CHAPTER 2

Setting Goals and Selecting Tasks

Before you can begin to work on the five practices, you must first set a goal for student learning and select a task that aligns with your goal. Smith and Stein (2018) have described this as *Practice 0*—a necessary step in which teachers must engage as they begin to plan a lesson that will feature a whole class discussion. As they explain:

> *To have a productive mathematical discussion, teachers must first establish a clear and specific goal with respect to the mathematics to be learned and then select a high-level mathematical task. This is not to say that all tasks that are selected and used in the classroom must be high level, but rather that productive discussions that highlight key mathematical ideas are unlikely to occur if the task on which students are working requires limited thinking and reasoning.* (Smith & Stein, 2018, p. 27)

In this chapter, we first unpack what is involved in setting goals and selecting tasks and illustrate what this practice looks like in an authentic elementary school classroom. We then explore challenges that teachers face in engaging in this practice and provide an opportunity for you to explore setting a goal and selecting a task in your own teaching practice.

Part One: Unpacking the Practice: Setting Goals and Selecting Tasks

What does it take to engage in this practice? This practice requires first specifying the learning goal for the lesson and then identifying a high-level task that aligns with the learning goal. Figure 2.1 highlights the components of this practice along with key questions to guide the process of setting goals and selecting a task.

Figure 2.1 • Key questions that support the practice of setting a goal and selecting a task

WHAT IT TAKES	KEY QUESTIONS
Specifying the learning goal	Does the goal focus on what students will learn about mathematics (as opposed to what they will do)?
Identifying a high-level task that aligns with the goal	Does your task provide students with the opportunity to think, reason, and problem solve?
	What resources will you provide students to ensure that all students can access the task?
	What will you take as evidence that students have met the goal through their work on this task?

In the sections that follow, we provide an illustration of this practice drawing on a lesson taught by Tara Tyus in her first-grade classroom. As you read the description of what Ms. Tyus thinks about and articulates while planning her lesson, consider how her attention to the key questions influences her planning.

Specifying the Learning Goal

Your first step in planning a lesson is specifying the goal(s). Consider Goals A and B for each of the mathematical ideas targeted in Figure 2.2. How are the goals the same and how are they different? Do you think the differences matter?

For each of the mathematical ideas targeted in Figure 2.2, the goal listed in Column A is considered a performance goal. Performance goals indicate what students will be able to do as a result of engaging in a lesson. By contrast, each of the goals listed in Column B is a learning goal. The learning goals explicitly state what students will understand about mathematics as a result of engaging in a particular lesson. The learning goal needs to be stated with sufficient specificity such that it can guide your decision-making during the lesson (e.g., what task to select for students to work on, what questions to ask

Figure 2.2 • Different goals for learning specific mathematical ideas

TARGETED IDEA	GOAL A	GOAL B
Counting *Kindergarten*	Students will be able to count numbers of objects up to 20.	Students will understand that when counting a set of objects, the last number said indicates the number of objects counted.
Place Value *Grade 2*	Students will correctly read and write three-digit numbers.	Students will understand that each digit in a three-digit number represents a different magnitude and that each digit to the left is ten times greater than the previous digit.
Equivalent Fractions *Grade 4*	Students will be able to recognize and generate equivalent fractions.	Students will be able to explain why two fractions are or are not equivalent using visual models.

Source: The goals are based on the Common Core State Standards for Mathematics, http://www.corestandards.org/Math/ (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010).

students as they work on the task, which solutions to have presented during the whole class discussion). According to Hiebert and his colleagues (2007):

> *Without explicit learning goals, it is difficult to know what counts as evidence of students' learning, how students' learning can be linked to particular instructional activities, and how to revise instruction to facilitate students' learning more effectively. Formulating clear, explicit learning goals sets the stage for everything else.* (p. 51)

In general, "the better the goals, the better our instructional decisions can be, and the greater the opportunity for improved student learning" (Mills, 2014, p. 2).

According to Hunt and Stein (in press), "too often, we define what mathematics we wish students to come to 'know' as performance, or what students will 'do,' absent the understandings that underlay their behaviors." If we want students to learn mathematics with understanding, we need to specify what exactly it is we expect them to understand about mathematics as a result of engaging in a lesson. Hence, goals you set for a lesson should focus on what is to be learned, not solely on performance.

Ms. Tyus's first-grade students were working on subtracting two-digit numbers. They had already established that a two-digit number is made up of a number of tens and a number of ones and had started subtracting two-digit numbers that were both multiples of ten. They had just started to subtract two-digit numbers where the larger number (i.e., minuend) was not a multiple of ten but the number being subtracted (i.e., subtrahend) was a multiple of ten.

As a result of the lesson, Ms. Tyus wanted her students to understand that

1. When subtracting two-digit numbers, tens are subtracted from tens and ones are subtracted from ones. If you are subtracting a multiple of ten, then only the number in the tens place changes because there are no ones to subtract.
2. Decomposing and recomposing numbers in systematic ways can help you solve problems and make relationships among quantities of tens and ones more visible.
3. Numbers can be rounded up or down to make a multiple of ten before subtracting. The amount rounded up or down must then be subtracted from or added to the difference to compensate for the amount added to or taken away initially.
4. Multiple representations (e.g., models, drawings, numbers, equations) can be used to solve problems, and the different representations can be connected to each other.

