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Teaching Statement

I am the product of a long line of influential mathematics teachers and professors. Through teaching and mentoring, they have left an impact on how I view mathematics, myself, and others. I intend to carry on that legacy.

Teaching Philosophy (What and how do I think about teaching?)

In my second year as an undergraduate, I was thrown into a mathematics class in which I had very little background. Suddenly being in the deep end of mathematics felt like being lost in a jungle; as challenging as this experience was, this imagery now helps verbalize how to navigate new realms of mathematics. Learning should evoke a spirit of progression and adventure, and my primary role as an instructor is to prepare my students to not only survive in the jungle but to thrive in it.

Exploring means using one's inherent notions as an invitation to encounter and consider new ideas. A student is simply exploring what is out there and seeing if they can recognize anything new. **Developing** constitutes an inverse to this procedure. Having been familiarized with some of the mathematical landscape, students should begin seeing how and where they fit in. Developing aims to answer the question, "What do I already know that is similar to this?" My goal in this stage is to help them realize that their toolbox already contains one of the most important tools they need: the mathematics that they already know. Having begun this thought process, students can start to furnish their toolbox with what is needed to further explore the jungle. **Sharpening** requires looking ahead. At this step, I deliver a statement, introduce a theorem, or demonstrate an example that is perhaps unexplored territory, and the students are shaken up by it. I compare this to pointing to a lamppost in the distance: *Can you use this lamppost to contextualize where you are now and to give you guidance for where you want to be?* I play the role of showing my students where, how, and why they ought to use their tools in this new way.

The value of the jungle analogy is that it creates an engaging narrative while giving the students ownership of their learning. Usually, a student comes in with little knowledge of the subject matter at hand and it is my job to teach them that material. In order for me to do that, I need them to consider what they themselves already know. Doing so allows the class to understand the starting point of our mathematical journey. The course therefore proceeds by asking questions and trying to expand on what we know in small steps. The question posed in **Sharpening** is an effort to expose students to the big picture of the course. I aim to structure a course so I can actively enlighten students that mathematics is a moldable structure that is continuously built upon and strengthened.

Classroom Experience (What would it look like to sit in my lecture?)

Exploring by asking simple questions is often how I introduce new concepts. A single-valued function $f : \mathbb{R} \to \mathbb{R}$ is an object that most students are comfortable with. In Multivariable Calculus, I need to present them with the idea of expanding the domain or codomain to $\mathbb{R}^2$ or $\mathbb{R}^3$. This procedure includes nuances that I need to address such as, *Can we still graph this function?* or, *What does it mean to take a derivative of a function in 2 variables?* I will often pose questions to lead the class in a certain direction. There is a delicate balance between giving students time to form their own conclusions from these open-ended questions, and just giving them an answer. This allows for a class discussion that leads to contemplating what tools we should acquire moving forward.

In my Pre-Calculus class, we approached the curriculum in an unconventional manner. Rather than saving the discussion of limits and rates of change for the final topics, we delved into these concepts during the initial weeks of the course. The course proceeded to study elementary functions, including polynomials, rational functions, exponentials, logarithms, and trigonometric functions. By establishing this foundational knowledge

early on, students were given the opportunity to **explore** these functions in relation to limits and rates of change. Consequently, we maintained a consistent emphasis on understanding derivatives, regardless of the specific type of function under study. This approach allowed students ample time to solidify their understanding of derivatives before taking Calculus.

The construction of integration relies on one's understanding of calculating and approximating the area of some region. Once this concept has been sufficiently **developed**, I can use that to generalize and **sharpen** what integration is. A *lamppost in the distance* statement can be given since the integral has the intrinsic ability to relate the area of integration to its boundary. Reconstructing the idea of integration by relating it back to a familiar concept rewards students with a lot of mileage: understanding single-variable integration better, as well as easing them into Generalized Stokes' Theorem.

Technology is also a powerful tool that aids and enhances learning. Once several preliminary concepts such as row-reduction and linear independence have been introduced in my Linear Algebra class, I will spend a day introducing and demonstrating Wolfram Alpha. I want it emphasized that technology is able to help skip the menial steps so that students can understand the bigger picture of the course. Simply by inputting a matrix into Wolfram Alpha, loads of information are readily available. A goal of mine is for students to be able to relate the properties of a matrix to one another. This is succinctly made clear with square matrices via the Invertible Matrix Theorem. Linear Algebra can be made simple for a student if they realize how interconnected the topics are.

