I have been involved in mathematics education as an instructor of thirty-two courses ranging from introductory thru graduate level; as advisor to student research; as a teaching assistant for another thirteen courses; as an NSF GK-12 fellow focused on inner-city education and teacher training for two years; and while participating in numerous service activities.

To me, education is any process an individual undergoes in becoming more than prior. A student is anybody actively pursuing development, and a teacher anybody that facilitates it. My dedication to teaching in my career is rooted in a desire to help others achieve the advantages of education, recognition that I continue learning through teaching, and my love for exploring mathematics.

This statement is organized as follows:

• Goals and Assessment
• Teaching Methodology
• Undergraduate Research
• Professional Development Involvement
• Course Evaluation Comments and Metrics

Materials from current and many past courses are available on my website.

Goals and Assessment

My goals for a student of mathematics include:

(1) Learn to solve “standard” problems and develop the intuition to solve similar problems by creatively applying knowledge.

(2) Communicate mathematics well in writing and orally.

(3) Appreciate the usefulness of material, both within mathematics and across disciplines.

(4) Improve analytical reasoning skills.

(5) Enjoy doing mathematics and have a positive experience.

I assess progress toward these goals in several ways. Exams test problem solving with a mix of calculation, theory, and application. Mathematical communication is assessed with weekly written problem sets, which I emphasize should be final drafts (the goal—indeed the grading standard—is that another student in the class follow a solution easily and without filling in details). In upper level courses I have experimented with presentations, term papers, computer labs, and oral exams.

My teaching methodology, detailed in the next section, emphasizes personal interaction with students in class and office hours. This helps assess progress on a more informal and frequent basis, and provides a feel for the elusive “are they really getting it” question. I ask soft questions too, such as “how’s the class going?” or “so why are we doing this?”—these provide insight to a student’s appreciation for
the material and enjoyment of the class, and typically lead to more specific follow-up opportunities or simply a chance to connect.

I find course evaluations useful for assessing overall student experience and reflecting on aspects of the course to preserve or improve. Comments and statistics from past course evaluations are provided in the last section of this statement.

**Methodology**

My early and frequent message to students is that a mathematics *course* is much more than lecture, and that success depends on attention to all its aspects:

- Preparation, including assigned readings and focus questions
- Class
- Office hours
- Online assignments (lower division)
- Written problem sets
- Discussion section
- Preparation for exams

My methodology reflects this message in that as an instructor of a *course* and not just a lecturer, I attend to all aspects diligently, knowing that complementing and reinforcing other aspects will best achieve the aforementioned goals, and because some aspects resonate better with different students’ learning styles.

Because there is a philosophical divide between lower division vs upper division vs graduate instruction, I will address them separately.

**Lower Division.** I teach calculus sequence and other lower division courses in a primarily example-centric manner, where lessons are motivated and illustrated with concrete problems. The “why” is emphasized, although at times it may be via geometric intuition or outline rather than complete proof. Hands-on practice is always emphasized and students are always expected to be active!

I prepare semester calendars and let students know lecture-to-lecture what section comes next. In some classes I assign readings and focus questions. All classes begin with news and typically a warm-up.

Recently I have been teaching lower division classes with slides alongside chalkboard, where the chalkboard is used for walking through details. Two clear benefits are efficiency in delivering information and the ability to incorporate visuals. Slides are made available online after lecture. In a 50 minute class, I typically lead the class for up to 30 minutes, reserving 15 minutes for practicing in groups while I circulate to give individual attention, and use the final 5 minutes for review, closing remarks, or to work a practice problem. In smaller courses (my sections have been 40-70 students) I could see possibly replacing slides with handouts. I have regularly incorporate technology and demonstrations into lower division courses.

I use online homework tools (WebAssign, MyMathLab) so students get practice with instant feedback. Parameters are set for unlimited attempts to make it purely a learning tool with no pressure other than completing it. Written weekly problem sets build on the online work, challenging students a little more while honing mathematical communication and introducing further directions and applications.
My experience to date covers most standard lower division courses, having instructed multiple large sections of the various main sequence calculus, four semesters of linear algebra, finite probability, and written my version of a course titled Ideas in Mathematics emphasizing the spirit of mathematics as explored through the history and practical applications. Responsibilities in all cases included setting the syllabus, designing lessons, coordinating graduate TAs, supervising undergraduate graders, some administration, and assigning grades. I enjoy the combination of accessibility, intuition, and application that these courses have allowed, and the ability to influence students' ideas about mathematics.

Upper Division. I teach upper level courses in a more traditional overview-definition-theorem-proof-example structure. I prefer to use the chalkboard only in lecture, supplemented with edited lecture notes after class. As with lower division classes, I always expect my students to be active participants!

