

Teaching Statement (Excerpt)

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1 Prelude

From an early age, I was captivated by the beauty of mathematics, and it inspired my pursuit of becoming a professional mathematician. However, due to family responsibilities and the challenges of maintaining a long-distance family life, I chose a different path, becoming a lecturer instead of pursuing a tenure-track research position. Initially, I questioned whether this was the right choice for someone deeply passionate about mathematics. But since joining the Mathematics Department at UC Berkeley, I have grown to truly appreciate this role, and it has evolved into a lifelong commitment that I hold dear.

As a lecturer, I actively engage in mathematical research while making meaningful contributions to teaching. I integrate my research experience into my courses, creating a dynamic and enriching learning environment. Over time, I have found this role to be an excellent fit, bringing me immense satisfaction and joy. Guiding nearly a thousand students—some inspired to pursue mathematical research and others strengthening their foundation for future studies and careers—fills me with great pride.

2 Professional Knowledge and Continued Growth in Mastering New Topics

To ensure a well-structured and engaging lecture, I dedicate extensive efforts to preparation. This not only helps deliver material clearly and accessibly but also allows me to anticipate student questions and adapt flexibly to various situations. Thorough preparation is particularly important when tackling complex concepts, enabling me to explain them with precision and depth, often using multiple approaches.

Even in undergraduate courses, a deep understanding of advanced-level mathematics is essential. While the material may appear basic, it often involves profound mathematical ideas and logic that require comprehensive knowledge. My role extends beyond explaining textbook content—I guide students in exploring more profound concepts and addressing complex questions. A strong foundation in higher-level mathematics allows me to broaden students' perspectives and inspire their curiosity and deeper thinking.

- **Broadening Mathematical Expertise**

A solid foundation in mathematics underpins my teaching, involving both a deep understanding of content and the ability to think and conduct research—two mutually reinforcing skills. While teaching is my primary responsibility, I firmly believe that active engagement in research is essential for continually improving my teaching.

In recent years, I have expanded my knowledge by auditing graduate courses and attending seminars. I also maintain a consistent pace of publishing research papers. These experiences enable me to supervise advanced reading courses and enhance my regular teaching by bringing cutting-edge research directly into the classroom.

- **Continuous Growth in Teaching**

I continuously refine my teaching methods to ensure that I deeply understand the material and communicate it effectively. I actively experiment with innovative approaches to enhance student learning. Below are examples that demonstrate this commitment:

- **Refining and Improving Teaching**

When I first taught Abstract Algebra (Math 120A and 120B at UC Irvine) in 2015, my background was primarily in analysis and geometry rather than algebra. However, through careful preparation and student feedback, I refined my teaching approach and deepened my knowledge in Galois Theory, Number Theory, and Representation Theory. I now integrate key problems and examples into Math 113, which consistently garners positive feedback. The course evaluation for Math 113 is now consistently above 6.5 out of 7, significantly higher than the department average. Each semester, demand for my courses is so high that waitlists fill up, with students often standing in the hallway during the first few lectures.

Another example of my commitment to improvement is my experience teaching Math 126, an undergraduate course on Partial Differential Equations (PDEs), in Summer 2023. While the course was successful, I sought further enhancement by auditing graduate PDE course in Fall 2023. This deepened my understanding of advanced PDE topics and allowed me to refine the Math 126 materials.

- **Conducting Teaching Experiment**¹

To engage students further, I incorporate small projects that spark curiosity and promote independent problem-solving. For example, in a take-home quiz for Math 113, I asked students to classify commutative and associative binary operations on sets of two or three elements up to isomorphisms. This project deepened their understanding of binary operations, commutativity, associativity, and isomorphisms while fostering valuable research skills and encouraging collaborative discussions—skills that extend beyond textbook learning. After the quiz, I presented my solutions, demonstrating not only a basic counting method but also an approach

¹These two examples with take-home quizzes are part of a systematic approach I am developing for the entire Math 113 course.

using group actions and Burnside's lemma to solve the problem. This example illustrated the power of group theory in solving combinatorial problems. A key outcome was that, despite group actions being introduced ahead of schedule, students showed great enthusiasm when the topic was formally covered later, reaffirming the success of this teaching experiment: research-oriented problems, when guided appropriately, can genuinely ignite students' interest. (See [8].)

