

# Teaching Statement

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### Teaching Experience

I have been involved in teaching mathematics since I was a student at the University of Würzburg, where I worked as a teaching assistant for linear algebra and also tutored high school and college students in math. Since being a graduate student at the University of Texas at Austin, I have gained wide experience both as a teaching assistant (TA) and assistant instructor (AI). My assignments as a teaching assistant have included a variety of undergraduate courses (such as different levels of calculus and elementary differential equations) as well as graduate algebra, a summer topics course in analysis for high school teachers and the TA training course “Supervised Teaching in Math”. In the course of my teaching, I have been exposed to class sizes ranging between 13 and 90 students and thus have learned interactive methods that work well in very small settings and have developed methods for reaching individuals in large classrooms. I have taught students at different levels, like freshmen in calculus, graduate students in algebra and the TA training class as well as math teachers in the topics course.

In order to keep improving as mathematics teacher, I have participated in a number of special programs at the University of Texas at Austin. These programs, Supplemental Instruction (SI), the Texas Interdisciplinary Plan (TIP), the Emerging Scholars Program (ESP) and Saturday Morning Math Group (SMMG), carry different responsibilities and have given me the opportunity to try new teaching methods in the classroom, share experiences with fellow teaching assistants and explore methods beyond the usual homework-help discussion section.

While being an SI Leader, I benefited greatly not only from the training offered prior to my first semester but also from exchanging ideas with other experienced teaching assistants. In weekly meetings we shared teaching philosophies, processed observations/evaluations and discussed techniques for making our classes more valuable. I continue to implement many of those ideas to the day with the main focus, apart from surveying the course material, on helping the students acquire better study habits. I personally like to stress the importance of note-taking, using various available resources, including the text book, and the ability to write coherent solutions to a problem. Also, I like to train my students in test analysis, that is in evaluating and learning from past mistakes. This is why I usually ask them to turn in test corrections in order to be able to provide valuable feedback. In the classroom I regularly put my students in groups to work together in problems and it is amazing to see how group work enhances the students’ independent learning and improves their performance.

TIP is a highly selective academic program which provides students with a rigorous course of study and an introduction to critical thinking. I was a discussion leader for the TIP calculus section. I planned meaningful and engaging activities, applying the techniques I learned in SI to help them improve their critical thinking and problem solving skills.

During the summer of 2005 I assisted with the “Topics in Mathematics” class for high school teachers. The focus was on analysis, and it was a wonderful experience to have direct contact with those mathematics educators. I was curious to hear about their experience in the schools and glad to be able to show them some deeper aspects of mathematics and how they can be applied.

The “Supervised Teaching in Mathematics” course is designed to help new TAs become effective teachers. There are so many aspects of teaching that are specific to teaching mathematics. I specifically addressed those while being the TA for this class in the fall of 2005, when I helped to choose topics, invite panel members and lead discussions to expose other graduate students to resources and ideas for analyzing classroom situations. This course was very useful for me because it made me re-examine my own teaching.

In the fall of 2004 I was promoted to Assistant Instructor and given the opportunity to conduct a small-group workshop for 13 students in an ESP calculus section. ESP is an honors program for incoming freshmen at UT, targeted to high-achieving individuals from demographic groups which tend to struggle once they come to UT. In Texas these are often students from inner city schools and students from highly rural schools. My role was to create challenging worksheets for the two-hour problem sessions that met three times a week in addition to regular lectures. These worksheets would not only cover calculus concepts but also help students expand their understanding beyond the material in the text book. I always made an effort to show how those mathematical methods can be used in the natural sciences and include realistic applications of the current subject to help make the topics more interesting. One of the main goals was to increase students' self-sufficiency and self-confidence by working in small groups, collaborating with their peers and thus developing academic relationships to last throughout their college careers. This was one of the most rewarding classes I have ever taught; I was able to establish a personal relationship with most of the students and to monitor and guide their learning progress. To the day I am still in contact with many of these students and know that being part of this class has been of great value to them.

Beyond instructing undergraduates in calculus and other beginning math classes, one of the most fruitful experiences was serving as the coordinator for the Saturday Morning Math Group (SMMG) last year. Four times a semester a group of 70 to 120 middle and high school students gathered to learn about an interesting aspect of mathematics with the goal of showing students that mathematics is fun, intriguing and exciting. My responsibilities included recruiting speakers and designing activities and projects to complement their lectures. In particular, this meant finding speakers who do research in math or in any other field that uses math and who are able to give a vivid and exciting presentation about it to the young participants. Lecture topics have included fractals, 3D animation for video games, topology, spread of diseases, "patterns in nature and number". The most enjoyable part for me was to learn about these topics myself and create the activities. In one meeting we explored simple manifolds and built our own Möbius bands out of a strip of paper. In another, we simulated the spread of diseases with colored beads that the students exchanged while talking to each other. After a talk that mentioned statistical experiments we used an online animation of the Galton Board to simulate that Gauss and other distributions.

