Teaching Statement

Yan Zhuang

Teaching is one of my greatest joys as a Ph.D. student at Brandeis University. I love interacting with my students, sharing with them my passion for mathematics, and helping them succeed. I am committed to creating a comfortable and welcoming learning space for students of all backgrounds. While at Brandeis, I have had the pleasure of teaching four semesters of calculus under the supervision of a course coordinator as well as a course in probability and statistics taught independently during a summer session, and I am currently teaching a self-designed course on cryptology for non-majors, which is a one-time course offering funded by a $6,000 award from the Graduate School of Arts and Sciences. This statement describes my teaching activities and the teaching practices that I have utilized during my time at Brandeis.

Individualized Attention and Growth Mindset. As an undergraduate student at a small liberal arts school, I thrived under the individual attention offered by my professors. Teaching small classes at Brandeis has enabled me to offer my students the same level of support that once helped me succeed. I emphasize my availability outside of class throughout the semester, and in more recent semesters, I have incentivized students to come by my office at the beginning of the semester to briefly introduce themselves. I enjoy getting to know my students as people and have had many enriching conversations with them about their interests and hobbies, but these preliminary meetings also give me a key opportunity to listen to any concerns that they have about the course. This allows me to gauge their preparation for the course—in terms of both their mathematics background and mental readiness—and identify students who may be at risk of struggling. I personally reach out to students who do struggle early and invite them to meet with me on a regular basis.

My most difficult challenge is working with students who believe that they are not a “math person”, that they are simply predisposed to fail at math. I aim to cultivate a growth mindset—a belief that mathematical ability can developed as opposed to being innate—by comparing mathematics to other subjects and skills that can be learned by anyone through regular study and practice, such as playing the piano, and I express my eagerness to help students realize their potential. Surprisingly, some students perform better just by knowing that their instructor cares deeply about their academic well-being. I actively try to instill confidence in my students; rather than just showing them how to solve problems, I give them control of the wheel and indirectly guide them by asking specific questions that point them in the right direction. I enthusiastically point out the progress that my students make, as recognizing and claiming their own successes helps to remove mental blocks and increase self-confidence.

Near the end of the semester, I ask every student in my class to reflect on their academic and personal growth through a self-reflection survey. Questions that I ask include “Have you changed anything about the way you study math? Has it improved your learning at all?” and “What have you learned about yourself, as a person, through this course?” This activity helps students realize the immense progress that they have made over the course of the semester and identify possible ways to improve their study habits in preparation for the final exam and for future courses.

Active Learning. I am a staunch advocate for teaching methods that allow students to be active participants in their own learning. Active learning helps students by giving them opportunities to engage directly with the course material and also by facilitating a dynamic learning environment that fosters agency and belonging in the classroom.

In my second year of teaching, I implemented with the course coordinator a partial flipped classroom structure in my differential calculus class. The implementation was partial because I did not flip every lecture, but only specific sections of the course material that are especially suitable for self-learning, such as limit and derivative rules. In these sections, students completed a pre-class assignment at home—which usually consisted of a series of short videos and a short problem set on WebWork—and I spent class time answering students’ questions about the pre-class assignment.
and having students work on more challenging practice problems in groups, thus extending their knowledge of the material. Not only does this approach allow us to cover more interesting material in class, it also shows students that they are capable of mastering the basics on their own, thus helping to develop a greater sense of agency and building confidence in their abilities.

In my cryptology course, I supplement interactive lectures with numerous team-based activities, and most of the graded assignments involve collaboration as well; these include team homework, team quizzes, and a final team project. This focus on teamwork reflects the reality of how mathematics is done, helps students develop interpersonal skills that are essential to almost any career, and creates a sense of belonging. Many students who struggle feel too ashamed to seek help and believe that they simply don’t belong in a math class, but in a collaborative environment, they are more likely to realize that they are not the only student who is struggling—and that struggling is actually part of the learning process!—and to work together with their peers to better understand the material.

**Interdisciplinarity.** Because all of the courses that I have taught so far have a target audience of non-majors, I take an interdisciplinary approach to discussing mathematics in order to generate enthusiasm for the subject. When teaching calculus, I emphasize the role of mathematics as the language of science and calculus in particular as providing a framework for understanding change, through which we perceive the world. When teaching probability and statistics, I discuss the sheer pervasiveness of the discipline—not only in science, but also in subjects ranging from political opinion polling to sports analytics—as well as the importance of probabilistic intuition in making everyday decisions, all with many concrete examples. Cryptology, at its very core, is an interdisciplinary subject at the intersection of mathematics, computer science, and linguistics, but I also talk about cryptography as a historical force that has led to new advances in mathematics, which has in turn led to new cryptosystems and new cryptanalytic attacks that have changed the tide of history on many occasions. Thus I communicate mathematics as being vibrant, dynamic, and an essential part of human knowledge as well as everyday life.

