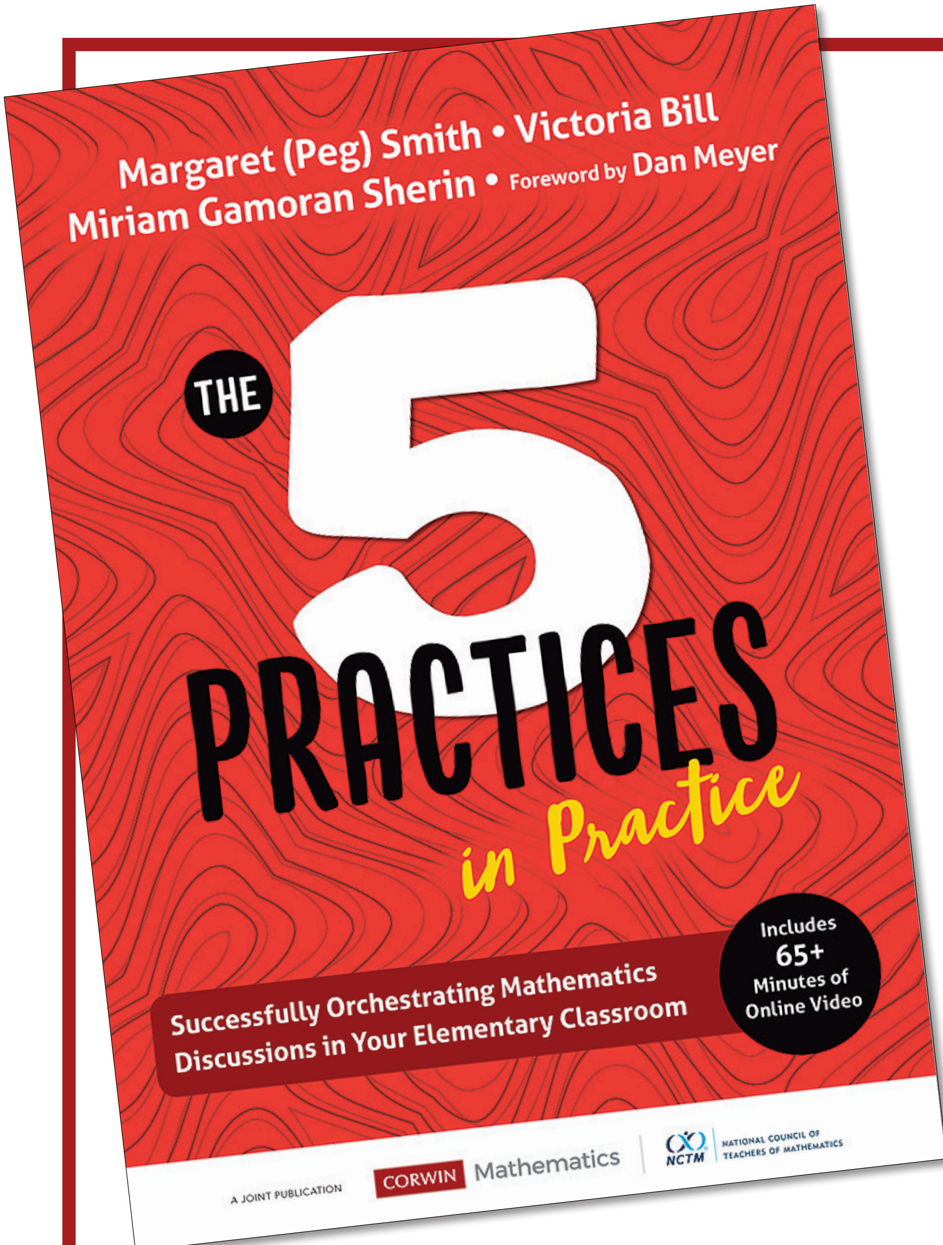


Thank you

FOR YOUR INTEREST IN CORWIN

Please enjoy this complimentary excerpt from T*he Five Practices in Practice, Elementary*, by Margaret "Peg" Smith. This practice involves thinking about different ways students might solve the task, planning to respond to students using assessing and advancing questions, and preparing to notice key aspects of students' thinking in the midst of instruction.

LEARN MORE about this title, including Features, Table of Contents, and Reviews.

Part One: Unpacking the Practice: Anticipating Student Responses

What is involved in anticipating students' responses? This practice involves getting inside the problem (thinking about different ways students might solve the task), planning to respond to students using assessing and advancing questions, and preparing to notice key aspects of students' thinking in the midst of instruction. Figure 1 highlights the components of this practice along with key questions to guide the anticipating process.

Figure 1 • Key questions that support the process of anticipating students' responses

WHAT IT TAKES	KEY QUESTIONS
Getting inside the problem	How do you solve the task?
	How might students approach the task?
	What challenges might students face as they solve the task?
Planning to respond to student thinking	What assessing questions will you ask to draw out student thinking?
	What advancing questions will help you move student thinking forward?
Planning to notice student thinking	What strategies do you want to be on the lookout for as students work on the task?

