Goldilocks Discourse — math scaffolding that’s just right

By Rachel Dale and Jimmy Scherrer

The Common Core introduces new requirements for mathematics literacy and those call for instructors to do neither too much nor too little scaffolding to acquire mathematical practices.

The Common Core State Standards has brought a sharp shift in what it means to be mathematically literate. Becoming mathematically literate is now as much a matter of acquiring mathematical practices as of acquiring any defined set of content standards (Scherrer, 2015). To meet this challenge, teachers are implementing more cognitively demanding tasks. While this is encouraging, evidence suggests that there can be a substantial difference between the task as written and the task as implemented (Stein, Remillard, & Smith, 2007).

Consider the following three vignettes; they are of three different teachers implementing the same task in three different ways.

The task in the vignettes is based on Common Core 3.NF.3: Explain equivalence of fractions. In each vignette, the following task is written on the front board:

Tyler and Sam order personal-sized pizzas. The pizzas were the same size, but Tyler’s pizza was cut into eighths, and Sam’s was cut into tenths. Tyler ate four pieces of his pizza. How many pieces did Sam have if she ate the same fraction of her pizza? Explain your work with words, pictures, or numbers.

Vignette #1: Mrs. Roberts

Mrs. Roberts reads the task aloud and asks students to get with a

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partner to solve the task. Mrs. Roberts starts to circle. The first group she encounters has written the fractions 5/10 and 4/8 on their paper. One of the students announces that Sam had to have eaten 5/10 because of doubles. He explains that, “4 doubled is 8, so 4 is half of 8. Five doubled is 10, so 5 is half of 10. These are equal fractions.” Mrs. Roberts notices that his partner is confused by the explanation. She decides to let them figure it out and moves on to another group that is arguing about the task. As she gets closer, Mrs. Roberts hears them arguing about the type of pizza Sam and Tyler ate. They are debating if Tyler and Sam are eating pepperoni or cheese pizza. Mrs. Roberts is happy that the students are interested and moves along. Mrs. Roberts begins to notice that many groups are drawing circles to represent the pizzas. However, they’re having difficulty partitioning the circles into equal pieces. She thinks it is best to let the students struggle; thus, she decides not to say anything. As the class comes to an end, Mrs. Roberts decides to assign 20 equivalent fraction problems for homework.

Vignette #2: Mr. Mueller

After reading the task to students, Mr. Mueller begins to walk around and check on groups. The first group is solving the task by drawing pictures. Mr. Mueller notices they have drawn two pizzas but made the mistake of cutting both of them into eight pieces. He tells students they haven’t divided the pizzas correctly. Mr. Mueller picks up a student pencil and draws two equal-sized circles. He divides one into eighths and one into tenths. The students thank him as he moves to another group. Students in this group have written 4/8 = ?/10 but are unsure how to proceed. They complain to Mr. Mueller that they don’t know how to compare fractions with different denominators. The following interactions take place:

Mr. M: It might be helpful if you draw the two pizzas.
Student: I don’t get it.
Mr. M: Draw one circle and divide it into eight equal pieces. Then draw another circle the exact same size and divide it into 10 equal pieces.
Student: (As instructed, the student draws the two circles and then asks): Like this?
Mr. M: Yes. Now the one with eight pieces is Tyler’s pizza. So color in four slices. Now you have to determine how many pieces of Sam’s pizza would give you the same amount that you just colored.
Ms. Florin:
How might you be able to convince me that 4/8 equals 5/10 without using numbers?

The students think and discuss for a moment and then decide to draw the pizzas to show the fractions.

The next group Ms. Florin visits is talking about their favorite pizza. She immediately refocuses them on the task and asks one student to restate what it is they are trying to find.

Ms. Florin notices that another group is having a difficult time partitioning circles into equal pieces. The following interactions take place:

Ms. Florin: What are the circles meant to represent?
Student: Pizzas.
Ms. Florin: How is that going to help you solve the task?
Student: We were going to compare the circles.
Ms. Florin: Say more about that.
Student: If we can get this circle into 10 equal pieces, we could see how many of these pieces would equal the four pieces that we shaded in the other circle.
Ms. Florin: I see. If you are having a difficult time dividing the circle into equal pieces, perhaps you can apply your method using a different shape.

As Ms. Florin walks away, she can hear the group discussing squares and rectangles. She decides to let students work for five more minutes before bringing the class back together for a whole-group discussion.

Goldilocks Discourse

Taken together, the three scenarios presented in the vignettes illustrate a case of what we call “Goldilocks Discourse.”

Too little scaffolding: unsystematic exploration

In the first vignette, Mrs. Roberts avoided providing any substantive guidance. Many of her students struggled, yet Mrs. Roberts was unprepared, or at least unwilling, to address these difficulties. This too little scaffolding is a common occurrence in the classrooms of teachers who are attempting to be less didactic (Smith & Stein, 2011).

Too much scaffolding: constraining opportunities to persevere

In complete contrast to Mrs. Roberts, Mr. Mueller in the second vignette jumped too quickly to save his students. Whenever he sensed that a student was...
struggling, Mr. Mueller suggested a solution strategy, modeled a solution path, or simply solved the problem for students. This desire to not see students struggle is very common in the culture of U.S. teaching (Stigler & Hiebert, 1998).

The right amount of scaffolding: productive struggle

Although there is no perfect mathematics lesson, we use the third vignette, Ms. Florin’s class, as an example of teacher-student interactions that contain just the right amount of scaffolding. Similar to Mrs. Roberts and Mr. Mueller, Ms. Florin circulated the classroom as students worked. However, her interactions with students were markedly different from the other two teachers. Unlike Mrs. Roberts, Ms. Florin did not hesitate to get involved in the groups’ discussions. However, unlike Mr. Mueller, her interactions did not reduce the cognitive demands of the task. Rather than suggesting solution strategies, Ms. Florin asked questions that forced students to think about their solutions and possible alternatives.

This approach of Goldilocks Discourse is an example of productive struggle (Kapur, 2014). The key to making student struggle productive is providing the right amount of scaffolding, like Ms. Florin did in the third vignette. Scaffolding is often thought of as a strategy employed through the structure of a task. But scaffolding plays another important role: getting students to reflect on their work. Asking a question that gets students to reflect on their work — rather than just giving them answers — maintains the cognitive demand of the task and lets students struggle with ideas that they otherwise could not resolve on their own. Furthermore, evidence suggests that this scaffolding strategy facilitates deep learning (Reiser & Tabak, 2014).

In summary

The vignettes presented here illustrate how the same mathematical task can be implemented in very different ways, leading to very different cognitive demands. The term Goldilocks Discourse provides a common referent when gauging the amount of scaffolding we provide our students. Too little scaffolding leads to student frustration and unsystematic exploration. Too much scaffolding constrains students’ opportunities to learn how to persevere in solving challenging tasks. Just the right amount of scaffolding lets students productively struggle with content that they otherwise could not access.

References


