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Teaching Statement

I taught my first math class as a master's student in the fall of 2009, about three months after finishing my undergraduate studies in computer science. Without instructional guidance, I modeled my course after the experiences I had as a student, drawing on the aspects I found most effective while trying to avoid the ones I found actively unhelpful. I aspired to deliver the types of lectures that had kept me captivated during the two hour long class meetings I had as an undergraduate. Mimicking the professors who made the biggest impression upon me as a student, I devoted the bulk of my preparation time to organizing a lecture that *flowed*: definitions were motivated by observing naturally occurring phenomena, results were stated as observations that follow from examples that hint at a proof, and the homework sets assigned at the end were carefully curated to cement the concepts discussed in the students' minds.

I continued to hone my skills as an expositor throughout my time as a graduate student. As my command of mathematics improved, I found it easier to explain concepts in a clearer and more concise manner. I incorporated techniques that I found useful in the courses I took as a graduate student, resulting in a more conversational lecturing style that should better engage students. By the end of my time as a graduate student I was making marked progress towards the ideal I had envisioned when I first started almost a decade earlier. However, to my bewilderment, the outcomes in my classes had changed remarkably little over the years, in spite of the progress I believed I had made on my lecturing style.

After having been pedagogically adrift for the better part of eight years as a master's and doctoral student, I crashed abruptly into my first appointment at a small liberal arts college. The environment was dramatically different from anything I had experienced either as a graduate student at public universities or as an undergraduate at a polytechnic institute. During my time there, I received an immense wealth of feedback on my effectiveness as an instructor, as well as crash courses on techniques like active learning and inquiry based learning.

Implementing these strategies made it clear that engaging with mathematics in this way provided students the opportunity to collaborate with and explain their ideas to their peers, which not only improved student performance in the course, but also helped to develop the critically important problem-solving and communication skills necessary to effectively utilize the material beyond the confines of the classroom. While the literature confirms this observation for all students [1], the evidence that students from historically underrepresented groups in STEM fields reap these rewards at disproportionately high rates is incredibly compelling. Indeed, active learning has proven an effective tool in closing the achievement gap between genders in physics [4], improving student outcomes for economically and educationally disadvantaged students in biology [2], and increased retention of female students in mathematics [3]. As a result, I have made it a priority during my time at the University of Louisiana Monroe to structure my courses to be as active as possible in an effort to promote an inclusive and diverse learning environment for my students.

Beyond the classroom, I use a mastery based grading scheme to accommodate the varied backgrounds of my students. Towards the end of my Calculus I courses in the Fall 2018 semester , I observed in several of my students a pronounced disparity between their average and their understanding of the material. The source of the disparity was clear: the students simply had not mastered limits and derivative rules before the first exam, and their score *only* conveyed that particular piece of information; it did not reflect that those students had flawlessly applied the chain and product rules to solve complicated related rates problems, or handily dispatched subtle limit computations in service of sketching rational functions, both applications being far more complicated than their first exam counterparts. Suddenly those early exam scores seemed more punitive than accurate; my grading scheme was far too rigid to accommodate students who were capable of mastering the content, but simply needed a little extra time to do so.

In the following semester, I implemented a new grading scheme that breaks the material into standards that the students must master during in-class assessments and provides multiple opportunities to demonstrate mastery throughout the semester. For the students, this iterative process afforded them relief from grade pressures so they could focus on learning the material, rather than focusing on how to get enough points on each of the exams to attain the grade they desired. At the conclusion of the semester, I observed that not only had I rectified the problem of students earning a grade that under-represented their knowledge, I had unexpectedly fixed the secondary problem of students earning a grade that *over*-represented their knowledge.

As the name suggests, mastery based grading forces students to actually master a given number of topics in the course, rather than string together partial credit for an incomplete understanding of those topics. With nearly identical grade distributions, the students in each grade category from the initial implementation had a more complete understanding of the material than their counterparts from the previous semester. Since then, I have utilized mastery based grading in many of the courses that I teach, and intend to continue this expansion in the future.

As an instructor, I structure my courses around the observation that mathematics should be done collectively to create an inclusive and responsive classroom environment that both challenges and engages my students. I keep my courses as conversational as possible, guiding the development of the material by providing the framework of necessary definitions and techniques, while leading the class to collaboratively make connections beyond purely mechanical or algorithmic manipulations through discussions, group work, presentations, and activities. This not only encourages students to be active participants in the learning process, but builds the intuition necessary to utilize the material beyond the confines of the course-work and molds them into independent learners capable of critically assessing the mathematics that they and their peers produce.

References

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[2] David C. Haak, Janneke Hille Ris Lambers, Emile Pitre, and Scott Freeman, *Increased structure and active learning reduce the achievement gap in introductory biology*, Science **332** (2011), no. 6034, 1213–1216.

[3] Marina Kogan and Sandra L. Laursen, *Assessing long-term effects of inquiry-based learning: A case study from college mathematics*, Innovative Higher Education **39** (2014), no. 3, 183–199.

[4] M. Lorenzo, C. H. Crouch, and E. Mazur, *Reducing the gender gap in the physics classroom*, American Journal of Physics **74** (2006), 118–122.