CHAPTER 2

During the Unit

The choice of classroom instruction and learning activities to maximize the outcome of surface knowledge and deeper processes is a hallmark of quality teaching.

—Mary Kennedy

Learning is experience. Everything else is just information.

—Albert Einstein

Much of the daily work of your collaborative team occurs during the unit of instruction. This makes sense, as it is during the unit that you place much of your collaborative team effort put forth before the unit into action.

Your team conversations during the unit focus on sharing evidence of student learning, discussing the effectiveness of lessons or activities, and examining the ways in which students may be challenged or need scaffolding to engage mathematically. While discussion about some of the tasks and the end-of-unit assessment planning take place prior to the start of the unit, teachers often plan and revise day-to-day unit lessons *during the unit* as they gain information regarding students' needs and successes. What your students do and say while developing understanding of the essential learning standards for the unit provides the data for your teacher team conversations.

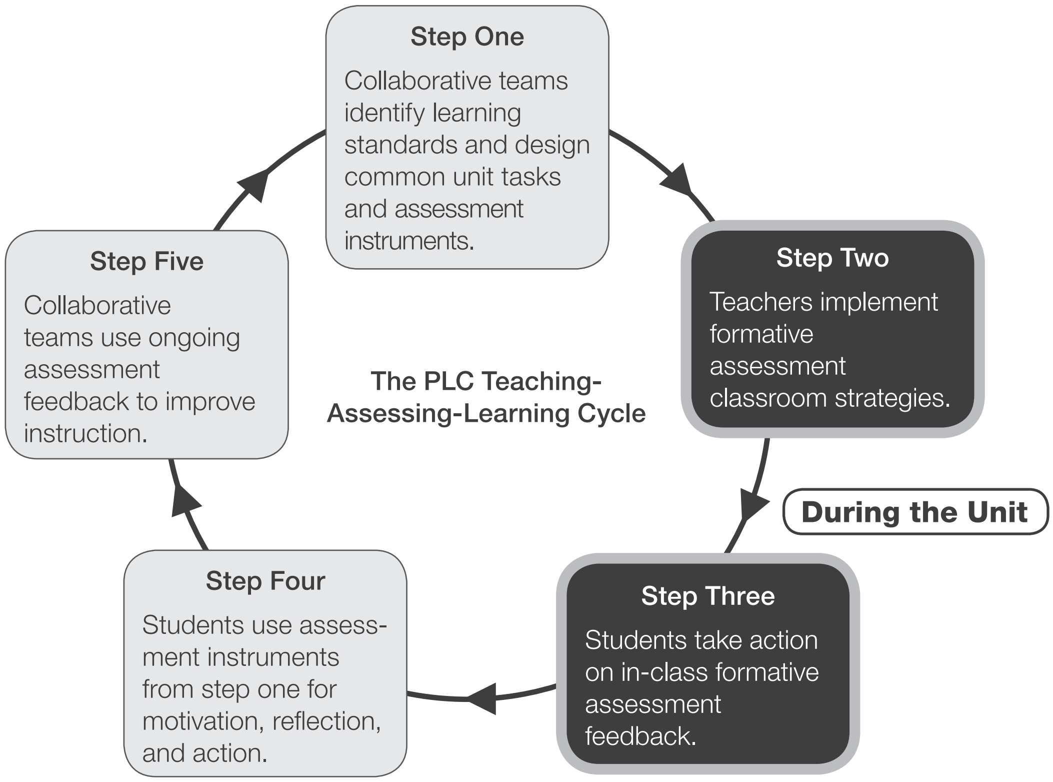
This process of data gathering, sharing, providing feedback, and taking action regarding student learning forms the basis of an in-class *formative assessment process* throughout the unit. By sharing these efforts, your grade-level team can make needed adjustments in task development and instruction that will better support student learning during the unit. An effective formative assessment process also empowers students to make needed adjustments in their ways of thinking about and doing mathematics to lead to further learning.

This chapter is designed to help you and your collaborative team members prepare and organize your team's work and discussions around three high-leverage team actions during the unit of instruction. These three high-leverage actions support steps two and three of the PLC teaching-assessing-learning cycle in figure 2.1 (page 68).