**Countering Stereotype Threat.** One of my recent interests is the role of social identity in the mathematics classroom, and in particular the widespread phenomenon of *stereotype threat*—the fear of conforming to stereotypes about one’s social group—and its well-studied detrimental effects on the academic performance and mental health of students from historically underrepresented groups. I implement active measures for countering stereotype threat in the classroom; in fact, most of my teaching practices described in this statement—such as instilling a growth mindset and fostering a sense of agency and belonging—function to neutralize such threats. I have also facilitated a workshop for graduate student instructors at Brandeis on countering stereotype threat, and I plan to organize similar outreach efforts in the future.

**Research Supervision.** In addition to my work in the classroom, I am mentoring a senior at Lexington High School as part of MIT PRIMES, an after-school program for talented high school students in the Boston area to work on mathematics research projects under the guidance of graduate student mentors. The project that I designed for my student, Richard, is related to my own research in permutation enumeration, yet accessible enough to be approached using basic principles; see Section 4.2 of my research statement for details. After assigning to Richard some background reading and problem sets relevant to the project, I have met with him weekly to discuss his research findings and offer my own ideas. I presented our preliminary results at the 15th International Conference on Permutation Patterns, and I am proud to say as a mentor that Richard did the vast majority of the work.

My approach to teaching is still a work in progress, as I am constantly re-evaluating my teaching practices and searching for expert blind spots within my own thinking. I have learned so much from my students at Brandeis, and I look forward to teaching all of my future students with the same level of effort, compassion, and enthusiasm to convince them that, regardless of their background, they too can excel at mathematics.
Appendix: Comments from Course Evaluations. The following are some comments from my course evaluations.

- Professor Zhuang was an amazing teacher. As a student, I could feel his passion in everything that he taught, and that helped me that most to stay engaged. Math can be tough to get through sometimes, but he made it easy because I wanted to share his enthusiasm for the subject.

- Yan always encouraged questions and was pretty good at judging whether or not students were actually understanding as he went on with the lecture. Yan was more than helpful during office hours and reached out to students when he felt they may need extra help. He was great at connecting with his students.

- Although this was Yan’s first year teaching Math 10b I think he is an amazing instructor. He honestly inspires me, he is the kind of teacher I want to be if I decide to follow the path of becoming a high school math teacher.

- Yan Zhuang is passionate about teaching and the subject being taught; his enthusiasm and devotion to the subject and the students allows for a comfortable learning atmosphere. Zhuang was concerned with each students’ development and learning and went out of his way to ensure each student understood the subject matter.

- This instructor was very encouraging and seemed to care equally about students and subject matter- and he cared a lot. He was very helpful to me in office hours and was willing to answer any questions I had. Other professors could learn from his enthusiasm and dedication.

- Yan was a great teacher. He was very clear and precise and made sure everyone understood the topic before moving on. He was very open to questions and would always remind us of his office hours. He is an effective teacher with a clear interest in his students, and showed a genuine concern for our learning and well-being.

- Professor Zhuang was a pleasure to have as an instructor, the most useful thing in learning is a good teacher. Zhuang was a supportive and thorough teacher that made sure students were following the content and he constantly encouraged us to take advantage of the resources available to get help in areas of weaknesses.

- I really liked the "flipped" classroom lectures. Before learning a particular skill/topic in the classroom lecture, we were assigned to read a particular section of the textbook, watch online videos, and complete a mini 4-question assignment relating to that information. Next, we would come in to lectures with questions and our professor would go over more complex material that related to what we learned on our own. I think this was incredibly useful and it really allowed me to develop a better understanding of the particular material we were learning. It was efficient and allowed us to promptly skip basics and dive straight into the more complex problems.

- Yan is very passionate about teaching Math 10A. The fact that he seemed to love math and love teaching math made me feel interested in the subject.

- Yan was very helpful in providing help to students. There were always opportunities to ask for help on material that wasn’t clear. He also encourages us to work hard and be successful in the course. Yan is very hardworking and organized in the class structure and has clearly put a lot of effort in trying to prepare beforehand to teach us.