As a woman in mathematics, issues of diversity, equity and inclusion have had a huge impact on me directly. Over the last three thousand years, almost exclusively men have driven the development of mathematics. As a result, men (but not women and minorities) in math find themselves belonging to a rich, well-established culture. Forming a similarly rich mathematical culture for women and other underrepresented groups requires forethought and intention in order to achieve equity where it has not previously existed. We can directly see the consequences of the community (or lack-there-of) in the ‘leaky pipeline effect’ where more and more women drop out of pursuing a career in math along the course of their education and careers. In fact, women are 1.5 times more likely to leave STEM after calculus compared to men.¹ Throughout my graduate career, I have made it my mission to help create a supportive environment for women and other underrepresented groups in mathematics in many ways, especially as coordinator for Women in Math (WiM) at the University of Minnesota (UMN).

Women in Math

In order to help build a strong community for women in mathematics at UMN, I held the position of Graduate Student Coordinator for Women in Math for two consecutive years. I was appointed to this role through the Women in Science and Engineering (WISE) Initiative to promote equity among women in the sciences and, as such, served as a liaison between the women of the department, the department itself, and the College of Science and Engineering. Through this role, I initiated both social and academic events and organized groups within the department to support both graduate and undergraduate women in math.

When women decide to leave a math department or drop out of a STEM program, lack of support and community is often given as a reason for their discontent. It has been my experience, and the experience of many of my classmates, that being successful in graduate school is highly influenced by feeling a sense of belonging and becoming a member of a community, both socially and professionally. WiM’s mission is to help develop this community. As Coordinator, I immediately recognized the need to develop a social program in order to have a positive effect on the ‘leaky pipeline.’ I applied for internal and external grants to supplement departmental funds for fun activities and get-togethers over breakfast, lunch and lots of pizza. I started an annual Trivia Night hosting nearly 50 graduate women in the department and hosted an annual “Prelim Bee” to build comradery among graduate students while helping them study for their upcoming prelim exams.

However, building a social community is only the beginning. Promoting academic events to aid career development and networking among women is also extremely important. Through WiM, I hosted luncheons for visiting female mathematicians so students could ask questions about their research and career paths. For graduate students in particular, I put together a series of panels consisting of female department members discussing topics ranging from preparing for oral exams to entering the job market. Since math research is often a mystery to undergraduates, I also organized an Intro to Math Research Seminar in which graduate students and postdocs presented math research in a way that was engaging to undergraduates regardless of their background. Each spring we held a Graduate School Applications Workshop for undergrads considering applying to math graduate school. The interest generated from these seminars led me to put together a list of graduate students interested in mentoring.

undergraduate research in an effort to match them up with undergrads with common academic interests. The result showed an increase in undergraduate/graduate student pairs applying for Undergraduate Research Opportunities Program (UROP) grants and helped to recruit female undergrads to participate in math research at UMN.

Last year, with the help of two colleagues, I spearheaded development of a 4-day annual workshop – the Mathematics Project at MN (MPM) – for undergraduate women at the UMN interested in pursuing a math major. The workshop received a $2,300 “Watch Us” grant through the University of Nebraska (funded by NSF), as well as other grants from the university. We invited a diverse group of participants across different backgrounds to share their knowledge and experience about future careers in mathematics while the students themselves developed relationships with their peers and began to develop a sense of community. We also invited a representative from the Diversity Office to help us organize activities about diversity and privilege, bias, impostor syndrome, and more. Each participant chose a math paper to read and present to the group at the end of the conference. Feedback we received from participants was extremely positive and encouraging. The opportunity to work with so many amazing women was one of the highlights of my time at UMN. We invited a diverse group of participants across different backgrounds in order to inform them about future careers in mathematics and form a community among women undergraduates. Each participant chose a math paper to read and present to the group at the end of the conference. We also invited a representative from the Diversity Office to help us organize activities about diversity and privilege, bias, impostor syndrome and more. Through MPM, we set in place a mentoring program which paired participants with a female graduate student mentor. In their 2016 study, Ellis, Fosdick, and Rasmussen conclude,

When comparing women and men with above-average mathematical abilities and preparedness, we find women start and end the term with significantly lower mathematical confidence than men. This suggests a lack of mathematical confidence, rather than a lack of mathematically ability, may be responsible for the high departure rate of women. Feedback from participants showed that MPM helped participants feel more confident by giving them a math community when they returned to school the following semester. Further, MPM helps plug the leaking pipeline of women in mathematics before these women decide to opt for a different major.

