Teaching Statement

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I have had the privilege of interacting with a wide range of students at various universities (Univ. Mich-Dearborn, Univ. Mich-Ann Arbor and Mich. State Univ.) and collegiate levels, from beginning freshmen to advanced graduate students. My professor-pupil interactions have resulted from teaching an assortment of classes (Circuits 1, Analog Filter Design, Calculus 1 and 2, Matrix Algebra, Intro to Numerical Methods, undergraduate PDEs, graduate Dynamical Systems, etc...) as well as one-on-one mentoring of both graduate and undergraduate students. My experience over the past eight years has led me to believe that, regardless of the student's background, every student with an interest in the subject is capable of learning the basic concepts. In this document, I will talk about my teaching experiences.Since most of my mentoring is related to my role as research advisor, I will talk about mentoring in my research statement.

My approach to teaching is in part to try and convey enthusiasm and interest in the subject. If the professor is enthusiastic, it helps foster the students' natural curiosity about the subject matter. This curiosity on the part of the students generates a good learning environment where the students are willing to ask questions. Further, this type of environment encourages the students to explore new ideas and concepts outside of the classroom. Although conveying enthusiasm is always a goal, my success has varied. In spring of 2007 I taught undergraduate PDEs (MTH 442 at MSU). This term I was more successful at expressing passion for the subject, as the students noted it in their evaluations of me and the course. None of the reviews were negative. The key question was would you recommend this instructor to a friend. Some of the responses were

- "I already have - this has been one of my favorite math classes here at MSU. Probably one of my more difficult classes, but it was a very worthwhile class to take."
- "Yes - very enthusiastic about the course material, takes plenty of time to explain everything, very helpful during office hours/email/in class, overall great job. (and thank you)."
- "Yes. He is very apt at explaining mathematics. He reviews important material from other classes that we may be rusty on. He was very efficient, and made sure we knew what was going on with the material."

The class rated very highly with a 3.75 out of 4.0 in my ability to explain material. In the rest of this document I am concerned with the more elementary task of how to convey concepts in a classroom setting on a daIly basis.

One of our primary responsibilities is to develop the skills necessary to provide a good education in a classroom setting. This skill set is a more refined set of tools than those needed to explain material in a single student-professor interaction, where it is much easier to gauge the understanding of the pupil. This is because in a one on one setting, the instructor is focused on a single persons visual and verbal cues versus the clues which are provided by an entire class. Over the past eight years, I have continued to work on improving my teaching. My experience has taught me that a good educational environment starts in the classroom via the instructor's efforts. The main elements of a good classroom are easy to list but take practice to perfect; carefully planned presentations, organized blackboard work, frequent visual and verbal contact with the class, always coming prepared, learning the students names and providing adequate feedback on homework and exams. If these elements are well executed, a class runs like clockwork and the semester is fun.

Well planned lectures are a corner stone of a successful semester. As mathematics professors, we are passionate about the subject and it is easy to fall into the trap of wanting to present every nuance of a

given topic. However, the first thing we must do as educators is learn how to filter out unimportant details. Classroom lectures should be aimed at linking the big concepts while only providing enough details so as to make the proof or calculation clear. Learning the right level of detail for a lecture takes practice and changes from semester to semester and with course level. I have found that when I do not connect with the students it is attributable to a lack of filtering.

The use of blackboard space can enhance the material. Forethought can help avoid splitting equations between multiple lines. Further, in classes such as calculus (MTH 132 MSU), undergraduate PDEs (MTH 442 MSU) and intro to nonlinear dynamical systems (math 404 UM), drawings are key in the illustration of fundamental concepts and good placement on the board allows one to keep these sketches around for a while. As an example, in my math 404 course (I taught regularly at UM), when I am discussing dynamics of discrete maps, I like to place a sketch of the tent map in the upper corner of the board, making it easy to refer back to something visual when questions come up during the discussion. Additionally, it is also important to pace the rate at which you update material on the board. Students need time to write and digest what has been put on the board. Visual cues are a strong indicator as to whether the class has caught up. I watch to see if they are still writing or if they have stopped. Verbal cues are equally important and indicate if the students are digesting the material that was just covered. A good way to engage the students and pace the presentation is to frequently collect verbal cues by asking the students to participate in the development of a proof or in the current calculation. The best success I have had to-date was when I taught MTH 442. For example, we made a series of sketches on the board to discuss the maximal principal. After we had discussed the sketches, the students had enough intuition to lead me through the proof. In general, I try this in all my classes. What made 442 more notable than my previous efforts was that I learned to wait for the students to answer questions, even thought it seamed like it took a very long time.

Following the boy scout motto, "always be prepared", is really important. The students are happiest when they feel you are an authority on the subject matter, and being prepared is key. Additionally, making sure that one is well prepared for questions that come up during lecture presents the right image. Students need to understand that their questions are important. Taking their questions seriously and offering multiple explanations can convey this.

Getting to know the students is important. Taking the time to learn about your students helps express concern about them and what they get out of the class. When I taught MTH 442 in the spring of 2007, I had a class of 17 students. During this term, I was able to learn the students' names, majors, interests and things about them outside of class. I know this made the students more comfortable during discussions.

Finally, the students need regular feedback regarding their homework and exams. It is important that the instructor takes the time to sketch a set of solutions for the students to compare with. In addition, students desire feedback right before their exams. To help with this, I always hold a review session before the exam as well as extra office hours. After the exam, I use the following class to go over solutions to the exam. As with a normal lecture, I ask them to help lead me through the proofs or calculations that segments of the class had trouble with. In doing this I hope they can make sense of the missed underlying concept.

Since starting at MSU, I have taught Calculus 1 (MTH 132), Graduate Numerical Analysis for PDE(MTH 950), Graduate Numerical Analysis for ODE's (MTH 852-part of the qualifying exam sequence), Undergraduate PDE's (MTH 442). I am currently teaching the undergraduate Capstone Corse (MTH 442) and MTH 852. Upon request, I will provide all of my review for my teaching while at MSU. In addition, I am happy to provide sample exams and homework's, if desired.