Building a Discourse Community: Initial
Although it is not a new idea, discourse continues to be a topic of discussion among teachers, teacher educators, and researchers in mathematics education. NCTM (1989; 2000) and the Common Core State Standards for Mathematics (CCSSM 2010) describe mathematics classrooms as discourse communities in which whole-class discussions give students opportunities to share their thinking. In such discourse communities, different problem-solving approaches become explicit topics of conversation that can challenge, extend, and support all students’ initial practices.

Work toward building a strong foundation for future classroom discourse by asking students to solve the open-task Fencing for a Dog Pen problem.

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understanding. Further, opportunities to engage in discourse support students in becoming more confident problem solvers (Ball 1993; Kazemi and Stipek 2001).

Collectively, mathematicians have learned quite a bit about discourse. A substantial body of research identifies teachers’ and students’ roles in small-group and whole-class discussions and the intentional planning that is involved in guiding discussions that are consequential to students’ learning (Cobb, Yackel, and McClain 2012; Lampert and Blunk 1998; Smith et al. 2009). Existing research clearly describes what quality discussions look like and the instructional practices that serve to design and facilitate such high-quality discussions (Smith et al. 2009). Our focus in this article is to consider initial steps in building discourse communities like those that the research describes and that the instructional recommendations envision.

As mathematics teacher educators, we work with preservice teachers who are in their first year as interns teaching in a middle school or high school. Consistently, we observe nonverbal cues and hear comments during coursework and in field-placement conferences about how daunting the teachers find the challenge of engaging students in discussions about mathematical ideas and processes. The majority of preservice teachers comment about how far they and students have to go to “get there” in terms of discourse. At the same time, many preservice teachers make it clear that they value discourse and would like to foster deep and thoughtful discussions in the classrooms in which they teach. For these reasons, we have found it helpful to discuss manageable initial steps that can build a strong foundation for the future development of classroom discourse. We discuss four key first steps that beginning teachers with whom we work have found helpful (see fig. 1).

**PRACTICE 1: USE A MORE OPEN TASK**

Much has been written about the role of tasks in supporting collaborative work and conversations in mathematics classrooms (Stein, Silver, and Smith 1998; Kabiri and Smith 2003; Lotan 2006). As this previous work suggests, task design and selection are important in facilitating productive discussions. We encourage preservice teachers to draw from existing tasks and modify them on the basis of their understanding of students’ thinking and prior experiences. We recently observed one preservice teacher, Ms. Brown (all teacher and student names are pseudonyms), pose the following task to her sixth-grade students:

**Example 1: A Revised Task**

**Fencing for a Dog Pen**

You have 60 feet of fencing to build an area for your dog to run and play.

1. What are three different sized pens that can be built? What is the area of each pen?
2. What is the area of the largest dog pen that you can build using this fencing?

Use a diagram and explain in words your answers to questions 1 and 2.

We were able to find a problem in a textbook that addressed the concepts of area and perimeter in a different way. The problem below in example 2 might have been the inspiration for the more open task that appears in example 1:

**Example 2: Textbook Problem**

Find the area and perimeter of a rectangle with length 20 feet and width 10 feet.
With some tweaking, original problems such as example 2 can be made more open in a process described by Kabiri and Smith (2003). We have summarized the key steps in this process in figure 2.

In our example, the Fencing for a Dog Pen task presented opportunities for students to use a real-world context as well as pictures and drawings to support and clarify their solutions. Further, the problem gave students a chance to engage in a problem-solving task that explores the relationship between area and perimeter, rather than merely calculating perimeter or area. The Fencing for a Dog Pen task “opens” the more closed task shown in example 2. In this way, the task offers more possible solutions and approaches for students to develop. With these relatively minor adjustments, the Fencing for a Dog Pen task served as a resource for discourse building because students were able to use their responses as contributions to a class discussion about the task. Students had more to say than only the solution to calculating the area in example 2.

One strength of open tasks is that they offer multiple entry points that allow students with a range of understanding and prior success in mathematics to engage with a task in some way. This engagement provides students with some kind of contribution to share during a conversation about the task. When students are able to contribute, even in a small way, to advancing the class’s mathematical thinking, they can become more confident over time in their ability to do and be successful in mathematics (McClain, McGatha, and Hodge 2000). Pattern tasks also allow multiple entry points and different approaches and solutions for students. In addition, these kinds of tasks provide a safe foundation for establishing norms and routines as well as building a discourse foundation (Smith, Hillen, and Catania 2007). In figure 3, we include helpful resources for open tasks, including pattern tasks.