Getting Inside the Problem

The first step is to get inside the problem! Many teachers find it useful to start by thinking about their own approach. How do you solve the task? You will want to think generally about the approach you use and at a detailed level about steps in your process (which may be different from someone else's). Next, consider how students might approach the task. You might investigate the problem using a different representation or think about how manipulatives might shape the way students explore the task. Do some approaches move students more easily toward the learning goals you established? You could also think about whether the task has different entry points. Often when students begin a task by working on different parts of the problem, their solutions look different (Lambert & Stylianou, 2013). Finally, as you explore these various approaches, keep in mind any challenges you think students will face as they solve the task. Are certain parts of the task likely to be difficult for students? Do you expect that students who use certain approaches will face particular kinds of challenges? Where do you think students might get stuck?

In Analyzing the Work of Teaching, we return to the Ms. Tyus's Markers task (Figure 2) that Ms. Tyus selected for her first-grade students. In this activity, you will engage in solving and thinking deeply about the task. We will then look at the strategies that Ms. Tyus anticipated her students would use in solving the task.

Figure 2 • Ms. Tyus's Markers task

Ms. Tyus's Markers

1. Ms. Tyus has 69 scented markers. She gives 40 scented markers to her friend. How many markers does she have left? Make a diagram and write an equation that shows how Anna can solve this problem.
2. Ms. Tyus has 79 neon markers. She gives 30 neon markers to her friend. How many markers does she have left? Make a diagram and write an equation that shows how Anna can solve this problem.

Solve each of these problems.

59 – 20 = ________	88 – 30 = ________

Source: Image from Pixabay.

Analyzing the Work of Teaching

Getting Inside a Problem

Solve the Ms. Tyus's Markers task in at least two different ways. Then consider the following questions:

- What did you need to know to solve the task?
- What do you think might be challenging for students about this task?

Getting Inside a Problem—Analysis

While there are several ways *you* might approach this problem, we will explore two possible methods for solving the first problem. One strategy involves *decomposing and recomposing*. When decomposing, you break a number (the minuend) up into its place value components. In this case, you would decompose 69 into 6 tens (60) and 9 ones. You could then subtract tens from tens, $60 - 40 = 20$. Since there are no ones to be subtracted, you would *recompose* the tens and ones, adding the 20 to the 9, which is part of the original 69.

Alternatively, you might choose to use a *rounding and compensating* strategy. First, you would *round* 69 to 70 and then proceed to subtract 40 from 70, $70 - 40 = 30$. Because you *added* 1 to 69 when rounding to 70, you need to *subtract* 1 from your answer of 30 to complete the task, $30 - 1 = 29$. We refer to this process of subtracting at the end to offset the initial adding that you did as *compensating*.

In order to use the first strategy (decomposing and recomposing), you would need to know that numbers can be represented by their place value component parts. You would also need to know that you could operate on those parts independently and then add the subparts back together. In order to use the second strategy (rounding and compensating), you would need to understand that addition and subtraction are inverse operations—if you add an amount to the minuend, then you must subtract the same amount from the difference in order to compensate for what was added initially.

Elementary students may be challenged by this task if they do not yet have a solid foundation in number sense or may not have access to the same methods that we would tend to apply. Students who have not fully grasped place value and rely on counting strategies may find it difficult to count back 40 ones from 69. Students may not understand the meaning of subtraction and may have difficultly modeling a subtraction problem with concrete objects. Students may not realize that after you decompose the values in a subtraction problem, you need to subtract tens from tens and ones from ones. They may also not

TEACHING TAKEAWAY

Exploring the ways *you* would solve the task is just the first step in anticipating! Leverage colleagues and prior student work to anticipate the various entry points and strategies your students might use.

realize that if you subtract a multiple of ten, you do not need to subtract any ones from the minuend. Students might also have difficulty relating their solution strategy to an equation.

Ms. Tyus did the task herself in a few ways and also talked with a colleague to come up with other approaches (see Figure 3). In anticipating these different methods, Ms. Tyus considered in detail the different ways her students might solve the Ms. Tyus's Markers task and also the reasoning that might underlie their strategies.

Based on how students were currently solving subtraction problems involving multiples of ten (e.g., $80-20$), Ms. Tyus expected that students might use manipulatives to model the situation with the markers. Specifically, she expected a number of students to use base ten blocks because that had been popular with her students recently. Using base ten blocks, a student would first "build" 69 and then remove 4 of the tens blocks (Solution A, Figure 3). Ms. Tyus explained that the base ten blocks help students "see the tens and the ones, that decomposition of numbers," and that a student might explain the situation as "Okay, I did 60 minus 40. That gave me 20, plus 9" and represent it with the equations $60-40=20$ and $20+9=29$.

Since her class had recently "been looking at patterns on the hundreds chart," Ms. Tyus thought that might be another tool students would use. With this method, a student would first locate the number 69 on the hundreds chart and then subtract 10 four times by moving vertically to 59, 49, 39, and finally to 29. Using the hundreds chart requires the student to understand the organization of the chart—and why moving horizontally reflects adding and subtracting ones, while moving up or down vertically reflects adding and subtracting tens. Ms. Tyus thought students might represent this strategy using a series of equations in which 10 is subtracted four times (Solution B, Figure 3).

