TEACHING STATEMENT

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As a teacher of mathematics, I believe students can learn to do more than just solve problems and understand the course material. In a math class, they can build complex relationships between the abstract and the concrete, and develop the ability to coherently explain these connections. Perhaps most importantly, they can become confident to ask questions because their experiences guide them to see that questioning can be the first step towards further progress. These are transferrable skills which a math class gives the opportunity to develop. When I graduate from the University of Virginia, I will have been the instructor of record for the entire calculus sequence, both for science and non-science majors. Some of these courses were coordinated, and others not. In addition to this experience in the classroom, I assisted Professor Paul Bourdon in designing aspects of the active learning, or "Michigan style", Calculus I course, part of a transformation of the introductory calculus sequence at Virginia.

As an instructor, I try and work on two levels. On one hand, I make sure there is big picture to motivate the individual components of the course and provide a coherent narrative. On the other, I aim to provide varied examples and be clear about calculational details. I think it is important that a course build on itself when it can and that the students are aware of the context in which the work they are doing belongs.

In lecture-based courses, I unite the conceptual and calculational by presenting many examples, and framing them from various points of view. In the case of the Calculus III course I recently taught, I placed a strong emphasis on translating geometric statements into algebraic problems. Many of the ideas defined in the course have can be formulated in either fashion. I preferred to motivate the algebra through the geometry by presenting examples and assigning problems with two phases: an initial one involving geometric intuition and manipulation, and a second, algebraic one to find a solution.

I contributed to the calculus course redesign in the spring of 2017, taught the course for the first time the following semester and again a year later. I participated in a number of course design workshops as we prepared the structure and materials for the new course, and have been a panelist on departmental discussions about the redesign since. I also contributed a number of short instructional videos for the Calculus I course, which the students would watch before coming to class.

The goal was to implement an active learning calculus sequence which would increase student engagement and improve course outcomes across a number of metrics. Since the course was structured around group work, ensuring that each student was comfortable and confident in participating was crucial. In the classroom, this requires being attentive and responsive to the varying needs of students to ensure their continuing engagement.

In one of the workshops, I designed a weekly online reflection form for the students. Many of the instructors now use it in their the calculus sections, since the reflections provide the students with an avenue to communicate any concerns to which the instructors can promptly respond, e.g. switching them to a new group if they feel uncomfortable in their current one. The students also had to write a short review of the week's material in the reflections, and were given space to ask any lingering questions or suggest material to cover in the discussion section at the end of each week. Since I also led the discussion sections, this last aspect of the reflections was particularly helpful, as I could tailor the material reviewed in the discussion to the needs the students themselves articulated.

In the active learning courses, students work in groups of three or four on worksheets which are constructed to offer a selection of problems highlighting the conceptual aspects of the day's topic and develop the relevant calculational tools. I encouraged my students to discuss their work as they progressed. Throughout the semester, each student was occasionally called upon to present their solution for a problem to the class. This was beneficial in surprising ways. For example, both times I taught the course, the students became much better than usual at correctly working with limits and the associated notation. Since the students were able to see their peers' work and have a public discussion about the presented solutions, they realized that the notation had meaning and that in order to communicate their solutions effectively they needed to use the notation correctly.

On the whole, students developed strong mathematical communication skills, as the class met for two and a half hours a week. Collaborating and communicating with their peers strengthened the students' problem-solving skills as they adjusted to having to be able to explain their work: they began to cogently transform problems from the form in which they were assigned to a state where they could apply their mathematical toolkit. They also became surprisingly good at asking coherent questions — occasionally a real challenge in a lower-level undergraduate course.

I found my role in the calculus redesign exciting and rewarding, and I look forward to finding ways to contribute my experience with the program at Virginia. In the future, I plan to continue using innovative pedagogical methods in my instruction. In larger lecture-based classes, I would be interested in trying iClickers, and also implement more student participation along the lines of think-pair-share questioning. I also look forward to teaching an even broader selection of courses and working with new people to deliver an excellent educational experience for all students of mathematics.