Teaching Statement – Rachel Arnold

I view the mathematics that I teach as a playing field on which students develop as resourceful, analytical thinkers. As I help students shed rigid, formulaic mathematical thinking, they experience mathematics as a broadly relevant model of logically structured problem-solving. The skills this model fosters enable students to tackle problems flexibly and creatively.

I begin this process on the first day of class with a seemingly unrelated activity. I ask students to answer in groups the question, “If you are driving somewhere that you have never been before, how do you prepare for your trip?” Here are some actual student responses:

Student A: *Know where you’re going so you know what to bring.*

Student B: *Build in extra time because you might get lost or need to stop.*

I then ask students what their responses suggest about problem-solving and proof-writing.

This activity is a first step in encouraging students to use desired conclusions to motivate their exploration of paths toward those conclusions. Just as you wouldn’t begin a trip by choosing turns at random, you wouldn’t begin solving a problem or writing a proof by arbitrarily piecing together hypotheses. Instead, as student A indicates, the desired conclusion of the problem or proof reveals which aspects of the given information are pertinent. And, as student B suggests, one must allow time to explore different thought paths and even take breaks. Without the strategies highlighted by both students, how can one make good choices from among many potentially relevant givens and their implications?

The exploration of possible solution paths is supported by asking questions—an activity that is central to learning. I establish inquiry as a social norm in my classroom. Together, students and I develop mathematical ideas via a back-and-forth conversation undergirded by my leading questions. I also create ample space for students to ask their own questions. Discussing ideas in groups intermittently throughout class offers an important opportunity for students to formulate their questions in real time. Moreover, listening to group conversations enables me to ask questions of the whole class that are designed to tease out misconceptions and encourage students to overcome their learning obstacles.

Mathematical reasoning based on clearly formulated conclusions combined with questions about how to reach those conclusions is analogous to the reasoning necessary for solving real-world problems. Because such reasoning requires sense-making, much of my teaching activity centers around developing this skill. When introducing a new definition or theorem, I prompt students to discuss in groups the high-level concept of the mathematical statement at hand. Sometimes, I give students colloquial vocabulary terms and ask them to rewrite a definition using those words. I also use geometric visuals to support understanding of formal mathematics. I discuss with students the interplay between their calculations and the big-picture ideas. Because I encourage students to frame their approach with high-level intuition, they are better able to push through any algebraic roadblocks encountered in low-level details. Their conceptual understanding supports their suggestion of new paths toward the solution.

Ultimately, I remind students that solving problems is messy and takes time. To transform their self-doubt into confidence, I draw explicit attention to the productivity afforded by their struggles. They learn to assess their progress relative to where they began rather than whether they’ve reached the conclusion. I empower them to suggest and explore ideas, even if their ideas are not yet fully formed. Finally, I emphasize that mistakes often reveal new paths toward the solution—initial intuition leads to the recognition of misconceptions and the development of new intuition. This process propels effective problem solvers toward the desired conclusion.