TEACHING STATEMENT

JAYADEV S. ATHREYA

Teaching and communicating mathematics are, and will always be, important parts of my life. Seeing a student or colleague understand a new concept for the first time makes any day better. It is a great thrill to see a classroom full of students evolve from tentative and confused to confident and knowledgeable, knowing that they can tackle the challenges I (or others) throw at them.

Teaching, for me, has always been more than a one-way street. Of course, a teacher's main responsibility is imparting knowledge and skills to the students, but what's often exciting and inspiring is the flow of information in the other direction. Especially with calculus, student questions have often made me think of a subject or theorem that I thought I knew inside and out in a new and interesting way.

Chicago has provided a wonderful laboratory to develop teaching ideas and skills. A wide variety of experiences (3 quarters of being a College Fellow (equivalent to teaching assistant), 5 quarters of teaching calculus, and 2 quarters of mentoring advanced students 1-on-1, and a summer helping with the Chicago REU) has given me many lessons and ideas, which I hope to continue to develop in my next job.

The main lesson that I acquired at Chicago was simple: be flexible. There is not one hard and fast way for everyone to learn the same material. This lesson was really driven home by teaching two different Calculus sequences. My first year teaching, I taught Math 151-2-3, Chicago's main calculus sequence for undergraduates. This was a class of about 30 very solid students, who responded pretty well to my (somewhat naive at the time) teaching style. I tried to keep them involved by asking each student specific questions in each class, and for the most part, they were confident enough not to be intimidated. The next year, I taught Math 131-2 in the winter and the spring, an off-quarter version of Chicago's lower-level calculus class. Here, the students were, in general, less well-prepared and not as confident. So, while I continued to ask questions, I would be quicker to help students out, and to move the focus away if they were struggling with the answer. And while I tried to emphasize rigor and method in both courses, I realized that for the 'weaker' students, one would have to work through more examples of any given method or technique. Of course, weaker and stronger are general terms- the best student I had in either of the classes was a 130's student who was simply brilliant, and ended up in the class because he had taken some time off.

The calculus classes were, compared to the classes I TA'd, large. However, building on my experience as TA, where I saw that my most productive interactions with students seemed to be when working one-on-one or in small groups, I tried to be very accessible outside the classroom, in particular holding extensive office hours. The presence of undergraduate assistants for both the courses also helped the students get more one-on-one attention, and helped me learn how to manage TA's and multiple sections of a course.

Date: Fall 2005.

One unusual thing about Chicago is the degree of autonomy granted the graduate student instructors. We were allowed to set our own homework and exams, and of course, prepare our own lectures. This was a great opportunity to learn from both the positive and negative experiences of other lecturers. It was very useful to be able to compare notes with other teachers in the same course, or those who had taught it before, on what techniques work and which ones don't. This (mostly informal) interaction with my peers was another aspect of teaching that I really enjoyed.

So, how do I believe math should be taught? With simpler, more basic material (pre-calculus, calculus), a firm base of calculation and problem solving, while not sufficient, are certainly necessary for any understanding. Rigor needs to be emphasized, but it needs to be made meaningful and understandable. I tried to explain $\epsilon - \delta$ proofs, for example, by saying that the input variable was raw materials, the function a factory, and the dependent variable the output. They own the factory, and were given an order demanding that the output satisfy some range of specifications (ϵ). Could they specify an acceptable error range for the input raw materials (δ) to guarantee that their output would satisfy their customer?

With more advanced material (say, the content of a research paper or monograph) I think that students need to develop their own understanding and intuition. I believe that one of the best ways to learn is to try and deliver a lecture on it. I've been part of many graduate student seminars where this was the approach, and they were incredibly productive, probably more than many of my graduate classes where we were, in comparison, learning more passively. I also realized the value of this approach when I was mentoring more advanced students, as part of Chicago's Directed Reading Program (DRP). The first time I participated in the program, in Winter 2003, my student Adam Yavitz wanted to study low dimensional geometry and topology. Since this was material I was extremely familiar with, I initially tried to tell Adam what was going on, using my intuition and understanding. What ended up working better (for both of us) was him lecturing to me - this way, he developed his own intuition, if he made a mistake, I could correct him more quickly and easily, and I got some interesting new insights to the material as well.

In conclusion, I'm looking forward to applying these lessons and ideas in the future. In particular, I'd like to teach classes, or run seminars, for more advanced mathematics students. When I teach calculus, I'd like to be able to work with the students in relatively small groups, or at least have them work with each other in small groups. I look forward to hearing about and learning more from my peers (and my students) about teaching (and understanding) mathematics. Finally, I'd like to be able to go to continue going to work in the morning everyday with the possibility that I might help somebody understand something new for the very first time.