TEACHING TAKEAWAY

Specificity is one of the keys to setting learning goals and finding appropriately aligned tasks.

The level of specificity at which Ms. Tyus articulated the learning goals for the lessons will help her in identifying an appropriate task for her students, and subsequently, it will help her in asking questions that will move students toward the goal and in determining the extent to which students have learned what was intended.

Identifying a High-Level Task That Aligns With the Goal

Your next step in planning a lesson is to select a high-level task that aligns with the learning goal. High-level or cognitively challenging mathematical tasks engage students in reasoning and problem solving and are essential in supporting students' learning mathematics with understanding. By contrast, low-level tasks—tasks that can be solved by applying rules and procedures—require limited thinking or understanding of the underlying mathematical concepts. According to Boston and Wilhelm (2015), "if opportunities for high-level thinking and reasoning are not embedded in instructional tasks, these opportunities rarely materialize during mathematics lessons" (p. 24). In addition, research provides evidence that students who have the opportunity to engage in high-level tasks on a regular basis show greater learning gains than students who engage primarily in low-level tasks during instruction (e.g., Boaler & Staples, 2008; Hiebert & Wearne, 1993; Stein & Lane, 1996; Stigler & Hiebert, 2004).

Tasks that provide the richest basis for productive discussions have been referred to as *doing-mathematics* tasks. Such tasks are nonalgorithmic—no solution path is suggested or implied by the task and students cannot solve them by the simple application of a known rule. Hence students must explore the task to determine what it is asking them to do and develop and implement a plan drawing on prior knowledge and experience in order to solve the task (Smith & Stein, 1998). These tasks provide students with the opportunity to engage in the problem-solving process—understand the problem, devise a plan, carry out the plan, and look back (Polya, 2014). Central to this process is the opportunity for students to wrestle with mathematical ideas and relationships that are inherently part of the task.

While the level of cognitive demand is a critical consideration in selecting a task worthy of discussion, there are other characteristics that you should also consider when selecting a task. Specifically, you need to consider the following: the number of ways that the task can be accessed and solved, the extent to which justification or explanation is required, the different ways the mathematics can be represented and connected, and opportunities to look for patterns, make conjectures, and form generalizations. These characteristics are a hallmark of rich mathematical tasks and help ensure that students will have the opportunity to engage in the mathematics practices/processes (e.g., make sense of problems and persevere in solving them, reason abstractly and quantitatively, construct viable arguments, use repeated reasoning) that are viewed as essential to developing mathematical proficiency. When sizing up the potential of a task, keep in mind the questions shown in Figure 2.3. These questions will help you in selecting rich tasks that will make engagement in key mathematical practices and processes possible.

Figure 2.3 • Questions to help you *size up* the richness of a task

- Are there multiple ways to enter the task and to show competence?
- Does the task require students to provide a justification or explanation?
- Does the task provide the opportunity to use and make connections between different representations of a mathematical idea?
- Does the task provide the opportunity to look for patterns, make conjectures, and/or form generalizations?

Answering "yes" to each of these questions does not guarantee that students will engage in the mathematical practices. However, the use of the five practices, together with doing-mathematics tasks that have the characteristics described, will help ensure that this will occur. So rather than thinking about separate process goals, such as the Standards for Mathematical Practice advocated for in the Common Core State Standards for Mathematics (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010), we encourage you to consider characteristics of tasks that will provide your students with the opportunities to engage in such processes.

TEACHING TAKEAWAY

Doing-mathematics tasks, rather than procedural exercises, lend themselves to rich and productive mathematical discussion.

For her lesson, Ms. Tyus created the Ms. Tyus's Markers task, shown in Figure 2.4. In creating this task, she paid very close attention to the context and to the numbers she selected. First, the context was one that students would be able to make sense of. Ms. Tyus could actually show students a bucket of markers and act out giving some away. Second, she wanted to have a relatively large number of markers for problems (e.g., 69 and 79) so that students would not be inclined to count out a set of markers. This would encourage them to use other strategies. She also chose a number of markers that was one (or in one case, two) away from a ten so that rounding and compensating would be a viable strategy to consider. She chose a multiple of ten to be subtracted that was sufficiently large so that it would be tedious to count back by ones. Her careful consideration of the context and the numbers was key in ensuring that students would be able to make sense of the task and that they would have the opportunity to engage with the mathematical ideas she was targeting in the lesson.

Figure 2.4 • 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.

