Teaching Experience and Approach

Beyond imparting specific content I imagine that it is the calling of teachers to nurture the ability and the desire of their students to learn for themselves. I have chosen teaching as a profession because I enjoy the process of learning, the thrill of the ah-ha moment, the proud feeling of accomplishment and the energy and idealism of youth. I think that I am an effective teacher for many of the same reasons that I am a good student: because I strive to be introspective, analytical and flexible.

As a student I have found that there are two main obstacles to learning new material. Learning requires effort and it often involves periods of intense frustration. At every level from high school to graduate school I have found that interaction with teachers, mentors and peers has helped me to resolve obstructions and to reduce the feelings of frustration. The payoff that keeps me moving forward is of course the ensuing feeling of accomplishment and occasionally mastery.

As students we have total control over the effort that we invest. As teachers we have little and at best indirect control over the effort of the student. The metaphor with enzymes is nearly perfect. Enzymes cannot change the free energy difference of a chemical reaction they can only lower the transition state barrier by interacting with the substrates and the products along a reaction coordinate. My teaching philosophy is simply to do all that I can to reduce the barriers to learning through interaction with the students, in short to be an optimal catalyst.

I have learned a variety of principles, approaches and techniques to improve my teaching from mentors, colleagues, books and through experimentation. I continue to learn with each class that I teach. I have found that I can encourage the students to invest their efforts through the following principles:
1). **Reduce grade anxiety.** My goal is to ensure that the evaluation process is motivational and positive and does not create anxiety and that the earning of grades does not become the focus at the expense of understanding the material and does not compromise the ideal of learning for its own sake. From Krantz [1], and from students I have learned the value of establishing trust by making expectations clear and giving straightforward exams. I learned a great device from Professor David Singer at Case Western, who would give exams on a Friday. Each student receives two copies of the same exam. One to work in class and one to turn in on Monday. The students receive the average of the two test scores. This is a winning idea because the students love it and it makes them review and reflect on the problems for longer. I grade them at the same time and it is very little extra work. I also allow students to drop their lowest grade and provide extra credit problems that factor only in the numerator of their grade. None of these ideas are novel or revolutionary, but they do seem to help alleviate grade anxiety.

2). **Encourage cooperation.** I routinely encourage cooperation in my classes and have students work in groups. I first encountered group learning strategies during my graduate work at Carnegie Mellon University where I was an instructor for workshops hosted by the Pittsburgh supercomputing center and by my thesis advisor Professor Charles L. Brooks III. The workshops integrated lectures with hands on group exercises. At Georgia Tech I worked as a math tutor for the Organization for Minority Education run by a GT graduate Dr. Mona Meddin. Generally the students that I tutored would honestly and unselfconsciously reveal their ignorance in a way that they would not when I was the teacher in a similar one-on-one setting such as office hours. This experience has shown me that student perceptions of authority and evaluation do affect the learning environment and that properly structured cooperation among the students can help to re-
duce barriers to asking questions and to seeking help. Building on these experiences, I experimented with many of the ideas described by Reynolds et al. [2] while I was teaching at Case Western. Most recently I have received professional development in project based learning that is inherently group-work oriented and have developed numeracy and problem solving modules.

3). **Encourage active learning.** At CMU I had a graduate biochemistry course in which each week we were assigned two or three journal articles to read, evaluate and present. At GT I had a topology course taught in the style of R. L. Moore. Both of these experiences resulted in positive growth and I have tried to modify and incorporate the idea of independent discovery and active learning into my teaching at all levels. At Case Western I began experimenting with different approaches to involve the undergraduate students more actively. In a class of 30 students I devoted one class period a week to having the students work assigned problems at the board. Five students at a time would write their solutions on the board and then field questions from me and from their peers. It was clunky, but fun. I have also experimented with assigning short articles from undergraduate math journals to be presented during the last week of class as a component of the final grade. I bring donuts and make it festive, encouraging the students to ask questions of each other. The student presentations always exceeded my expectations.

4). **Promote undergraduate opportunity.** I began this exposition by mentioning that as an ideal my goal is to encourage students to learn cooperatively and to nurture intellectual curiosity. While in-class group projects can provide students with a hands on mathematical experience, generally course constraints limit the scope of the work. I am dedicated to fostering opportunities in which undergraduates can apply all of their skills in the pursuit of an authentic mathematics experience. Authentic opportunities can take many forms such as preparing
for a math competition, performing guided research, or participating in an internship program. The Department of Biomedical Informatics at Vanderbilt University has a summer internship program funded by the National Library of Medicine that pays undergraduate students a summer stipend to participate in the program. I have mentored seven students in this program. One of the students continued their summer work as a senior design project. In completing the project, the student won honors in the senior design competition and was invited to give a talk at a national meeting. In the undergraduate research setting, as in the classroom, my goal is to model for the students the principles of cooperation and curiosity. There is evidence to suggest that this is the consideration that the students value the most [3].

References

