Statement of Teaching Philosophy

There are two key principles that form the foundation of my teaching: the use of **active** and **inquiry-based learning** (IBL) techniques, and a focus on creating an **empathetic, inclusive and equitable learning environment**. I use the former to *engage my students in critical thinking* about mathematics, and I use the latter to *encourage and inspire my students to reach their mathematical potential*. As an educator, I work with students from all backgrounds, including honors students, first-year students, and students from underrepresented groups in STEM, and I have found these principles to be useful in teaching at all levels of mathematics, from first semester calculus to graduate-level mathematics. These principles shape how I have designed my courses, ranging from large calculus courses, to small proof-based courses, to training undergraduate TAs in how to teach mathematics.

Active and Inquiry-Based Learning

"*The only way to learn mathematics is to* do *mathematics.*" - Paul Halmos

I use inquiry-based and active learning techniques to make my classroom a welcoming environment where my students are encouraged to actively engage with and think critically about the course material. I emphasize to my students that *communication* and *collaboration* are essential to doing mathematics, and that in particular, mathematics is about *asking questions*. Moreover, I teach my students the art of asking questions: namely, how to use questioning as a tool to clarify concepts, to stimulate new ideas, and most importantly, to communicate mathematics.

In my courses, I use questions to guide and augment lectures. I typically design lectures around a motivating question, and I use these questions to give context to the formulas, theorems, and proofs. I also use questions during lecture to check for student understanding: after introducing a concept, I will give a problem for them to attempt. With these problems, I use think-pair-share: that is, I encourage my students to discuss their strategies and answers with their neighbors, before asking a student to share their ideas with the whole class. I've found that these checks keep them engaged, and also gives my students a voice in the classroom.

I structure discussion sections as collaborative problem solving sessions. In a typical discussion section, I assign my students a two-stage quiz. In the first stage, the students attempt the quiz individually, and in the second stage, they work together in groups of 4-5 to discuss their work and complete the quiz. I've found that this format emphasizes the learning process over getting the correct answers, and reinforces the importance of collaboration in mathematics, as it empowers my students to become resources for each other.

Another way I emphasize critical thinking and collaboration in my courses is through assignments I call "Challenge Problem Reports". In these assignments, I give my students a problem set that explores a (real-world) application of the course content. Previous problem sets in my multivariable calculus courses have included investigations into PDEs and the Laplace equation; as well as studying the Möbius strip as an example of a non-orientable surface.

These assignments emulate how mathematicians think about and do mathematics. My students are encouraged to collaborate and discuss their solutions, and they have a week to individually submit a polished report on their solutions. These reports are graded on not only the correctness of the mathematics, but also on how they explain their mathematical ideas. Moreover, they have the opportunity to reflect and make revisions after the first report is graded. I've found these assignments to be successful in teaching my students how to communicate mathematics, as it gives them the opportunity to think about, discuss, and explore mathematical ideas.

When mentoring students, I also adapt these techniques to build and develop my student's mathematical confidence and maturity. In a typical meeting, we begin by having the student explain

their assigned reading, or present a solution to a homework question. However, I also emphasize to my students that they can (and should) bring questions and/or partial solutions, since asking questions is an essential part of the learning process. Furthermore, I focus on helping my students develop the ability to have productive mathematical discussions, even if they are confused. To do so, I use questions as a way to clarify concepts and guide discussion. For example, I might ask them to think about examples, and explore what a theorem might say about that example, or I might ask them to think about the hypotheses of a theorem, and how it might generalize (or whether counterexamples might exist). In this way, I can help my students develop the skills to flourish mathematically.

Empathy, Inclusivity and Equity

"Everyone can have joyful, meaningful, and empowering mathematical experiences." - Federico Ardila

My use of active and IBL methods is reliant on my focus on creating an inclusive and equitable learning environment where *all* students feel welcome to voice their questions and ideas. I build rapport with my students by getting to know them as individuals, which allows me to adapt my teaching style to their knowledge and needs. I can then rely on that rapport to strike the right balance between encouraging my students to struggle productively and providing the guidance that they need.

I build community on the first day of class by guiding a discussion about the broader context of the course material. This immediately gets my students comfortable with sharing their ideas and asking questions, and allows them to get to know their classmates. Moreover, in this discussion, I emphasize to my students the importance of mathematical collaboration, and I also encourage them to support and rely on each other to succeed. This classroom culture is reflected in my student evaluations: most recently, in Math 94, *my students mentioned they felt extremely welcome in seeking help in or outside of the class* (average 8.5, median 9, on a scale from 1-9).

Throughout the course, I also actively work to counteract any inequities that might arise in the classroom. For example, I use low-stakes assessments to track student participation and engagement, and I take the initiative to intervene and reach out to my students before they are at risk of dropping out or failing. This is especially important in terms of equity, as students from underrepresented groups might struggle with asking for help. In my Math 94 student evaluations, *my students felt that I was concerned about student learning* (average 8.75, median 9, on a scale from 1-9). By demonstrating that I care about their success, I get my students invested in the learning process, which in turn helps them to reach their mathematical potential.

Concluding Remarks

Teaching and communicating mathematics is an important part of my mathematical identity, and I value the impact that I have as an educator. From my teaching experiences, as well as my continued engagement with pedagogical development and research, I have found that my emphasis on active and inquiry-based learning techniques, as well as my focus on empathy, equity, and inclusivity, improves the learning experience for students at all levels, regardless of the systemic barriers that exist due to race, gender, socio-economic background, or cultural identity. As an educator, my goal is to break down these barriers, and to use mathematics as a tool to inspire, affirm, and empower my students.