The three high-leverage team actions that occur during the unit of instruction are:

HLTA 6. Using higher-level-cognitive-demand mathematical tasks effectively
HLTA 7. Using in-class formative assessment processes effectively
HLTA 8. Using a lesson-design process for lesson planning and collective team inquiry

Steps two and three of the teaching-assessing-learning cycle provide a focus to your collaborative team's use of effective in-class lesson strategies as you support students' mathematics learning during the unit's instruction. How well your collaborative team implements formative feedback and assessment processes (step two) is only as effective as how well you and your team are able to elicit student actions and responses to the formative feedback you and their peers provide (step three). You can only effectively implement formative assessment if students are actively involved in the process.



Source: Kanold, Kanold, & Larson, 2012.

Figure 2.1: Steps two and three of the PLC teaching-assessing-learning cycle.

As you begin your during-the-unit team discussions, set the stage by developing a common understanding of key terms you will use. You and your team should complete table 2.1 to organize your thinking prior to continuing through this chapter. Each team member will present common as well as different ways of thinking about teaching, assessing, and learning. A common understanding of the terms provides a foundation that facilitates thorough consideration of mathematics instruction to maximize student achievement. Once again, this work is about the constant and ongoing discussion between you and your team regarding knowing thy impact.

After each team member has responded to table 2.1, discuss how your team can use these key terms during the unit of instruction to bolster students' mathematics learning through collaborative team efforts. For example, some might include *student learning* in their definition of *teaching*, and others might not have considered that teaching does not truly occur unless a recipient of that teaching actually learns. This should lead to a discussion of how team members interpret the term *teaching*. You should revisit and consider understandings such as this as you work your way through this chapter. It is important to align your understandings of these terms to pursue an equitable formative assessment process.

Table 2.1: Common Understandings of Key Terms

Directions: Record your understandings of the following key terms. Provide an example to illustrate your understandings, and compare and contrast your understandings with other team members.		
Term	**Your Understanding**	**Example to Illustrate Your Understanding**
Teaching mathematics		
Assessing mathematics		
Learning mathematics		
Checking for understanding		
Using formative assessment processes		

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As you focus attention on the Mathematical Practices and processes as an integral part of your instruction, the challenge is to envision these practices as student outcomes in the classroom. As you collaborate with your colleagues around instruction, your dialogue will focus specifically on the tasks you use, the questions you ask and students answer, the nature of your whole- and small-group discourse, and the way you manage the daily activities in which students participate. This should lead your team to consider the question, What are students doing as they engage in the Mathematical Practices?

The three high-leverage team actions in this chapter will allow you to go deeper in your use of higher-level-cognitive-demand tasks, implement the formative assessment process connected to the Mathematical Practices, and design lessons centered around K–5 learning standards and Mathematical Practices that include attention to both teacher and student actions. The Mathematical Practices lesson-planning tool discussed later in this chapter (see figure 2.21, page 108) provides one framework for synthesizing each of the three high-leverage team actions, moving your team closer to engagement in informal lesson study.

HLTA 6: Using Higher-Level-Cognitive-Demand Mathematical Tasks Effectively

The sixth high-leverage team action highlights the team's work to present, adjust, and use daily common higher- and lower-level-cognitive-demand mathematical tasks. These tasks were designed in step one of the teaching-assessing-learning cycle as part of the second HLTA (page 20).

The What

Recall there are four critical questions every collaborative team in a PLC culture asks and answers on an ongoing unit-by-unit basis.

1. What do we want all students to know and be able to do? (The essential learning standards)
2. How will we know if they know it? (The assessment instruments and tasks teams use)
3. How will we respond if they don't know it? (Formative assessment processes for intervention)
4. How will we respond if they do know it? (Formative assessment processes for extension and enrichment)

The sixth HLTA, using higher-level-cognitive-demand mathematical tasks effectively, ensures your team reaches clarity on the second PLC critical question, How will we know if they know it?