For the spring 2007 semester I had been chosen by the department as one of only four graduate students to be the instructor of record for my own Integral Calculus class. I gave three lectures and led two discussion sections per week. I made arrangements with the UT Dana Center to provide funding for an undergraduate student assistant so that I was able to turn the discussion sections into an ESP-style workshop and give students a more varied learning environment. It was a great opportunity for me to design this class and have a deeper impact on the students' learning and development. I feel very honored that I was already offered another instructor position for the fall.

### **Teaching Philosophy**

The most important aspect of effective teaching is to get the students actively involved and learning in the class. I believe that a student can only be successful if he or she is truly engaged in his or her own learning process. Small group work, writing activities, problem-solving activities and student presentations are just some of the techniques I use to promote active learning. This presents an immense challenge, though, because many students are used to being passive recipients of learning and naturally tend to resist being active participants at first. But if done successfully, the students learn to appreciate that active, engaged learning is more effective (and more fun!) and the experience is very beneficial. Even in a bigger classroom interactive activities can be successfully implemented.

I always try to be very engaging and convey my own love for mathematics. Being enthusiastic about the students and the course material makes students more responsive. Getting students involved in the class also means helping them to become more engaged in the material outside of

lecture and discussion session. Therefore, I encourage independent and peer learning, for example by facilitating study groups for them to work on their homework sets. I also stress the importance of office hours which gives both the teacher and the student a chance for the one-on-one attention which can be so vital, especially in large classes.

We all know that, especially in lower division courses which people might be taking as a requirement only, one of the biggest challenges is to overcome the initial frustration of not believing one is good at math – and thus not being interested in it. I always try to remember my own learning experience, the many times that I have struggled with concepts and the fact that once we understand it, math can seem trivial. Therefore I never trivialize or belittle a question but rather encourage questions from my students. I always try to find out what misconception underlies even the most confused or seemingly trivial question.

My teaching style and methods vary greatly depending on the size of the class, topics covered and the needs of the students. As mathematics educators we need to accommodate different student backgrounds, interests and abilities and this requires flexibility and creativity to adapt our approach to each situation. To make the course material interesting and accessible for many different learning styles is always a challenge. It is thus important to provide a balance between modeling, teaching, practice and feedback. I want to help the students master skills like solving problems, using algorithms, breaking problems into smaller pieces, finding examples or counterexamples, to only mention a few. But it is also important to convey to them the basic concepts, to give them the bigger picture and make underlying ideas transparent so that they can remember these.

In this context I usually emphasize how concepts are what form the link between math and other subjects. Mathematical methods are the foundation of so many other disciplines, especially the natural sciences. It is important to motivate a new math topic with real world examples, that is, examples from physics, biology and other areas to which students can relate even if they don't share the same passion for pure math as we do. It also often sparks a student's interest to see things in a historical framework.

To me, the goal of each course is not only the mathematical material presented, it is also learning mathematical reasoning and writing. Skills I especially try to encourage in all students are common sense, critical thinking and self-sufficiency. In order to foster that, I discuss how one approach to a problem might be preferable to another, I try to pose problems that help students create their own mathematical tool kit and help them see how to start solving a problem is often the hardest step. I want them to develop intuition and use common sense to check solutions and proofs. Qualitative problems will require deeper understanding of the material and help them refine their critical thinking skills. These are what will be of use to them in other areas of study as well as their everyday lives.

As educators of mathematics we should demonstrate to each student how their natural abilities can generate this rigorous mathematical reasoning. It is too ambitious to expect that students will master all these skills in one semester but the goal is to make them understand that they have the power to learn them.

One of the things that I still want to improve in my teaching is to make broader use of technology in the classroom when appropriate. Mathematical programs like *Maple* or *Mathematica*, for example, could be immensely helpful in calculus for illustrating examples of more complicated functions and their behavior or for plotting direction fields. It is a great tool for visualizing concepts, especially when it comes to showing applications of math in neighboring disciplines.

My diverse experiences have given me a broader view of the various aspects of teaching. They have enriched my life as a graduate student and have been very valuable. I enjoy teaching and it is easy for me to get excited about my students and the subject I am teaching. I look forward to more opportunities for teaching and learning, for introducing new generations of students to the world of math, and for building more bridges between mathematics and other natural sciences.