Teaching Statement | David Mehrle

I have two main teaching principles. The first is to ensure that students are active participants in their own learning. The second is to make mathematics accessible to any student.

When I say that I aim to ensure that students are active participants in their own learning, I mean that I employ lots of active learning strategies in my classrooms. At the university level, mathematics is often taught in a lecture format. While this is effective at information transfer, it is significantly less effective at building comprehension and enabling students to analyze and apply the mathematics we teach. In other words, the lecture format doesn't give students the ability to solve problems.

When I say that I aim to make mathematics accessible, I mean that classrooms should be inclusive spaces where students always feel comfortable asking questions and participating. I also mean that I work to meet students at their level, regardless of background. Too often, math is perceived as arcane, algorithmic, individual, and difficult to engage with. In reality, math benefits from a diversity of ideas, different modes of thinking, and collaboration.

Creating Active Classrooms

To build an active classroom, I structure my lessons to encourage practice and participation and design classroom activities that promote engagement with the material. In terms of lesson structure, I often employ a format called *flipped classroom*, where students are asked to learn some material outside of class and then practice it in the classroom, as opposed to listening to a lesson in class and doing homework on their own. When I taught calculus one summer, I devoted at least two out of five classes each week to active problem-solving sessions. Prior to each problem session, students had a short reading assignment to introduce the concepts they would practice in class. In class, the students worked in groups to solve problems and presented their work to their peers. While the students worked, I circulated around the room observing, answering questions, and giving hints and encouragement. These problem sessions gave students an opportunity to engage with the material in an environment where they could receive quick feedback, and allowed them to work in groups and learn from their peers. This active approach increased both comprehension and confidence. As the class went on, the students became more engaged. I saw more hands raised to answer questions, and students volunteered to share their work more often. By the end of the summer, students from other sections were attending my class because they found the problem-solving sessions helpful.

I have since adopted this approach in other classes, and nearly all of my lessons now include components of active learning. Although students have homework to practice, doing problems in class has several advantages. It gives students personal and immediate feedback, reinforces important skills, and allows them to work in groups and learn from their peers. This kind of engagement is essential to the learning process because it asks students to think about the process of problem-solving.

To build an active classroom, I use a variety of activities. Here are a few examples. When assigning group work in class, I will give one handout per group instead of one per person. I find that this simple change creates a lot more discussion and cooperation among students. To close out group activities, I ask each group to put an answer to one question on the board, which we then review as a class. Alternatively, I use the *jigsaw* format, where each group is given a different problem and then, after shuffling the groups, students explain their answers to their new group. I think it's useful for students to explain their process and hear how their peers solve problems. During the times when I do need to demonstrate something on the blackboard, I keep the class engaged by asking questions in a *think-pair-share* format or polling the class. Think-pair-share questions ask students to think through the question by themselves, then share with their neighbors, and finally share with the whole class. When polling the class, I offer several answers and ask students to vote with their eyes closed. With their eyes closed, each student has to think through the problem themself — and it saves them from any potential embarrassment of picking the wrong answer.

I also have experience with a very different kind of active learning: mentoring student research projects. The most challenging — and some of the most rewarding — teaching I've done was as a mentor for a summer undergraduate research program. In this program, the students quickly became more knowledgeable about their projects than I was. Rather than guiding students to an answer, as I might have done for a calculus class, I found it more effective to work with the students as peers.

Together, we would answer their questions by bouncing ideas back and forth, reading references, sharing intuition, or simply talking about why they were stuck. Throughout this process, I got to know the students and watch them develop from novice to expert.

My approach to mentoring has since informed how I teach lower-level classes, where I work together with students instead of giving out answers. Although I can give more hints in calculus, I will let students explore a dead-end until they realize it won't work. When working with students individually, I ask them to explain the work they've done so far. I believe that this ultimately leads to better learning outcomes, as students are more likely to remember why they got stuck and avoid it in the future.

Making Math More Accessible

When aiming to make math more accessible, I think both in terms of the learning environment and the material. My students have a diverse mix of backgrounds, both personally and mathematically. Because my lessons involve active participation, it is especially important that anyone feel comfortable and welcome. I want to empower all of my students to ask any question, voice their ideas, and participate.

I intentionally cultivate an inclusive learning environment. At the beginning of the semester, I learn my students' names and pronouns to make them feel welcome. When I design activities, I give a mix of problems ranging from introductory to challenging so that everyone has something to work on. I avoid describing anything as "easy" or "trivial" as we so often do in math; what is easy for one may not be easy for others and calling it trivial may be alienating. When a student makes a comment or answers a question, I find aspects of their work that are right or nearly so, and give them praise for partially correct work. I far prefer to say "that's on the right track," rather than "that's wrong." When working with students individually or in small groups, I always either crouch down to eye-level or pull up a chair. This body language conveys that I am not in a rush to move on. Instead, I am there to help work with them.

I also aim to make the material accessible to any student. One way I do this is through active learning; problem sessions allow students to work at their own pace with personal feedback. Another way is by helping students be comfortable with finding new ideas difficult at first. To do so, I share stories of my own struggles with math. I think it helps to hear that even mathematicians find it difficult sometimes. Helping students work past this difficulty and achieve something they thought was impossible for them is one of the most fulfilling parts of teaching for me. For instance, last Fall I was the teaching assistant for *Mathematical Explorations*, a class for non-majors. The class is designed to get students to think logically and rationally about the math found in everyday things, like origami or floor tilings or flipping a coin, with the goals of improving numeracy and breaking down barriers to mathematics. The typical student in this class brings a lot of math anxiety and bad experiences with prior math classes. In addition to sharing stories of my own difficulties with math, also asked students to keep journals and responded to them regularly. By creating a dialogue between students and mathematicians where their ideas were respected, we dispelled many misconceptions about the subject. The feedback reflects this; to quote from one evaluation: "*When I enrolled in this class, I had no idea how much this opportunity to connect, collaborate,* [and] *surprise myself about my own mathematical abilities would mean to me. Truly, thank you so much*."

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In the future, I hope to teach more classes for non-majors like *Mathematical Explorations*. I would also be excited to bring active learning strategies to upper-level undergraduate courses, and to refine my teaching in calculus or other lower-level courses. Finally, I would be thrilled to mentor more undergrad research projects. Much of my research involves Mackey functors, which are fundamentally composed of a finite collection of groups and homomorphisms — things that you learn in undergraduate algebra. I have a few research questions that would be appropriate for motivated undergrads.

I am constantly updating my teaching practices as I learn more about pedagogy, teach new classes, and discover what works and what could be improved. I value feedback, whether from students, peers, or other instructors. I make sure collect student feedback mid-semester, so that I can make course corrections if necessary. After each lesson, I keep detailed notes on ideas to improve or things to change for next time. The strategies that I use to promote accessibility and active learning have grown out of these reflections. Nevertheless, I believe there is still a lot of room for me to grow as a teacher. I bring this commitment to a reflective teaching practice, together with all of my previous experience in the classroom, to my future career as a teacher of mathematics.