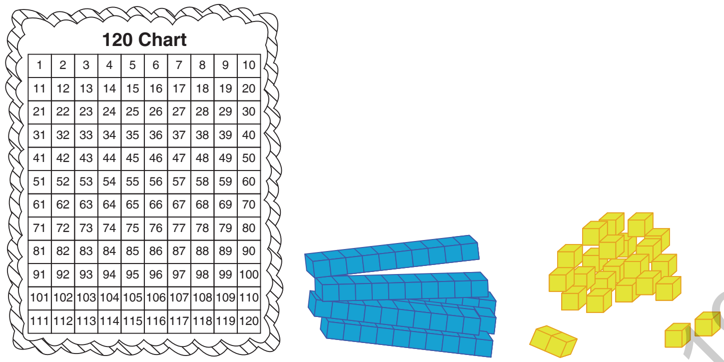
59 − 20 = ________	88 − 30 = ________

Source: Task by Tara Tyus. Image from Pixabay.

online resources Download the Task from **resources.corwin.com/5practices-elementary**

To ensure that students would have access to the task, Ms. Tyus planned to provide students with a hundreds chart (shown in Figure 2.5a) and base ten blocks (shown in Figure 2.5b) on which they could draw in solving the task along with their usual toolkits, but she would leave it up to the students to decide which, if any of them, would be useful. In addition to these material resources, Ms. Tyus also decided that she would provide "human" resources by having students work on the task in pairs or trios so that they would have others with whom to confer. [NOTE: What Ms. Tyus refers to as the hundreds chart actually goes up to 120. This stems from the fact that first-grade students are expected to be able to count up to 120 and read and write numerals and represent a number of objects with written numerals in this range.]

Figure 2.5 • Material resources provided to Ms. Tyus's students



1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110
111	112	113	114	115	116	117	118	119	120

a. Hundreds Chart

b. Base Ten Blocks: blue (rods that represent tens) and yellow (units that represent ones)

When asked what students would say, do, or produce that would provide evidence of their understanding of the goals in the lesson through their work on this task, Ms. Tyus indicated that students would do the following:

- Describe their strategy for subtracting 40 from 69 and explain how different solution strategies are connected;
- Explain that rounding up means getting more markers than they initially had, so they would have to subtract to compensate for the additional markers they added initially; and
- Decompose a two-digit number into tens and ones, then subtract the tens from the tens, and explain that since there are no ones to be subtracted (e.g., 9 – 0 = 9), you still have the same number of ones, which you then combine with the tens.

Tara Tyus's Attention to Key Questions: Setting Goals and Selecting Tasks

During her initial stage of lesson planning, Ms. Tyus paid careful attention to the key questions. First, in setting her goals for the lesson, she clearly articulated what it was she wanted students to learn about mathematics as a result of engaging in the task. The specificity with which she stated her goals made it possible to determine what students understood about these ideas and to formulate questions that would help move her students forward. While she wanted her students to find the difference between two two-digit numbers, she also wanted to make sure they understood that subtraction requires removing or taking away an amount and that they must attend to the place value of the digits when subtracting.

Second, she created a high-level *doing-mathematics* task that aligned with her goals. Students could not solve the Ms. Tyus's Markers task by applying a known rule or procedure because they had not yet learned one; it would require students' perseverance and sense-making. Ms. Tyus *sized up* the task (see Figure 2.3) to ensure that it had several other important characteristics. Specifically, there were a number of approaches that students could use to enter the task (e.g., making a base ten model of 69 markers with blocks or drawings and removing 4 tens, starting at 69 on the hundreds chart and counting back by 4 tens to 29, rounding 69 to 79, subtracting 40, and then subtracting one more from the difference of 30), and the material and human resources that the teacher planned to provide would support their work. Students had the opportunity to use (e.g., context, base ten blocks, hundreds chart, contents of their toolboxes) and produce (e.g., equations, diagrams) several different representations. Hence through their work on the task, students could learn important mathematics and engage in key practices.

The Ms. Tyus's Markers task, along with the resources the teacher made available to students, allowed all students to enter the task at some level. Rather than differentiating instruction by providing different students with different tasks, she selected one task and met the needs of different learners by providing a range of resources for students to consider and questions that would challenge learners at different levels. In addition, while the teacher's primary intent was to focus on the first two questions in the Ms. Tyus's Markers task, the inclusion of the additional questions (i.e., 59 – 20 and 88 – 30) provided opportunities for students who solved the Ms. Tyus's Markers tasks quickly to engage in repeated reasoning and try out a strategy previously used or a different strategy.

Finally, Ms. Tyus indicated some things that she expected students to say and do that would provide evidence students were making progress on the ideas she wanted them to learn. By considering this evidence in advance of the lesson, she was ready to pay close attention to students' work for indications that they were making progress in their understanding.

Through her careful attention to setting goals and selecting a task, Ms. Tyus's planning was off to a productive start and she was ready to engage in the five practices. In the next chapter we will continue to investigate her planning process as she anticipates what she thinks her students will do when presented with the task and how she will respond. We now turn our attention to the challenges that teachers face in setting goals and selecting tasks.

Part Two: Challenges Teachers Face: Setting Goals and Selecting Tasks

As we described in the chapter opening, setting goals and selecting tasks is foundational to orchestrating productive discussions. Setting goals and selecting tasks, however, is not without its challenges. In this section, we focus on four specific challenges associated with this practice, shown in Figure 2.6, that we have identified from our work with teachers.

