SOAR

Teaching Frames® for Literacy

MATHEMATICAL DISCUSSIONS
Module One Manual

EPF Essential Practice Frames for teaching

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Essential Teaching Practices and Practice Frames

FOCUS QUESTIONS

- Which teaching practices are most essential for supporting implementation of College and Career Readiness Standards?
- In what ways do these essential teaching practices interconnect during instruction to support student learning?
- How can a corresponding set of classroom videos, vignettes, and instructional strategies be used to illustrate what the essential teaching practices look like when enacted in the classroom?

Essential Teaching Practices

The expectations for teachers as reflective practitioners when implementing new College and Career Readiness Standards* are plain to see. But where can educational professionals find answers to questions like these?

- What does the practice of a particular teacher look like in engaging and supporting all students in learning?
- How do these practices change as they emerge across the continuum of teaching?
- What tools can support development of these essential practices through sustained, reflective analysis and professional development?

Because we believe that questions like these are at the heart of successful CCSS Mathematics implementation, our team of educational researchers and practitioners have engaged in more than a decade of systematic research and development to identify the essential practices that teachers can use to integrate mathematics instruction and academic language development. More specifically, we identified research-based practices at the intersection of promoting academic-language development and disciplinary understanding through analyses of data from Delphi panel studies of expert consensus, [1] video observations of classroom instruction,[2] existing instructional practice protocols with established reliability and predictive validity, [3, 4] and an extensive review of the research literature on effective mathematics instruction. [5, 6, 7, 8, 9]

Five High-Impact Practices (see pages 10-11) emerged as having significant potential to enhance student learning as articulated in the CCSS Mathematics and state ELD standards. These practices, which are embedded within the SOAR Teaching Frames®, are the following:

* College and Career Readiness Standards include the Common Core State Standards (CCSS), the Next Generation Science Standards (NGSS), and state ELD Standards.

Mathematical Discussions: This practice focuses on structuring, strengthening, and supporting students' ability to engage in mathematical discussions. Mathematical discussions can consist of face-to-face interactions, online dialogues, and student-to-student number talks. Effective teachers build mathematical conversation skills and provide extended and supported opportunities for students to participate in mathematical discussions.[10, 11, 12, 13, 14]

Mathematical Thinking Processes: This practice focuses structuring, strengthening, and supporting mathematical thinking skills to deepen conceptual understanding as well as strengthen procedural fluency, strategic competence, and adaptive reasoning. Effective teachers provide explicit instruction about mathematical thinking processes. Effective teachers also provide extended and supported opportunities for students to engage in these thinking processes. Mathematical Thinking Processes include: representation, problem solving, reasoning and proof, and inquiry.[15, 16]

Communicating Mathematical Understanding: This practice focuses on structuring, strengthening, and supporting students' ability to communicate mathematical understanding through oral and written output. Examples include pictorial and symbolic representations, graphs, models, spreadsheets, and oral or written justifications as discussed in the CCSS. Effective teachers provide multiple and supported opportunities for students to communicate their understanding of mathematical concepts through oral and written output.[17, 18, 19]

Mathematical Perseverance: This practice focuses on structuring, strengthening, and supporting students' ability to persevere, which includes productive disposition and struggle, a growth mindset, and taking risks as part of the problem-solving process. Effective teachers intentionally build mathematical perseverance skills and create cognitively demanding tasks that are accessible, require long-term goal setting, and for which solution pathways are not readily apparent. [20, 21, 22, 23]

Acquisition of Foundational Numeracy Skills (TK-2 only): This practice focuses structuring, strengthening, and supporting students' understanding and working knowledge of counting and cardinality, numbers and operations, algebraic thinking, measurement, and geometry. The foundational skills being taught are aligned to the standards for the grade level being observed. [24]

Our research also suggests that these essential High-Impact Practices, while central to effective implementation of CCSS Mathematics, do not operate in isolation. Instead, effective teachers enact a set of dynamic instructional moves in support of the High-Impact Practices. We labeled this set of three instructional moves Cross-Cutting Practices.

