The Five Practices in Practice **at a Glance**

Candid quotes from been-there teachers illuminate the topic of each chapter.

> "As I monitor the groups and see where they're at, I'm also thinking about the discussion and what ideas to share and what groups. The key for me is that with selecting and sequencing, I can make sure that the goals are highlighted in a way that helps really create a story for the students."
>
> —CORI MORAN, HIGH SCHOOL MATHEMATICS TEACHER

Pause and Consider moments invite teachers to reflect on and make connections to their own practice.

PAUSE AND CONSIDER

How could you solve the Cycle Shop task shown in Figure 3.13 using visual, physical, and symbolic representations?

Visual:

Physical:

:tangles, that the base and height of the staircase is *n* for : there are *n* "stair steps" along the diagonal.

ıdents may be challenged by this task if they do not ·xperience using geometric approaches to solve visual ı looking at the staircases, students may recognize that ıcreases by 1 along the height and the width but may o use that information to find a generalized solution. In ·tudents may attempt to use a table to identify a pattern, ey have successfully used this approach to identify linear eriving a quadratic equation from a table is, however, ·rward (Rhoads & Alvarez, 2017). Instead, what may be ıts is the recursive relationship—that is, that the number :cessive staircases increases by the stage number.

he task herself and asked two colleagues how they would · found a couple of potential solutions online. Through . Moran identified several possible methods for solving : that she thought her students might use (see Figure 3.4).

oran thought that students might identify a recursive

TEACHING TAKEAWAY

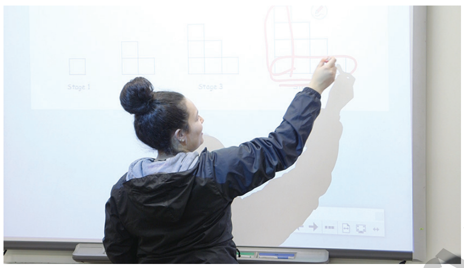
Exploring the ways *you* would solve the task is just the first step in anticipating! Leverage colleagues and prior student work to anticipate the various entry points and strategies your students might use.

Teaching Takeaways provide on-your-feet support for teachers, so they can jump into implementing the strategies discussed.

Video showcase panels highlight the rich film footage available for each topic and include related questions for consideration.

Analyzing the Work of Teaching 2.1

Launching a Task



Video Clip 2.1

In this activity, you will watch Video Clip 2.1 from Cori Moran's Transition to College Math class. As you watch the clip, consider the following questions:

- What did the teacher do to help her students *get ready* to work on the Staircase task?
- What did the teacher learn about her students that indicated they were ready to engage in the task?
- Do you think the time spent in launching the task was time well spent?

online resources Videos may also be accessed at **resources.corwin.com/5practices-highschool**

I think that in the sixth generation back, 64 great-great-great-great-grandparents would have been born." At this point, Mr. Washington asked Rebekah if she agreed with Ricardo. She said, "That's what we got too!" At this point, Mr. Washington invited Rebekah to come up and share the table that she and Claire had created.

Rebekah: We started with a picture like Ricardo's but we gave up too. When Mr.Washington came over, we were trying to decide what to do next. He asked us, "Can you organize your findings in some way?" "Do you see any patterns?" So we decided to make this table.

NUMBER OF GENERATIONS AGO	2s	NUMBER OF GREAT-GRANDPARENTS
3	2 × 2 × 2	8
4	2 × 2 × 2 × 2	16
5	2 × 2 × 2 × 2 × 2	32
6	2 × 2 × 2 × 2 × 2 × 2	64
7	2 × 2 × 2 × 2 × 2 × 2 × 2	128
8	2 × 2 × 2 × 2 × 2 × 2 × 2 × 2	256
9	2 × 2 × 2 × 2 × 2 × 2 × 2 × 2 × 2	512
10	2 × 2 × 2 × 2 × 2 × 2 × 2 × 2 × 2 × 2	1,024

Mr. W.: So can you tell us about your table? It looks different from the other tables I saw.

Rebekah: Well, our first table only had two columns—the number of generations ago and the number of great-grandparents—and we only went to 5 generations back. Then we noticed a pattern—you keep multiplying the number of "great" grandparents born in one generation by 2 to get the number of "great" grandparents born in the next generation back. So 8 × 2 = 16, 16 × 2 = 32, 32 × 2 = 64, and so on. So we went up to 10 generations back. So then we decided to keep track of how many 2's were being multiplied, so we put in a middle column.

Mr. W.: Does anyone have any questions for Rebekah? *(Two students raise their hands. Mr. Washington calls out, "David then Sofia," indicating that they can ask their questions in that order.)*

David: Why did you start with 3 generations back instead of starting at 0 or 1?

Rebekah: Well, Ramona didn't have "great" grandparents born until 3 generations back like we saw in the picture, so we just decided to start there. Any of the numbers before that wouldn't be "great" grandparents. *(David gives a thumbs up indicating he understands.)*

Sofia: I am not sure I understand what the middle column represents.

Mr. W.: Can someone explain in their own words how Rebekah thought about the middle column? Damien?

Damien: Rebekah said it was the number of 2's that were multiplied. So for the 3 generations back, there were 8 great-grandparents born—so 2 × 2 × 2 = 8. For 4 generations back, there were 16 great-grandparents born—so 2 × 2 × 2 × 2 = 16. It keeps going like that.

Illustrative vignettes and examples demonstrate real-world applications of the concepts discussed in each chapter.

groups, and the kinds of supports she might want to offer students as they present. She kept in mind that her selection of presenters matters and could play a role in promoting an equitable learning environment for students in her class.