**PRACTICE 2: SUPPORT THINK, PAIR, AND REVOICE/COMPARE**

For discourse building, we encourage preservice teachers to draw on a modified version of think, pair, share. This revised practice looks like this:

1. **Think:** Ask students to think about a problem and write down their solution or their initial thoughts and questions.

During our observation of the Fencing for a Dog Pen lesson,
Ms. Brown directed students to use think, pair, revoice/compare to discuss the second question about which pen design would yield the largest area. Students worked individually first in answering the question or in listing questions or initial thoughts if they were unsure about the solution.

2. **Pair**: Ask students to share their solution method and questions with their shoulder partner and to ask questions if they do not understand any aspect of what their partner has shared. The goal for students is to understand what their partner has shared.

During the Fencing for a Dog Pen lesson, we listened to one conversation between Abbey and Sue as each shared her own approach. Abbey explained that she thought of the pen as a rectangle with two opposite sides of one meter each. The other opposite sides were 29 meters each (see fig. 4). Sue summarized that she gave the dog pen a different kind of shape that was a square with all sides of 15 meters each. She also mentioned that the area she calculated was 225 square meters (see fig. 5). The conversation continued with Sue explaining that she used a table that helped her see that the square yielded the largest area (see table 1).

3. **Revoice/Compare**: As students continue to work in pairs, have them revoice their partner’s ways of thinking to each other. An extension is to ask students to find the similarities and differences between their two approaches or between two approaches presented to them.

As Abbey and Sue talked about both solutions, they moved from first discussing and revoicing their two approaches to comparing them. During their conversation, they commented that both their pens involved four sides but that Abbey thought a rectangular shape would give her dog the longest space to run, whereas Sue chose a shape that was more “spread out like a square.” Further, they brought up the fact that Abbey used a drawing to show her approach but that Sue used a table to show her thinking about a couple of different sizes of pens, leading up to the square pen. Their conversation also raised the issue of considering practical aspects of the problem, such as running space, in addition to the mathematics of calculating area.

This practice of think, pair, and revoice/compare promotes occasions for students to understand what it means to talk about math, beyond listing procedures that they used in solving a given problem. More important, it gives them a chance to listen and understand a peer’s explanation. In addition, this situation allows students to work out their role and ask questions in a less intimidating setting with one other student rather than the entire class. Then, while walking around the classroom and providing feedback, teachers can formatively assess students’ understanding of talking mathematically. After using think, pair, and revoice/compare for a period of time, teachers can then transition students to a whole-class discussion.

This illustration offers a glimpse of the kind of student conversation that can occur with the structure of think, pair, revoice/compare. We observed that students who struggled a bit more with the task were still able to participate in conversations, sharing their ideas and questions and also revoicing other students’ approaches. The compare extension

Students who struggled a bit more with the task were still able to participate in conversations and share their ideas and questions.
gives students a chance to analyze their solution methods. This analysis can suggest topics to consider further in a whole-class discussion.

**PRACTICE 3: OFFER THREE WAYS TO PARTICIPATE**

Many students in mathematics class have participated in whole-class discussions previously. However, the occurrence of whole-class discussions alone does not mean that discourse is meaningful for students. For example, research has offered illustrations of typical whole-class discussions; these are dominated by a pattern called an IRE (initiation-response-evaluation) interaction (Mehan 1979). IRE consists of the teacher talking with specific students in a script-like, predictable manner, focusing on students’ answers, with little or no student explanations of their thinking (e.g., The teacher begins: What is your answer to this problem? The student responds with his or her answer. The teacher responds with “good” or another evaluative term).

Clearly, the IRE pattern does not include opportunities for students to build on one another’s comments, which is a hallmark of effective discussions. One of the challenges that we hear from beginning teachers is how to encourage students to build on one another’s explanations as resources during discussions rather than making random or disconnected comments. The preservice teachers with whom we work have found it helpful to offer their students’ different ways to participate:

1. Ask a question about what you heard.
2. Restate what you heard in your own words.
3. Add on to what you heard.

Some students may not have had an opportunity to understand the learning practices (Cohen and Ball 2001) or ways to participate effectively in mathematics class. Therefore, an important part of discourse building is supporting students’ understanding of their role in discussions. We have found these three ways of participating to be a useful tool for beginning teachers as they build a discourse foundation. The three are general enough to be used in any whole-class discussion or small-group work focusing on a range of mathematical topics, and they are specific enough to provide students with concrete ways to contribute to discourse. The three ways of participating offer support to students as they learn about discourse, especially for those who struggle with mathematics or communication in general.