In high school, I did not care that I had to repeat Algebra 1 because it meant I could spend more time with my friends. Astonishingly, this time not only allowed me to realize I could excel in mathematics if I wanted to, but it also made me aware of the advantage of being in a safe and trusting classroom environment. As an instructor, I make it a point of getting to know my students to give the process of learning mathematics a more human feel. This looks like memorizing their names, getting to class early to interact with them, or sharing non-mathematical thoughts and stories that relate to the mathematical concept in a question. To ease student nerves on exam day, I will distribute a piece of Jolly Rancher candy to each of them. This type of environment facilitates a key intention of mine which is to foster a learning environment where students are comfortable interacting. I will often coordinate students to work in groups to tackle problems together. As mentioned before, this creates better discussions within the classroom as well as allows students to adopt an unembarrassed posture toward asking questions.

Outside Classroom (What have I done outside the classroom to further my teaching expertise?)

Over the course of 5 years at Penn State, I have taught College Algebra, Pre-Calculus, Linear Algebra, and Multivariable Calculus in addition to grading a Differential Equations course. However, I have been given opportunities to mold my teaching identity outside of the classroom. These opportunities come in two flavors: administrative duties and my introduction to mathematics education.

During the Fall 2023 semester, I am acting as Coordinator Assistant for the College Algebra course. The Course Coordinator is regularly charged with designing the course syllabus, materials, assignments, and exams while ensuring that instructors are using these resources effectively and at an appropriate pace. In my specific role, I created rubrics for homework assignments and exams using Gradescope, and held bi-weekly meetings with course instructors to communicate goals for the next week, as well as address any teaching concerns that the instructors may have. A unique advantage of such a position is that it gives me insight into what it takes to efficiently run a coordinated course that I would otherwise be unaware of as an instructor: for example, the responsibility of managing instructors, suggesting solutions for administrative concerns to colleagues, familiarizing myself more with department policies, and the practice of creating and preparing for an exam at least a month before the exam date. Having the opportunity to be a coordinator assistant has given me further confidence and knowledge for when I coordinate and run my own courses in the future.

I have also taken advantage of the mathematics education courses offered by the College of Education. This exposed me to mathematical epistemology via Piaget's theory, and how one may actively test and implement teaching methods in a classroom. Piaget's theory introduced me to conceptualizing mathematical ideas and

notions as objects that I can manipulate, refer back to, and **sharpen**. For example, the gradient appears in the tail end when learning about differentiation in several variables. As I was preparing my notes, I found myself needing to frequently say the statement *the gradient points in the direction of maximal increase*. To help students wrestle with the gradient and this hallmark feature of the gradient, I introduced, denoted, and repeatedly referred to this statement as "the class tattoo". Calling it this name served two purposes. First, it was sufficiently colorful and distinct enough for students to create a mental box dedicated to this statement. Secondly, this is a *lamppost in the distance* statement students could recall in case they were confused or needed to be reminded about what the gradient does. Even when we were on integration, I referred back to our "class tattoo" and students were able to echo the hallmark feature of the gradient without pause or confusion.

Being the only person in my mathematics education course whose student demographic was university students, a unique challenge I faced was extrapolating what I was learning to a university classroom rather than a K-12 setting. To help bridge that gap, I have participated in the Mathematics Department's teaching seminar. In this seminar, we discuss recent publications on pedagogy and share teaching practices and methods that we can implement for the college demographic. I became more familiar with online mathematics tools such as Geogebra and Mathcha.io through this seminar and have been using these software since.

The teachers whom I have had captivated me beyond mathematics and consequently have influenced how I view teaching. Dr. Clifford taught me how to explore, survive, and thrive in a jungle. Mr. White assured me it was okay to be upset when I was stuck. My eighth-grade mathematics teacher showed me that failure did not dictate my trajectory, but set me up for success. My goal is to be an effective mathematics professor, but I hope to also be an educator who further teaches students meaningful life lessons using mathematics.