Teaching Statement
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The main philosophy behind my teaching is that students learn by doing. Our role as educators should be to guide students in their own explorations and push them to actively engage in mathematics. This can involve training them how to apply a technique or algorithm to solve certain kinds of problems, it can involve providing a framework for them to think about a topic, and it can involve helping them refine their own ideas by listening and providing feedback. Of course we must also inspire them, and this involves presenting mathematics that we think is elegant, clever, surprising, important, powerful, etc., to foster enthusiasm in the subject.

Problem seminar: When I took over the running of MATH294 (the problem solving seminar) ten years ago, it was primarily aimed at students preparing for the Virginia Tech and Putnam competitions. Since then I have developed this course to address a secondary purpose, namely, to introduce students (particularly first years) to a broad range of topics that they would not otherwise encounter in, say, the calculus sequence. Many of the students find topics that appeal to them, and go on to learn more in upper level courses, the Directed Reading Program, and other undergraduate research opportunities.

Undergraduate research: We are fortunate to have some exceptionally talented and motived undergraduates at UNC. I have supervised five honors projects and almost all of these students have continued their success in PhD programs. One has written a dozen papers/preprints and is now a postdoc at the Max Planck Institute, one will graduate from Oregon this year, one is a fourth year at Georgia Tech with three papers/preprints already, and another is a fourth year at Columbia who has already written an 84 page preprint. My most recent student was the recipient of a Summer Award for Research-Intensive Courses and later presented her work at the Undergraduate Mathematics Symposium at the University of Illinois Chicago.

My approach to undergraduate research is to center the work around a problem, ideally something that the students can explore from different viewpoints and understand some special cases. Even if the problem already has a solution (which we sometimes discover to be the case), they still learn how to do research by trying to solve it themselves. And they learn about the topic with greater depth and understanding than just by reading about it elsewhere.

Promoting diversity: Involving students in undergraduate research early on is also important for diversifying mathematics, as these students are more likely to stick with their major and continue on to graduate school and careers in mathematics. I have supervised undergraduate participants in the Science and Math Achievement and Resourcefulness Track (SMART) summer program for underrepresented minority students. I have tried to recruit more students from underrepresented groups into the problem solving seminar (e.g., from the Carolina Covenant, the Chancellor’s Science Scholars, and UNC Firsts). I have helped them apply for summer REU programs and in some cases worked directly with them on research projects. In the last couple of years I have joined the Math Alliance and served as a mentor for the “Facilitated Graduate Applications Process”, assisting minority students applying to graduate school.

Graduate program: I served as Director of Graduate Studies from 2015 to 2019. Following a period of six years with no female students completing a PhD in pure mathematics, I put an emphasis on diversifying our program through careful recruitment and enhanced support
structures. I also made seeking external funding a priority, by encouraging and assisting students with their applications. These two goals were often complementary, as our female and minority students have been most successful in winning NSF Graduate Research Fellowships. Of the students I am currently supervising, one is fully supported by an AGEP (Alliances for Graduate Education and the Professoriate) supplement to my NSF grant and I have assisted another in applying for Ford Foundation funding to support minority students.

I have worked to enhance our graduate program in other ways too, for example, by organizing mini-schools in geometry for our graduate students (four in the past five years).

**Online teaching:** Spring 2020, the first semester affected by the pandemic, was challenging. Without a stylus and tablet, I prepared slides for my online classes, which was neither efficient nor particularly effective. In fall 2020 I started using an Apple Pencil and Notability, and classes went more smoothly. The challenge of online teaching has been to maintain a sense of connection and level of engagement with the students. In MATH294, the problem solving seminar, I used breakouts rooms and (together with the TA) rotated through the rooms to assist each group and encourage their collaboration. I introduced written work, asking each group to submit a solution each week, that I provided feedback on, while also providing them with written solutions to most of the problems (when in-person this would instead have been on the board during class).

In MATH521 I added more office hours (three scheduled hours per week, plus additional meetings as requested), and sometimes incorporate breakout rooms into class sessions. I introduced more low-stakes assessment (weekly quizzes) to provide students with more frequent and timely feedback; these quizzes usually tested basic but fundamental concepts.

In fall 2020 I also led several informal reading courses, on Riemannian geometry and on elliptic curves and cryptography, for students who were missing the opportunity to participate in the Directed Reading Program (which was temporarily suspended in fall 2020).

**“Post”-pandemic teaching:** I continued with some of these innovations when we returned to the classroom in fall 2021. The most significant disruption to student learning was bound to be students having to go into COVID isolation or quarantine, and missing classes. I ensured full-accessibility by live-streaming my classes (writing on a tablet and simultaneously projecting to a large screen and sharing to Zoom) and uploading notes to Sakai and video-recordings to Panopto. Using Gradescope has made it more efficient for students to submit their homework and to receive feedback.

For now, this approach seems essential, though there are obvious concerns about the level of engagement of students following classes remotely. Starting in March I will be participating in an online course development program at UNC, to learn ways to enhance the experience of online students and address these concerns about engagement.