

# The Pleasure of Finding Things Out

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”It is not knowledge, but the act of learning, not possession but the act of getting there, which grants the greatest enjoyment.” - Gauss

I aim to inspire in my students a thirst for understanding and knowledge commensurate with my own, and my hope is that my students enjoy themselves while learning. A student once stayed until the end of my office hours to thank me because my class was the first math class she had ever enjoyed and, not coincidentally, the first in which she had understood everything. Recently, I ran into a student named Farzad from my UCSD linear algebra course who used to frequent office hours with probing questions beyond the scope of the class; on reflecting about the class, he spontaneously exclaimed “that was a good time!”

How do I go about instilling in my students the attitude that learning mathematics is fun? I have taught in several different contexts, from leading high school students in independent research to helping college students pass their one math requirement, to teaching graduate students about zeta functions of graphs at the Institute for Advanced Study and the salient lesson has been that if you lead people will follow. I teach with enthusiasm, put in hard work, and do a good job, and I make it clear to my students that their reciprocity is expected.

Beyond enthusiasm and hard work, over the years, the following three facets of my teaching ideology have emerged as the most important.

1. **Respect.** I solicit questions during class and in office hours, and consider each one seriously, maintaining a belief that even the most mistaken-sounding question could have its roots in a subtle and difficult issue. I acknowledge to the class that one may be so confused as

to be unable to verbalize their thoughts correctly, but that they should try anyway.

Conversely, I pepper my lectures with questions for the class: from the challenge problem on the board at the beginning of lecture, to definitions they should know, to conjectures they might have about up-and-coming topics. It is a great show of respect, a good didactic technique, and a big challenge for the professor, to ask a question of the class and stand at the front of the room waiting until someone answers. Recently, I took twenty minutes of lecture time to let my linear algebra class come up with each of the equivalent parts of the Invertible Matrix Theorem when I could have just jotted them down myself in five. This way, though, they had to think actively, assimilate the observations we had been making for several days on their own, and feel how much I trusted they could come up with it. As soon as they successfully got the last condition, a celebratory reaction filled the classroom: “We did it! We lived up to her expectations!”. There really is nothing like the morale coming from justifying someone’s respect for you to boost thinking, participating, studying, and learning!

2. **High standards.** The best way to manifest respect for students is to expect a lot from them. Lots of work to help them practice, fast-paced lectures to make them think on their feet, hard exams to allow them to shine. This is the stuff of a good class in which the students know you believe they can perform at a high level. Tailoring one’s standards to be “high” for the particular class at hand is an art, but getting immediate feedback by encouraging participation in class is a good start.
3. **Clarity.** Clarity of one’s expectations really is the only excuse for very high standards. I recently gave such a hard linear algebra midterm that everyone I consulted about it beforehand warned me it would be devastating. However, I informed my students a week in advance that “I may look like a softie, but I am going to give you a difficult exam so study hard.” And study they did. Not only did I witness them glued to their books on campus over the weekend, but they out-performed even my best expectation on the exam: average of seventy-seven percent! My doctrine of clarity extends beyond fair warning for exams, though. I present an organized website, replete with lesson plans, homework assignments, clearly stated grading policies, and timely updates about

review sessions, practice exams, extra office hours. I always show up a few minutes early to class to post a challenge problem, a list of topics covered the day before, the plan for the current day, the suggested reading in the text for the following lecture, and any pertinent announcements. I lecture in an organized fashion, with neat hand-writing, and I attempt to motivate each topic with a roadmap of what we have accomplished, where we are heading, and why we care.