- **Supervising Advanced Students in Reading Courses**

Over the past three years, I have supervised several advanced reading courses ², guiding students through foundational concepts to more advanced mathematical topics. Under my instruction, they have studied Donaldson's *Riemann Surfaces*, Etingof's *Introduction to Representation Theory* (co-authored with Golberg et al.), and Milnor and Stasheff's *Characteristic Classes*. Engaging with students on these subjects has equipped them with the skills and confidence to pursue graduate-level research. This process has further allowed me to synthesize knowledge across different fields, enhancing my ability to guide students through complex concepts and research challenges.

3 Effective Teaching and Student Engagement

I set high standards for myself in teaching. While I aim to make my classes engaging and enjoyable, I never compromise on rigor. I set clear expectations and work to spark students' interest in the material, guiding them to reach these goals by helping them build strong mathematical learning habits. Below are some examples that illustrate my approach:

- **Structured Weekly Plans**

I develop detailed weekly teaching plans for each course and adhere to them strictly. This structured approach ensures a steady pace and helps students organize their study and review schedules effectively. It makes students stay on track and actively engage during lectures. (Refer to my syllabus for details [10, 11, 12, 13, 14, 15, 16]).

- **Effective Classroom Presentation**

I carefully organize my lectures to balance clarity and engagement. Since the pandemic, I've come to appreciate the effectiveness of using slides for presenting definitions and theorems. This approach saves time and minimizes distractions. However, for examples and proofs, I continue to prefer using the blackboard to keep students engaged and allow for real-time interaction. This keeps students focused and encourages them to follow along actively. The blackboard method also allows me to respond to student questions in real time. Many students have commented that this balance of slides for theory and the blackboard for proofs helped them understand difficult

²Typically, I provide a topic and schedule, meet with students for 2-3 hours weekly, ask them to present material, provide feedback, and suggest further reading and small research projects. They are also required to type the material and write a short survey paper.

concepts, with one remarking, “The combination of slides for theory and blackboard for proofs kept us engaged and helped us follow the logic step by step.” (Refer to [20, 21, 24, 26] and course evaluations for additional comments from students.)

- **Well-prepared Lecture Content**

My lecture notes [2, 3, 4, 6] often go beyond the textbook, providing concise and insightful explanations, with some proofs and theorems presented in innovative ways. Students consistently find these notes invaluable. In Math 104, Math 110 and Math 113, many students encounter rigorous proofs for the first time, so I emphasize clear and structured proof techniques in both my presentations and notes, helping them practice and refine these skills throughout the course [20].

I continuously improve my lecture notes, incorporating clearer explanations and meaningful examples based on feedback. My lecture notes are highly regarded by students, with some referring to them as “bibles.” However, I am committed to further polishing these notes, striving for continual improvement. My short-term goal is to create a perfect set of lecture notes for each core upper-division course (Math 104, Math 110, Math 113, Math 185), a goal that I have nearly achieved (see [2, 3, 4, 6]). In the long term, I aim to write a series of lecture notes for graduate-level foundational courses, ensuring they are rigorous yet accessible to advanced undergraduates.

- **Dynamic Classroom Presentation**

I excel identifying challenges students face and providing personalized guidance to help them reach their full potential. I regularly adjust my teaching methods based on student performance, using my experience to diagnose difficulties and assess understanding. When necessary, I introduce additional examples or simplify content to emphasize key ideas.

I encourage students to ask questions and ensure they feel comfortable doing so (as reflected in my consistently high scores in course evaluations. See also my classroom observations in [30, 31]). In response to questions, I adapt my explanations, sometimes previewing upcoming material or reinforcing earlier concepts. My classes are dynamic, with students actively participating and feeling respected—something often difficult to achieve in large classes or AI-driven instruction.

