TEACHING STATEMENT

ALEX KRUCKMAN

To teach is a core part of what it means to be a mathematician. Indeed, the efficient packaging and communication of complex ideas plays a unique role in the methodology of mathematics, in the development of new definitions and notations, and the concept of proof. This social component, the sharing of knowledge, is one of the aspects of mathematics that I love the most, and I take my responsibilities as a teacher very seriously; whether lecturing in a classroom, writing a proof, working with students in office hours, chatting with colleagues, mentoring undergraduates, or participating in community outreach.

In the past 11 years, I have gained a significant amount of teaching experience, in a number of roles and a wide variety of math and computer science courses. My formal teaching experience began when I was an undergraduate at Brown University, where I worked as a TA for the computer science department, starting in my second year (Fall 2007). In addition to grading, this job involved running lab projects and holding office hours. The many hours I spent working one-on-one and in pairs with students on their programming assignments taught me how much learning takes place outside the classroom.

In graduate school at UC Berkeley, I regularly worked as a GSI (Graduate Student Instructor). GSIs in mathematics usually serve as teaching assistants, teaching recitation sections and grading. This was valuable experience, but I was eager to teach my own classes. Math graduate students at Berkeley can apply to instruct summer session courses, and I signed up to do this three times, including my first summer of graduate school – in summer sessions, I taught Linear Algebra & Differential Equations twice and Abstract Algebra once. The mathematics department also appoints one GSI to be the main instructor for precalculus each semester. I sought out this role early on and taught Precalculus three times.

Teaching Precalculus was my first major challenge in teaching. My students came from diverse educational backgrounds, with widely varying levels of mathematical preparation. It was a balancing act to avoid leaving behind those students who had trouble adding fractions, while also stimulating those who had already taken AP Calculus in high school. This was not made easier by the size of the class: In Fall 2013, I was lecturing to a room of 223 students and overseeing a staff of five other GSIs. But it was also very rewarding, especially to see some of my Precalculus students go on to major in math, statistics, and the sciences.

As a postdoc at Indiana University, I have continued to broaden my teaching experience, from large-enrollment intro classes (Math 118, Finite Mathematics, is one of the largest courses at IU, with over 3,000 students enrolled each semester), to graduate-level courses (in set theory, model theory, and a topics course in logic in Spring 2019).

The key features that I strive for in the classroom are clarity and inclusivity. This involves not just preparing well-organized lectures and carefully choosing illuminating examples, but also putting myself in the shoes of a student who is encountering the ideas for the first time. I always try to foster a positive, fun environment in the classroom – former students frequently approach me to ask about my cat, who has been featured prominently in many Finite Mathematics examples. I want every student to know that I care about their success, and to feel comfortable engaging fully in class. I maintain an attitude of cheerful enthusiasm, I pause frequently to solicit questions, and I make sure to take every question seriously.
I have found that it is highly effective to supplement lectures with active learning activities, and I try to incorporate these into my classes whenever possible. In graduate school, I started developing worksheets that introduce new material to students through a series of concrete problems, allowing them to discover concepts for themselves, in a guided way. I also like to break up lectures with small-group activities, or quick “think-pair-share” questions. I have received positive feedback on these strategies from students, and I plan to continue experimenting with new strategies for increasing student engagement in my future courses.

My teaching skills are reflected in my course evaluations, which have been consistently strong throughout my career. At IU, I have been rated above the math department average on almost all course evaluation criteria in all the courses I have taught. Over six years of teaching at Berkeley, I achieved an average rating of 6.32 out of 7 for instructor effectiveness and 6.25 out of 7 for course effectiveness. Restricting attention to the summer session courses for which I was the sole instructor, these averages are higher: 6.57 and 6.37, respectively. My teaching was recognized by the Berkeley Graduate Division with an Outstanding Graduate Student Instructor Award for 2011-2012 (my second year of graduate school).

In addition to classroom teaching, I also have significant experience mentoring undergraduates. In graduate school, I participated in Berkeley’s Directed Reading Program, in which undergraduate math majors are paired with graduate students for an independent reading project. One of my students went on to write a senior thesis on material related to our reading project. In addition to his faculty thesis advisor, he continued to meet regularly with me while developing his thesis. At IU, I again volunteered to mentor a student on a Reading for Honors course in Spring 2017. That student is now pursuing a PhD at the University of Notre Dame.

In Summer 2018, I worked with an undergraduate student on a very successful research project as part of IU’s long-running REU program. The project resulted in a paper, which is currently in preparation. I love working one-on-one with students; this has been my favorite teaching environment, ever since my days as an undergraduate TA. And I look forward to future experiences mentoring undergraduate research; in particular, I would be interested in applying for REU grants or similar support for undergraduate research programs.

My love of teaching extends also to the web, primarily on the site Math.StackExchange, where I am one of the top users who post in the logic tag. This site sometimes gets a bad reputation as a place where students post homework problems, with no effort – and I discourage these types of questions. But the site also attracts many motivated students with very interesting and thoughtful questions. I have learned a lot and grown as a mathematician and a teacher through engaging with these questions on Math.StackExchange, and I like to think I have helped many others learn and grow as well; the StackExchange metrics estimate that my posts have been read by around 142,000 people.

Finally, I believe it is critically important to improve math and science literacy, and to reduce biases in our society around math and who can be a mathematician. Towards this end, it is important for mathematicians to engage with the community, and to share the knowledge that math is beautiful, interesting, and fun. I have been active in outreach in partnership with my wife, Emmy Brockman. Emmy is an educator, an award-winning children’s musician, and currently the Director of Education at WonderLab Museum of Science. In Summer 2017, I worked with WonderLab to design and teach a “Math and Games” summer camp curriculum for students in 4th–6th grades. And I am currently working with Emmy on her forthcoming science-themed album Science Is For Me. I look forward to continuing to grow as a teacher in a new environment, with new opportunities for outreach and community partnerships.