers is that many of my students enter the semester with a weak notion of mathematical justification, especially in cases of showing that a pattern or result holds in general. Instead of standing in front of the class and demonstrating correct example after correct example, we examine students’ solutions as a class. In many of these solutions, the justification is weak or non-existent. Examining the weaknesses in those justifications is an integral part of understanding what constitutes a good justification. This public dissection of incomplete solutions provides a more nuanced feedback about the nature of justification than a numerical grade on an individual homework assignment. In weekly problem sets, I’ve seen excellent student improvement in this particular area over the course of the semester. Several students whose justifications at the beginning of the semester consisted of demonstrating three examples now produce near flawless justifications of general phenomena.

Another important aspect of my teaching is the value I place on continuous personal improvement. In particular, I constructively use feedback from colleagues and students to improve my teaching. Student evaluations are not always valued because common wisdom says that “you can’t please everyone.” However, some student comments that others may view as whiny or unfounded, have inspired very positive changes in my teaching. One semester a student criticized me for being intimidating. She went on to describe teaching practices I’d consciously developed and thought of as “productively socratic,” in which I refused to answer questions outright and instead countered my students’ questions with further questions. I did this intentionally, as I knew it was important that students developed their own sense of mathematical correctness rather than relying on instructor say-so. Instead of faulting the student for not understanding my teaching methods, I considered what kinds of changes I could make to change this kind of perception. I did not abandon my teaching ideals in response to this comment, but I did make two lasting changes: I took the time to explain to my students why I wouldn’t always answer their questions, and I started being more careful with the tone such questions could take. With these two minor changes, I’ve fostered much better relationships with my students—I have more students come to office hours, more students ask questions in class, and students understand that my choices as a teacher are
intentional and not arbitrary.

I communicate frequently about teaching with colleagues in my department as well as instructors across the country (such as on the listserv of the Academy of Inquiry Based Learning). These conversations center on teaching methods and practices, student learning, and curricular choices (such as particularly interesting problems). Within my department this may take the form of weekly meetings, or yearly peer observations. I find peer observations to be a uniquely productive way of giving and receiving concrete feedback. The observer sees examples of both “what to do” and “what not to do,” and the instructor gets evidence-based feedback from a colleague.\(^1\) Even small observations can make a big difference. During my first summer teaching an observer noted that I wasn’t pausing long enough after questions for my students to respond. This is important because students won’t feel responsible for answering if they know I will eventually answer it myself. I now wait as long as is needed for a student to answer. I sometimes let them squirm to the point of awkwardness until one of them offers a suggestion. I gain insight from the role of observe as well: no one ever suggested that I have a student revoice what another student has said, but when I observed another instructor doing this, the value of the practice was immediately obvious and I started using it. When observing the same instructor, I noticed that she often became more authoritative when students became confused. There were times this seemed to be incredibly effective in clearing up student misconceptions. But there were other times when students had clearly voiced productive ideas she failed to draw on. This made me more aware in my own teaching to listen very carefully to what students have said, for it often has more value than an initial glance might grant it.

I enjoy teaching mathematics immensely. I’m engaged by the spontaneous teacher-student interaction and absorbed by my own growing and changing insights into my students and their mathematical understanding. Everyday I’m challenged to solve problems related to teaching—some over time, and some in a split second. What are my students understanding? How can I motivate my students? How can I better connect these two concepts? What would make this class discussion more productive? Have the other students understood this student’s explanation? What kind of example or problem will be most instructive at this point? What problems will my students run into solving this problem? I can’t always answer these questions alone. However, much like solving a math problem, I reach new insights about teaching by talking about it with others.

\(^1\)In a similar vein, I have found the observing *myself* through video recordings, is also valuable.