

Make a Difference This Summer

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Are you a graduate student interested in making a difference this summer? Why not start an outreach program like we did?

Summer Illinois Math (SIM) Camp is a week-long math day camp for middle and high school students hosted by the Mathematics Department at the University of Illinois at Urbana–Champaign. SIM Camp was started by a cohort of graduate students (and one postdoc) in Summer 2015, and as we enter its fifth summer, it remains graduate student run. Why would a group of mathematics PhD students pursue such an endeavor? We were inspired by our own experiences: the magical moments when we glimpsed real research-level mathematics, years before choosing to pursue graduate school.

In January 2015, we knew we wanted to do *something*, but we didn't know what it would be. Over a cup of coffee in the basement of our favorite cafe, with fellow math grad students Michelle Delcourt and Hannah Burson, and chemistry postdoc Olivia Lee, we took stock of what was already available to the Urbana–Champaign community. Our graduate student chapter of the Association for Women in Mathematics provided many opportunities for middle school and high school girls, but we noticed there wasn't something for all-gender groups that focused on developing intuition for what a mathematician does and the creative side of mathematical discovery. We settled on a five-day math camp for high school students.

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SIM Camp Omega (rising tenth through twelfth grade) Summer 2018, the first summer with three camps.

When organizing the first camp, we used infrastructure and knowledge from the other outreach activities in the mathematics department. We decided against hosting an overnight camp. We had big dreams of what our camp could be, and hoped to expand in future summers. Since that initial summer, we have grown to include three different week-long camps, with a staff of nine graduate and undergraduate students.

In 2015, 23 rising ninth through twelfth grade students attended the inaugural SIM Camp. Students classified compact surfaces, developed strategies for tic-tac-toe on a torus and Klein bottle, learned the basics of proofs and modular arithmetic, and enjoyed encrypting and decrypting messages using ciphers. Each day included plenty of breaks to enjoy the lovely outdoors, a daily math puzzle challenge for prizes, and catered lunch.

In 2018, there were three one-week camps for 80 rising eighth through twelfth grade students. These students learned problem solving techniques, game theory and probability, set theory, and fractal geometry.

One thing we found helpful when starting SIM Camp was working from our own experiences and bringing in other people for their expertise. Melinda and Claire were inspired to create a camp based on summer math experiences at the Carleton Summer Math Program for Women (SMP) and Johns Hopkins Center for Talented Youth (CTY). Our first summer's curriculum drew heavily on notes and course documents from SMP and CTY. Simone was brought in for her experience working with kids. Our business office helped with logistics, and our first year's registration form was modified from a form used by another camp on our campus.

An important part of starting SIM Camp was knowing our department and university's policies for having minors on campus. The University of Illinois Police Department has a form that we submit for every event we host. We provide plans for medical and other (i.e., weather, active shooter) emergencies and make sure to have emergency contact information for each participant. We make sure to review campus policies every year in case they change.

As SIM Camp grew, we encouraged new instructors to use existing mathematical resources when creating lesson plans. Between general audience math books, various math outreach programs, and math blogs, there are a lot of resources for teaching middle and high school students all kinds of college- and research-level mathematics. Pulling ideas from these resources means having some already-tested materials and saves time during course planning.

One ongoing challenge is funding, since we have tried to keep SIM Camp free to campers while paying the graduate and undergraduate student staff. While our first year was primarily a volunteer effort, in the past three years we've been lucky to be funded by the Department of Mathematics, National Science Foundation under Grant Number DMS-1449269, and the Mathematical Association of America's Dolciani Mathematics Enrichment Grants. Another way to fund a camp would be to charge tuition (you could still apply for additional funding sources).

Another challenge is building connections with the community to recruit campers from groups who are traditionally underrepresented in math and on our university's campus. We are always looking for better ways of getting the word out to students and parents, convincing students to apply, and getting them to come. One way to do this is to email schools in the area and local parent groups, which often have some kind of an online presence.

Every year, we collect feedback from staff and participants. As a result of this feedback, in preparation for the third year of camp we implemented a weeklong pedagogy training for SIM Camp staff, and a half day of community building activities for campers on the first day of camp. We developed three core values for campers to focus on:

- 1) noticing Aha! Moments and supporting others' Aha! Moments,
- 2) viewing math as a collaborative process



SIM Camp staff 2016, the first summer with undergraduate assistant instructors.



Campers working on tropical geometry during SIM Camp Epsilon (rising eighth and ninth grade), Summer 2017.



Campers during an after-lunch activity on graph theory, Summer 2017. This was the first summer with after-lunch activities and math talks.

3) asking lots of questions (we say ‘the right answer is the next question’).

On the first day of camp, we organized activities to support discussion of each of these ideas, and continued those discussions throughout the week.

Over our four years of running this camp, we have learned how to take a dream, formulate it into a concrete idea, bring it to life, and grow an organization. SIM Camp is an example of the positive impact graduate students can have on their home institutions and community. As we move into the next phases of our professional careers, we encourage other graduate students to pursue opportunities for mathematical community involvement.

Think about starting math outreach activities for kids in your area! This is really all you need to start:

- a goal and target age group/demographic (i.e., driving-distance, girls, underrepresented minorities)
- dates and facilities (rooms on campus, etc.)
- a way to recruit campers, such as an email to teachers or parent groups
- lesson plans and someone to run activities, such as other graduate students or postdocs
- university policies for minors on campus
- registration forms and possibly application forms
- if using an application, a way to decide which students come

Good luck and have fun!



Campers learn about partitions from undergraduate assistant instructor Wendy Vergara, Summer 2017.

Credits

All photos are courtesy of the authors.