# Teaching Philosophy

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Teaching is an optimization problem. From the outset, deciding on my objective function is of paramount importance: **What am I trying to achieve in a semester with a group of students?** Certainly, conveying understanding of the subject matter is a chief goal. I don't believe it should be the only goal, though: I want my students to leave with an appreciation for the broad themes underlying the topic. I want to maximize students' joy in learning, while minimizing suffering and frustration. Finally, I want to maintain feasibility, producing the best outcomes for my students while preserving my own time for research and service.

Below, I will describe my strategies for pursuing these goals and some of the conclusions I have reached at my current local maximum.

***Selecting a starting point***

During my preparation for each semester, I decide which region of the teaching landscape I will be exploring. This involves research, consultation with mentors and peers, and considerable planning. In recent semesters, this process has led me to adopt—and in some cases, abandon—unconventional classroom strategies. My participation in **Project NExT** (Peach'18 cohort) exposed me to a vast universe of innovative teaching techniques. The techniques that seemed most promising and workable to me were *mastery-based grading* and *flipped classroom*.

In a **mastery-based grading** system, students are given a list of $\sim$20 topics for the whole semester, and then have frequent opportunities to demonstrate mastery of those topics in exams. Before attempting this strategy in Fall 2020, I attended the Mastery-Based Grading Conference to learn more; there, I became convinced of its strong advantages. My results later that semester confirmed my impressions: students' cumulative performance on mastery exams was much stronger than when I taught in the traditional exam model. Since no exam is make-or-break, students do not experience the same pressure and anxiety and have less incentive to cheat. They have more time to adjust their study habits or focus their attention if they are struggling with some key concepts. Students take more ownership of their progress in this model, finding more joy in achieving mastery after multiple attempts than in receiving partial credit for a similar problem.

The **flipped classroom** paradigm flips the traditional roles of homework and lecture: students are instructed to view lectures or read texts at home, and then work on problems collaboratively in class. I decided to pursue this strategy to address the following situation I observed: students were passively receiving information in class, then using online resources like Math StackExchange or Chegg to complete assignments at home. As a result, they were never forced to grapple with the material. I first rolled out this method in two classes: For my calculus course, I recorded lectures and posted them to YouTube, while for linear algebra, I used a pre-existing video series. Students were instructed to view the lecture video before class and come in prepared to work through problems.

My results with this method were more mixed. My more mature linear algebra class diligently viewed the videos, but they needed additional lecture time to solidify their understanding before our problem sessions began. As for the younger calculus class, YouTube analytics revealed that very few students (first-years with a variety of majors) watched the full lecture videos. Instead, they relied on others to guide them through the problems once

they were in class. I considered requiring a pre-quiz to confirm that they viewed the lecture, or deducting participation points for students found to have skipped the assigned video. However, I also found that the long problem sessions did not work as well for this class: first-years did not have the same endurance as the older math majors. Since then, I have used flipped classroom, combined with a short review, for upper-level and graduate courses. This ensures that students have at least some opportunity to actively engage with challenging problems. As for the lower-level courses, I keep the lecture in the room – but interspersed with short problem sessions. This keeps their attention engaged and their participation active.

### *Gradient ascent*

Once I am mid-semester, I employ targeted mechanisms that allow for course correction. A full transformation of the course structure while the semester is underway (starting over at a new point in the optimization landscape) is unlikely to produce positive outcomes. Instead, I perform a type of gradient ascent, making small improvements on my original structure.

Every lecture I deliver involves some degree of **adaptation and improvisation**. As I make a point, or explain an example, I look around the room to gauge the students' understanding and engagement. I often solicit input from the students: whether to apply the concept I just explained, or even to fill in an arithmetic calculation to make sure they're with me. When I determine that the students are losing the thread, I back up and try a new example or a new line of reasoning.

I issue **class surveys** several weeks into the semester to assess the success of the instruction so far. This had led me to modify aspects of the homework assignments, format of group work sessions, length of exams, and more. After 2-3 mastery exams, I schedule meetings with the students who have mastered the fewest topics. In those meetings, they are able to communicate to me what accommodations I can make for them; I can also give them advice on effective studying. Another way I adjust course using mastery exams is by calibrating test questions: if my "partial fractions" mastery question was too challenging for my audience on the first exam, I can modify the difficulty on future exams with no harm to the students.

### *Humility and Humanity*

While I constantly strive to optimize my performance, I also approach my task with a sense of deep responsibility and humility. I am profoundly aware that my position involves the power to pass or fail, the power to make demands on students' time and energy, and the power to shape students' attitudes and ideas. I meet this grave responsibility with humility knowing that optimal performance cannot be achieved, but it is my obligation and my sacred mission to continually reach for it.

I am also aware that students from minority and disadvantaged backgrounds encounter serious obstacles in many math courses. Teaching at Florida Atlantic University, a Hispanic-serving institution (HSI) and a commuter school with racial, economic, and cultural diversity has given me renewed sensitivity to the challenges students from diverse backgrounds face. I try to meet every student where they are, scheduling one-on-one meetings to fill in gaps in their background, or allowing flexible submission schedules for assignments. I approach each student knowing that they are a human being with burdens and obligations, dreams and aspirations. I do my best to serve them in a way that honors their humanity and nurtures their tremendous potential. Most importantly, I let every student know how much their contribution to our mathematical discourse is valued.

## Teaching Experience

I have always had a passion for teaching, beginning informally as a middle school and high school student, then in the Tutoring Center at Penn as an undergraduate. I began teaching formally as a graduate student; since then, I have taught in the following positions:

- I served as a graduate student instructor (GSI) in Berkeley for three semesters, teaching MATH 1B (second-semester Calculus) and MATH 10B (Mathematics for the Life Sciences). My responsibilities included six weekly hours of teaching, as well as weekly office hours, exam review sessions, and grading homework, quizzes, and exams.
- In my postdoc at University of Pennsylvania, I served as primary instructor for MATH 320 (Computer Methods in Mathe- matics), focusing on root-finding, differential-equation solving, and linear algebra algorithms. I designed the curriculum, and I wrote and graded all homework assignments, quizzes, and final research projects.
- Since joining the faculty at Florida Atlantic University, I have taught the following undergraduate classes: Calculus 2 and 3, Methods of Calculus (for business majors), Discrete Mathematics, Matrix Theory, Linear Algebra, and Modern Algebra. I have also taught three graduate courses: Enumerative Combinatorics, Commutative Algebra, and Advanced Algebra & Geometry (for MA in math education). From that list, I taught seven semester-long courses online. I also received grants from the Center for Online and Continuing Education at FAU to design the online version of the Linear Algebra course and the graduate Commutative Algebra course.