

My Philosophy of Teaching

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Teaching is an activity, a profession that requires a commitment to human relationships, an understanding of the human condition and a deep knowledge of a particular subject. Teaching is an intense form of communication in which knowledge, understanding and attitudes are conveyed from teacher to student.

Subject-centered

The process of teaching should be subject-centered. The mathematics teacher is, metaphorically, one student in a circle of students who are *all* examining the subject of mathematics, which sits in the center of the ring. The teacher, having more experience and a greater understanding of the subject, should lead this examination, but should keep the learning focused on the subject of mathematics. Occasionally, a digression into a discussion on *how* one examines the subject is appropriate, but the mathematics teacher needs to be, foremost, a mathematician, one intensely involved in the study of mathematics.

Mathematics is a diverse, vibrant, growing subject, important in our culture, central to our understanding of the universe. I want students (whether in elementary algebra, calculus, statistics, complex analysis or advanced group theory) to appreciate the diversity of mathematics and the underlying beauty of mathematical principles.

At every level of the educational system, people should be encouraged to learn and love mathematics. A math teacher should be willing to promote mathematics to four-year-olds, to high school students, to undergraduate college students and to doctoral students. For this reason I teach a wide variety of age groups. At CMU I have taught high school classes and mentored doctoral students.

Humanitarian

Teaching is a humanitarian activity. Teaching should involve commitment to the personal growth of each student. A teacher should help his (her) students develop into scholars. They should become problem solvers. They should use their knowledge to analyze the world around them and so achieve results in diverse environments.

I know all my students by name. I speak with them outside class; some of them become good friends.

College students are adults. My relationship with them should display respect and courtesy. I expect students to act professionally in class, participating in the class lectures and class discussion. Occasionally, as young professionals or "pre-professionals", they may need some coaching on the characteristics of professional, responsible behavior, but that coaching should be done carefully, with sensitivity and respect.

Courageous

Teaching is a courageous act! True learning involves some discomfort and some very hard thinking. It is human nature to withdraw from hard work when it is required and therefore part of the role of the teacher is to help students learn how to confront learning barriers and to help the students learn to think *deeply*.

In learning mathematics, a student may be tempted by shortcuts that give a false appearance of understanding where deeper thinking is required. Twenty years ago, a

calculus student may have mechanically manipulated a formula until he reached the answer in the back of the book. Today, a student might press certain keys on a calculator until she sees the right graph (again available in the back of the book.) In either case, the student must be pushed to think further, to go beyond mere calculations to an understanding of the concepts.

It takes time and energy to organize material and then energetically communicate it to others. It is stressful to push people past simple answers and past "cookbook" solutions. There is considerable evidence that standard student evaluations correlate with the student's grade in the course (Williams and Ceci, p. 14), and that students want a "comfortable" classroom where the professor "will not demand more of them than they are willing to give" (Trout, p. 28.) The promotion of genuine learning requires, at times, that some students will be uncomfortable and thus tension may develop between the student and the teacher. A teacher should be prepared for this tension and friction, treating the student with respect, while continuing to push, coach, lead.

Methodology

In my attempts to communicate the principles of mathematics, and to excite my students in its study, I combine standard "classical" lecture with discussion and occasional group work. I typically lecture at the blackboard, make a few comments, and then back off and ask questions and encourage discussion. I know all my students by name and usually involve them (at some level) in the class conversation.

I use relevant technology, when it is available, but I attempt to avoid focusing on the use of the technology. In undergraduate classes, I often use *Maple* (or similar software) and occasionally a graphing calculator; in graduate algebra classes I have an assignment or two in which *GAP* is used. In research projects, my students will use some type of software in their work, usually *Maple* or *GAP*.

Assessment

Learning is difficult. So also is the assessment of learning and of effective teaching. In undergraduate classes, my students fill out standardized student evaluations; I generally score above the department average on those forms. (But there are problems with standardized student evaluations -- see the section "Courageous".)

Ideally, I would like to evaluate my students several years after they have taken my classes. But it is difficult to set up a process where student success can be tracked after they take a certain class. I have (anecdotal) evidence that my students continue on to do well in later classes; undergraduates in my classes often go on to graduate studies in mathematics; a large number of my students use me as a reference in later applications.

A significant number of my undergraduate students seek me out as an instructor in later classes and ask me to guide them in undergraduate research or a senior thesis. Graduate students who take a class from me often ask me to direct a masters thesis or a Plan B paper. I directed the first doctoral dissertation in mathematics at Central Michigan University.

I have had the privilege of mentoring some exceptional students. In 1999, a Wyoming high school student took a problem I suggested and won the 1999 Mathematics Prize at the Westinghouse Science Fair. (Matt Ong is now an undergraduate student at Princeton.) Christine Berkesch, an undergraduate student from Butler University, worked under my

direction on a project on relative difference sets during the summer 2002 CMU REU. Her poster presentation at the annual meeting of the American Mathematics Society (Baltimore, January 2003) won a prize. Jeff Ginn worked on a project in difference sets under my guidance; he recently won a prestigious appointment to Penn State University's Mathematics Advanced Study Semesters (MASS) Program.

Conclusion

I see teaching as a calling, a mission. I *love* mathematics, reading and learning. I enjoy people and find them interesting. It is a thrill to see a young student, a twenty-year-old adult, get excited about learning and make choices on how they intend to live the rest of their life!

Occasionally, on some mornings, I brew a cup of coffee and stand by the window of my office and think, "How could life be any better than this, to be a teacher of mathematics?" Even on the bad days, I enjoy mathematics. *Most* of the time, I enjoy teaching.

References

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2. Parker J. Palmer, *The Courage To Teach*, Jossey-Bass, San Francisco, CA 1998.
3. Wendy Williams and Stephen Ceci, "How'm I Doing?" Problems with Student Ratings of Instructors and Courses, *Change Magazine*, September/October 1997.
4. Paul Trout, What the Numbers Mean, *Change Magazine*, September/October 1997.