TEACHING STATEMENT

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I devoted a major part of my graduate school career to acquiring different kinds of teaching experiences. I've been a teaching assistant for Abstract Algebra and, currently, for Algebraic Topology at the undergraduate level. For two years, I was a teaching fellow with an initiative at Tufts called the Poincaré Institute for Mathematical Education, for which I was the instructor of record for classes of ten to fifteen in-service middle and high school teachers from a range of schools in northeastern Massachusetts. I taught my own section of Math 22, Introductory Statistics, which serves students from many majors at Tufts, and I developed a curriculum to teach them the programming language R as part of that course. In recognition of my innovation and effectiveness, the department recognized me with its Distinguished Teaching Prize for the academic year 2018-2019.

In this statement I will profile two of the non-standard teaching formats that I've developed in my years as a graduate student, and close with some brief reflections on my goals as an educator.

Teaching Statistics in a Flipped Classroom

In Spring 2018, I designed my own syllabus when I was asked to teach Introductory Statistics at Tufts. I taught the course "flipped": each day students were assigned to watch video lectures and practice some problems outside of class. They would then come to each 75-minute class having been exposed to the material already. I would begin the class with a 20-30 minute lecture on the content the videos covered, stressing some of the harder concepts and using motivating examples. The rest of the time was devoted to hands-on student work in a question-centered format.

As everyone who has taught non-major statistics courses knows, the first challenge was to get the students interested in the material. I motivated the students in two different ways. First, I conducted a survey of interests at the beginning of the course—and I actually *used* it to drive my approach to the examples throughout the semester. For instance, catering to the many biology/pre-med students in my class, I introduced Bayes' theorem by applying it to compute the conditional probability of a patient not having a particular disease given that they tested negative for a test, from knowing the prevalence, sensitivity and specificity of the disease. Many of my students were also interested in political science, which is a signature area at Tufts, so I created questions catering to them as well. For example, when I was teaching the χ^2 goodness of fit test, I compared Iran's observed election data from 2001 to expected election statistics based on polling data just taken days before the election. Surprisingly, (or not, since Ahmadinejad won..), the predictions and the election results did not agree at the 5% significance level. This was an interesting result as Ahmadinejad was accused of election fraud that year.

Secondly, I decided to make it a project-based course, to break their associations of math being completely about routine problems. It was a joy to see some of the students really apply themselves in this project. One of them even collected their own data to study whether there was a correlation between the racial makeup of a high school population and the number of advanced placement (AP) courses offered. They surveyed 30 surrounding schools in the New England area and found that there was a positive correlation at the 5% significance level!

The flipped classroom model is still new for many students, and teaching a course this way has some pitfalls one needs to avoid. One of the major challenges is student noncompliance with the flipped model by coming to class without having done the necessary homework. I addressed this by setting the tone right from the start: the in-class worksheets I made were hard for students who didn't actively watch the video lectures. This worked—students learned to watch carefully, and came to class with notes from their individual viewing.

Teaching Teachers through Online Courses

The Poincaré Institute was an NSF-funded initiative of the Math and Education Departments at Tufts, in partnership with public school districts throughout New England, that ran from 2011 to 2017. Through this program, active in-service teachers would sign up for skills renewal and professional development, including courses focused on "mathematical content and on teaching responsive to students' reasoning about mathematics." Besides being geographically dispersed, the participating teachers had full-time teaching jobs, and most were also balancing a family. Therefore, the program brought them to Tufts in person only every few months, and the weekly instructional format was mainly online. Every week the teachers learned from videos and reading assignments, then produced a write-up of problem solutions. If they had questions about the material, they would post on a forum (which I moderated) or message me directly. I held "virtual office hours" where the teachers joined by videoconference. Additionally, I also visited their schools on a monthly basis to hold face-to-face office hours and build personal relationships.

Even though most of the teachers had already seen all of the mathematical content in the scope of our course—from elementary arithmetic to Algebra I—the Poincaré Institute introduced basic topics through a major emphasis on functional reasoning, which is a staple of advanced mathematical thinking but not traditional at the high school level. For instance, addition on the real line is introduced as a function $\mathbb{R}^2 \to \mathbb{R}$. Likewise, solving equations was illustrated through a series of transformations on the plane or real line. This approach was new to the teachers taking the courses.

Unlike when I taught introductory statistics, these teachers didn't need to be motivated to appreciate mathematics. However, they needed to be motivated to depart from their usual viewpoint and learn a new one. Each time I taught the course over my two years with the program, I experienced resistance from the teachers in adopting the functional framing. I overcame this challenge by communicating, whenever possible, how the new approach would naturally build up their geometric intuition. For instance, if one uses transformations of the plane to view the solving of a linear equation, one can actually visualize in the plane each step of the process (since addition is a translation and multiplication is a dilation). Once they saw that many of these approaches had geometric explanations behind them, the teachers readily seemed to accept them, as they themselves try to use as much visualization as possible when they are teaching mathematics to their students.

Reflections on My Goals as an Educator

I grew up in a family that held great regard for academic pursuits. My mother had a Masters in business logistics management. My dad was the only one among 6 siblings to get a college degree. He taught morning school (between 6-10am) for young students who worked afternoons in carpet factories and paid the equivalent of $1/month in tuition. My dad understood that education raised quality of life, since his parents and all of his siblings struggled through their lives for lack of it. Therefore, even though his morning school paid next to nothing, he kept up with it, committed as he was to helping the community. So, growing up, I learned to prioritize schooling and academia before anything else.

My parents implicitly assumed that I would follow in my dad's footsteps and follow a teaching career, although, the type of teaching career they had in mind is likely different from what I am today pursuing. In Nepal, the schooling system is oriented to a minimal functional level of training, mainly serving students who will join the labor force. Via rote and memorization, students learn to follow instructions leading to the solution of a problem rather than coming up with the process themselves (which I know is sometimes the case in the United States as well!) They are taught to find the correct answers, but never to pause and interpret them. Having come to the United States to attend Hamilton College – an undergraduate liberal arts institution that focuses on teaching its students "how to think" – and then having had the chance to teach at Tufts, I have come to realize the stark difference between routine lecture-style teaching and some of the effective pedagogical practices I have seen as a model. Hence, I want to pursue a student-centered teaching career that focuses on fostering curiosity and inquiry and not just getting correct answers to problems. I want students to be able to question assumptions and think critically enough to think twice before taking "leaps of faith."