

TEACHING PHILOSOPHY STATEMENT

MITCHEL T. KELLER

Mathematics is an exciting and beautiful subject to me. As a teacher of mathematics, I endeavor to share my enthusiasm with my students every time I step into the classroom. How I approach teaching has evolved over time to become more learner-centered, leading to improved student performance. Outstanding teaching involves many components, and this statement highlights topics that I believe are important and illustrates them with examples. These topics include shared responsibility between students and faculty for student learning, the importance of effective feedback, and ways to teach students of diverse backgrounds and abilities.

My varied experiences as an instructor of record and teaching assistant have established a solid framework for future experiences in teaching. I have had full authority for introductory precalculus and calculus courses and a junior-level applied combinatorics course for computer science and mathematics majors. Previously, I served as a TA for recitations and *Mathematica* labs. In addition to learning through experience, I have taken a course on teaching, learning, and course design. This course, targeted at future science and engineering faculty, reinforced many of my existing beliefs about teaching. More importantly, it introduced me to new and exciting ideas to implement in a learner-centered classroom.

One of the principles about teaching that I believe most strongly is that students and faculty must share responsibility for what students learn. Many mathematicians tell their students “mathematics is not a spectator sport.” Too often, however, students interpret this as meaning the faculty member does not care to help them learn. To avoid this perception and emphasize shared responsibility, I communicate with my students early and often about the roles we each play. Certainly, homework is one area in which instructors expect students to take responsibility. However, in my classes, I take things even further. I expect students to read the assigned portions of the textbook *before* they come to class. To encourage them to complete the reading, I have them answer one or two questions to check their understanding. Regardless of whether their answers are correct, students receive credit for serious attempts at the reading assignments.

Guiding my students’ preparation for class has allowed me to best use our time together. In the applied combinatorics course where I first implemented reading assignments, I used reading assignments to focus class time on areas the students found challenging. This semester in precalculus, I have made the students’ preparation even more important by incorporating a classroom response system, commonly referred to as “clickers” because of their similarity to remote controls. I use clicker questions to follow up mini-lectures and facilitate learning activities in class. Clickers have made it much easier for me to adapt to my students’ needs during class. I am now a more agile teacher, adjusting on the fly after getting input from everyone in the class. When appropriate, clicker questions are followed by small-group discussions. I debrief the small group discussions, sometimes after polling the class again to see how answers changed. Test scores indicate this peer instruction helps students to better understand the concepts.

I believe that it is crucial to implement a concrete plan to provide students with meaningful, non-intimidating feedback. Clear grading through the use of rubrics helps provide this type of feedback. For courses above precalculus, I grade each question against a rubric that focuses on overall quality instead of getting tied up in partial credit. Students adjust to this scale fairly quickly and appreciate the information it provides. The use of this rubric also allows more grading time to be spent on providing feedback to help students improve. In precalculus, I use rubrics to facilitate peer feedback on application problems. These problems are designed to help students meet a course goal of being able to communicate mathematics in written English. Their solutions to these problems are to contain a complete sentence explaining each step of their

work. Students use a rubric to provide feedback to group members about the quality of their solutions, and they then use the feedback to revise their solutions. They are required to turn in a portfolio of their solutions for formal feedback only twice, although they are always welcome to ask for unofficial feedback. In their portfolios, I ask them to reflect upon their strengths and weaknesses, the peer feedback process, and any insights they have had. Their reflections have better informed how I approach these assignments and also showed how they have benefited from the assignments and self-reflection.

Establishing a way for students to provide feedback to the instructor is also important to me. I always remain open to student input regarding my teaching, but some students are uncomfortable raising such issues with even the most approachable instructors. Formal end-of-term course evaluations can be useful, but by that time, it's too late to adjust for current students. For these reasons, I always implement a mid-semester anonymous course survey. I discuss the feedback with the students and usually find some suggestions to implement immediately. I'm glad to hear what my students have to say about the course, and they appreciate the opportunity to reshape aspects of the class. The mid-semester survey is also an occasion to reinforce the concept of shared responsibility for learning by asking the students not only what I should change but also what they must change to succeed. Their responses to those questions are often insightful.

When teaching mathematics, we often encounter students with a wide variety of abilities and backgrounds in a single class. I believe it is important to develop ways to work with these students and help them all learn to the best of their abilities. For me, active learning is a useful strategy for addressing differing ability levels, since it allows me to intervene early and keeps the students working in a friendly, collaborative environment. In precalculus I have worked with some of Georgia Tech's least-confident and least-mathematically-prepared students. However, these experiences have provided some of my most rewarding moments as a teacher. I have seen students who had been treated in the past as if they could not do mathematics realize that they *could* solve these problems. I will never forget the excitement on the face of a student-athlete when he realized that matrix multiplication was something that he could almost do in his sleep.

For Fall 2009, I adopted an additional way to address varying abilities outside of class. I now use an online homework system to assign exercises for precalculus. Instead of posting a list of questions and hoping students do them, this system allows me to assign exercises and ensure the students do them. Students receive immediate feedback on their answers and can repeat variants of exercises they did not solve correctly. This allows students who understand to move on while encouraging those who are struggling to persist. I have also implemented mastery exams as a mechanism to ensure baseline competencies in skills that are essential for future courses.

The transition from high school to college mathematics can also be a challenge even for well-prepared students. Many of my students previously were taught mathematics as a mechanical manipulation of symbols. In contrast, my courses emphasize the importance of the underlying concepts. To work with generally well-prepared students who struggle in my courses, I suggest ways in which they can incorporate better study habits into their routine. Every semester, I have had students who were foundering at midterm because of poor study skills make remarkable turnarounds and earn good grades. These success stories have bred further success, as students feel reassured about their ability to succeed after hearing about past students' improvements.

For me, teaching is a lifelong journey. Each term, I embark on the next leg of that journey with a new group of students. I work to excite them about mathematics through active involvement. I challenge them with high expectations and help them meet those expectations while enabling them to learn on their own in the future. Experiences with students help me develop as a teacher, and although I do not know where my teaching journey will lead, I know I will enjoy the trip.