

# TEACHING PHILOSOPHY STATEMENT

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Teaching mathematics is an opportunity for me to share my subject and my passion for it with others. My enthusiasm for mathematics and determination to help students achieve highly underpins both my teaching philosophy and practice. Critical thinking and problem-solving, coupled with persistent hard work, are key components in long-term achievement, both inside and outside of mathematics. I aim to foster these general qualities alongside discipline-specific attributes such as mathematical thinking, rigorous argument, and clear presentation.

## Approach to Teaching

Teaching and learning are more than the transmission and memorization of content. As such, I endeavor to emphasize the “bigger picture” to my students. By the “bigger picture” I mean understanding the intuition that is being formalized in a particular definition. Knowing not just what compactness is but why it is useful. Not just being able to define  $\sigma$ -algebra’s but being able to justify their necessity. Some will argue this type of understanding is the reserve of “top students”, but all students find it easier to recall and apply concepts when they have a clearer idea of where a concept sits in the “bigger picture”. My conviction is reflected in my assessments and grading by asking students to express theorems in their own words or to explain why a certain result is useful or necessary. In an assignment for my Simulation for Finance course, I asked my students to explain in their own words why both strong and weak convergence are useful concepts for quantifying how well a discrete-time stochastic process approximates a continuous process. I still expect my students to be able to state definitions and prove important theorems, but these learning outcomes are immeasurably enriched by understanding how they form a cohesive whole. When teaching mathematics to non-specialists the “bigger picture” naturally extends to applications in the students’ major. In my differential equations course, students completed a final project comprising of a mathematical and numerical analysis of a simple mathematical model related to their major and my probability course had a large proportion of economics majors so I presented applications of key results to stock price models.

My teaching style naturally leads to a great deal of discussion and interaction with students; numerous past students have commented that my “interactive teaching style” was one of their favorite aspects of my courses. I believe a high level of student-lecturer interaction is key to keeping students engaged and active in lectures, as well as improving retention. At DCU, I served as Maths Learning Centre Director and trained undergraduate and postgraduate math tutors in providing one-to-one and small group math support; I also worked as a math support tutor since I was an undergraduate. These experiences were vital in helping me to structure and maximize the benefit of student interactions during lectures, tutorials, and office hours. Drawing on this experience, I hold “collaborative office hours” in a classroom, rather than my office, so that groups of students can attend, work and ask questions together (students who prefer a one-to-one format can book a time). Most students come to office hours with their friends in small groups and this format very successfully fostered peer to peer learning, as well as community building. Building an inclusive and welcoming community is vital to a positive learning experience and is an important focus in all of my courses. Before class begins, I ask students to introduce themselves briefly to their classmates (online) and in our first couple of classes students get to know each other in small groups; this particularly helps students who might otherwise be isolated in class groups where they don’t know anyone. I taught differential equations at Brandeis fully online and Piazza proved invaluable in fostering a sense of community

in this format. I incentivized Piazza usage in my grading scheme and students often answered each other's questions and shared useful resources/insights unprompted.

To appeal to a variety of learning styles and to allow all students to participate fully in the learning process, my methods of presentation vary from the use of the blackboard to slideshows, and problem sheets for self-directed learning. Whatever medium I am using I try to keep my students engaged by regularly asking them questions and encouraging them to interrupt me with their own questions or comments. While teaching differential equations, I replaced many lectures with problem sessions where the students worked together in breakout rooms on Zoom. I monitored each group's progress as they documented their answers on a Google sheet, joined breakout rooms as needed to help them and each group presented the solution to part of a problem to the class. This was also an opportunity for me to probe students on their understanding of their answers and for them to work on their communication skills when relaying their solutions.

Timely and informative feedback is essential for students to validate and guide their learning. I use marking rubrics and provide early and regular opportunities for feedback to ensure that my expectations and standards are always clear to my students. This clear and regular communication is particularly important because it gives students added confidence in the instructor, and avoids unnecessary stress and anxiety for the students. When teaching differential equations I implemented "mini-quizzes" to check that students had understood the content of pre-recorded lectures; this instant feedback also ensured that students were ready to contribute actively to group problem-solving sessions during our live Zoom class times. In my probability course, I gave my students partial credit (20% marks back) for producing a full correction to their mid-term exams along with a short learning reflection to encourage them to fully engage with this important form of feedback.

### **Personal Development**

Excellence in teaching can only be achieved, and maintained, by continually re-evaluating and trying to improve one's practice over time. As I am guided in my teaching by the principles of student-centered education I highly value feedback and evaluations of my teaching from my students. I have given mid-term teaching evaluations even when not required by the university, and in my recent online course students completed short weekly learning reflections which also allowed me to assess how well the course was functioning. Assessing students regularly provides useful feedback both for the students and teacher, and I find this allows me to make adjustments to better meet students' needs while a course is still ongoing. For example, fortnightly quizzes in my probability course revealed that students were not as proficient in some basic calculations as their homework grades suggested and I addressed this with revision exercises. Along with these forms of feedback, and my own self-assessment, I have been fortunate to have experienced and enthusiastic departmental colleagues at both Brandeis and DCU with whom to discuss best teaching practices and new ideas. I hope these steps will ensure that my instruction accurately reflects my pedagogical beliefs while helping my students to achieve as highly as possible and to reach their personal educational goals.

### **Mentoring & Advising**

Mentoring and advising younger researchers is one of the most fulfilling aspects of my job. It was my pleasure to mentor 5 excellent undergraduate researchers during my time at Brandeis and later at Princeton; they worked on projects involving mathematical biology, applications of PDEs in active matter, network models in epidemiology, and interacting particle systems. As a postdoc, I have also been active in organizing and leading semester long reading groups bringing together graduate students, postdocs and faculty; past reading group topics included the mathematical theory of spin glass models, network theory, slow-fast dynamical systems and mathematical neuroscience.