PHILOSOPHY OF TEACHING STATEMENT

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In the fall of 2005, about two weeks before the start of the semester, I was contacted by the School of Mathematics about my willingness to be the lead instructor for a two section (approximately 80 students) *Calculus I* course. The previous spring, I had been lead instructor for a sophomore level "discrete mathematics potpourri" course populated mainly by junior and senior non-majors. According to the course surveys, and my own personal impressions, I was fairly successful in teaching the discrete mathematics course; the students learned and they were able to apply what they had learned to other areas (for instance, attempting to understand/solve the Rubrik's Cube). Despite being out of town until the day before classes started and not having access to the course materials, I was confident in my teaching abilities and agreed to teach *Calculus I*. I then spent the entire semester behind in my preparations. Eventually, the students started to just go through the motions, and I did as well. Although it was certainly not the worst job of teaching, it was also not a good job of teaching. This experience lead me to begin thinking, reading, and talking to others about what makes a good teacher, and in particular, what I need to do to make myself a better teacher. What follows are a few "aphorisms" about teaching that I feel are most relevant to me.

Respect the Position I have always believed that, as a teacher, there is a moral imperative to be the best teacher possible at a given place and time. However, respecting the position is more than this moral imperative. It is also acknowledging that teaching well is not an easy task. In the progress of a teaching career, or even a single class, there will be challenges large and small, and it will require work, thought, and effort to overcome them. And even then, failure is a possibility. The importance of putting forth that effort was made abundantly clear to me during my first semester in graduate school. In a foundational course (required for the comprehensive exam) I took, the professor flippantly acknowledged that he was teaching the course in order to learn the material. However, it was obvious from his teaching that he wasn't putting in the effort required. As a result, I never really respected the class or the professor, not because he was a poor teacher, but rather because he wasn't respecting the difficulties of the position. Respecting the position means that sometimes your best is just not good enough, and consequently, being a teacher morally requires significant thought and effort in order to constantly improve your best.

Accept the Unchangeable Student learning comes about as the intersection of three things: the teacher, the students, and the material. Unfortunately, no matter how much effort is put in, only rarely can the students be changed and often there is little choice in the material. For instance, when teaching *Calculus I* at Georgia Tech, I had little to no control over the material that was taught because of the requirements of the College of Engineering and the expectations of the *Calculus II* professors. Further, I had no control over the nature of students in my class. I spent too much of that semester frustrated with the differences between my expectations and the actual nature of my students. Although it isn't easy, I now know that I should turn my focus to more productive pursuits that could actually improve my teaching. In particular, to deal with the issue of un(der)qualified or under-motivated students, I have begun to challenge my students early and often during the semester, so that they realize how much and how hard they will have to work. For example, in *Introduction to Proof*, I start the course with a rapid introduction to formal logic and logical proof. This serves the dual purpose of anchoring the terminology and importance of formal discussion of mathematics, and also is far enough outside their comfort zone that students take the course seriously. I also plan, in future sections of *Calculus I*, to start the class with a serious pre-calculus exam which will serve two purposes. First, it will identify the students who are being set up to fail by taking a class for which they are not qualified. Knowing this, I can

encourage them to at least revisit the prerequisites, if not take the prerequisite class. Second, the test serves, especially since *Calculus I* is a first semester class at Georgia Tech, as a wake up call to the freshmen, letting them know that this will not be like high school. This is the heart of accepting the unchangeable; not only is wailing and moaning against the "slings and arrows of outrageous fortune" futile, but that effort would be better invested in adapting to those difficulties which cannot be changed.

Acknowledge the Unorthodox Over the past two years I have found myself several times in Center for the Enhancement of Teaching and Learning (CETL) seminars such as "Teach, Test and Hope for the Best???" or "Engaging Students in Large Lecture," wondering how I could possibly apply the ideas in the seminar to my teaching. Despite the occasional seminar that lacks relevance to me, I keep returning to the CETL Seminars and finding value in all of them. By hearing and examining ideas outside my personal "orthodoxy" of teaching, I learn more about how and why I teach, and what I can do to teach better. Even if I never take an idea from any of these seminars into my classroom, attending the seminars makes me a better teacher by forcing me to consider what will and will not work for me and my teaching personality. Furthermore, it gives me the confidence to attempt non-standard (at least to me) teaching methods. For instance, in response to the perpetual complaint, when teaching *Calculus I*, of "I know how to do the problems, I just can't do the specific ones," I devised a unique, to my knowledge, final exam. After much thought and consultation with my colleagues and faculty mentor, my *Calculus I* final consisted of a single question: What do you know about calculus? Although grading the final exam was a nightmare due to its open ended nature, it allowed me, in combination with other more standard tests, to clearly determine the level of knowledge of my students. More importantly, it forced the students to address their own level of knowledge, or lack there of, removing a common barrier to learning, especially in *Calculus I*. In a more mundane version of stepping outside my personal "orthodoxy," this semester in *Introduction to Proof*, instead of a standard theorem-proof-discussion lecture, I spent two days in a more facilitator-like role. On the first day I gave the definition of the Euler φ-function, and had the students observe and prove, as a class, many of the properties needed for future lectures. This continued through the second day and concluded with me fleshing out the knowledge they had derived into a fully formed understanding. I feel that this pair of "lectures" gave the students a more thorough understanding of the φ-function, and more importantly, gave them a better appreciation of how mathematics works as a whole. In particular, they began to realize that mathematics does not come fully formed into someone's head; it is a process of patient discovery and serendipitous insight.

The insight that the true nature of mathematics is both serendipitous insight and patient discovery is what I hope to impart to every student I teach. It is an unfortunate byproduct of our educational system, which focuses on the practical mundanities of *'rithmetic* as mathematics, that we turn a majority of our students into mathematical Luddites. So much time is spent training students on the use of the "hammer and nails" of mathematics that they fail to see what can be built with those same tools. It has always saddened and frustrated me that when non-mathematicians find out my career, many times their immediate response is, "You must be good at adding." As my wife teases me, this is only true on my good days! In response to this mentality I try, in every class I teach, to sprinkle in parts of the big picture. Whether this is taking a day to show students that e-commerce wouldn't exist without Fermat's Little Theorem (and its generalization) or just showing them that the world is a little weirder than they think by convincing them of the existence of an everywhere continuous, nowhere differentiable function. I want to open their minds to mathematics beyond the day-to-day and convince them that not only is "non-practical" mathematics interesting and worth doing, but it is worth their time and effort. If I succeed at this, then I feel that I have succeeded as a teacher.