

Teaching Statement

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During the past four years, I have had the privilege of interacting with a wide range of students at various collegiate levels, from beginning freshmen to advanced graduate students. My professor-pupil interactions have resulted from teaching an assortment of classes (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 four 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. As I am dyslexic, and it does alter the way I approach both teaching and research, I address this issue in a supplemental document.

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 winter of 2005 I taught undergraduate PDEs (math 454). This term I was more successful at expressing passion for the subject, as the students noted it in their evaluations of me. 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 person's visual and verbal cues versus the clues which are provided by an entire class. Over the past four 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 (math 115), undergraduate PDEs (math 454) and intro to nonlinear dynamical systems (math 404), 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, 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 math 454. 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 454 more notable than my previous efforts was that I learned to wait for the students to answer questions, even though it felt 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 math 454 in the winter of 2005, I had a class of 20 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.

In general, my teaching evaluations have steadily improved as I have continued to learn about what it takes to be successful in a classroom setting. Last winter, my teaching evaluations hit an all time high. I was teaching Math 454, undergraduate PDEs. During this semester, I was able to balance all of the above ideas as well as engage my class outside of lecture. I received a teacher evaluation of 4.7 out of 5 and the students had nice things to say. A sample of their comments are:

- “... By far, one of the best classes I have taken. Very applicable and very interesting. I’m glad I took this class.”
- “... The material was presented in such a way that to me as a physics/math major the extensions of the course seemed interesting to learn about, and have piqued my interest into further applied math courses.”
- “This was the best taught math class I’ve had here at U of M. Prof. Christlieb presented the material very well. ... His way of explain/teaching the new material while reiterating and relating to old material of practical problems was very helpful.
- “good, sometimes spent too much time waiting for students to answer questions”

I am very proud of the job I was able to do during this term. During the summer term I taught math 471, introduction to numerical methods. The class ran concurrently with my infant son’s arrival from south Korea, and I was not able to provide them with enough feedback on home work and exams. Clearly this was an issue, as it was discussed in my teaching evaluations. However, I was still able to achieve an evaluation of 4 out of 5. Currently, I am teaching math 404, intro to nonlinear dynamical systems, and I am making a concerted effort to get all of these things right.