Figure 2.6 • Challenges associated with the practice of setting goals and selecting tasks

CHALLENGE	DESCRIPTION
Identifying learning goals	Goal needs to focus on what students will learn as a result of engaging in the task, not on what students will do. Clarity on goals sets the stage for everything else!
Identifying a doing-mathematics task	While *doing-mathematics* tasks provide the greatest opportunities for student learning, they are not readily available in some textbooks. Teachers may need to adapt an existing task, find a task in another resource, or create a task.
Ensuring alignment between task and goals	Even with learning goals specified, teachers may select a task that does not allow students to make progress on those particular goals.
Launching a task to ensure student access	Teachers need to provide access to the context and the mathematics in the launch but not so much that the mathematical demands are reduced and key ideas are *given away*.

Identifying Learning Goals

Identifying learning goals is a challenging but critical first step in planning any lesson. It is challenging because we often focus on what students are going to be able to do as a result of engaging in a lesson, not on what they are going to learn about mathematics.

Consider, for example, a lesson that Jada Turner was planning for her third-grade students. Ms. Turner was beginning a unit on fractions and decided that she would use the Pizza Comparison task (see Figure 2.7) as the basis for the lesson. She selected this task because she thought the pizza context would be engaging for her students who loved pizza. In addition, since students could use drawings, words, and numbers to consider José's claim, there would be different ways to solve it.

Figure 2.7 • The Pizza Comparison task

Pizza Comparison

Think carefully about the following question. Write a complete answer. You may use drawings, words, and numbers to explain your answer. Be sure to show all of your work.

José ate $\frac{1}{2}$ of a pizza.

Ella ate $\frac{1}{2}$ of another pizza.

José said that he ate more pizza than Ella, but Ella said they both ate the same amount. Use words and pictures to show that José could be right.

Source: The Pizza Comparison Task appeared on the National Assessment of Educational Progress in 1992. U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1992 Mathematics Assessment.

online resources Download the Task from **resources.corwin.com/5practices-elementary**

Ms. Turner initially indicated that her goal for the lesson was for students to understand fractions. When Ms. Turner was pressed by her mathematics coach to be more specific about what she wanted students to learn about mathematics, she acknowledged, "That is the hard part for me."

In a subsequent team meeting, Ms. Turner, along with her coach and grade-level colleagues, worked together to clarify in detail what understanding of mathematics students would need to solve the Pizza Comparison task and thus determined the following learning goals for the lesson. Specifically, as a result of engaging in the lesson, Ms. Turner wanted her students to understand that

- A fraction $\frac{1}{b}$ is the quantity formed by one part when a whole is partitioned into b equal parts: $\frac{1}{2}$ of a pizza is one part of a pizza that is cut into two equal pieces;
- A fraction must be interpreted in relation to the size of the object (in this case, a whole pizza); and
- Comparisons are only valid when two fractions refer to the same size whole: $\frac{1}{2}$ of one pizza is only equal to $\frac{1}{2}$ of another pizza if the two pizzas are the same size.

With new clarity regarding what she wanted students to understand, Ms. Turner was now ready to anticipate what students would do with the task and prepare questions that would help her illuminate what her students understood about these ideas.

Why does this level of specificity matter? It matters because with this level of specificity, the teacher will be able to determine whether her students understand the meaning of the fraction $\frac{1}{2}$, that all $\frac{1}{2}$s do not represent the same amount, and that the $\frac{1}{2}$s will not be the same size if you have two different-sized wholes. So when Ms. Turner actually interacts with her students as they work on the task, with these targets in mind, she can press them to explain what it would mean for José to be correct and under what conditions that would be possible. In addition, this level of specificity will help Ms. Turner consider the solutions she would want students to share during the whole class discussion and the questions she wants to ask about them later in the lesson. Hence, the specificity of the goal is going to provide guidance to her during the lesson and help her determine what her students do and do not understand. This information will then help her in planning subsequent lessons. (See Hunt and Stein [in press] for a description of three interconnected phases—defining a goal, unpacking the mathematics and refining the goal, and relating goals to pedagogy—that teachers can use individually or collaboratively to create and refine goals for student learning.)

Identifying a Doing-Mathematics Task

While doing-mathematics tasks provide the optimal vehicle for whole class discussions, not all curricular materials are replete with such tasks. Traditional textbooks tend to feature more procedural tasks that provide limited opportunities for reasoning and problem solving. While such resources do include *word problems*, they are often solved using procedures that have been previously introduced and modeled and require limited thinking. While standards-based texts (Senk & Thompson, 2003) contain some procedural tasks, they also include high-level tasks that promote reasoning and problem solving. If you are using a resource that does not include high-level tasks, what should you do? In this section we will explore three possible options—adapt an existing task, find a task in another resource, or create your own task.

TEACHING TAKEAWAY

If your textbook does not provide worthwhile enough tasks for discussion, you have options: adapt, find, or create your own!

Adapting an Existing Task

Most textbooks include low-level tasks that can be solved using the procedure that was introduced in the current chapter. If you can recall the rule, you can simply apply it in order to solve the new problem. If you don't remember the rule, you can usually refer back to an example problem in the chapter that will walk you through the steps involved. While such problems do provide students with the opportunity to practice a learned rule, they provide limited opportunities to think and reason about mathematical relationships and connections. So one thing to consider is how you can provide more thinking opportunities while still providing time for practice.