High-Leverage Team Action	1. What do we want all students to know and be able to do?	2. How will we know if they know it?	3. How will we respond if they don't know it?	4. How will we respond if they do know it?
During-the-Unit Action				
HLTA 6. Using higher-level-cognitive-demand mathematical tasks effectively				

= Fully addressed with high-leverage team action

= Partially addressed with high-leverage team action

You and your team intentionally plan for, design, and implement mathematical tasks that will provide student engagement and descriptive feedback around the elements of the learning objectives as well as standards for Mathematical Practices and processes. As mentioned in chapter 1, effective use of higher-level-cognitive-demand tasks also means that you do not lower the cognitive demand of the tasks implemented during instruction.

When students work on cognitively demanding tasks they often at first struggle. Some mathematics teachers too often perceive student struggle as an indicator that the teacher has failed instructionally. Thus, the teacher will jump in to rescue students by breaking down the task and guiding students step by step to a solution (Leinwand et al., 2014). This, in turn, deprives students of an opportunity to make sense of the mathematics (Stein, Remillard, & Smith, 2007) and does not support student engagement with Mathematical Practice 1—"Make sense of problems and persevere in solving them."

Through your work on high-leverage team action 6, you help your students see that *productive struggle* is an important part of learning mathematics (Leinwand et al., 2014) and you begin to develop student proficiency in the Mathematical Practices and processes by using higher-level-cognitive-demand tasks in class that support learning the essential standards of the unit.

HLTA 6 consists of three action components:

1. Understanding student proficiency in Mathematical Practices and processes
2. Using higher-level-cognitive-demand tasks effectively during the unit of instruction
3. Keeping a sustained focus on the essential learning standards during the unit of instruction

By placing your limited time and energy on these three teaching and learning components during the unit, you and your collaborative team can dissect this high-leverage team action and develop plans for making it a reality during instruction. The process begins by revisiting and exploring what is meant by student proficiency for the Standards for Mathematical Practice: practices that describe *how* students should engage with the mathematics during class. To review, the CCSS for mathematics provide eight Standards for Mathematical Practice. The eight Standards for Mathematical Practice (presented in more detail in appendix A, page 149) are (NGA & CCSSO, 2010, pp. 6–8):

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

The How

To begin your work on this high-leverage team action, spend time deeply exploring each of the eight Mathematical Practices with your team. These standards represent important processes for student learning, whether your state is participating in the Common Core standards or not. In *Common Core Mathematics in a PLC at Work, Grades K–2* and *Grades 3–5* (Kanold, Larson, Fennell, Adams, Dixon, Kobett, & Wray, 2012a, 2012b), three key questions help you and your team better understand the Standards for Mathematical Practice.

1. What is the intent of the Mathematical Practice, and why is it important?
2. What teacher actions facilitate student engagement in this Mathematical Practice?
3. What evidence is there that students are demonstrating this Mathematical Practice?

Each team member should be able to respond accurately and with depth to these three questions. Some ideas for your team to facilitate this process appear in the Mathematical Practice tool in table 2.2.

Table 2.2: In-Depth Study of the Standards for Mathematical Practice Tool

Directions: Choose one of the following assignments below and record your plans to carry out the assignment for studying the Mathematical Practices, and then record the outcome of the assignment.

Mathematical Practices Study Assignment	Plans to Carry Out Assignment	Outcome of the Assignment
Engage in a book study, using chapter 2 of *Common Core Mathematics in a PLC at Work, Grades K–2* (Kanold et al., 2012a) or *Common Core Mathematics in a PLC at Work, Grades 3–5* (Kanold et al., 2012b).	Sample plan: Each member of our team will read chapter 2 prior to our next collaborative team meeting. We will come to the meeting with a list of two things we learned, two actions we will take as a result of what we learned, and two questions that we need to discuss.	Sample outcome: Each team member participated and felt that his or her instruction was influenced by what was read. Sharing activities was helpful in coming up with new ways to support student engagement with the Mathematical Practices. We were able to answer questions brought by our team members.
Develop scenarios from your instruction, and discuss ways to increase focus on the Mathematical Practices that will positively impact students' learning.		
Select a Mathematical Practice, and locate a journal article that describes the practice conceptually or represents the practice in action. Discuss the article as a collaborative team.		