My approach to teaching mathematics majors in non-honor courses, where a goal is to explore an essential cornerstone of mathematics, involves providing a motivating question and then addressing it the way a mathematician does—through exploring toy examples, abstracting the problem, developing general methods and using rigorous argument, and finally revisiting examples, looking for application, and asking new questions. This format occurs on a lecture-to-lecture basis as well as throughout units and the course. For example, my class Introduction to Rings and Fields was motivated by questions of constructibility from antiquity (can one “square the circle” or “double the cube”?), and developed the requisite modern tools to answer them (in the negative) by the end of the semester while making detours to related topics along the way.

On the other hand, I teach honors-level courses in a systematic and rigorous manner (e.g. mostly following Dummit and Foote, Rudin, Munkres, etc), with the goal of preparing students for possible graduate study. I aim to challenge students on problem sets and exams; results have been very good, as students have been excited and mature.

I look forward to teaching a variety of upper division courses in the future. My personal favorites are geometry/topology, algebra, and advanced probability/statistics, but there are no courses I would decline outright.

Graduate Instruction. I have instructed four graduate courses (all in geometry or topology). I also supervised a successful Ph.D. minor thesis in Seiberg-Witten theory, which involved advising a graduate student who had taken my second-year Riemannian geometry class for an additional year.

I believe two components of successful graduate instruction are problem sets and individual attention. I do assign homework to graduate students and in turn provide careful feedback on that work. Another form individual attention has taken is one-on-one meetings with graduate students. My manifold theory course, for instance, used mandatory office meetings to pose a few easy questions but mostly discuss interests and concerns for the class and graduate studies in general.

Teaching at either the graduate level or designing undergraduate electives based on typically graduate material would be especially welcome.
Directing undergraduate research will be another welcome component of my career. My goals for any undergraduate project are:

1. Focused exposure to material beyond the undergraduate curriculum
2. Practice giving written and oral mathematical presentation
3. Introduction to the tools of mathematicians (arXiv, journals, \LaTeX, Matlab)
4. Appreciation for the difference between research and coursework
5. A positive experience
6. Prove something new, although I don’t consider this crucial.

I am happy to supervise short term projects (e.g. seminar talks) covering topics across mathematics (as well as statistics and data science). Research projects appropriate for a year-long undergraduate thesis are readily available within my geometry expertise.

OTHER PROFESSIONAL ACTIVITIES

AP Calculus Involvement. I have worked with Educational Testing Services (ETS) as a reader for AP Calculus seven times. Each reading involved seven days of grading open ended responses, professional training, and interaction with calculus instructors from all types of institutions from across the country. The experience has been especially influential on my exam design and grading standards, such as the proper balance of easy/medium/hard and core/theoretical/application questions, the fair wording of questions, and awarding partial credit.

NSF GK-12. I spent two years as an NSF GK-12 fellow while at UCLA, serving as a mathematics fellow one year and a physics fellow the next (this was a 15 hour/week year-round commitment). This program seeks to expose future university faculty to issues in public K-12 education while simultaneously helping struggling inner-city Los Angeles high schools. I worked closely with several recent UCLA math education graduates, appearing in their classrooms weekly. We discussed lesson plans and general classroom issues, collaborated in designing and presenting lessons, and at times attended professional development together. One semester I focused exclusively on teaching mathematics to students who spoke little or no English (I speak conversational Spanish). The experience was valuable in that I worked with students from a socio-economic background rarely encountered by research mathematicians. It required working especially hard at making math and physics inviting and exciting to those not often encouraged to study them and unfamiliar with their usefulness. The best results I think came in hands-on activities where the student could see mathematics at work. While challenging at times, the GK-12 experience conveyed the value of math education service, of inquiry-based lessons, and confirmed the importance of having good teachers in one’s life. During the summers I was heavily involved in UCLA’s Math Content Program (professional training for elementary and middle school teachers).

Academic Mentoring. I have served as faculty advisor to approximately a dozen potential mathematics majors, involving occasional meetings over the academic year.
and follow-up emails concerning academic performance, registration, living on campus issues, etc. I also served as mentor to incoming grad students while finishing at UCLA, helping guide them through first-year courses and their transition to new teaching responsibilities.

**Course Design.** I worked closely with the UCLA’s Center for Mathematics and TEaching for a summer writing and editing Introduction to Algebra, a math curriculum that has since been adopted by the state of California.

I wrote from scratch my version of a course entitled Ideas in Mathematics at Boston College seeking to convey the spirit of mathematics through a broad selection of topics and activities. The materials are available on my website.

I also designed a course in my final year of graduate school entitled “Enumerative Geometry: Old and New Approaches”, intended as an elective for mathematics majors. It went far in university competition for funding. I would enjoy implementing it at some point.