Take the Baking Cookies task, for example. In the original task (left side of Figure 2.8), students need to recognize the problem as a multiplication situation (most likely implied by the placement of the problem in the textbook chapter) and then apply the standard algorithm to arrive at the answer of 65 minutes.

Figure 2.8 • The original and modified Baking Cookies task

<table>
<tr><th>Baking Cookies—Original</th><th>Baking Cookies—Modified</th></tr>
<tr><td>Shawna plans to bake five batches of cookies for the class party. Each batch of cookies will take 12 minutes to bake in the oven.

How long will it take to bake all five batches of cookies?

</td><td>Shawna plans to bake cookies for the class party. Each batch of cookies will take 12 minutes to bake in the oven.

1. How long will it take to bake five batches of cookies?
2. How long will it take to bake six batches of cookies? Seven? Eight? Nine? Twenty? Write number sentences that describe how long it will take to bake the different batches of cookies.
3. Use drawings, tables, numbers, and/or words to explain any patterns you notice in the set of problems.
4. Describe how to use your pattern to determine how long it will take to bake any number of batches of cookies.</td></tr>
</table>

Source: Image from Pixabay.

online resources Download the Task from **resources.corwin.com/5practices-elementary**

When Carmen Ortiz saw the Baking Cookies task in her textbook, she decided to modify the task so that her students would have to do more thinking and reasoning (see the Modified Task on the right side of Figure 2.8). In comparing the original task to the modified task, you will see that Ms. Ortiz made the following changes:

- She asked students to find the length of time it would take to bake different numbers of batches of cookies and to write number sentences to describe each.
- She asked students to use a range of different representations to explain any patterns they notice.
- She asked students to describe the length of time it would take to bake any number of batches of cookies.

By making these changes, Ms. Ortiz transformed a low-level task into a doing-mathematics task. In addition, her modified task has some of the additional characteristics we previously discussed (see Figure 2.3)—it requires students to use and make connections between different representations, and it asks students to find patterns and to generalize beyond a specific situation. (See Arbaugh, Smith, Boyle, Stylianides, & Steele, 2018; Boyle & Kaiser, 2017; and Smith & Stein, 2018, for more insight on how to modify tasks.)

While the original task focused on numbers and operations (i.e., multiplying a whole number by a one-digit number), the modified task focuses on numbers and operations as well as on algebraic thinking (i.e., analyzing). By adding a sequence of problems to the initial task, students are encouraged to look for a pattern and, ultimately, to generalize. Blanton and Kaput (2003) describe the process Ms. Ortiz used to modify this problem as "algebrafying." They explain:

> *Existing arithmetic activities and word problems are transformed from problems with a single numerical answer to opportunities for pattern building, conjecturing, generalizing, and justifying mathematical facts and relationships.* (Blanton & Kaput, p. 71)

The technique of algebrafying can be applied to a wide range of arithmetic tasks across grade levels and provide students with "large amounts of computational practice in a context that intrigues students and avoids the mindlessness of numerical worksheets" (Blanton & Kaput, 2003, p. 73). Algebrafied tasks provide students with the opportunity to look for and express regularity in repeated reasoning, one of the Standards for Mathematical Practice (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010).

TEACHING TAKEAWAY

Algebrafying existing tasks can provide students with opportunities to look for patterns and make generalizations while getting computational practice at the same time.

Finding a Task in Another Resource

You can find high-level doing-mathematics tasks in many print and electronic resources. The challenge is to find a task that meets your mathematical goals, is accessible to your students, has the potential to advance their learning beyond their current level, and fits with the content and flow of your curriculum.

Michael McCarthy's fifth-grade students had some experience in generating and analyzing patterns. He wanted his students to gain experience in analyzing a growth pattern in order to determine the underlying structure of the pattern and use the identified structure to describe any pattern in the sequence. The ability to analyze, describe, and generalize a pattern is a critical component of algebraic thinking (Driscoll, 1999), and Mr. McCarthy wanted to make sure that his students had lots of opportunities to generalize beyond specific numbers and situations.

Although the textbook Mr. McCarthy was using contained some visual pattern tasks, he felt that the problems provided too much scaffolding and left little for students to actually grapple with. As a result, he decided to use the Tables and Chairs Investigation (shown in Figure 2.9) he found online at Mathwire (http://mathwire.com). The task featured a real-world context in which students could explore the relationship between the number of customers who could be seated and the number of square tables needed and ultimately generalize the number of people who could be seated at any number of tables.

Figure 2.9 • The Table and Chairs Investigation task

Table and Chairs Investigation

Restaurants often use small square tables to seat customers. One chair is placed on each side of the table. Four chairs fit around one square table. Restaurants handle larger groups of customers by pushing together tables. Two tables pushed together will seat six customers.

