Teaching Statement - Katherine M. Kinnaird

I believe that everyone can be a successful mathematician, but that everyone may not know it yet. This deep belief drives my teaching and learning philosophy, causing me to create learning environments that are accessible to each and every student. These environments seek to support students’ deep learning of mathematical concepts and to instill each student with confidence in their mathematical understanding and skills. This means that when teaching mathematics, I have two equally important goals: to communicate mathematics and to dispel the notion that one is innately good or bad at doing mathematics. To accomplish these goals, I use teaching techniques that engage students beyond each class meeting and that complement classroom activities.

My teaching style has been influenced and informed by teaching my own courses, being a MAA’s Project NExT fellow, participating in a variety of teaching focused seminars at Dartmouth College, and by being as a fellow in the NSF GK-12 Project at Dartmouth. While my approach is different than traditional lecture based styles, I have successfully implemented my teaching methods in a multi-section course with the instructor of the other sections using more traditional lecture based teaching methods. For my broad experience and my successful implementation of innovative teaching methods, I was awarded the Dartmouth Graduate Studies Teaching Award in 2013.

Convincing students that mathematical skill is a learned process and not a gift is, in my opinion, an indispensable part of teaching mathematics. For students who hold the belief that they are “bad at math,” I aim to re-engage them in mathematics, and restore their confidence in learning mathematics. For those who believe they are “good at math,” I push them towards deeper understanding of the material, while encouraging their enthusiasm.

To address both of my classroom goals, I first create course learning outcomes that concretely state measurable goals for a student taking the course. I design exams, lectures, collaborative learning activities, and homework assignments with these course learning outcomes in mind and link to these outcomes at the top of the course Moodle page. These stated goals give students a roadmap for where the course is headed and provide students with mechanisms for reflecting on their learning throughout the course. By highlighting those relevant to each activity, I provide students with a larger context for daily material and demonstrate that mastering one mathematical idea takes time and work.

To solidify students’ understanding of the new material and to continue building their confidence in their mathematical skills, most class meetings are spent working in small groups on collaborative learning activities that make use of techniques and concepts from the reading assignments. These activities are designed to guide students through answering challenging questions by breaking the solution into smaller pieces. I carefully design these smaller steps to help students understand not only the procedure, but also why each step of the procedure makes sense. These activities demonstrate that mathematics is a reflective process, not simply an answer, and can increase a student’s confidence in their own mathematical skills. The small group settings provide opportunities for students who are more
confident with the material to deepen their understanding by explaining the relevant concepts to others in their groups. These collaborative activities often expose when a student has simply memorized a procedure without understanding the conceptual underpinnings. Additionally, these in-class collaborative learning activities help me stay in touch with the needs of the whole class as well as the individual needs of each student; I can then tailor our collaborative learning activities to their specific needs.

To further challenge the notion that one’s mathematical abilities are predetermined, my students play a game called “Mathematician of the Week” where students identify a mathematician from an image and share a fact about that person. This game has several goals. The first is to show that mathematics has a long history and is a living, breathing subject. Second, the students witness that the concepts they are working to master in just one term have taken hundreds of years to develop and codify. With a chocolate bar as the prize, students can have fun with this game without having it tied to their grades.

My teaching techniques have also proven effective in settings beyond the traditional mathematics classroom, and in each new setting, I have learned how to apply, stretch, and reinvent my teaching methods. At Macalester College, I have incorporated my teaching methods into an introductory computer science course and into an introductory statistical modeling course. For example, being cognizant that many students take these introductory courses for practical experience and skills that are applicable to their future endeavors, I have added writing components to my classes this term where students immediately apply their course knowledge while also developing and honing their technical writing skills. During the 2013-14 academic year, as an NSF GK-12 fellow, I co-founded a new club called “Lady Hack” at a local high school that taught motivated, female students how to program. In December 2014, inspired by the transition that undergraduate students make from college to work relating to data science, such as being a graduate student, a member of an R&D department, or a new hire at a start-up, I founded the Data Science TRAIn Lab (dsTRAIn) that exposing undergraduate students to data science by encouraging them to (T)ry, (R)ead, (A)sk, and (I)ncorporate. During weekly lab meetings, dsTRAIn discusses a recent data science or machine learning peer-reviewed research paper, and lab members present the current state of their self-directed individual or small group research projects. For their active participation in dsTRAIn students can earn either work-study hours or 1-academic credit. In just one term, dsTRAIn at Macalester College started six machine learning projects, led paper discussions with two machine learning researchers, and read seminal papers on topics from spectral clustering to topic modeling.

Believing that teaching should not be limited to formal courses, I seek additional opportunities to share both mathematics and computer science more broadly. I also strive to be a role model and mentor, who happens to be an applied mathematician, by participating in outreach activities such as the Sonia Kovalevsky Math Day and college-wide activities like the VDAY Dartmouth campaign. For my service to the Dartmouth community, I was awarded the Dartmouth Graduate Studies Graduate Community Award in 2011. By actively participating in the broader community, I have additional forums in which to share and accomplish my goals of communicating mathematics and challenging stereotypes about mathematics and mathematicians.