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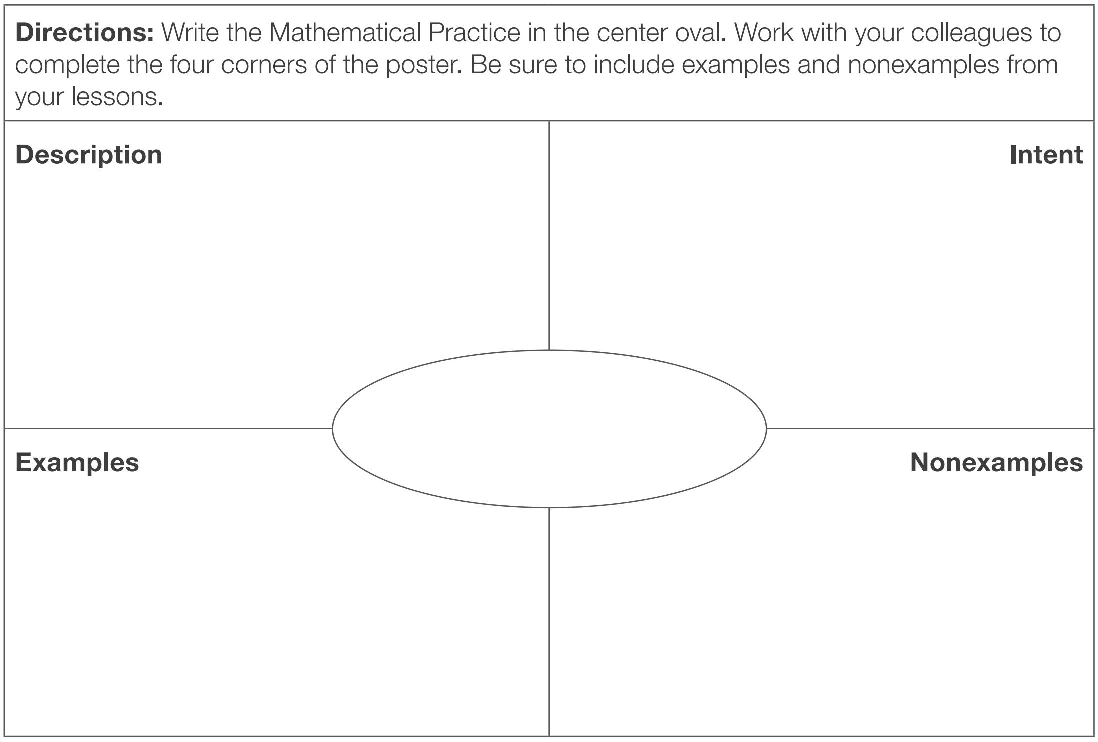
In addition to completing one of the assignments in table 2.2 with your team, use the adaptation of the Frayer model as an effective technique to investigate the intent and reasoning behind each Mathematical Practice. (See figure 2.2, page 74.) This model provides a useful framework to unpack the meaning of the Mathematical Practices with a focus on classroom implementation. You and your collaborative team should work through each of the eight practices one at a time to create posters (electronically or with poster paper) using the Frayer model. Post these in your teacher work area as a reminder of student expectations for demonstrating each Mathematical Practice. What does each practice look like and sound like in your classroom? That is, what should you expect to see and hear from your students when they are doing mathematics in your classroom?



Source: Adapted from Frayer, Frederick, & Klausmeier, 1969.

Figure 2.2: Using the Frayer model for Mathematical Practices.

Since the Mathematical Practices represent what students are to do, one of your first responsibilities is to expect students to demonstrate their understanding of each process standard as the year progresses. Your second responsibility is to ensure students experience mathematical tasks or activities that allow them to actually demonstrate the Standard for Mathematical Practice as part of your lesson planning for each unit.