Revisiting the Fencing for a Dog Pen lesson after the *think, pair, and revolve/compare* time, Ms. Brown’s students participated in a whole-class discussion. The teacher drew on Abbey and Sue’s conversation to bring out some important issues for the class to consider. During the whole-class discussion, we observed students participating in all three ways, as encouraged by Ms. Brown:

- Farhan asked a question about the calculations for the area of Sue’s pen and Abbey’s pen. Toby asked Sue about how she determined that 15 would be the length of each side of the pen.
- Gretchen restated that to arrive at Abbey’s solution, she would take Sue’s pen and “pull it out to give the dog more room to run.”
- Michael added on to Gretchen’s

\[\begin{array}{|c|c|c|c|c|}
\hline
\text{Side} & \text{Side} & \text{Side} & \text{Side} & \text{Area} \\
\hline
5 & 5 & 25 & 25 & 125 \\
10 & 10 & 20 & 20 & 200 \\
15 & 15 & 15 & 15 & 225 \\
16 & 16 & 14 & 14 & 224 \\
\hline
\end{array}\]
revoicing by saying that the area for Sue’s pen was greater than Abbey’s pen but that Abbey’s pen “gave the dog a good place to run.”

In this illustration, the three choices of participating gave students concrete options while generating student contributions that sustained or increased the mathematical substance of the discussion. The fourth practice to which we now turn also supports students’ learning about what it means to participate in a whole-class discussion.

**PRACTICE 4: DEFINE A CONTRIBUTION**

In a whole-class discussion, students can offer a range of responses, from yes or no to specifying the steps and explaining why they used particular procedures in solving a problem. These different responses can influence how useful discussions are in providing students access to other solution approaches. Clearly, for discussions to be productive, student responses or contributions should be more than simple yes or no answers. Further, student responses that focus solely on solutions and procedures have limitations as well. Responses that include both procedures that were used and an explanation of why they were used can be the most helpful in supporting student learning. Such contributions give other students access to procedures and their rationale.

For this article, we define a quality contribution as an explanation that includes both calculational and conceptual discourse (Lampert and Cobb 2003; Thompson et al. 1994). This kind of discourse includes an explanation of the procedures involved in solving a task and the reasons behind the procedures. Consider this contribution from another student, Toby, who described an approach that he and his partner had shared:

> When we were thinking about the biggest area for the dog to run, we tried to think about the different sizes of rectangles and squares. So we listed the different sizes in order of the length and started seeing a pattern in the areas. We made a chart to remember what we did. There was only one kind of square. This way we didn’t have to calculate every area once we saw a pattern. The square gave the biggest area for the dog to run.

As we are working with beginning teachers, we emphasize that supporting students’ learning about a quality contribution is a process that is proactively guided by the teacher. The teacher supports students through explicit modeling, communicating what makes a quality contribution, and calling attention to moments when students provide a quality contribution.

**DISCUSSION AND CONCLUSION**

As already noted, all four practices shown in figure 1 create a foundation for discourse in the mathematics classroom. Through these practices, beginning teachers can support their students in understanding and taking on appropriate roles in discussions. As students learn how to participate in classroom discussions, they become resources for themselves and one another by explaining mathematical ideas and listening to the ideas of others.

For preservice teachers, these initial steps are a manageable way to start building toward a discourse community. However, another component is necessary to realize the full potential of discourse in mathematics.
classrooms. We contend that making adjustments and providing additional supports on the teacher’s part are also critical. This kind of improvisation involves a mindset that teaching includes identifying challenges that students may face in classroom discourse situations and offering the necessary supports to address these challenges. Therefore, in addition to these initial practices, we ask beginning teachers to consider the following two questions for every lesson:

- What challenges will your students face in participating in this classroom discussion?
- What supports are necessary to address these challenges?

Our work with preservice teachers in the area of discourse involves showing them how and why teachers (1) build on initial practices, (2) develop a mindset of identifying challenges, and (3) support all their students. In these ways, discourse then becomes an ongoing process rather than a destination.

BIBLIOGRAPHY


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