# GROWing a Graduate Cohort

*Evelyn Lamb*

Bryna Kra was frustrated. It was early 2015, and the math professor at Northwestern University had seen the number of women applying to her program decline for several years, even as the total number of applications was increasing. Anecdotally, her colleagues at other institutions were reporting similar problems. She wanted to do something to reverse the trend. After talking with other mathematicians at Northwestern, she decided to organize a conference specifically focused on encouraging women to apply for graduate school in math. A few months later, fifty undergraduate women descended on Evanston for the first iteration of the Graduate Research Opportunities for Women, or GROW, conference in October 2015. This year, it received the Programs that Make a Difference award from the American Mathematical Society. "It's an honor and rewarding to know that the program has been recognized only five years after it was established, and it makes it clear how valuable such programs are," Kra says. "My hope is that this will give the impetus for other institutions to take charge of the program in future years, hosting GROW and building more diverse departments."

In the five years since the first conference, GROW has taken place three times at Northwestern and once each at the University of Michigan and the University of Illinois at Urbana-Champaign. In October, it will move to the University of Chicago for the sixth iteration. Hundreds of young women have participated in GROW and been encouraged to consider graduate school in mathematics. "Ultimately, the main point of GROW is to increase the comfort that bright women undergraduates have with the idea of doing a doctorate in the mathematical sciences, that it is something available to them," says Ezra Getzler, one of Kra's colleagues at Northwestern and co-organizer of the conference when it took place there. Kra says that many alumnae have told her GROW gave them the nudge they needed to apply to graduate school.

**Figure 1.** GROW participants at the 2017 conference.

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DOI: https://dx.doi.org/10.1090/noti2088

## Genesis

Putting on a conference for dozens of undergraduates in just a few months was no small feat. Kra and her co-organizers Getzler and Laura De Marco had the resources and connections to make GROW happen on their condensed timeline. They used funds from a Research Training Group (RTG) grant, in addition to university-level funding that they could secure on short notice. "Part of the purpose of an RTG is to create a vertical conveyor belt for mathematics in the United States, and so here we're dealing with a key transition point from undergraduate to graduate school," Getzler says. "It's a continual struggle to make sure that people are trained at the graduate level in mathematical sciences in the United States, and [GROW] is a very good way of increasing awareness among an important and to some degree underserved group."

Once the plans were in place, the organizers had to get the word out. "I sent information about the conference to everybody we knew," Kra says. "In two months, we had 120 applications from students at 40 schools." The first year, they accepted 50 students. In subsequent years, they increased attendance to 80 undergraduates to balance their goals of reaching as many people as possible while allowing as much one-on-one interaction as possible between attendees.

Organizers wanted to make sure to welcome students from communities that do not have good access to information about graduate school, including first-generation college students, women from underrepresented racial or

ethnic groups, and those who come from socioeconomically disadvantaged backgrounds. "There are a lot of middle class assumptions baked into the PhD, which means there's a cultural divide for people not coming from that background. So I would hope that part of the role of GROW is to bridge that divide as well as the gender divide," Getzler says.

They advertised to departments all over the country, including historically Black colleges and universities, schools without graduate programs in math, and schools that rarely send students to graduate school in mathematics. They wanted to reach as broad a group as possible of interested undergraduates who could benefit from the conference. "I was extremely impressed at what a cross section of America these students were," Getzler says of the women who participated. (There have been some international participants as well, but the majority have been American women.)

## The Conference Weekend

GROW is a weekend event with a mix of talks from invited speakers, panels about topics such as how to apply to graduate school and what to expect from a career in research mathematics, and less-structured time for one-on-one interactions. The organizers invited a large number of mentors—about one for every two students—to participate over the course of the weekend. Some mentors were on panels, and some were local professors and graduate students who were available for informal chats with undergraduates.

"I think here in this conference, anyone can approach anyone else," says Zoi Rapti, one of the organizers of GROW when it went to UIUC. She says the atmosphere at GROW, especially the amount of time given for undergraduates to talk with older students and professors, made them feel comfortable approaching speakers and asking questions.

"One thing that I have always done in my career, and will continue to do, is if I have to do something new, like apply to grad school, or apply for this job, or apply for this fellowship, I will always seek the counsel of older people who have done it before me," says Sarah Koch, who co-organized the conference when it moved to Michigan. "I think these conversations are really special and can make a huge difference in the direction that somebody wants to go."