Likely, your examples and nonexamples will reflect what you currently see, or plan to see, in your classroom around each Mathematical Practice. For example, a Frayer model poster for Mathematical Practice 5, “Use appropriate tools strategically” might have information related to the following for its description, intent, examples, and nonexamples:

- **Description—**Students know what tools are useful for given problems and use those tools in ways to increase efficiency and understanding. Students know the benefits of using one tool over another for a given problem context and discern appropriately when to use different tools.
- **Intent—**Students have access to a wide variety of tools. The tools students choose provide data in the formative assessment process related to how students think about the problem.
- **Example—**Second-grade students choose base ten blocks to solve a multidigit addition problem that involves regrouping but use an open number line to solve an addition problem where the first addend is two digits and the second is one digit.
- **Nonexample—**The teacher directs the students to use base ten blocks to solve all multidigit addition problems.

Discuss your team's examples and nonexamples from the Frayer model activity to determine if all of the described actions in the examples are present in your classrooms and what teachers can do to make them more common. The example describes what student proficiency in a Mathematical Practice might look like. You can use the ideas from your team discussion as a basis for understanding how to capture student proficiency.

Understanding Student Proficiency in the Mathematical Practices

It is important to note that your team's investigation of the Mathematical Practices is all about understanding how students are to *learn and do* mathematics. As a reader and user of this handbook, whether or not your state adopted the Common Core, is a member of one of the Common Core assessment consortia, or has established singular state standards and assessments, is not essential to this high-leverage action. Research about how students learn mathematics at high levels of achievement is the basis on which the Mathematical Practices and processes stand (Hattie, 2012; Kilpatrick, Swafford, & Findell, 2001; NCTM, 2014). In short, your deep understanding of how to develop student proficiency in these practices has a considerable learning benefit to the student. (See appendix C on page 155 or visit **go.solution-tree.com/mathematicsatwork** to access research resources related to the ten high-leverage team actions in this handbook.)

Student proficiency with the Mathematical Practices must involve both conceptual and procedural understandings of mathematics. Most likely, the level of student proficiency will vary for many reasons. For example, what proficiency looks like for a kindergarten student will be different from what proficiency looks like for a fifth-grade student. Proficiency will also vary across topics within a grade. For example, topics within the fourth-grade standards in the domains Number and Operations in Base Ten (4.OA) versus Geometry (4.G) will warrant different types of proficiency (see NGA & CCSSO, 2010, pp. 29, 32).

You and your colleagues will need to develop consensus on the meaning of *proficiency* relative to students' engagement with the Mathematical Practices. To support this work, use figure 2.3 (page 76) to organize your collaborative team's initial ideas about proficiency and the Mathematical Practices. It will be helpful to return to the source of the Standards for Mathematical Practice. You should take caution if using posters available online to make sense of the standards as they are often oversimplified and based on interpretations of the Mathematical Practices that may not be true to the source. The original descriptions of the Standards for Mathematical Practice are provided in appendix A (page 149).

Students' proficiency with the Mathematical Practices will be apparent through effective class discussion and instruction around both lower- and higher-level-cognitive-demand mathematical tasks. The lower-level-cognitive-demand mathematical tasks might involve teacher-student dialogue; however, the higher-level-cognitive-demand mathematical tasks must include student-to-student discussions around the tasks.

Directions: Record your insights about proficiency with the Standards for Mathematical Practice.
Mathematical Practice 1: When students are proficient with making sense of problems and persevering in solving them, they . . .
Mathematical Practice 2: When students are proficient with reasoning abstractly and quantitatively, they . . .
Mathematical Practice 3: When students are proficient with constructing viable arguments and critiquing the reasoning of others, they . . .
Mathematical Practice 4: When students are proficient with modeling with mathematics, they . . .
Mathematical Practice 5: When students are proficient with using appropriate tools strategically, they . . .
Mathematical Practice 6: When students are proficient with attending to precision, they . . .
Mathematical Practice 7: When students are proficient with looking for and making use of structure, they . . .
Mathematical Practice 8: When students are proficient with looking for and expressing regularity in repeated reasoning, they . . .

Figure 2.3: Identifying proficiency with the Standards for Mathematical Practice.

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