TEACHING STATEMENT

MIA MINNES

I am passionate about exploring ideas through teaching which involves the active engagement of students. I have been a teaching assistant (TA) an instructor of math courses in the last nine years, and have been involved in various mathematics outreach programs during that time. In each of my teaching experiences, I strive to convey my enthusiasm for the subject, clearly articulate the material, and probe the connections of the new concepts to the students' experiences. I also believe that discussing pedagogy and teaching strategies with colleagues is immensely valuable, and have pursued various avenues for such dialogue. I look forward to many more opportunities to both teach and learn as I continue along my academic career.

I started working as a TA at Queen's University in the Fall of 2001 and was among the first undergraduates hired to assist with engineering calculus and linear algebra. In that capacity, I ran weekly problem-solving tutorials. When I came to Cornell, my first TA job also revolved around working with first-year engineers. The students were often very capable, but also had very busy schedules due to their heavy courseload. I tackled the challenge of making calculus relevant by giving examples grounded in applications (such as modelling the capacitance of a camera flash). I enjoy helping students make connections between practical applications and the seemingly esoteric symbols used in calculus.

Later, I assisted with more theoretical mathematics courses, such as vector calculus for math majors and a senior undergraduate introductory mathematical logic course. As the TA for the vector calculus course, I ran problem solving sessions and graded homeworks. I emphasized group work during these sessions, since I believe that both the strong students and those who are struggling benefit. By attempting questions themselves, students realize how much of the material they understand and can formulate specific questions to ask for help. Also, by explaining their work to other students, those who were able to work out the questions have to articulate their thoughts coherently, thereby deepening their grasp of the concepts involved.

While grading homework for these upper-level courses, I emphasized the need for mathematical communication in addition to numerical correctness. Mathematical writing is a very difficult skill for students to learn. To help the students gauge if they are on the right track, I suggested that they read their homework aloud: the mathematical symbols translate to sentences, and each solution should read like a well-formed paragraph. When I presented examples in tutorials and when I created homework solutions, I modelled the style I expected from the students. However, I recognize that becoming comfortable with mathematical writing is difficult, and so I annotated their homework with praise for particularly clear work and suggestions for improvement. It is extremely rewarding to help students learn the language of mathematics and to develop the rigours of logical thought.

Most recently, I am working with the first calculus course offered mainly to students interested in medicine and economics. My involvement has been two-fold: I am teaching my own section, and I assist the head instructor with all logistical co-ordination of the course. This has been my first experience teaching my own class, and I love it. I take pleasure in crafting lectures which include enough of the computational detail, but also motivate the concepts. I believe that students understand new material better when they can ground it in ideas they already grasp, and when they can follow a story arc of its development. My additional responsibilities for this course involve communicating with the fifteen other instructors and facilitating discussions about pedagogy, exam writing, and any other issues that arise. Designing appropriate assessment and grading mechanisms can improve communication with the students, and can often be used to facilitate more learning. Moreover, I hired and trained the undergraduate homework graders who work with us. These graders run homework study groups for the students and grade the weekly homework. I meet with them regularly to discuss strategies for constructively assisting students (without giving away answers) and for fair grading.

I believe that mathematicians should also work outside the classroom 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. Cornell runs an annual "Expanding Your Horizons" conference for girls in grades seven, eight, and nine. From 2004 to 2006, I helped organize, plan, and run the math department's workshop for this conference. The topics for our workshops included using probability theory to predict likely events; soap bubbles and minimal surfaces; and winning strategies for games like Nim.

Building on my successful experience with EYH, I led the math department's first involvement in a 4-H Career Explorations conference held at Cornell in 2007. The participants in this conference were teens aged thirteen and fourteen from throughout the state of New York. I recruited undergraduate students, graduate students, and faculty members and we worked together to build three workshops: (1) Optimal strategies for Travelling Salesman and "Deal or No Deal" ; (2) Error-Detecting and Error-Correcting Codes; and (3) Winning strategies for dominoes, Hex, and Nim. These workshops were all very well-received. To allow more people to benefit from them, I created websites outlining the activities and describing the mathematics behind each of the workshops. These websites 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.

As I endeavour to grow as a teacher, I seek out opportunities to reflect on my craft. In my first year of graduate studies, I participated in what started out as a case-studies based course on teaching strategies (Math 500). The course transformed into a department-wide seminar, the Teaching seminar, and I became one of its two organizers. During seminar meetings, we discuss topics ranging from current mathematics education research to specific questions about classroom management and activities. For example, I led a seminar talk on finding resources outside the classroom for students. We also discussed the various resources that are available to instructors and TAs. I helped create one such resource: the Good Questions database. A senior lecturer at Cornell, Maria Terrell, has put together conceptual and high-level questions to be used in calculus classrooms. These might be used to promote conceptual thinking, to encourage group work and active learning, or as a quick check of the students' understanding. Such questions are hard to write, and it is often difficult to tell whether a question will have the desired effect. I believe that collaboration is tremendously helpful in teaching, and that it can be very helpful to learn from others' experiences. To facilitate sharing our experiences, I created a database of activities (including the original Good Questions, worksheets and activities I had used in previous teaching experiences, and material I collected from fellow graduate students). This database is still available to all TAs and instructors in the math department at Cornell.

Over the past two years, I have also been one of six experienced TAs who run the three-day TA training workshop at the start of the year. We are responsible for introducing first-time TAs to pedagogical issues, ideas for planning tutorials, principles of grading, and more. I enjoy meeting the new members of the department and discussing teaching philosophies with them. To continue such conversations, I initiated (with two other graduate students) a mentoring program for incoming graduate students.

I have benefited greatly from my teaching experiences. In preparing lecture material or selecting problems for tutorials, I distil the key elements of the concepts involved and work to convey their connections with other concepts or 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. While interacting with the 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 progress.

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