Statement on teaching, service, and mentorship

Throughout my teaching and mentorship, I aim to share a joy in mathematics with my students and help them get as excited about the topic as I am. While I find this most important for younger students, such as my outreach teaching at Mathcamp and MIT's Splash program, it still dramatically enhances the learning experience for undergraduates and graduates as well.

While I value all of my teaching experiences, I am particularly proud of the cases where I created something new: a Mathcounts team at a local middle school, researchseminars.org during the pandemic, or a new course (the Computational Number Theory at the University of Calgary for example).

1 Teaching

Many of my courses have focused on giving students a broader view of mathematics. This feature appears most clearly when I teach short courses for high school students. For many years at Mathcamp, I taught courses ranging from quadratic forms to elliptic curves to homotopy groups to number fields, with the aim of introducing students to parts of math they had never experienced. I have the same goal for a calculus course, but it manifests in a different manner. In a course focused on acquiring a specific skill set, one should always try to provide context and applications in addition to the mechanics of carrying out computations. Understanding how the material fits into a bigger picture will make students more excited about learning.

The craft of teaching improves with practice, feedback and reflection. In order to improve, one needs to try new approaches, and I've been fortunate to teach in places like Mathcamp and MIT's Experimental Study Group that actively encourage innovation. My success in these venues can be measured by the fact that I earned tenure at Mathcamp after my first year teaching there as a graduate student (allowing me to return without reapplying), and the teaching award I won as a senior at ESG after teaching there for four years as an undergraduate.

To get the feedback necessary to evaluate teaching experiments, I make a habit of creating an anonymous online feedback form for all of my classes. When students see that I respond to their anonymous comments (sometimes they have good suggestions!), it helps encourage them to open up with questions in class as well. I also employ standard methods to encourage class participation: setting a welcoming tone at the beginning of the semester and ensuring that I pause long enough when soliciting questions for students to process whether they have something they want to ask. Class interaction is the primary ingredient that differentiates a course taught live from a video of a lecture, and I do what I can to encourage it.

In addition to the student interactions, I also enjoy creating new curricula while teaching. I have done this many times for courses at Mathcamp and the Splash program run by MIT's Educational Studies Program, but only once for a semester long course. The Computational Number Theory class I taught in 2012 at the University of Calgary blended programming assignments where students implemented algorithms together with lectures on topics such as elliptic curve primality proving and integer factoring methods. I had a lot of fun teaching it, and have had a few inquiries since from faculty at other schools interested in teaching a similar course.

2 Mentorship

My mathematical mentorship activities began in high school, when I founded a Mathcounts team at the nearby West Sylvan middle school. I do not know the full history of the team after I left, but a student from West Sylvan went to the state competition in 2020, so the tradition continued at least sporadically. In college I TAed for 18.821 (Project Lab in Mathematics), working with small groups on research projects, including advising them on their writing. Since then I have organized several conferences, which often involves helping others one-on-one with Sage, Magma or the LMFDB. This kind of in-person mentoring helps newcomers gain facility with these software packages, and can encourage some of them to contribute to these open source projects.

The most traditional mentoring that I have done is UROP advising, in the summers of 2022 and 2023. I was pleased with the progress of all three of the students that I worked with: they worked independently, all made substantial progress in their planned project, and had written output by the end of the summer

(either an exposition of their progress or functional code contributed to the LMFDB). I anticipate that my research on mathematical databases will lend itself well to undergraduate projects, since many of the problems involved are accessible and have a well defined output. I look forward to advising more UROPs in the future.

3 Service

In addition to the normal service duties expected of researchers in my position (refereeing papers, serving on program committees and editorial boards, and providing feedback on NSF grants as part of a panel), I have undertaken several less standard projects aimed at benefitting the broader mathematical community.

At the beginning of the COVID-19 pandemic, research seminars around the globe suddenly moved online, making them accessible to a much larger audience. However, there was no central index enabling mathematicians to take advantage of this opportunity. To address this deficiency, together with Edgar Costa, I created researchseminars.org, a searchable webpage indexing these seminars. The tools that we used to rapidly create this website arose out of our research on the LMFDB. This site has been used very broadly by mathematicians, physicists, computer scientists and others, with over 40,000 talks and 3.5 million page views since its creation. While the in-person interactions have resumed, I believe that there is still value both in providing tools for organizing and running seminars (speakers can add their own abstracts on the site, and it provides an embeddable schedule for use in a seminar homepage) as well helping enable the fully online seminars that continue to this day. Edgar and I won several awards for creating this resource.

I also see much of my implementation work on databases and software as having a major service aspect. In addition to the intrinsic research benefits, tools such as SageMath and the LMFDB enable other researchers to work far more efficiently than they would otherwise be able to. These efficiency gains benefit the research community broadly, including in individual cases where the benefit is relevant but minor enough that no citation is warranted. The ability to work directly with examples also aids in teaching at both the undergraduate and graduate level.

Finally, I am currently serving on the SageMath Code of Conduct Committee. The work of this committee has increased dramatically over the last year, as we have mediated between several community members at odds with each other. This committee work has required empathy, tact and organizational effort. I anticipate that my experience on this committee will transfer effectively to other committee work in the future.