

Teaching Philosophy

Ross E Magi

Over the past few years, I have had the privilege to teach many different math courses. I have taught general college algebra courses, remedial algebra, algebra focused on business applications, and calculus. I have had the opportunity to serve as a Teaching Assistant (TA) for an advanced undergraduate mathematical biology course, and have led in the supervision of a group of undergraduate students working on a research project. I have also had the opportunity to tutor since I was an undergraduate student. These have been positive experiences, and have helped me develop a joy in teaching math. In addition to being enjoyable, these experiences in front of a classroom and one on one interactions with students have helped inform and develop my opinion of what it means to be a successful math teacher.

As an applied mathematician by training, my first goal is to teach my students to apply mathematical concepts to solve real problems. I have found that one of the difficulties about teaching mathematics is impressing upon students the relevance of what they are learning. Demonstrating relevancy takes different forms depending on the audience. For a class of business majors, I try to focus my lectures towards real life business applications. For a class of engineering and physics majors, I focus on examples and problems from physical situations. For math majors, I place more emphasis on the theory underlying the concepts covered in class. The exact method may change depending on the audience, but my goal is always to try to make the concepts covered in class relevant in the broader context of my students' education.

In my goal to teach students to use mathematics to solve practical problems, I find that I am generally much more focused on working through examples than explaining abstract theory. Even in advanced classes, I believe that most students learn more from a worked example than from the proof of a theorem. The construction of a proof is an important exercise and an important demonstration of the underlying mathematical theory, but I feel that the proof should be the dessert, not the main focus in the lecture or class. I try to have at least one worked example of every concept in the lecture. This not only gives my students something to look back on as they solve problems themselves, it also allows me to describe my thought process as I solve a problem. Mathematical intuition is difficult to teach, but talking and working through a problem provides a setting to describe the ways that I think about and visualize a problem and help build intuition for my students.

In addition to building intuition and teaching concepts, I have found that working on examples is a great way to involve the class. Even when I have taught large courses, I have made an effort to learn my students' names so I can call on them during the lecture and have them walk me through an example problem. My goal is not to put students on the spot or highlight their lack of knowledge, but rather to highlight the knowledge they do have, and to help make them an active participant in the class. I try to ask questions that I expect students will be able to answer so that speaking in class will build and not break

student confidence. And I try to make it clear that it is ok to say, "I don't know." I warn my students at the start of a class that I will call on them, but that I don't expect them to know all the answers. One of my goals when I lecture is to provide an environment where it is safe to learn and ask questions, and I feel that actively involving my students by asking them questions is a way to help foster that safe and interactive environment. Implicit in the goal to include relevant examples in my classes is the idea of adequate preparation. I have found that my ability to deliver a successful lecture is directly related to my prior preparation. This preparation involves not only choosing good examples, but also looking for ways to leverage other technology. Maple is a great tool for plotting and visualizing functions. Matlab can be leveraged to demonstrate iterative techniques such as Newton's method. I have used a spreadsheet to provide practical examples of loan amortization equations. Khan academy and other websites can be a great resource for additional example problems and explanations. It may be tempting to save time by working straight from a textbook and only working through textbook example problems, but I have found that adequate preparation allows me to step beyond the textbook and make use of varied technological tools.

Of course, a good class isn't all about the lecture. In my experience as a student, it hasn't mattered how good the lecture was, I still haven't really learned the concepts until I worked through problems on my own. I am a firm believer in homework, regular quizzes, and exams. Ideally, students would be so interested in the concepts covered in class that they would work through problems for the pure joy of learning, but in real life, I have found that my students need extra incentive to practice. For that reason, I assign a significant number of carefully selected homework problems, and usually have chosen to make homework worth twenty percent or more of the final grade. That way when the weekly quiz comes, students have had real practice in solving problems. I don't make my regular quizzes very long, but I have found that even a short quiz provides students with incentive to spend a little more time with the material. In addition to assigning problems, I believe that homework should be collected with a firm due date. I remember that even as a good student, I was much more likely to put off an assignment when the due date was not firm. This may be acceptable in some fields, but learning new mathematics hinges so strongly on understanding the precursors that I do everything I can to help my students to stay current in their study. I'm not so firm that I don't recognize extenuating situations, but as a general rule, I expect students to do homework and turn it in on time.

In my experience, homework has been another great place to leverage technology. In the classes I have taught at the University of Utah, I have had good success with the WebWork online homework system. WebWork is a system that allows me to choose problems from a problem bank, modify existing problems, or write my own homework problems. I have found the benefits of using a technology like WebWork to be three fold. First, since I don't have to grade the homework, my time is spent choosing and developing good assignments that reinforce concepts covered in class rather than grading pre-prepared assignments. Second, because WebWork problems can be written to randomize the constants

used in problems, students are less able copy from their classmates and are more likely to do their own work. Finally and most importantly, an online technology like WebWork provides students with instant feedback on all worked problems. This allows students to immediately discover whether they know how to do a certain type of problem or whether they need to look back through their notes or approach me for additional help. I have used online homework technology in various classes, and while not universal, the student feedback has generally been positive, and I believe it has proven to be an effective way to assign homework and reinforce the concepts covered during class lectures. In addition to homework, a valuable way to reinforce student understanding is through regular office hours. As much as possible, I want my students to feel comfortable approaching me individually for help. I do this first by scheduling office hours during times when I expect the greatest majority of my students to be free. I also repeatedly encourage my students to come visit during office hours or to schedule additional times if the office hours dont work with their schedules. With current technology, I have found email to be a valuable way to interact with students. The WebWork system allows students to email directly from a problem they are struggling with. My goal has to been to provide feedback to those emails as quickly as possible, usually within a few hours and never more than 24 hours later. Through a variety of techniques, I try to be approachable as a teacher and to make my students feel comfortable contacting me for additional help or explanation.

My experience teaching mathematics has been a positive and rewarding experience. Being entrusted with the teaching of others has been a great responsibility, but also a great joy. I have appreciated both the time in front of the class and the time spent interacting personally with students during office hours or private tutoring sessions. I have loved seeing students' eyes light up when they finally understand a difficult concept, and have had the satisfaction of watching struggling students improve and succeed in a class. Each class I have taught has been an improvement on the previous one, and I have enjoyed watching my own ability and effectiveness as a teacher increase. The varied classes I have taught up to this point in my career have helped inform my ideas of how to effectively teach college mathematics, and I look forward to years of future classes to further boost my ability as a teacher and increase my effectiveness in imparting mathematical concepts to my students.