TEACHING STATEMENT

MIA MINNES

In each of my teaching experiences, I work to convey my enthusiasm for mathematics, highlight the connections between new concepts and the students’ background knowledge, and clearly articulate the subject matter. I believe that discussing pedagogy and teaching strategies with colleagues is immensely valuable and have sought and created opportunities to do so. I have been an instructor and teaching assistant for math courses for over ten years, and have also been involved in various undergraduate research and mathematics outreach programs during that time. I look forward to many more opportunities to both teach and learn as I continue my academic career.

I believe it is important to tailor my teaching style to the subject, size, and level of the course I am teaching. I have lectured to classes of varying sizes, ranging from 10-15 students all the way up to 200 and 300 students. In all of these contexts, my goal is to encourage active student participation. My main strategy focuses on questions: asking lots of questions at different levels of complexity, waiting for responses, and soliciting questions from the students as well. A student in my course on Differential Equations at UCSD (Spring 2011) noticed this and said in the CAPEs¹ that

When students raise their hands, she repeats the question, gets to the heart of where their confusion is coming from, and settles their confusion with a reiteration of the principles relating to that issue.

Another of my guiding principles in planning lectures is to include multiple explanations and analogies for key concepts. Thus, each student can find their own entry-point to the new material in a way that is meaningful for him or her. In addition to demonstrating multiple perspectives for a new concept, this approach also acknowledges the variety of learning styles that people use. In the CAPEs for my Calculus class at UCSD (Fall 2010), one student noted that

Not only are [the] examples engaging, but she also uses visual as well as arithmetic explanation for terms.

I look for examples that are relevant to the interests of the students as well as to the subject matter. In a Calculus class for non-math-majors, I have used the function that describes how energy usage varies with month of the year to illustrate periodic functions. In an “Introduction to Proofs” class for beginning math majors, I used Diffie-Hellman encryption as an application of modular arithmetic. In an advanced class about Computability Theory, I discussed the applications of the Halting Problem to the unsolvability of Diophantine equations.

I view my interactions with students as opportunities to help develop their technical communication skills. I emphasize the importance of precision and rigor in exposition. In lower division courses, this takes the form of encouraging students to work together: by explaining their work to each other, students learn to articulate why and when certain modes of reasoning can be applied. In upper division courses, I focus on modeling good proof style in lecture and work to design appropriate homework and assessment criteria that encourage effective mathematical communication. To help students gauge if they are on the right track, I suggest that they read their homework aloud: the mathematical symbols translate to sentences, and each solution should read like a well-formed paragraph. At MIT (Spring 2009), I taught a seminar course for undergraduate students

¹CAPEs are UCSD’s Course and Professor Evaluations.
one of whose goals was to develop mathematical communication. Balancing delivering content (Kolmogorov complexity and algorithmic randomness) with workshops on paper writing and effective presentations raised different pedagogical questions from more traditional lecture-based courses.

While I have yet to teach any graduate-level courses, I co-organized a year-long graduate reading seminar at UCSD on Logic and Randomness. In the context of this seminar (and, earlier, as part of the Cornell Logic Seminar), I gave several lecture series on recently published papers. Planning these lectures involved accommodating a variety of backgrounds among the participants (the UCSD seminar was attended by graduate students in logic, computer science, and combinatorics and by faculty members) and highlighting open research questions and new directions. These experiences will be useful as I expand my teaching repertoire to include more advanced courses.

I pay careful attention when structuring a new course. The syllabus must be coherent and should follow a narrative so that new concepts are motivated in the context of previous material. Informative and relevant assessment and grading mechanisms improve communication with the students and are used to facilitate better learning. If I am working with other instructors and TAs, coordinated planning and regular updates ensure that the course runs smoothly. I have worked collaboratively on multiple courses and in multiple roles: as one of the instructors in a coordinated course, as the instructor working with a team of TAs, as a supervisor for undergraduate homework graders, etc.

I have extensive experiences with instructional technology (Blackboard, webCT, MapleTA, MATLAB labs, clickers and Good Questions, etc.) and have had many discussions with other instructors about balancing the potential benefits of such tools with their challenges.

Reflection and professional development have always been important to me as a teacher. While a graduate student at Cornell, I was one of two organizers of the Teaching Seminar. During seminar meetings, we discussed topics ranging from current mathematics education research to specific questions about classroom management and activities. One initiative that sprang from this seminar was a repository of activities and lesson plans for tutorial sections and lectures. I was involved in spearheading a similar project at MIT that has blossomed into a sophisticated tool. The CI-space (oeit.mit.edu/gallery/projects/mit-math-ci-space) is an online community for instructors in the mathematics department who collaborate on teaching tools for communication-intensive courses. In the few years it has been active, the site has amassed a wealth of resources and is widely used. It is now available to all mathematicians as part of the MAA Digital Library and was featured in an Inside Higher Ed article (July 2011). Moreover, the platform we developed for hosting the community (based on Wordpress blogging) can be ported to support any group wanting to share and comment on documents (ecs.mit.edu). I will be co-teaching an MAA Minicourse on teaching communication in mathematics and on this technology during the Joint Math Meetings 2013.

One of the key roles of academic mathematicians is to mentor younger researchers. So far, I have directed two senior undergraduate reading projects at UCSD and supervised three undergraduate research projects at MIT. The most successful of these projects (with Maria Monks) led to new results about asynchronous automata and a paper posted on the arXiv.

I believe that mathematicians should reach out to the community to help foster a better general appreciation of mathematics. Outreach to children is especially important in ensuring that they are not turned off technical subjects early on. At both Cornell and MIT, I was involved in several projects for this audience. I helped organize, plan, and run the Cornell math department’s workshops for the “Expanding Your Horizons” conference for girls in seventh through ninth grades and for the 4-H “Career Explorations” conference for youth from rural areas in New York
State. Websites outlining these workshops are now part of Cornell’s Math Explorers’ Project (www.math.cornell.edu/~mec), in which advanced mathematics topics are made accessible to middle-school and high-school students. At MIT, I became involved with the Girls’ Angle math club in Cambridge MA whose mission is to foster the participation of girls and women in mathematics. I served as a mentor at weekly meetings and am still active on their Advisory Board. However, mathematics outreach is not solely aimed at children. I have given several general audience talks (at the MIT Parents’ Weekend Department Showcase and for both UCSD’s and MIT’s undergraduate math clubs, among others) which aim to present themes of current mathematics research at a level accessible to people with general scientific interest. I was also recently filmed as part of the “Women in Mathematics Video Series” (www.girlsangle.org/page/WIM_videos.html). I believe that talks like these help promote the important role that mathematics serves in modern society. Moreover, they can work towards dispelling the illusion that math is a “closed” or “finished” field and can spark curiosity in current research avenues.

My teaching experiences have helped me grow as a mathematician. I believe that students understand new material better when they can ground it in ideas they already grasp, and when they can follow its underlying story arc. In preparing lecture material or selecting problems for homework, I distill the key elements of the concepts involved and work to convey their connections with other concepts or with the students’ experiences. These skills can be transferred to research lectures and papers, where it is important to articulate the main results clearly and provide a broader context for them. When interacting with my students, I enjoy the challenge of sparking their enthusiasm and answering questions sensitively and fully. Finding ways to reach students who may not be mathematically inclined helps me be an ambassador for mathematics when asked the inevitable question: “What do you do as a mathematician?” I will continue to hone such skills as I teach more classes and reflect on my teaching.

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