- **Thoughtful Homework, Quizzes and Exams**

- I carefully select exercises and make effective use of tools like bCourses and Gradescope to assign regular homework. In my Math 110 lecture notes [3], I include exercises that are closely aligned with the course content, helping students understand the material, stay on track with the course and think deeper. One student noted, “I appreciated how the problems tied back to class discussions, making the material stick.” Another student remarked in the course evaluation [34], “She designs brilliant questions that yield interesting results or demonstrate important principles.”
- I design quizzes that foster consistent engagement with the material. In Math 113, many textbook answers are available online, which led some students to rely on these solutions

and fall behind. To address this, I introduced weekly quizzes on Gradescope to keep them on track. Each quiz features basic questions that reinforce core concepts, along with more challenging problems to stretch their understanding [7, 8]. Refer the subsection ‘Conducting Teaching Experiment’ for more details in quiz design.

- In designing assessments, I aim to strike a balance between maintaining academic rigor and providing adequate support for student success. Rather than creating exams that closely mirror practice problems, I focus on fostering deep understanding by providing a clear review scope and introducing slightly more challenging problems during the preparation phase. To further support students, I break down complex problems into intermediate steps to guide their thought process and offer additional office hours for personalized guidance. This approach ensures that students are well-prepared while maintaining the intellectual challenge of the course. Students consistently respond positively to this method, finding the exams fair and beneficial for their learning, as they are able to engage deeply with the material while being adequately supported throughout the process. ([9]).

- **Continuous Improvement Based on Feedback**

- When I first taught Math 32, despite thorough preparation and using the department-provided textbook, I found the material too advanced for the students. After discussing with my GSIs and reviewing student evaluations, I adjusted my approach, tailoring explanations to better match the students’ level. I even consulted my middle-school-aged daughter, who was studying similar topics, to gain insights into the challenges beginners face in math. These changes led to a marked improvement in student evaluations between semesters, clearly reflecting the effectiveness of my adjustments.
- While end-of-semester evaluations are valuable for long-term reflections, they offer little immediate benefit to current students. To address this, I regularly conduct midterm surveys to gather feedback and make adjustments during the semester. In Math 104, for example, students expressed concerns about the pacing of lectures and the complexity of certain proofs. One student noted, “The lectures were insightful but sometimes felt too fast for such abstract material.” After receiving this feedback, I adjusted the pace, leading to more positive evaluations, with students later commenting, “The slower pace in the second half made a huge difference, especially in understanding the more complex proofs.”

- **Adapting to Technological Tools**

I am proficient in everyday tools like Canvas and Gradescope. When necessary, I also incorporate course recordings and Zoom to better structure my classes and support student learning. During unexpected disruptions, such as COVID-19, I seamlessly transitioned to online teaching, keeping the course on track and ensuring that students’ progress was uninterrupted. This flexibility has allowed me to maintain high standards of instruction while adapting to various challenges.

As long as technology enhances the learning experience, I am eager to stay up to date with the latest advancements. With the rapid development of AI, particularly in its applications to mathematics education and research, I am continually exploring ways to leverage these technologies to further improve my teaching. This thinking and exploration will likely become an integral part of my teaching in the years ahead.

4 Inspiring Students' Awareness and Understanding

I focus on helping students build a strong mathematical foundation while exposing them to the interconnectedness of mathematics. I encourage them to approach problems from multiple perspectives, drawing connections between different areas to develop intuition and grasp new concepts more easily. My goal is to inspire students to move beyond textbooks, applying knowledge independently and cultivating self-directed learning habits. Below are some examples illustrating how I implement this approach. More examples can be seen from other sections, e.g., the subsections 'Conducting Teaching Experiment' and 'Supervising Advanced Students in Reading Courses'.

- Many mathematics students take graduate-level courses during their final years of undergraduate study to broaden their knowledge. However, in my interactions with them, I've noticed that most are not adequately prepared for these courses. Without a strong foundation, and given the structure of graduate-level courses, their understanding often remains superficial, which can negatively affect their future mathematical studies.

This observation reinforces my commitment to building a solid foundation in my core upper-division mathematics courses. I ensure that all essential concepts required for higher-level courses are thoroughly introduced, equipping students with the tools they need to succeed as they advance in their studies. This approach has proven to be highly effective, greatly benefiting my students.

