

## Teaching Philosophy

Craig Spencer

May 10, 2007

“Obvious” is the most dangerous word in mathematics. -- E. T. Bell

During my years of tutoring and teaching, I've learned that there is no such thing as “obvious” in mathematics. Each student learns in his or her own unique way, and it takes a patient, creative instructor to motivate and educate an entire class, whether it is populated by budding mathematicians or students trying to satisfy a general education requirement. In the classroom, I try to illustrate key points using geometric, algebraic, and quantitative reasoning, and my lecturing is broken up by applied problems and projects that students work on in a small group environment. I view an instructor's role outside of class to be just as important as his or her role in class. I hold as many as ten office hours a week in order to fill in students' gaps in both current material and course prerequisites, and I also encourage students to come to my office to discuss challenge problems. In addition to attempting to expand students' theoretical understanding of mathematics, I try to develop students' abilities in exposition and problem solving.

Since students' ideal learning environments and approaches to mathematics differ, I split up class time into many components. I tend to have a series of short mini-lectures, separated by student-centered activities. My mini-lectures tend to address the diverse ways that students can understand and use key ideas, and in some class sessions, each presentation might attack the same problem but use a different viewpoint. For instance, when covering the Fundamental Theorem of Calculus, I might spend fifteen minutes presenting the material algebraically, ten minutes describing the geometric meaning of the theorem, and fifteen minutes showing how to use the theorem numerically. Between my mini-lectures, I do a variety of activities. Most of the time, I have students work on problems, both applied and theoretical, that clarify the material that was just presented. These problems are often motivated by the academic interests that students list on a survey at the beginning of the semester. I also have students do a variety of projects such as using an Etch A Sketch to demonstrate parametric equations and using Play-Doh shapes to illustrate the center of mass. With one class, I had students play various forms of math games, and I have also implemented short student presentations in my calculus classes. About a month into each class, I create an anonymous online method for students to send me comments from the section web page, and I try to figure out what types of activities have been doing the best job of motivating and educating the class. Also, I use this feedback to make sure that I correct any problems and address my students' concerns.

When working with students at San Antonio PREP, a program designed to fortify math and science education for inner-city high school students, much of my success occurred when working with individuals or small groups. At this program, I worked with many students to fill in gaps in their basic mathematical abilities, and I mentored an exceptionally strong student in cryptography. Upon coming to the University of

Michigan, I have implemented my learning from these experiences into my calculus classes. First of all, I view my office hours as a great environment to clear up questions that linger after class, go over homework problems, and provide short reviews of topics from algebra, geometry, and pre-calculus. By making myself highly accessible to my students, I have had many students make giant leaps in their mathematical abilities over the course of a single semester. Furthermore, having students come to office hours gives me an opportunity to discuss their future academic plans and what math classes may be needed for them to reach their goals. In addition to working with calculus students, I have spent time mentoring a group of undergraduate research students at the University of Waterloo. I feel that rising mathematicians benefit greatly from reading advanced topics and performing research under the close supervision of a professor, and in the future, I hope to serve as an advisor for multiple undergraduate reading courses and research groups.

Although I have served as the primary instructor for each of my classes at the University of Michigan, my students' grades have mainly been determined by their performance on uniform exams. In addition to daily homework and weekly quizzes, I assign group homework problems that students complete in small teams. I generally have found that students gain a lot from interacting with their peers, especially since students tend to approach problems in quite different manners, and many times, the group homework teams in my classes have led to the formation of student-run study groups. Furthermore, group homework has given me an opportunity to give students feedback on their technical writing skills. In the future, I would like to shift part of the grade emphasis in my classes to take-home exams, projects, and presentations. Especially in upper-level classes, I'm more interested to see what a student can produce when given the time to be creative and carefully plan out their exposition.

Studying at Michigan has given me many opportunities to develop as a teacher. I have audited math education classes, attended the math education seminar, and participated in a summer program designed to make graduate students aware of challenges faced by young faculty. Each of these environments has provided me with useful ways to modify my approach to teaching. In the summer program, I learned how to implement advances in technology, such as clickers, into the classroom setting. In my math education classes and seminars, I received many opportunities to look over data and discuss methods of attracting underrepresented minorities to mathematics. I hope to continue taking advantage of similar opportunities in the future in order to develop into a more creative, motivating instructor.