One of the key events was the "nuts and bolts" panel about how to apply to graduate school. (The panel was so popular that the organizers made it significantly longer after the first year in response to feedback after the conference.) Panelists gave students information about how to apply and answered specific questions about everything from GRE scores to graduate stipends. A panel like that would have been helpful to Karen Smith, another Michigan conference organizer, as a student. "When I was an undergraduate, I had never heard of graduate school," she says. "Even after I had heard of it, I thought I would have to pay for it. I had never heard of getting funding for graduate school."


**Figure 2.** Sarah Koch describes her work to participants at GROW.

**Figure 3.** Bryna Kra talks with students at GROW.

As the daughter of an academic mathematician, Kra knew plenty about how graduate school worked and what a career as a researcher could look like. But when she was an undergraduate, she was nevertheless uncertain if going to graduate school would be the right choice for her. "It certainly didn't feel so welcoming that I'd never seen a class by a woman," she said. "I think it's important that people see that there are other women out there." She hopes that the conference gives women, whether they are already graduate school savvy or not, a way to see themselves as having the potential to have fulfilling careers in mathematics.

The organizers chose not to include presentations of undergraduate student research during the weekend in order to keep the focus more on the decision of whether to go to graduate school and how to get there. "It's not an undergraduate conference. It's a conference about going to graduate school in math," Koch says. "If we had the undergraduates present their work, I think that would have kind of detracted from getting together and thinking about going to graduate school. What does that look like mathematically? What does that look like practically?" Undergraduate presentations add a layer of stress for students, distracting them from those questions. "We wanted them to be looking forward and looking at the graduate students, looking at the postdocs, looking at the math talks," Koch says. "It's really about the next step for them instead of what they're already working on."

A highlight of each conference for Kra was the Saturday evening banquet, which featured a plenary talk by an august senior woman mathematician about her career journey. In 2015, the speaker was Alexandra Bellow, the first tenured woman mathematics professor at Northwestern. Eighty years old, she spoke softly, even with the microphone. "The

room was so silent," Kra says. "Everybody was just glued to her stories. It was quite moving."

## Evolution and GROWth

As the conference moves around to different universities, each organizing committee makes their own tweaks to GROW, and the experience will continue to evolve. "I think it's taken on its own life," Kra says. In 2018, after hosting three GROW conferences, she and her colleagues handed the duties off to Koch, Smith, and Mel Hochster at the University of Michigan.

Koch was a panelist and mentor at the 2017 conference. "It was such a positive, hopeful atmosphere," she says. She went back to Michigan enthusiastic about continuing the tradition. She and her co-organizers adapted the structure of previous GROW conferences to their own setting, modifying some parts of it to match their goals more closely. They kept Northwestern's emphasis on one-on-one mentoring opportunities and expanded the idea by creating booklets with pictures and short biographies of the allies and mentors who were attending the conference so students could get some relevant information, such as their institutions and research areas, before meeting them in person. "We only had a weekend with all these students, and we wanted them to get the most out of their experience," Koch says.

The Michigan organizers also decided to bring other scientists on board as they were planning the meeting. They consulted with researchers in the university's psychology department who study retention in STEM PhD programs. They wanted to get advice from the experts on what they could do to make the conference as effective as possible in encouraging interested women to apply for graduate school and helping them succeed when they got there.

The psychologists made a few recommendations. First, they recommended that the conference include people in a variety of roles on career panels, not just professors. The organizers included panelists from government agencies, the tech industry, and a nonprofit math education organization to broaden the perspectives offered. "It wasn't just about becoming a professor," Smith says.

They also broadened the scope of the colloquium-style talks, incorporating more applications of math to biology and social justice. In addition to standard theoretical math talks, they had a colloquium by an entrepreneur who designed an app that uses math to help people manage or prevent jet lag and one about gerrymandering, a hot-button political issue with connections to interesting problems and solutions in theoretical mathematics.

Second, the psychologists recommended an even greater focus on early career role models, "making sure that the participants saw people that were just a little bit older than they were succeeding in those roles," Smith says. "So instead of having a lot of programming where professors,

**Figure 4.** Ingrid Daubechies and Emmy Murphy serve on a panel at the 2017 GROW conference.

**Figure 5.** Dusa McDuff speaks to the 2016 GROW conference.

**Figure 6.** Participants at the 2015 GROW conference.

even female professors, were presenting their work, it was very important to have first-year graduate students presenting their work, people who would be just one step ahead."

When mathematicians at UIUC were approached about hosting GROW 2019, "of course we jumped on it," Rapti says. Jeremy Tyson, their department chair, attended the 2018 conference as a panelist and to help prepare for hosting the next year. The team at UIUC adopted the same conference structure and added more of an emphasis on helping undergraduate students learn about potential departments to apply to for graduate school. "They got to think about particular graduate programs, and maybe compare them and see what would be a good or a bad fit for them," Rapti says.