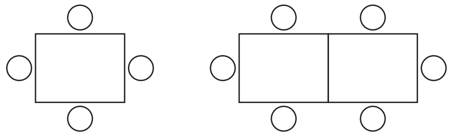


Figure 1 Figure 2

- Draw a diagram showing how many customers would be seated at three square tables pushed together.
- Complete the table for reference:

Number of Tables	Number of Customers
1	4
2	6
3	
4	
5	
6	

- Find a pattern you can use to predict the number of customers that may be seated at any size table. Describe the pattern in words.

CHALLENGE:

- Use your pattern to complete this table without drawing a picture or using manipulatives.

Number of Tables	Number of Customers
10	
25	
100	

Source: This task can be found at Mathwire, http://mathwire.com/algebra/tableschairs.pdf.

By replacing a task in the textbook unit with a doing-mathematics task, Mr. McCarthy provided his students with a rich task that *sized up* nicely (see Figure 2.3). Specifically, the task allowed entry to all students (e.g., students could build or draw subsequent tables, complete the table by building and counting), required making use of different representations (i.e., context, visual diagram, table, verbal description), and pressed students to look for patterns and to generalize beyond specific cases. In addition, there were many different ways to determine the total number of customers that can be seated, each of which could be described algebraically (e.g., $c = 2n + 2$, $c = 2(n + 1)$, $c = 4 + 2(n - 1)$), or descriptively (e.g., you multiply the number of tables by the seats on the top and bottom and then add two for the sides).

Mr. McCarthy found a website that had a storehouse of good tasks. But not all websites are of equal value. In Appendix A, we have included a list of web resources that may be helpful to you in finding doing-mathematics tasks. This list is not exhaustive but should be helpful in getting started.

Creating a Task

If you cannot find a task you want to use, you may decide to create one yourself. This was the case for Jesse Samson. Mr. Samson's kindergarten students were working on counting and cardinality. He decided to create a mathematical task based on the book *Caps for Sale: A Tale of a Peddler, Some Monkeys and Their Monkey Business* (Slobodkina, 1940). The story is about a peddler who is selling caps. What is unusual about this peddler is that he carries the caps—four gray caps, four brown caps, four blue caps, and four red caps—on his head on top of his checkered cap (see Figure 2.10). One afternoon the weary peddler rests against the trunk of a large tree and falls asleep. When he awakes he finds all his caps are gone.

Figure 2.10 • Image of the peddler and his caps from the book *Caps for Sale*

Source: *Caps for Sale: A Tale of a Peddler, Some Monkeys and Their Monkey Business* by Esphyr Slobodkina, 1940. Harper Collins New York, New York.

He looks up to see monkeys in the tree, each wearing one of his caps. (If you are not familiar with this story, you can find a reading of the book at https://www.youtube.com/watch?v=WTRs9D3H3Lk&feature=youtu.be or search YouTube for "Caps for Sale.")

This book was popular with young children, and Mr. Samson thought it provided a fun context for counting and comparing numbers of objects. Although he did find a number of activities related to the story on the Internet, none of them seemed exactly right, so he created the Caps task (see Figure 2.11). He planned to provide each pair of students with a set of 17 circles—colored to represent the caps—as well as crayons, paper, and a glue stick. In addition, he decided to reproduce and post a large version of the monkeys wearing the caps for students to reference.

Figure 2.11 • The Caps task

Caps Task

Using the illustration, answer the questions below.

1. How many caps does the peddler have? How do you know? Find a way to keep track of the number of caps so you can tell the peddler how many caps he should collect from the monkeys.
2. Write numbers and draw a picture to show his total number of caps.
3. Is the number of blue caps greater than, less than, or equal to the number of red caps? Draw a picture or use your circles to show what you think.
4. Is the number of checkered caps greater than, less than, or equal to the number of brown caps? Draw a picture or use your circles to show what you think.

online resources Download the Task from resources.corwin.com/5practices-elementary

Mr. Samson's idea to connect children's literature with mathematics is a good one. Marilyn Burns, a well-respected mathematics educator and founder of Math Solutions, explains:

> *I've found that children's books are extremely effective tools for teaching mathematics. They can spark students' math imaginations in ways that textbooks or workbooks don't. Connecting math to literature can boost confidence for children who love books but are wary of math. And students who already love math can learn to appreciate stories in an entirely new way*. (Burns, 2015)

While creating tasks is certainly an option, it is a challenging endeavor! If you decide to create a task yourself, we encourage you to ask others to review and solve the task so that you can identify any possible pitfalls before you give it to students. This is exactly what Mr. Samson did with the Caps task! (See Monroe, Young, Fuentes, and Dial [2018] for an extensive annotated bibliography of children's books that can be used for mathematics instruction in the elementary grades. Also see Proud to Be Primary, https://proudtobeprimary.com/childrens-books-teaching-math/, for a list of books that can be used to teach specific mathematical topics or ideas.)

Ensuring Alignment Between Task and Goals

Another challenge teachers often face is making sure that there is alignment between the task and goals—that is, ensuring that the task they have selected as the basis for instruction provides students with the opportunity to explore the mathematical ideas that are targeted during the lesson.