- I provide students with a holistic view of mathematics by exposing them to a wide range of branches. By staying up-to-date with current research trends, I'm able to offer well-rounded academic advice. Many students have developed a passion for research under my guidance, with several going on to pursue graduate studies at prestigious institutions such as Harvard University, Stony Brook University, the Simons Center for Geometry and Physics, and the University of Michigan.
- Connecting mathematical concepts across fields transforms abstract ideas into more tangible ones, turning passive learning into active engagement. In Math 113 and Math 110, I present matrix multiplication through path composition, helping students grasp the concept intuitively. This moment of realization often transforms disengaged students into active participants and reveals the inherent nature of mathematics.

I strive to make abstract concepts more concrete to foster deeper understanding. For example, in Math 113, I connect advanced topics to elementary mathematics. The Unique Factorization

Theorem, an extension of the fundamental theorem of arithmetic, can be visualized by breaking down LEGO blocks into basic units. Similarly, when explaining the concept of least common multiple, I compare it to being a mom who wants to save money: when my daughter asks for LEGO to build sets A, B, and C, I buy only the minimum amount of LEGO that can build all three sets, though not simultaneously. Students love this analogy, and it often sparks ‘aha’ moments as the concept suddenly becomes clear. This approach helps students visualize abstract mathematics, making the ideas more accessible and relatable.

5 Embracing New Challenges and Innovating in Teaching

I am always open to embracing innovations in teaching, especially those driven by technological advancements. Any method that enhances student learning is worth exploring. Below are some examples of how I have integrated new approaches into my teaching:

- **Blending PowerPoint with Blackboard Teaching**

Before the 2020 pandemic, I relied solely on the blackboard for teaching. However, during the transition to remote instruction via Zoom, I found that PowerPoint presentations could greatly improve efficiency. Traditionally, mathematics instructors have been cautious about using PowerPoint, fearing it might lead to passive learning. I developed a hybrid approach, using PowerPoint for precise definitions and theorems, while relying on the blackboard to demonstrate processes and explain key ideas. This combination enriched the learning experience and proved more effective than using either method alone, as evidenced by positive student feedback.

- **Adapting Quizzes to Improve Engagement**

From summer courses teaching experience, I discovered that weekly quizzes in Math 113 helped students stay engaged and on track. However, limited class hours during the regular semester made it challenging to implement this system. To address this, in Fall 2023, I used Gradescope to administer quizzes outside of class, giving students a 30-minute window to complete them. While effective in maintaining student accountability, some students raised concerns about the potential for cheating in an unsupervised setting.

In the following semester, I revised my approach based on a teaching workshop suggestion. I made the quizzes fully open-source, encouraging students to collaborate, consult external materials, and even use AI. This transformed quizzes from routine assessments into opportunities for creative application of knowledge. By promoting collaboration and the use of academic resources, these quizzes bridged the gap between textbook exercises and real-world problem-solving in mathematical research, fostering critical thinking and adaptability. (For more discussion on this topic, see the subsections: ‘Conducting Teaching Experiments,’ ‘Thoughtful Homework, Quizzes, and Exams,’ and ‘Continuous Improvement Based on Feedback.’)

- **Embracing New Courses and Challenges**

I am always eager to take on new courses, as they present fresh challenges and fuel my passion for teaching. Over the past five years at UC Berkeley, I have taught a diverse range of courses, including Math 32, 54, 104, 110, 113, 126, 140, and 185, spanning both lower- and upper-division levels in subjects such as analysis, algebra, and geometry. In each course, I continually refine my teaching methods to better meet the needs of my students. My ability to teach such a broad spectrum of courses not only demonstrates my capacity to handle new subjects but also offers the department flexibility in course scheduling, ensuring that students have access to the courses they need.

I am also well-equipped to design and deliver new courses that align with the department's evolving needs. For example, during the time as a visiting assistant professor at UC Irvine, I developed and taught Math 161 (Modern Geometry), a course in which I employed surfaces as a framework to explore three distinct types of metric geometries. I am eager to continue pursuing similar projects and have several more course development initiatives in mind for the future.