The UIUC GROW conference also continued Michigan's emphasis on graduate students mentoring undergraduates. One of the most popular events that year was a mentoring session run by the local Association for Women in Mathematics (AWM) chapter. Faculty members left the room so undergraduate and graduate students could talk privately about the graduate application process. "It was a huge success," Rapti says. "People just wouldn't leave the room."

## The Student Experience

Priyanka Nanayakkara attended the first GROW conference as a sophomore at UCLA. She enjoys both math and writing and wanted to find a way to combine those interests, eventually deciding on statistics. "I was so focused on figuring out my major in undergrad, but the time to apply for grad school comes pretty quickly, so I think it was helpful to hear, 'You could really do this. It's not out of your reach. You're capable of it,'" she says.

Nanayakkara was impressed at the generosity of the mentors she talked with at the conference and believes they helped her see a future as an academic. "I knew it existed. I knew I wanted to go to grad school, but GROW helped me actually do it," she says. "That space to really feel confident was so useful, and I don't think it can be understated how valuable that is."

Nanayakkara is now working on a PhD in technology and social behavior at Northwestern as part of a joint program between the computer science department and communication studies. "I go to Northwestern now, and every time I walk past Tech [Technological Institute, a building on campus], I always think about eating lunch right there with all the people from GROW," she says. "I think about that conference as a turning point in my early college career."

She also feels like GROW helped her understand the importance of community in her academic discipline. "It was a really important step in introducing the idea of a cohort: these are the people who will be progressing with you throughout your life and career, and you'll see them again and again," Nanayakkara says. GROW's demographics give her hope that she can be part of an inclusive cohort as she continues in her career. "It has a community effect, and it shows you that the community can be diverse."

Emilee Cardin knew she wanted to go to graduate school when she applied for GROW in 2018. She was a student at the College of William and Mary and had participated in an REU at the University of Michigan–Dearborn the summer before she attended the conference. She was eager to continue studying math, but she worried that she might not get into the graduate programs she was interested in. "I felt like I was here to get as much advice and learn from as many people as possible," she says.

Friday afternoon, before GROW even officially started, she ended up in a conversation with Koch about recommendation letters. "I had a moment with Sarah, where she helped me take a breath and not be stressed out about it," she says. "She took the time to be helpful, even though I wasn't even a student there yet." Talking with Koch, Smith, and other Michigan faculty and students at GROW influenced her graduate application decisions. "I think it made me more confident in applying to Michigan," Cardin says. "I felt like it would be a more welcoming place after I went to GROW. It seemed less unapproachable."

Cardin is now in her first year of graduate work at Michigan. When we talked on the phone for this article, she was standing in the atrium where another favorite moment at GROW took place. She was sitting with a Boston College graduate student for lunch. "I remember her talking about how she loved it and she was so happy to have the people she was with [in graduate school], and I thought, 'Yes, that's what I'd like.'" She says the graduate school application process had felt like a constant competition, but talking with graduate students and faculty members about their experiences helped her prioritize the community she would find in graduate school and beyond. The Boston College student told her about how she was working to prioritize mental health in graduate school and how her cohort had helped her out when she needed it. "I hear those words ringing in my ears a lot," Cardin says.

## Work/Life

"Work-life balance" can be a bit of a cliché, but the fact is that people of all genders have to consider how they will manage the demands of their careers, their other interests and hobbies, and the needs of their partners or family members when they are considering their potential career paths. Despite changes in American society in the past few decades, women still spend more time on childcare and caregiving for infirm relatives than men do, and they are more likely to face negative repercussions for it in professional settings.

It's no surprise, then, that conversations about family and career are common at GROW. "More 20-year-old women think about having a family than 20-year old men, or at least that is my impression," Getzler says. GROW

**Figure 7.** Students participate in a workshop at the 2015 GROW conference.


**Figure 8.** Laura De Marco talks about her work at the 2015 GROW conference.

provides a safe environment for women to talk with other women, both fellow students and women who are further along in their careers, about how they have managed or plan to manage the sometimes competing demands of career and family. "These things have to be thought over a bit more deeply when we're discussing women grad students," Getzler says.

Dusa McDuff and Ingrid Daubechies gave plenary addresses at GROW in 2016 and 2017, respectively. McDuff talked about taking time off from her career to raise children, and Daubechies spoke about weathering unexpected events in life that may mean you have to put your work on the back burner. "I think the students were really impressed by listening to these senior women talking about things that they also worry about," Kra says.

