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Statement of Teaching Philosophy

An undergraduate mathematics classroom is an exceptionally diverse setting – diverse in mathematical experience, learning style, and cultural background. No two undergraduate math students have exactly the same needs, and it is my job to create an engaging environment that can capture the attention and imagination of any student, no matter the path that has led them to my classroom. I tackle this diversity by intentionally crafting lessons that address various learning styles, by frequently seeking and responding to student feedback, and by making technology central to my classroom, both as a pedagogical tool and as a means of creating organized, accessible content. I aim to be a charismatic, approachable instructor who fosters a challenging, yet supportive, classroom environment where both the boisterous participators and reserved notetakers feel fully capable of success.

I focus on creating an interactive classroom environment where students are guided to making natural mathematical insights in a way that is both organic and efficient. Before class begins, an “ice breaker” problem is waiting on the board. This allows students to reengage with current material by turning either to a neighbor or to their notes from the day before and allows me to set the stage for the insights we will make during lecture time. A personal mantra that I routinely share with my students is that any mathematical concept can be understood in four ways: graphically, symbolically, numerically, and in plain English. Any one of these may be a given student’s route to “ah ha!”, but mastery of all four is the ultimate goal. In keeping with this approach, I believe in crafting lessons with a natural cadence that addresses all of these styles. A highly technical example is prefaced by a strictly intuitive one. A problem that must be solved analytically is preceded by one that can be solved pictorially. In my Calculus I class, the seminal example of the Fundamental Theorem of Calculus is one that requires no calculus at all: how far does one go by traveling 60 miles per hour for two hours? Students intuitively know that the answer is computed by multiplication, and a discussion about the geometrical interpretation of that product – the area of a rectangle in the velocity-time plane – makes it clear that any area computed under the velocity function carries the interpretation of distance traveled. Once we trust the method, we move on to more technical examples where physical intuition is unavailable to us. One student’s “mmhmm” may be another’s “ah ha!”, and my job is to be flexible enough to facilitate these moments of clarity for every kind of student.

I prioritize bringing technology into my classroom as a means of illustrating difficult concepts, facilitating problem solving, and alleviating the tedium of written work. This is particularly impactful in a Calculus class, where pen-and-paper computations often fall short of breathing life into this subject that, at its core, describes motion and change. I make liberal use of animations and graphics that I generate in MATLAB, python, or Desmos to illustrate key ideas. A lesson introducing derivatives starts with a question: what does a curve look like the more you zoom in on it? Using Desmos animations, students observe for themselves that all smooth curves begin to look linear the more you zoom in. An animation will demonstrate that a sequence of secant lines approaches a tangent line or that higher and higher order truncations of a Taylor polynomial really do converge to an exponential function. I also do not shy away from introducing my students to elementary coding, insofar as it will serve the mathematical lesson. During a lesson on Newton’s Method or numerical integration, rather than having students perform the tedious iterative computations by hand, together in class we write a simple piece of code for them to use on their homework. These scripts are all shareable and executable in a web browser via online services such as pythonanywhere.com, reducing the barrier for entry for non-technical students. These moments provide me an opportunity to bring powerful tools such as MATLAB, python, and Desmos directly into the classroom and show the students that the concepts we learn transcend what is doable with pencil and paper.

Technology is also critical to the organization of my courses. I make use of Moodle to create dynamic online hubs where students can have access to a range of constantly evolving resources. When students do whiteboard work in class, I upload pictures of their work for other students to revisit. For a particularly difficult homework problem, I may provide a pre-prepared Desmos graph with sliders or animations to help it click. Any animations or graphics I present in class are available there for them to review or run themselves. Today's students are digital natives. By creating an online classroom that parallels our physical one, I can play to my students' strengths as savvy users of digital spaces. For this reason, I have jumped at every opportunity to employ existing technological infrastructure to augment my class. I am now teaching my second course to be fully video recorded. By giving students the ability to revisit the lecture recordings outside of class, they can choose to prioritize mental engagement over furious notetaking during class time, knowing that they can easily fill in any gaps in their notes later.

I focus on developing activities and modules that bring other STEM topics into the spotlight as meaningful context for Calculus. I have developed a module for my Calculus I classroom where the Ideal Gas Law is used as the equation of state for an internal combustion engine, using the changing pressure and temperature of the fuel to describe the upward and downward movement of a piston. This activity not only provided a meaningful showcase of the power of calculus, but also allowed students with strengths lying outside of mathematics to bring some outside expertise to bear in the math classroom. While interdisciplinary modules can be helpful for students, they require a great deal of effort to prepare and may require the instructor to venture outside of their comfort zone. For this reason, I have been eager to share the modules that I have prepared with my fellow instructors. Moving forward, I envision creating collaborative instructor networks, where instructors can disseminate stand-out activities they have developed and train other instructors in how to deliver them. This would put well-developed lessons into many classrooms, reduce burden on first-time instructors, and create uniformity between the many sections of these highly impactful courses.

As much structure as I plan for my classroom, there are inevitably moments when it becomes clear that the class and I are not on the same page. These moments have taught me the importance of seeking constant student feedback. During my Fall 2018 Calculus III course, a survey revealed that my once-weekly problem sessions were not productive for the students, so I had no choice but to scrap my initial conception of the course and incorporate more frequent break-out problem sessions. In my student evaluations from that semester, many students commented that they were glad that I had responded to their feedback – "He adjusted to the way we best learned throughout the year". As a young instructor, it has been vital for my own development to frequently ask for feedback from the class in the form of anonymous surveys or quick in-class polls. More recently, I have started an anonymous "comment box" google form that allows me access to a constant stream of feedback.

As grand as I feel the responsibility of a teacher is, I have learned that the most productive moments are often the imperfect, human ones. Taking a moment in the middle of a hard example to be lighthearted or to strike up a chorus of the class refrain – "when I say derivative, you say slope!" – can make all the difference for a student whose biggest hurdle is simply fear of failure or judgement. On particularly groggy mornings, offering a dollar to the student brave enough to pipe up has proven a universal approach to livening up the room. Seeking out these moments has helped me bridge the authority gap with my students in a way that makes students more likely to seek help when they need it. To quote a student evaluation, "He was very good at building relationships with students and making himself feel very approachable for help and questions." My former students frequently ask me for letters of recommendation, including a cohort of five students from my Fall 2019 Calculus III course who all applied for the prestigious Caldwell Fellowship at NC State. By being a figure that my students can trust and relate to, I aim to humanize both my position as professor and the field of mathematics, inviting my students to rise to the occasion and realize their own academic potential.

My approach to the classroom is designed with a broad spectrum of students in mind. My classroom is rigorous and engaging in traditional ways, while being flexible enough to allow students to play to their strengths. Technology is central to my classroom, helping me both communicate abstract concepts through demonstrations and alleviate the stress of class time by providing a variety of resources online. I have also invested time in the development of interdisciplinary and computational modules for my classroom and have shared these lessons with my fellow instructors. I hope to continue developing these collaborative networks to crowd-source these well-developed materials. I envision this approach as being valuable to a core sequence of courses requiring continuity between subsequent courses and uniformity between many sections. Moving forward, I am interested in teaching and designing Calculus courses where technology, student feedback, and instructor collaboration come together to creating a dynamic, engaging experience for the student.