

Statement of Teaching Philosophy

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This would be a wonderful time to possess a magic potion. You know, one of those recipes for instantly brilliant teaching and inspirational class leadership? Not only would such a potion improve my job performance, but it would also make this statement of teaching philosophy satisfyingly brief. Sadly, here on planet Earth, there isn't any secret formula for excellent teaching. The best I can do is a simply stated formula:

Everything matters.

That's really the bottom line. Content matters, presentation matters; my efforts matter, the students' efforts matter; the details matter, the big picture matters.

The first prerequisite for an instructor is understanding of the subject. Not familiarity with the subject; not skill with using the subject; but profound, robust understanding of the material in the course and its place in the field as a whole. It's our responsibility to know what's intuitive and what's surprising, to know what's analogous to knowledge from their earlier education and what's an honest-to-goodness paradigm shift. We have to know what to tell them first, what to save until later, what never to mention but instead to leave for an upper-level course, and when to say something that's technically a lie but will actually result in the students knowing more than they would if we had scalded them with the full truth. (In one of Bill Watterson's *Calvin and Hobbes* cartoons, Calvin asks his father what causes wind, and his father replies, "Trees sneezing"; "Really?" Calvin exclaims, whereupon his father says what we all must occasionally acknowledge: "No, but the truth is more complicated.") In every one of these cases, we must also know how best to respond when a curious student asks us about the facet we're saving until later, or omitting, or warping. Making educated decisions about the readiness of my audience to receive knowledge is part of the reason they pay *me* the big bucks to be the teacher, instead of an undergraduate two years further advanced, or for that matter a robotic arm attached to an overhead projector. We teachers need to know our subjects like a mother knows her child's face. Anything less is swindling the students out of their tuition.

The discipline of mathematics, more specifically to my own teaching, is unique in that we actually have absolute truth to impart. It doesn't matter what our race or religion is, or what social status or political leanings we have; when we square the lengths of the three sides of a right triangle, the two smallest numbers add up to the biggest number, for us just as much as they did for Pythagoras. Because mathematics deals with abstract objects about which absolute truth can be obtained, a lecture-dependent pedagogical style is key, despite its shortcomings. To borrow from Winston Churchill: lecturing is the worst form of teaching mathematics to many people at once, except for all those others that have been tried. Since a lecture is predominantly a one-way communication, the quality of that communication is extremely important; little imperfections which in a one-on-one conversation would be instantly perceived and addressed can add up to genuine barriers in the classroom. Especially in the condensed technical language and highly cumulative conceptual structure of mathematics, a student whom we lose for ten seconds can remain lost for the rest of the lecture.

In theory, all we would have to do to lecture effectively is to compose a thoughtful exposition and deliver it accurately. However, as Yogi Berra remarked: In theory there is no difference between theory and practice; in practice there is. There are (literally, I believe) a thousand things to think about during a lecture, such as: moving the blackboards around so that students can see as much at once as possible; using voice inflection to help the audience separate one topic from another; isolating one new concept at any given moment, so that students are being asked to master “only” a single idea at any time; taking into account questions and answers, construction-noise interruptions, technical malfunctions, and even (dare we hope) moments of epiphany—and making split-second decisions to include or to omit, so that we arrive at a natural stopping point when our time is up. For the past four years, this theme is one that my Mathematics Teaching Techniques classes have heard from me time and again: the technical (that is, unglamorous) aspects of lecturing make a big difference. In a way a teacher is like an architect: although no accomplishment is possible without a grand vision, neither one will get very far without mastering all the tiny tools of the trade.

From another perspective, though, I feel more like an actor, because with my every remark and movement I’m projecting *something* to the class, and it’s rather preferable for that something to comprise encouragement, optimism, and calmness rather than intimidation, uncertainty, and malice. There’s an art to asking questions that admit answers stated in positive terms, instead of requiring confessions of ignorance. There’s a knack to receiving remarks and queries in a way that treats them as shrewd and illuminating thoughts, instead of as challenges to my abilities as an instructor. There’s a tangible technique to employing body language that welcomes interaction and speculation (hence risk) from the audience, instead of conveying annoyance with the very real needs of the pupils. It only helps the cause of education for them to see me, not as some anomaly of acumen, but as an actual human being, being my irreverent and unpredictable self, having a good time with the material, getting excited about exciting mathematics that speaks to me all the more energetically precisely *because* I, like my students, was once mystified by it.

On the other hand, it isn’t possible for my students to learn to do mathematics by watching me do mathematics, any more than it’s possible to learn to juggle, or bake bread, or tap-dance, or make pottery by watching an expert, no matter how accomplished. So how can I encourage, coerce, or beg my charges to actively learn, during my lectures and beyond? I ask questions, lots of little questions, even (especially!) easy questions, so that they’re rewarded for the effort that original thought requires. I tantalize them with mysteries; I refresh their attention with a detour; I relate the material to their other mathematics classes, to their science classes, to the etymology of the terms we use, to music or movies or anything else. And as for their learning outside of class: I’ll be honest—I give *serious* homework, and it ain’t easy. (Nothing pleases me more than the comment on a course evaluation that reads, “The class was really hard, one of my hardest ever, I had to work like a dog the whole term. It was a great class!”) Fortunately, word gets around quickly that I’m a sucker for people who come to my office when they’re stuck in the middle of a homework problem. Getting stuck in the middle rather than at the beginning is a success, after all! Any student who expends enough effort to become stuck earns my help in overcoming the obstacle. Never putting the obstacle in their way, by comparison,

would be denying my class a barrier to conquer, which amounts to denying each of my students a personal triumph.

My several years of experience as a course leader have taught me something obvious (obvious truths often take the longest to learn) about the big picture as well: *my course isn't the only thing my students are doing*. For many of them, in fact, my course might be tenth or ninety-ninth on their priority list. Realizing this has helped me, during the inevitable sessions of witnessing student angst about their ultimate marks in the class, to ameliorate the situation by separating students' performances in the course from their worthiness as people. Their goal might be to earn the top mark in the class, or to get a B– to keep their scholarship, or to pass any way they can, and all of these goals are reasonable depending on the rest of the students' lives. My role is to tell them: Here's where you are, and here's what you'll need to do to achieve your goal. But you're the only one who can decide how significant the course actually is in your life, and which goal you'll be satisfied with. If you have only a limited amount of time and energy to expend on mathematics, then I'm not going to judge you. If you decide that the goal you've set for the course isn't compatible with the effort you'll be able to expend on it, then dropping the course not only is acceptable but might be the wisest choice. On a few such occasions, students who ended up dropping my course actually left our conversations with more of a bounce in their step, perhaps because it was the first time anyone actually gave them permission to be mortal and imperfect. . . . Apparently this stuff about teachers making a difference, not just in students' education, but even in their lives, is true after all.

Occasionally I'm asked whether teaching is hard; I've taken to replying, with a well-timed pause between the two sentences: "Oh, no, teaching is dead easy.—Teaching *well* . . . now that's hard." This description of my teaching philosophy, really, is just a longer version of that pithy notion. Understanding my field with utmost thoroughness, lecturing with consciously honed technique, creating a positive atmosphere via verbal and sub-verbal communication, stimulating students to strive, respecting their lives outside my course—these and dozens of other considerations all factor into the choices I make when I teach. It's not a simple recipe, I'm afraid; I have to admit that teaching doesn't come with microwave instructions. But in a time where microwave education is regrettably easy to obtain . . . I find this admission rather comforting.