

MY QUEST FOR EXCELLENT TEACHING

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Since I was in high school, I have been taking notes—first metally, then in writing—about factors that contribute to effective or ineffective teaching. Questions about pedagogy have become all the more relevant in the last several years as I have been both a teaching assistant and the sole instructor of a summer course. How can I take a subject that many of my students consider abstract, dense—even intimidating—and present it intuitively, conveying the elegance that attracts me to mathematics? How can I help those who are struggling in the course while still offering something to those at the top of the class? In order to answer questions such as these, I must consider my audience, methods, and purpose as a teacher.

AUDIENCE: WHO AM I TEACHING?

When I teach, I am not merely teaching a subject such as calculus. I teach students. I care about them as people, so I strive to offer them the best possible instruction. I respect my students and treat them with dignity. This involves taking their questions seriously, responding to their emails, and meeting with them during office hours. If I demonstrate that I care about my students and enjoy teaching them, then they are more likely to care about the course, and the semester is more profitable for us all.

I have noticed that the best teachers are able to see the course from the students' perspectives. These teachers are able to anticipate questions and gauge the level of understanding in the classroom. In order to see the students' points of view, I must get to know my students, finding out their mathematical knowledge and what they hope to gain from the course. When teaching a new topic, I must consider how it relates to what the students already know, making logical connections from the old material to the new. When presenting an example at the blackboard, I think about not only what I see, but also what the students see. Of course the material is clear to me, but does it make sense to them? I present topics in different ways—algebraically, graphically, numerically—to cater to students with different learning styles. By seeing the course from the students' perspectives I can better meet their needs and convey the material in a way they understand.

METHODS: HOW CAN I TEACH WELL?

Three of the most important aspects of good teaching are preparedness, clear communication, and appropriate use of technology. First, I must prepare in advance for the course I will teach. A professor who repeatedly gets confused during lecture and appears ignorant of the topic at hand will lose the attention of all but the most faithful students. Thus,

out of respect for my students, I ought to have the course content practically mastered before I enter the classroom. I ought to have thought through the examples ahead of time so that I will not stumble around at the blackboard. I should anticipate common questions and have answers ready. If I am prepared in these ways, then I can give a coherent lecture, from which my students will benefit.

Being prepared for the course, I am able to communicate the material clearly. Clarity is essential for quality instruction, but it does not come naturally. To convey mathematics effectively, I must be clear in my speech, writing, and organization. I attempt to speak clearly, at an appropriate speed and volume, using vocal inflection and pauses effectively. I must be aware of my nonverbal communication as well, so that it complements what I say. I write clearly on the blackboard, for students are quickly frustrated when the professor's handwriting on the board is illegible. When possible, I draw a picture to shed light on a confusing equation. Colored chalk helps me add emphasis or distinguish between different lines of thought, and English words provide context for the mathematical symbols. Also, I must be clear in my organization. I attempt to structure the class as a logical progression of concepts and examples, and I arrange my work on the board in a way that helps students follow my arguments. These are a few major aspects of clarity. By conscious attention to the clarity of my presentation, I can help students get the most out of our class time.

Along with clarity and preparedness, my instruction benefits from appropriate use of technology. Technology has given us wonderful tools that, when used wisely, can improve education. For example, I can use a computer animation to illustrate the concept of computing a volume of revolution by the washer method and by cylindrical shells. Guided computer exercises can help students discover concepts. For instance, students can investigate areas under curves before they know the rules of integration. By reducing the burden of computation, computers can help students develop insight. Technology also allows me to provide course information, homework solutions, and study aids for my students on the course web page. I enjoy keeping abreast of new technology, and I am willing to experiment to find ways that technology will strengthen my teaching. I know one professor who successfully used a class wiki to help his students learn linear algebra—the students collaborated in writing concepts in the wiki as they learned the material. Appropriate use of technology takes forethought and initiative, but can be a valuable asset to my courses.

PURPOSE: WHY DO I TEACH?

Having addressed who and how I teach, I cannot be satisfied without considering *why* I teach. Why should I teach calculus to undergrads, many of whom may never compute a derivative after they fulfill the math requirement for their major? What value is it for students to learn linear algebra or number theory? Mathematics education has value because it teaches students to think critically and solve problems. One of my goals in teaching math is to teach students to solve problems they have never seen before—a much more difficult task than memorizing some soon-to-be-forgotten formulas for use on the final exam.

Math courses should also teach students to think logically, in the context of a formal system, moving from assumptions to conclusions. Yet mathematics is much more valuable than this, since math describes the real world. The students who never think about derivatives after the end of calculus class will certainly deal with rates of change in various contexts throughout life. I enjoy the beauty of pure mathematics, but I find areas of mathematics most interesting when I understand their applications. I attempt to convey to my students that mathematics is both elegant and useful.

One last motivation for teaching is my desire to continue learning. Teaching helps me refine my mathematical knowledge, for I do not fully understand a topic until I have taught it. At the same time, I am constantly learning from my students, exploring new areas related to the course content, and searching for ways to teach more effectively. With an inquisitive attitude, I continually find new questions to ask and fresh ways to view old concepts. For me, teaching is a career of lifelong learning.

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