PHILOSOPHY OF TEACHING STATEMENT

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One of my earliest childhood memories is of a giant blue box of Legos at my grandmother's house. I remember spending many hours in "experimental engineering," building towers, bridges, and houses, only to watch them fall over, split down the middle, or just fall to pieces. In many ways, these early ventures into engineering are very much like the experience of teaching. As a budding Lego bridge engineer, you have seen a bridge and maybe even ridden over a few of them, you know what purpose a bridge serves, but you don't really understand how a bridge works and what is the purpose of all the parts of a bridge. However, after many afternoons of experimentation, you may finally successfully build something that can be recognized as a bridge in form and function. When I first began teaching, I found that I was in a similar situation as my much younger bridge-building self. I had been fortunate enough to witness exceptional teaching from the point of view of a student and knew the individual pieces of being a good teacher, but I had very little understanding of how to fit everything together into a coherent whole. Looking back at my teaching experience thus far, it resembles my early bridge building forays in that there has been a mix of success and failure, but there has been continual refinement and improvement. However, although "Lego engineers" may eventually develop a collection of techniques that allow them to build excellent bridges every time, someone striving to be an excellent teacher is faced with a new set of challenges every semester. Thus, I believe, quality teaching is less about a set of skills and methodologies, but rather an ongoing process whereby an individual discovers what works best for them, their students, and within their environment. As such, you could almost apply the experimental methodology from your Lego bridge building days to the continuing process of improving your teaching.

One of the fundamental imperatives in experimental science is the dissemination of experimental results and the replication of thereof. However, although there are many sources for disseminating observations and results of teaching "experiments," there are some severe challenges in replicating the results. Most notably, in contrast to the laws of physics, the "laws" of teaching can change from university to university, or even from department to department and class to class. For instance, I was recently discussing academic integrity issues with a colleague from Wellesley College in Massachuesets who mentioned that, because of their stringent honor code, the expectation is that the instructors are not in the room during exams and that the final exams can be taken any time during final exam week. This is in contrast to my experience at Georgia Tech, where instructors are expected to be actively looking for cheating, and where students are regularly found to have violated the equally stringent honor code at Georgia Tech. Additionally, since effective teaching is such a personal thing, other factors such as career status can also have a large effect. Thus, although disseminating teaching successes and failures is an important part of improving teaching universally, it is even more important to be able to discuss teaching locally within a community of peers. It is in response to this need that in the spring of 2007 I proposed to the School of Mathematics that there was a need to have an non-jugdemental environment where graduate students who were lead instructors or who were interested in becoming lead instructors would be able to discuss their experiences and ideas regarding teaching. Since the school approved (and funded) this proposal we have had regular enlightening and successful meetings. In fact, the school believes that this endeavor is worthwhile enough that have made it a feature of the teaching development program. Beginning this term they have given a teaching load reduction to the graduate student who organizes these meetings and performs other teaching developmental duties. Additionally, because of my efforts in this direction, I was recognized as one of the Outstanding Teaching Assistants in 2007-2008.

One of the first things I learned from my early failures as a Lego bridge engineer is that I needed to balance and compromise among many divergent wants and goals for the bridge; my inner aesthetic would want the bridge made up of entirely blue Legos because they look better than all the others, my

inner OCD-child wants all the seams to line up exactly, and my inner pragmatist wants the bridge to actually function as a bridge. Eventually I learned that all the seams couldn't line up and still have a functional bridge, and that really the key was to balance all of these wants. However, as a teacher, even determining what you, your students, and the school really want from a course is difficult. For instance, when I was lead instructor for my first course, *Calculus I*, several students came to me towards the end of the term saying, "I understand the material, I just can't do specific problems!" After considering these comments for a while, I realized that even though superficially these complaints were likely just a plea for a better grade somehow, I also realized that it was indicative of a deeper need of the students, they needed to know what they didn't know. After consulting with my teaching mentor and several other graduate students, I decided to give a somewhat unorthodox final exam to address all the issues brought up by these complaints. The week before the final exam, I announced that the exam would consist of a single question, "Tell me everything you know about calculus." Although in retrospect, this exam was truly a nightmare to grade, it elegantly addressed all the issues inherent in the students' complaints. If they truly knew the material but simply had trouble applying it to specific problems, this exam would give them an opportunity to demonstrate this. However, if they were mistaken about actually knowing the material, the exam would open the door to their learning by making them acknowledge what they actually know, rather than what they think they know.

Sometimes it is not so obvious that there is a need that is being unfulfilled. For example, this term I am teaching for the second time a sophomore discrete mathematics "potpourri" course primarily for industrial engineers. The first time I taught this course, I was very confused as to what the purpose of the course was as the course material was a hodge-podge of miscellaneous material that was tangentially connected at best and covered in large part by other required courses. Before starting this semester, I spent some time thinking about what the unstated goals of the course must be, since the stated goals didn't make much sense to me. As I was thinking, it came to me that since the coverage of the material is so cursory in this course, this must not be the primary goal of the course. After thinking on this for a while, I realized that at least one of the goals of the course should be for the industrial engineers to learn how to express technical material to a non-technical audience. Thus I decided to take the unusual action of creating a series of writing assignments for the course that would force the students to think about the course material and how it relates to their future career. Not only will these writing assignments give them sorely needed experience in expressing technical concepts using the written word, they also force them to think about the broader implications of the course material. Although the semester is not yet finished, I am very pleased with the overall results. Throughout the semester the students' ability to express themselves has gradually improved, and I have gotten feedback from some of them that the assignments have given them a greater appreciation for the material. Based on the success of this semester, I am considering how the writing concept can be adapted to other mathematics courses.

Although every semester I experiment a little and learn from those experiments, there is one constant theme in my preperation and teaching. Specifically, in every course I teach I try to reveal to my students that the true nature of mathematics is not the practical mundanities of *'rithmetic*, but rather a process of serendipitous insight and patient discovery. It is an unfortunate byproduct of the daily grind of our education system that many of our students have turned in to mathematical Luddites, fearing and dreading every mathematics class they have to take. In response to this mentality, I try to sprinkle throughout every class parts of the big picture. Whether this is taking a day to explain why e-commerce wouldn't exist without Euler's generalization of Fermat's Little Theorem or showing them that the world is a little stranger than they think by convincing them of the existence of a continuous nowhere-differentiable function, I want to open their minds to mathematics beyond the day-to-day and convince them that practical or non-practical mathematics is interesting and worth studying. If I succeed at this, I feel that I have succeeded as a teacher.