Cardin got to the conference preoccupied with getting into graduate school but says the panels and career talks helped her think about the process more holistically. "It was so good to hear you can be a human as well as being in a math graduate program," she says.

## What About the Men?

Kra deliberately included men as panelists and mentors when she started GROW. Women are disproportionately asked to participate in service and outreach events in STEM fields. Even if the events are important and the women enthusiastic about participating, the volume of service requests can be a burden. "I did not want the conference to be more of a 'service tax' on women and other people from underrepresented groups," she says.

The organizers also wanted students to be able to interact with a diverse group of panelists and mentors. "One of the things [Kra] was very firm about is that these programs should expose prospective graduate students to a realistic atmosphere of what graduate school will be like," Getzler says. "For that reason, she did not want the weekend to be heavily dominated by contact only with other women."

Moreover, men need to be part of the solution if the proportion of women mathematicians is going to change. "By not including male grad students, we would miss out on future vectors for this kind of program," Getzler says. "But we indeed have male grad students—who have now become junior faculty—who have taken this level of activism across the country."

Kra also hoped the conference would provide a valuable change of perspective to men who participated. "The men came away with a lot from it," she says. "A colleague said to me, 'You know, I never knew what it felt like to be in the minority, and that was a great feeling to understand.'"

Getzler agrees that GROW has encouraged this kind of introspection among men who have participated. "I think a huge problem is that women have a tendency to be silenced if there are men in the room. And part of the power of the program is that now, since women are the vast majority, it's a corrective for the men in the room, to remind them that being a little bit quieter could be a good fit for everybody, that voices which aren't always encouraged to take charge do so," Getzler says.

One of the criticisms Kra read in a post-conference survey after the first conference was about the number of men involved. "For the future, I addressed that straight up from the beginning, saying men are involved because there are many men actively working to change who's in the room. We can't do it on our own, and it shouldn't just be on women," she says. "And we never got another complaint about it."

## Broader Impacts

GROW is still a young conference. As such, there are no longitudinal studies tracking its effect on participants, though surveys done before and after each conference do show positive effects. Kra and other organizers believe it has already made a difference, not only to participants, but also to the schools that have hosted the conference and the broader profession.

As is the case with most conferences, person-to-person networking is one of the most valuable aspects. "GROW is exactly what it sounds like. It's GROW-ing a network, which I think is really awesome," Koch says.

Attendees have expanded their professional networks, creating connections with both their peers and more senior women mathematicians. "I'm still friends with some of the people I met at GROW," Cardin says.

GROW has also helped connect attendees to other existing programs and conferences for mathematicians. Nanayakkara learned about the AWM at GROW. When she got back to LA, she started looking up more information about the organization and learned about its annual essay contest for students. Her essay about Loyola Marymount University mathematician Alissa Crans won the undergraduate contest in 2016. "Before GROW, I don't think I really knew about the Association for Women in Mathematics. That was a direct result [of attending the conference]."

Cardin met mathematician Ruthi Hortsch, who works at Bridge to Enter Advanced Mathematics (BEAM), when she attended GROW. BEAM is a math education nonprofit organization for middle school students from underserved communities in New York City and Los Angeles. It provides enrichment for math-interested students and helps them progress in mathematics as they continue their education, primarily through summer programs.

"BEAM is probably one of the coolest math-related things I've ever done," Cardin says. After learning about BEAM from Hortsch, she spent part of the summer before starting graduate school in New York working at BEAM, and she has plans to join them again this year. Meeting Hortsch at GROW gave her "an immediate connection to something I fell in love with," she says.

Kra and other GROW organizers have also found that the conference has a positive effect on their departments. "I think it really did change the culture of the department," Kra says. Northwestern is creating a post-baccalaureate program for students from underrepresented groups in mathematics. "As much as it's a problem that there are very few women, it's a much bigger problem that there are so few people from other underrepresented groups," she says. A year-long program is very different from a weekend conference, but they are using some of their lessons from GROW as they shape the new program.

Both Northwestern and Michigan have seen the number of women who have applied to graduate school increase. "Our department got a lot out of it in many different ways, one of which was that we had this large number of really strong, really qualified female graduate student applicants last year," Koch says. "I wasn't really thinking of it as recruiting for Michigan per se," Smith says. "That was more of a side benefit for us."

Kra says the effect the conference has had at Northwestern is a reason it should continue to travel to different schools. "This is not any one department's problem; it's a problem in the field," Kra says. "If we fix it at Northwestern and get to parity, well that's great, but it doesn't do much for the field. I would rather see things fixed more broadly."

Evelyn Lamb

**Credits**

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