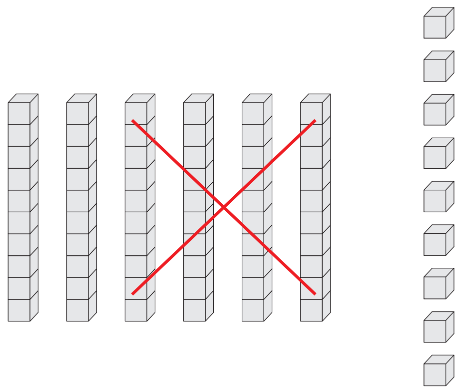
A third representation Ms. Tyus anticipated students using is an open number line. Because an open number line does not have any markings, the student would select a spot on the line and label it as 69. The student would then take four "hops" to the left to model subtracting 10 four times, ending up at 29. Ms. Tyus thought that a student using this approach might write the corresponding equation as $69-40=29$ (Solution C, Figure 3).

Ms. Tyus also suggested that students might use a rounding and compensating strategy. While she was not confident that students would come up with this approach on their own because they had recently been working on problems involving subtracting multiples of ten from each other, Ms. Tyus thought they might consider "going up 1 to reach a benchmark, a 10." After subtracting 40 from 70, the students "would have to remember that they have to subtract one out to get the correct answer." Students could use base ten blocks, the hundreds chart, or the number line to represent this rounding and compensating strategy (Solution D, Figure 3).

As Ms. Tyus anticipated how students might solve the Ms. Tyus's Markers task, she also thought about what might be challenging for students about the task. For example, Ms. Tyus thought that after decomposing 69 and subtracting 40, some students might subtract 9 from 20, rather than recompose $20+9$ (Solution E, Figure 3). This might be particularly challenging for students who are still developing their understanding of subtraction. As Ms. Tyus explained, "They might not think about 'What does that 9 represent?'" Also, students who use a rounding and compensating strategy might not fully understand the compensating process and might add 1 rather than subtract 1 in the final step (Solution E, Figure 3). Again, if students are just beginning to work with rounding and compensating, the connection between the two processes may not always be apparent.

Figure 3 • Anticipated solutions to the Ms. Tyus's Markers task generated by Ms. Tyus and her colleagues

A. Decompose and Recompose With Base Ten Blocks



Student decomposes 69 using base ten blocks and then removes 4 tens. Student recomposes the 2 tens and 9 ones.

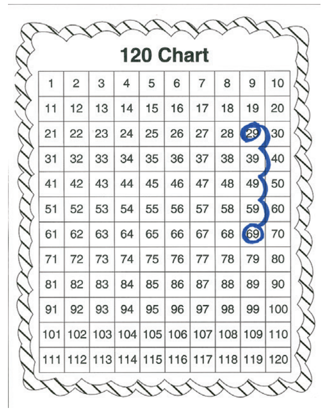
Student writes

$69 - 40 =$

$60 - 40 = 20$

$20 + 9 = 29$

B. Count Back by Tens on a Hundreds Chart



Student starts at 69 on a hundreds chart, then jumps to 59, 49, 39, 29.

Student writes

$69 - 40 =$

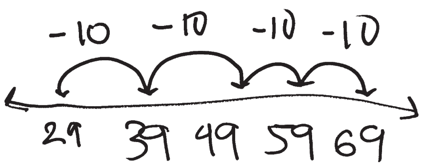
$69 - 10 = 59$

$59 - 10 = 49$

$49 - 10 = 39$

$39 - 10 = 29$

C. Count Back by Tens on an Open Number Line



Student draws a number line and labels the point 69. The student then makes 4 jumps back and marks 10 above each, stopping at 29.

Student writes

$69 - 40 = 29$

D. Round and Compensate

Student adds 1 to 69 to get 70. Student models 70 with base ten blocks or a base ten drawing and then removes 4 tens and has 3 tens left. Student then subtracts 1 from 30 to compensate for the 1 added initially.

Student writes

$69 - 40 =$

$69 + 1 = 70$

$70 - 40 = 30$

$30 - 1 = 29$

E. Subtract Tens, Then Subtract Ones Instead of Add Ones

Student decomposes 69 and then subtracts 40. Student incorrectly subtracts 9 from the remaining 20 rather than recomposing 20 + 9.

Student writes

$69 - 40 =$

$60 - 40 = 20$

$20 - 9 = 11$

F. Round Up, Subtract, and Then Add One Instead of Subtract One

Student adds 1 to 69 to get 70. Student models 70 with base ten blocks or a base ten drawing then removes 4 tens and has 3 tens left. Student then incorrectly adds 1 to 30.

Student writes

$69 - 40 =$

$69 + 1 = 70$

$70 - 40 = 30$

$30 + 1 = 31$

Reference

Lambert, R., & Stylianou, D. A. (2013). Posing cognitively demanding tasks to all students. *Mathematics Teaching in the Middle School*, *18*(8), 500–506.