As we described in Part One of this chapter, Ms. Tyus was clear about what she wanted her students to learn about mathematics (not just what they would do) and she selected a high-level doing-mathematics task that was consistent with her learning goals. This combination of a high-level task and a clear learning goal is optimal for providing students with the opportunity to learn mathematics with understanding.

But what would it look like to have a mismatch, and what implications does this have for instruction and learning? Suppose, for example, you are teaching a fourth-grade lesson on multiplication of whole numbers. You decide that you want students to use place value understanding and the properties of operations to perform multidigit multiplication. Specifically, you want students to understand the following:

- The multiplication of two numbers is equivalent to adding as many iterations of one of them, the *multiplicand*, as the value of the other one, the *multiplier* (e.g., $42+42+42+42+42$ is the same as 5×42—where the factor of five tells you how many of the other factor, 42, you are adding).
- A number greater than nine can be decomposed based on place value (e.g., $42=40+2$) and the multiplication statement can be rewritten using the decomposed number(s) (e.g., 5×42 can be rewritten as $5(40+2)$).
- The distributive property of multiplication over addition specifies that you multiply a sum by multiplying each addend separately and then add the products (e.g., $5(40+2)=(5\times40)+(5\times2)$).
- Multiplication can be shown using numbers, rectangular arrays, and area models.

You select a task that asks students only to find a series of products (such as 5×35, 4×64, 9×26, 7×42, and 3×89). This basic *naked numbers* task does not provide students the opportunity to develop an understanding of the meaning of the factors, the relationship between multiplication and repeated addition, or the relationship between place value and the distributive property. In fact, by providing no resources and asking students only for the product, you are implying that students have a procedure for solving such tasks. As a result, students may end up with correct or incorrect solutions but have limited understanding of the targeted mathematical ideas. In this situation, you have established a *learning* goal but have paired it with a low-level task that requires only application of a known procedure. If your goal had been for students to only find the product of a one-digit number and a two-digit number, then the low-level task would be a good match for this goal.

If you want students to understand the distributive property of multiplication over addition, a better choice would be a task such as the one shown in Figure 2.12. The Box of Crayons task provides a context for making sense of the problem and invites students to select from a range of tools for explaining their answers. By including a description of the range of ways students can express their answers and their thinking and making materials such as base ten blocks, base ten paper, and grid paper available, it is likely that the task will generate a range of different approaches that you can use to highlight the underlying meaning of the mathematics and the relationships you have targeted.

Figure 2.12 • The Box of Crayons task

Box of Crayons

Mrs. Phelps bought 4 boxes of crayons at the store to share with her students. Each box contained a total of 64 crayons. What is the total number of crayons Mrs. Phelps bought at the store? Explain your answer using diagrams, pictures, mathematical expressions, and/or words.

Source: Adapted from Smarter Balanced Assessment Consortium, MAT.05.ER.2.00NBT.A.245 Claim 2.

Ensuring alignment between your goals and task is essential and the foundation on which to begin to engage in the five practices. If you find that your task does not fit your goals, consider the ways in which you can modify the task in order to provide more opportunities for students to think and reason as we described previously.

Launching a Task to Ensure Student Access

Launching or setting up a task refers to what the teacher does prior to having students begin work on a task. While it is not uncommon to see teachers hand out a task, ask a student volunteer to read the task aloud, and then tell students what they are expected to produce as a result of the work on the task, research suggests that attention to the way in which the task is launched can lead to a more successful discussion at the end of the lesson. Jackson and her colleagues (Jackson, Shahan, Gibbons, & Cobb, 2012) describe the benefits of an effective launch:

> *Students are much more likely to be able to get started solving a complex task, thereby enabling the teacher to attend to students' thinking and plan for a concluding whole-class discussion. This, in turn, increases the chances that all students will be supported to learn significant mathematics as they solve and discuss the task.* (p. 28)

So what constitutes an effective launch? In Analyzing the Work of Teaching 2.1, you will explore Ms. Tyus's launch of the Ms. Tyus's Markers task. We invite you to engage in the analysis of a video clip and consider the questions posed before you read our analysis. [NOTE: While the launch of a task occurs during instruction, it is planned for prior to instruction. Rather than describing what Ms. Tyus intended to do, we decided to take you into her classroom so that you could see for yourself!]

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 Tara Tyus's first-grade 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 Ms. Tyus's Markers 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
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Launching a Task—Analysis

Ms. Tyus began the lesson by engaging students with the context of the problem. She showed students a basket of the 69 scented markers and had one of her colleagues (Ms. Gibson) come in to borrow 40 markers. (Although Ms. Gibson initially took all the markers, she subsequently returned the basket having removed the 40 markers she needed.) This role-play between Ms. Tyus and Ms. Gibson made clear that markers were being removed or taken away from the total number, thus setting the stage for the subtraction problem the students were to solve. Prior to the lesson, Ms. Tyus explained:

> *I want to make it very real life and relevant to the students. I'll have actual markers so they can see. Then someone will say, "Can I borrow some markers?" I'm like, "Okay." Just acting it out, making it very engaging and energetic so they can enter into the task.*

Students appeared to be engaged in the launch. They were eager to answer the teacher's questions. When Ms. Tyus asked about how many markers Ms. Gibson had taken and how many markers she had to start with, students were able to respond with 40 and 69, respectively. At this point, Ms. Tyus explained, "Now I want [you] to know how many we would have left" and "that is what you are going to go to your desks to help figure out."

