Learning mathematics within conversation

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I find great fulfillment in teaching and strive to help students stretch themselves mathematically. I enjoy the give and take of mathematical discussion in the classroom because students routinely think about a concept in new and different ways which are interesting to me. The times I can creatively address student questions and conjectures while communicating my knowledge of a mathematical idea are extremely rewarding. In the classroom setting, I hope to challenge students beyond their comfort level and constructively disturb their modes of thinking in order to induce fresh mathematical thought.

In order to foster student understanding, I work to expand student notions of what mathematics is and what it can be. I push back against conceptions of mathematics as a just-add-water recipe based on a box cake mix. Rather, I work to help students realize that mathematics is about getting to know individual ingredients and building an understanding of how these ingredients can be combined in appropriate and creative ways to make an interesting dish. With this culinary comparison in mind, I focus my classroom energy in two main areas. First, I motivate the topics under discussion by emphasizing pictorial, technological and historical contexts in which a mathematical idea reveals itself. Providing this context helps students understand the ingredients more deeply. Second, I lead discussions to establish the reasons for procedures and facilitate student verbalization of the connections between distinct procedural techniques. Acting as the conduit between the students and the mathematics helps them to see how the different ingredients relate to one another.

In preparation for class, I give equal weight to the ideas under consideration and the procedures needed to execute the ideas. To keep this balance, I write questions that motivate students to think about the concept, process, and structure of a mathematical notion. Whenever possible, I ground a new calculation technique in its logical underpinnings and emphasize connections

to other areas of general knowledge. If appropriate for the concept, I engage students in activities which give them experience performing mathematics through a mix of experimentation and logic. In these settings, I use technology as a springboard towards generalization and emphasize the transition to abstract representations which tell us why a statement is true. Through this method, I hope to model critical thought and increase student ability to draw valid conclusions from observations. Although the mathematical maturity of students varies within a given course and across courses, I use this approach because it strengthens student understanding of how concepts and procedures are interrelated.

While teaching, I formatively assess student understanding and make classroom decisions based on feedback from students. In parallel, I give students time and space to establish their own thoughts about the mathematics we discuss. During classroom meetings, I prompt students to describe how they are thinking about mathematical ideas as they learn. Involving students in this reasoning process allows for at least two benefits. One, the student who verbalizes their idea must formulate their understanding of the concept in a way that I and the other students can comprehend. This step is beneficial for the learning process of the speaker. Secondly, when other students listen to a peer's description of an idea, their own notions of the concept are either challenged or confirmed. This dynamic leads quickly to student creation of conjectures, examples and questions. As students become familiar with this structure, the classroom becomes a lively place where students actively engage with mathematical ideas by clarifying and extending their own understanding.

During lectures, I emphasize connections between logical approaches that are common to different mathematical areas so that students may build a more robust network of understanding. I link representations of ideas using mathematical correspondences and trace the evolution of examples as contexts change. By emphasizing the structural relationships between ideas, I hope to increase student flexibility of mind and encourage new ways of

discovering a proof or solution. When assessing student knowledge and understanding, I require precision in both calculation and justification so that learned procedural skills are linked to writing and communication skills.

I have been a teacher of middle school students, high school students, college undergraduates, K–12 classroom teachers and graduate students. Through this time, I have taught with excitement and humor in the classroom so that students see mathematics as a subject worthy of their time and attention. I am grateful that over the course of time, my students see their reasoning skills improve, work their way through problems with less assistance and ask better questions. I truly appreciate the challenge of helping students understand mathematical ideas.