Teaching Statement
Melanie Dennis

As an instructor, I focus on three main goals to engage my students’ mathematical potential and inspire collaborative, student-led learning. My first goal is helping my students to engage and actively participate in class so that they focus better, retain more knowledge, and feel ownership and investment in the class. My second goal is to help them learn how to do math independently so that they can approach math with more confidence. Finally, I prioritize making students feel valued and comfortable in class. Over the last two years, I have incorporated these goals into four different classes. As a primary instructor, I taught Calculus with Algebra, a course covering pre-calculus through derivatives; Calculus of Vector-Valued Functions, a multi-variable calculus class; and Topics in Algebra, an abstract algebra class that also covered introduction to proofs. I also co-taught Introduction to Combinatorics.

To keep students engaged and thinking critically, I have incorporated active learning into each of my courses. I have students work in small groups on problems and discussion questions that either apply what we found in lecture or prompt what we will cover next. While they work, I answer questions, listen to discussions, check for misunderstandings, and ask motivating questions. With active learning, students can work at their own pace and use the problem portion of the class to solidify material. This is particularly helpful for students with disabilities that require more time to absorb and understand material. Additionally, students who feel intimidated to ask questions in front of the whole class can ask me personally during the problem session. As a woman in math, I often did not ask questions in class because I felt judged by the men in the class. Problem sessions help mitigate judgement and anxiety since students can ask questions without the entire class listening.

I have used three different models of active learning to suit class size and content. In my calculus with algebra and abstract algebra classes, as a result of the sheer quantity of material, both classes were lecture-based, with five minute sessions consisting of a single problem spaced throughout each lecture. I used a second model in multi-variable calculus, where I lectured for about half of each class period and left the other half for active learning. Finally, as a graduate learning fellow co-teaching combinatorics, the vast majority of class was active learning, with ten minute lectures at the beginning of some classes to make sure everyone understood the definitions, and many classes having no lecture at all. In all of these classes, students reacted positively, reporting in evaluations that “group work questions were one of the most effective parts of the course.” Even in the more lecture-based calculus with algebra class, most students liked the active learning components, with one student writing that “the mixture between lecture and discussion definitely allowed for more constructive learning. We were able to question and explore concepts deeply.”

In addition to helping students be engaged in class, I also use active learning to help students do math independently. In the combinatorics class that I co-taught, we prepared a series of guiding problems that helped students develop each new combinatorial technique. We prompted students with motivating questions so that the students discovered each of the techniques on their own. In my abstract algebra class, students learned about applications of abstract algebra using group projects. The students picked and researched any topic using abstract algebra, culminating in an individual paper and 25 minute group presentations to the class. These projects were extremely student-driven. Many students reported that the structure of the classes bolstered their confidence in doing math on their own. One student reflected that the multi-variable calculus class deeply impacted their academic experience, writing, “I really feel confident about my math abilities.”

Beyond active learning, I take several measures to make students comfortable in class. From day one, I encourage students to ask questions, even if they should know the answer or I had already
answer thirty seconds before. I never gloss over student questions, but instead answer them thoughtfully, and follow up after class. Student evaluations indicate that this method works, with one student writing that “she created a space where I felt comfortable asking questions without fear of getting stuff wrong or sounding stupid.” I use class problem solving to build this atmosphere. For each set of material, I think of questions that I expect the class to have and give time for people to ask them during class. If nobody does, then I ask the questions to the class at large. Once someone answers, we reason through as a class what would happen if the given answer were correct, and either conclude that the answer makes sense, or find a flaw that not only shows that the answer is wrong, but why it is wrong. I highlight pieces of answers that are correct or almost correct, both to encourage students to give answers in the future, and also to institute a check on myself to avoid dismissing answers from minority students due to implicit bias. Addressing questions not only helped students feel more comfortable, but also helped them understand the material better. One student wrote in an evaluation that “the way she can manipulate questions and make examples on the spot to explain concepts is one thing that helped me a lot.”

In addition, I also get to know my students personally. I require students to come by my office hours in the first week so that they know where my office is and feel comfortable there. I always ask how they are doing outside of class, and many students end up staying to chat about how their term is starting up. A student’s performance in class is often intimately related to what is going on in the context of the rest of their life, and knowing what some of that context is helps me tailor the class to best teach each student. Many of my students come from diverse backgrounds that come with challenges that I have not personally experienced. Asking about students’ lives outside of class helps me understand their difficulties the best that I can. I have talked with many students about how family emergencies, difficult classes, current events, mental illnesses, and bullying have all impacted how they are able to manage their time and emotions. By individualizing my responses to my students based on their needs, I aim to support all of my students, including women, minority students, and students with disabilities, and encourage greater confidence and participation in math. My goal is that students feel welcome and supported to seek help, whether math-related or not, outside of class.

As an example of my three goals being realized, these teaching approaches altered the trajectory of two students in my abstract algebra class. They began the term at the bottom of the class, and hardly ever volunteered to ask or answer questions. Never having seen proofs before, they were extremely intimidated by tackling a much more abstract form of math than they had ever encountered, and simultaneously learning to write proofs rigorously. Then, partway through term, I grouped them together, walked them through many correct proofs, and had them work together to critique each other’s proofs. As a result, they decided to do their group project together on Pólya enumeration, becoming experts in the class on it as the only students studying that topic. Each time they explained new discoveries to me or their classmates, they grew more confident, and even began answering questions in class without prompting. At the end of the term, they gave one of the best presentations of the class, and their final papers had complete and rigorous proofs. One of them told me that, although he had not thought he would do well in the class, he thoroughly enjoyed it and was excited to continue taking more math classes.

Successful learning outcomes like theirs have reaffirmed to me the value of active participation, independent learning, and fostering a welcoming environment in the classroom. In my future teaching, I hope to apply this model for teaching both early calculus courses and more advanced courses. I hope to empower my students to take their math education into their own hands.