5th Grade: Tessellations

Over the semester, I worked on purposefully crafting questions to elicit, probe, and connect students' ideas during a discussion. These ideas were presented in our third class meeting and reinforced in our readings from Chapin's *Classroom Discussions* (2003). We talked explicitly about asking questions to elicit students' initial thoughts and solutions; asking questions to probe students' answers when the teacher does not understand what the student is saying, when he or she wants to verify that right answers are supported by correct understanding, and when he or she wants to understand the thinking behind an incorrect answer; and supporting students to make connections between solutions, methods, models, or mathematical concepts.

The discussions that transpired in my math lesson reflect my ability to skillfully ask purposeful questions when leading a whole-class discussion. In Discussion A, I began by asking students to tell me something they noticed about the Penrose tiling (00:40). By asking a broad question all students could answer, I was able to elicit initial thoughts from many of my students and attend to the learning of all students. Seven students were able to contribute their ideas about this design and many others had their hands raised. I also used "thumbs up or thumbs down" and "nod your head if…" questions to elicit answers from the entire class at once (07:48). This allowed me to get a sense of each student's thinking, even if he or she was uncomfortable participating in the whole-group discussion. Another series of questions meant to elicit answers raised some interesting ideas: "Do you see any holes in this design? Are there any holes between the shapes? And are there any overlaps between the shapes?" (3:34) The majority of students believed the shapes in the Penrose tiling overlapped, so this allowed me an opportunity to probe students' wrong answers to understand their thinking. "Ryan, will you come show us where you see overlaps? … So where are they overlapping?" I was able to uncover a general misconception that the shapes I was referring to were not the smallest rhombi in the tiling but other shapes multiple rhombi formed. This was an important point to clear up! In Discussion B, I probed Laura's correct answer to check for understanding: "I would like you to raise your hand and tell me if the triangle tessellated. Did the triangle work, yes or no? Laura, did it work, yes or no? [Yes it did.] How do you know? [Um, because I could put three of them together and they didn't overlap and they didn't leave a gap.]" (23:26) Through questioning, I was able to verify that Laura could use the definition of tessellation to support her answer. Another instance of probing a student's answer occurred with Evan: "Evan, do you have an idea? … So you want to measure the angle? How would we measure the angle?" (30:44) I rephrased his contribution to see if I understood what he was trying to say. Lastly, I used questioning to support students in making connections. In Discussion B, I focused on helping students connect what they already knew about polygons and angles to the new concept of tessellations (27:26). I used questions to lead students to conclude that a regular polygon will tessellate if its angle measures are a factor of 360º: "So how many degrees in a triangle? [360, 180] How many degrees in a triangle? [180, 60, etc.] Hold on. How many degrees *total* in a triangle? [180] Good, and are all these angles the same or different? [The same.]… So what Avital said is that we know that 180º are in a triangle and, since they are all the same, we can just divide 180 by 3. How much is one angle? [60] So can we add 60 to itself or multiply 60 by something to get 360? What would we multiply 60 by to get 360? Gabe, what would we multiply 60 by?" We then extended this conversation to observe and prove why a square tessellates and a regular pentagon does not.

This was an advanced concept for my fifth graders, but, through carefully sequenced questioning, they were able to use their knowledge of angles and polygons to figure out why certain regular polygons tessellate and others do not. The connections they made between these concepts helped them to succeed in this lesson.