Before Ms. Tyus sent students to their desks to begin work on the task, she first made it clear to students what they were supposed to do: "I want you to make a diagram and write an equation that shows how Anna can solve this problem. Think of if you were Anna. What would you do?" Ms. Tyus then had three students recap the main action in the problem—there are 69 scented markers (Laila), Ms. Gibson took 40 scented markers (Leah), and the mathematical question is how many scented markers does Ms. Tyus have left (Audrey).

As a result of the launch, Ms. Tyus learned that students could relate to the context of the problem and that they were able to make sense of the situation that was presented. They left the launch with a clear sense of what was expected of them. Following the lesson, Ms. Tyus indicated, "The children seemed excited about [the lesson], especially after my launch, and everyone could enter into it." She was glad that students recognized that they were not adding, as this had been the concept they were working on prior to this lesson.

TEACHING TAKEAWAY

A comprehensive launch ensures all students understand the entirety of the task, so that time is not spent later answering clarifying questions from groups or individuals.

Was the time spent launching the task time well spent? We could argue that it was essential to ensuring that students understood enough about what they were being asked to do to begin their work on the task. Too often, students are given a task and do not understand some aspect of it. When this occurs, the teacher then ends up moving from one group to the next answering questions that could have been clarified with a more comprehensive launch.

Jackson and her colleagues (2012) list "four crucial aspects to keep in mind when setting up complex tasks to support all students' learning" (p. 26):

1. Key Contextual Features of the Task
2. Key Mathematical Ideas of the Task
3. Development of Common Language
4. Maintaining the Cognitive Demand

Ms. Tyus's launch embodied most of the features described by Jackson and colleagues. She made sure that students understood the context of the Ms. Tyus's Markers task (1), that they were able to explain what the problem was asking them to find (2), and that the cognitive demand of the task was maintained by not suggesting a pathway to follow or giving away too much information (4). Developing a common language (3) is often needed when there is vocabulary used in the task that might not be familiar to some or all of the students. For example, in the Caps task (see Figure 2.11), you would want to make sure that all students understood what a *peddler* was and could describe it in their own words. In the Ms. Tyus's Markers task, however, this did not appear to be necessary.

Perhaps the most challenging part of launching a task is making sure that you do enough to ensure that students understand the context and what they are being asked to do but not so much that there is nothing left for students to figure out. For example, in the Pizza Comparison task (Figure 2.7), you would not want to tell students to start by drawing one small and one large pizza. This would lower the demand of the task by providing a strategy for students to use and limit their opportunity to figure out what to do and how. In the modified version of the Baking Cookies task (Figure 2.8), you would not want to tell students to make a table to show the amount of time it takes to bake a specific number of batches and to find the difference between successive values in the table because this is something you want them to determine.

Conclusion

In this chapter, we have discussed the importance of setting clear goals for student learning and selecting a task that is aligned with the goal, and we have described what is involved in this practice and the challenges associated with it. Our experience tells us that if you do not take the time to seriously consider Practice 0 as a first step in carefully planning your lesson, the remainder of the practices will be built on a shaky foundation.

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Ms. Tyus's work in setting a goal and selecting a task provided a concrete example of a teacher who thoughtfully and thoroughly engaged in this practice. Engaging in this practice in a deep and meaningful way does not happen overnight. It takes time and practice. As she said, "Pre-planning is very important and the more you do it, the better you will get at it . . . and your students will love and enjoy mathematics."

Ms. Turner's efforts to determine what students would learn during their lesson and to ensure that the goals and task align made salient the challenges that teachers can face and overcome when engaging in this practice. Working with colleagues helped her make progress on Practice 0.

Setting Goals and Selecting Tasks—Summary

Video Clip 2.2
To hear and see more about setting goals and selecting tasks, watch Video Clip 2.2.

online resources

Videos may also be accessed at
resources.corwin.com/5practices-elementary

In the next chapter, we explore the first of the five practices: *anticipating*. Here, we will return to Ms. Tyus's lesson and consider what it takes to engage in this practice and the challenges it presents.

Linking the Five Practices to Your Own Instruction

SETTING GOALS AND SELECTING TASKS

Identify a mathematical idea that you will be teaching sometime in the next few weeks. Working alone or with your colleagues:

1. Determine what it is you want students to learn about mathematics as a result of engaging in the lesson. Be as specific as possible. It is okay to indicate what students will do during the lesson, but do not stop there!
2. Select a high-level cognitively demanding *doing-mathematics* task that is aligned with your goals. Make sure that there are different ways to enter and engage with the task. Identify resources that are likely to help students as they work on the task.
3. Identify what students will say and do that indicates that they are meeting the goals you have established.
4. Plan a launch that takes into account the four crucial aspects identified by Jackson and her colleagues.

Reflect on your planning so far. How does it differ from how you have previously thought about goals and tasks? In what ways do you think the differences will matter instructionally?