6 Professionalism and Dedication

Over the past several years as a lecturer, I have approached all aspects of my teaching with the utmost professionalism and dedication. This includes thorough course preparation, carefully crafted lectures, thoughtful problem selection, timely feedback, close cooperation with teaching assistants, addressing student inquiries, and writing recommendation letters. Whether during the regular semester or summer sessions, I am fully committed to providing students with a high-quality learning experience.

- Support DSP Students

I have closely collaborated with the Student Learning Center and the Disabled Students Program to ensure that all students, including those with special needs, receive the necessary support. One student remarked, "Prof Wang was amazing about my DSP accommodations... I never felt judged and always felt safe asking for my accommodations" ([32]). This reflects my ongoing efforts to create an inclusive and supportive environment for all students.

- Dedication in Summer Teaching

Despite the typically lenient evaluations for summer courses, I remained fully committed. My Math 113 course in Summer 2024 received an impressive 6.63/7 (department average 5.77), and my Math 110 course scored 6.67/7. In just eight weeks, I covered nearly all of Linear Algebra Done Right and produced 130 pages of lecture notes.

- Collegiality and Departmental Involvement

As a committed member of the department, I have maintained a cooperative attitude, adhering to course assignments and building strong working relationships with colleagues and students. I have participated in new faculty orientations, shared lecture notes with postdocs, and observed classes

to provide recommendation letter for their academic job application [27]. Additionally, I have never encountered teaching conflicts and always adapt when emergencies arise.

I have also contributed to course structures. After taking over Math 32, I identified a divide between students needing it as a foundation and those taking it for a requirement. I collaborated with faculty and staff in 2023 to adjust course content and realign Math 32 and Math 1 to better serve these groups.

- **Adapting to Personal Challenges**

In recent years, I have faced some personal challenges, including a major surgery in Spring 2021 and the birth of my second child in Fall 2022. Despite these challenges, I maintained my teaching schedule without interruption. Even during these semesters, my teaching consistently received high evaluations, reflecting my commitment to maintaining high standards in all circumstances.

7 Diversity and Inclusion in My Teaching

As a woman in mathematics, I have faced numerous challenges and biases throughout my academic journey. These experiences have given me a deep understanding of the barriers that women and other underrepresented groups often encounter in academic settings. They have also strengthened my commitment to creating a supportive learning environment where all students, especially those from underrepresented groups, can confidently pursue mathematics.

In addition, I come from a working-class family and am the first in my family to attend college. Neither of my parents completed high school, and education has been the cornerstone of both my personal and professional achievements. Without the academic guidance I needed growing up, I am now deeply committed to offering support and mentorship to my students at critical moments in their academic journeys. I understand how profoundly education can impact the lives of students from similar backgrounds. Education has the power to transform lives, and I strive to ensure that my teaching provides every student—regardless of their background—with the opportunity to succeed.

I am very gratified that I can now help each of my students—regardless of their background—by providing them with opportunities for success in academia. I inspire them and show that, even in the face of family responsibilities, gender biases, or the unique challenges faced by underrepresented groups, the path to success is still achievable.

8 End Remark

While preparing for my Excellence Review documents, I reached out to several former students, asking them to write recommendation letters³. To my immense gratitude, these students, despite their busy schedules, immediately took time to write thoughtful and heartfelt letters. I was deeply moved by their

³All the recommendation letters are from former students, as I intentionally avoided asking current students to ensure objectivity and fairness.

words. Although I don't typically get emotional, I found myself tearing up more than once while reading their letters. Their recognition and appreciation are the greatest affirmation of my dedication to teaching, reminding me that the time and care I invest in my students extend far beyond the classroom.

I believe that everyone who loves mathematics carries a goddess of mathematics within their heart. It is the light of this goddess that compels me to teach and share mathematics, and it is this same passion that draws young people into my classroom. These emotionally charged moments are what give my teaching its meaning. They go far beyond the logical structure of mathematics, leaving an impact that is much deeper and more lasting than a typical college education.

Looking ahead, I feel an even stronger sense of purpose and commitment as an educator. My love for teaching continually drives me to refine my methods, explore new strategies, and help students unlock their potential, guiding the next generation of mathematicians. I believe I have earned the trust placed in me as an educator, and I will carry this sense of duty forward, confident that my efforts are making a difference.