Finally, in deciding how to sequence the presentations, Ms. Moran attempted to create a coherent structure that would allow the learning goals to become visible for all students, even those who had not used those particular solution strategies. We now take a look at some of the challenges teachers face as they select and sequence students' solutions.

Part Two: Challenges Teachers Face: Selecting and Sequencing Student Solutions

You must purposefully select and sequence the solutions that will be shared in order to ensure that the goals of the lesson are met and that class time is used efficiently and effectively. Selecting and sequencing can be particularly challenging because, although you can give some consideration to what you would ideally like to share as you plan the lesson, the actual decisions about *what* is shared, *who* is going to share it, and *how* the solutions will be ordered are made during the lesson. In this section, we focus on five specific challenges associated with these practices, shown in Figure 5.3, that we have identified from our work with teachers.

Figure 5.3 • Challenges associated with the practices of selecting and sequencing

CHALLENGE	DESCRIPTION
Selecting only solutions that are most relevant to learning goals	Teachers need to select a limited number of solutions that will help achieve the mathematical goals of the lesson. Sharing solutions that are not directly relevant can take a discussion off track, and sharing too many solutions (even if they are relevant) can lead to student disengagement.
Expanding beyond the usual student presenters	Teachers often select students who are articulate and on whom they can count for a coherent explanation. Teachers need to look for opportunities to position each and every student as a presenter and help students develop their ability to explain their thinking.
Deciding what work to share when the majority of students were not able to solve the task and your initial goal no longer seems obtainable	Teachers may on occasion find that the task was too challenging for most students and that they were not able to engage as intended. This situation requires the teacher to modify her initial plan and determine how to focus the discussion so students can make progress.

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An in-depth **Linking the Five Practices to Your Own Instruction** feature helps teachers move even deeper into implementation, providing detailed support and additional reflective opportunities.

Linking the Five Practices to Your Own Instruction

SELECTING AND SEQUENCING

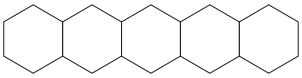
It is now time to reflect on the lesson you taught following Chapter 4, but this time through the lens of selecting and sequencing.

1. What solutions did you select for presentation during the whole group discussion?
   - Did the selected solutions help you address the mathematical ideas that you had targeted in the lesson? Are there other solutions that might have been more useful in meeting your goal?
   - How many solutions did you have students present? Did all of these contribute to better understanding of the mathematics to be learned? Did you conclude the discussion in the allotted time?
   - Which students were selected as presenters? Did you include any students who are not frequent presenters? Could you have?
2. How did you sequence the solutions?
   - Did the series of presentations add up to something? Was the storyline coherent?
   - Did you include any incomplete or incorrect solutions? Where in the sequence did they fit?
3. Based on your reading of this chapter and a deeper understanding of the process of selecting and sequencing, would you do anything differently if you were going to teach this lesson again?
4. What lessons have you learned that you will draw on in the next lesson you plan and teach?

Figure 3.8 • The Toothpick Hexagons task

Toothpick Hexagons

A row of hexagons can be made from toothpicks as follows.



a. How many toothpicks do you need to have a row of 5 hexagons? Explain how you found your answer.

b. How many toothpicks do you need to have a row of 9 hexagons? Explain how you found your answer.

c. How many toothpicks do you need to have a row of 100 hexagons? Explain how you found your answer.

d. Write a generalization that can be used to find the total number of toothpicks when given the number of hexagons. Explain your generalization using the diagram.

e. How long would the row of hexagons be if you had 356 toothpicks to use? Explain how you found your answer.

f. What can you say about the relationship found in this pattern?

g. Create a graph of this pattern. Are there any more observations you can make after viewing the graph?

Source: Developed by the Milwaukee Mathematics Partnership (MMP) with support from the National Science Foundation under Grant No. 0314898.

Clearly designed tasks promote mathematical reasoning and problem solving.

Figure 4.4 • Challenges associated with the practice of monitoring

CHALLENGE	DESCRIPTION
Trying to understand what students are thinking	Students do not always articulate their thinking clearly. It can be quite demanding for teachers, in the moment, to figure out what a student means or is trying to say. This requires teachers to listen carefully to what students are saying and to ask questions that help them better explain what they are thinking.
Keeping track of group progress—which groups you visited and what you left them to work on	As teachers are running from group to group, providing support, they need to be able to keep track of what each group is doing and what they left students to work on. Also, it is important for a teacher to return to a group in order to determine whether the advancing question given to them helped them make progress.
Involving all members of a group	All individuals in the group need to be challenged to answer assessing and advancing questions. For individuals to benefit from the thinking of their peers, they need to be held accountable for listening to and adding on, repeating and summarizing what others are saying.

Challenge and Description charts distill and demystify some of the common issues teachers encounter when teaching the concepts at hand.

What It Takes/Key Questions charts break down the critical components of the practice and explain what it takes to succeed and the questions you need to ask yourself to stay on track.

Figure 4.1 • Key questions that support the practice of monitoring

WHAT IT TAKES	KEY QUESTIONS
Tracking student thinking	How will you keep track of students' responses during the lesson?
	How will you ensure that you check in with all students during the lesson?
Assessing student thinking	Are your assessing questions meeting students where they are?
	Are your assessing questions making student thinking visible?
Advancing student thinking	Are your advancing questions driven by your lesson goals?
	Are students able to pursue advancing questions on their own?
	Are your advancing questions helping students to progress?

In the next sections, we illustrate the practice of monitoring by continuing our investigation of Ms. Moran's implementation of the Staircase task.