WiM works to serve the larger community of students through activities like tutoring sessions and provides community engagement by hosting activities (i.e. an interactive spirograph project) at the Minnesota State Fair and other public events where we teach the broader community about the impact of math while simultaneously breaking down stereotypes about women in STEM fields.

Number Theory
I am very lucky to be part of a field – number theory – with a supportive community of women, including Women in Numbers (WIN). Participation in Strength in Numbers (a conference for underrepresented peoples in number theory) and RE:boot (a workshop for women in number theory applying for NSF grants) have been extremely helpful.

My involvement in WIN inspired me to work towards equity at UMN by co-organizing the Student Number Theory Seminar (SNTS). When I originally began studying number theory, the seminar was an “impenetrable” all-male group. In the years since I started to help organize SNTS, it has doubled in size and has consistently had an attendance of nearly 50% women. We concentrated on creating a welcoming environment for all students and focusing lectures on topics that would appeal to a diverse active learning community. The SNTS now serves as a forum where all aspiring number theorists can present new ideas in a supportive and friendly environment.

2Ibid.
Teaching and Mentoring

I have heard many women mathematicians express that having outside influence which encouraged them to pursue mathematics was vital to their continuation in the field. Seeing the direct impact of mentoring on the ‘leaky pipeline,’ I have made mentoring a huge part of my graduate experience both inside and outside of WiM. For the last three years, I have been an Undergraduate Mentor to a variety of women pursuing a math major through WISE. In addition, I have informally mentored dozens of students who I have encountered at the UMN through teaching and other activities. I often meet students for coffee to advise them on classes to take, activities to become involved in and just to chat. Many of those students I mentored have gone on to apply to graduate school in the sciences and we met to discuss what classes to take and what schools might be the best fit for them. One such student is starting at the Indiana University Bloomington for a math PhD this semester and another is starting a Masters program at Stanford.

Mentoring undergraduate research beautifully compliments and furthers my own research program. I am currently mentoring three undergraduate math research projects – two of which are funded through the Undergraduate Research Opportunities Program (UROP) at the UMN and one funded through North Star STEM Alliance (a program through the NSF to encourage minorities in STEM). Yu, a bright, energetic young woman from China, is my first student and has made great strides working on a tough, unsolved problem closely related to my research. She will be applying to graduate school this fall. Bernardo, a smart, curious junior from Brazil, worked on a Directed Reading course with me last semester and is now working on his own research project. Bernardo and my newest student Yaren, a first generation college student from the Twin Cities, are learning Python to help us visualize some recent work in number theory. I feel very fortunate to have students help drive my own research and keep me excited to learn new things. For each of these projects, I have pushed myself to learn and read materials outside of my usual research path. I enjoy working with a diverse group of students who may not otherwise be given the opportunity due to particular social norms in the mathematics community. This is important to me because, as a woman in math, I was often overlooked or self-selected out of participating in math research as an undergraduate.

I view mentoring as part of my role as an instructor. Over the past few years I have taught dozens of courses at institutions of different sizes and types, including the development of an online calculus course at the UMN. In addition, I have volunteered as a tutor at a public middle school. At Metropolitan State University, I taught night classes to a diverse community of working adults and other nontraditional students. Most of these students were working towards degrees outside of STEM and had been conditioned to believe that they were “bad at math.” These teaching opportunities allow me to share my enthusiasm with students who have never positively connected with mathematics. By using guided worksheets to help accommodate a variety of learning styles and abilities, I strive to make my teaching accessible to many types of students. In the classroom, I emphasize group work and fight back against the myth of the “math genius” by showing students that math performance (like most things) improves with practice. These small steps help make women and minorities feel more confident in my classroom. I received a 2014-2015 Outstanding TA Award which illustrates that my passion for mathematics translates in the classroom. Each semester I make a point of individually e-mailing students in my class who show promise (often women or minorities) telling them of their potential. I hope these small actions can spark confidence and drive tremendous change towards equity.

My work with Women in Math and my teaching is not just my job – it is my passion. As an American woman in mathematics, it is my mission to remain passionate about the value of creating a supportive community at every university I am affiliated with in my future career in academia.