Facilitating Acquisition of Academic Language: This practice focuses on structuring, strengthening, and supporting the acquisition and use of the academic language needed to participate in knowledge construction and mathematical tasks. [25, 26, 27]

Fostering Metacognition for Mathematical Learning: This practice focuses on the degree to which a teacher visibly enacts and deconstructs metacognitive processes and strategies that foster students' metacognitive knowledge. There are two aspects of metacognition: reflective processes, i.e., awareness of what we know, and self-regulation, i.e., taking action to address flaws or gaps in what we know. [28, 29]

Connecting and Guiding Mathematical Learning: This practice focuses on how effectively a teacher elicits student thinking and uses that to engage student preconceptions and guide mathematical learning throughout each task, lesson, and unit of instruction. [30, 31, 32]

Finally, in preparation for enactment of the High-Impact and Cross-Cutting Practices, teachers employ a Foundational Practice.

Designing Instruction for Mathematical Thinking and Understanding: This practice focuses on the design of lessons and learning tasks to promote mathematical learning and support the target High-Impact Practice. This practice also focuses on how the teacher establishes high expectations and fosters in all students the willingness to participate in intellectually rigorous tasks. [33, 34, 35, 36, 37]

SOAR Teaching Frames

To illustrate the interconnectedness of the practices, we organized the practices into teaching frames, each consisting of a different High-Impact Practice supported by the Cross-Cutting and Foundational Practices, which are common across all frames. We call the collective framework Essential Practice Frames (EPF). The *Mathematical Discussions Teaching Frame* can be found on pages 12-13.

Together, the **SOAR** Teaching Frames® for Mathematics (with associated materials and rubrics) form a teaching protocol for improving nine essential practices for grades TK-2 and eight essential practices for grades 3-12. This protocol breaks the practices down into their component parts, which we call elements, to allow teachers to fully understand the practices, enact them, and reflect on them to elevate their teaching. In addition, the protocol provides a common language so that teachers and coaches can provide constructive and strategic feedback to their peers. A clarification of the important terms for each practice is included.

The **SOAR** Teaching Frames® for Mathematics apply to the academic language and mathematical practices requirements of the CCSS Mathematics and ELD standards. Other teaching frames that have been developed as part of this ongoing work include **SOAR** Teaching Frames® for Literacy TK–2, **SOAR** Teaching Frames® for Literacy 3–12, and **SOAR** Teaching Frames® for English Language Development TK–12.

The Strategic Observation and Reflection (**SOAR**) Teaching Frames offer teachers, coaches, and administrators who are currently implementing new College and Career Readiness Standards a suite of tools that drive continuous improvement in teaching and learning. The tools can be used for a variety of purposes: (1) informal or guided self-assessment of teaching practices, (2) peer-to-peer collaboration within learning communities to improve teaching, (3) site- and district-based professional-growth initiatives, and (4) formative and summative teacher assessment.

Implementing the SOAR Protocol

We designed this protocol to be used in several ways. First, we believe that it will support teachers in improving their ability to integrate mathematics instruction and academic language development and support their implementation of the CCSS Mathematics and state ELD Standards. Second, we believe it will foster peer-to-peer collaboration and facilitate cycles of strategic observation and reflection that are essential to improving teaching and learning. Having identified the practices that are most predictive of student growth, our team has also developed a corresponding set of videos and materials to illustrate what these practices look like when enacted in the classroom. The **SOAR** team has developed a platform designed around the **SOAR** Teaching Frames® (soarpractices.org), which fulfills several functions:

- Helps teachers and administrators deepen their understanding of the **SOAR** practices by engaging in a series of online modules and accessing additional instructional strategies.
- Allows teachers and administrators to use **SOAR** for self-reflection and for formative and summative teacher assessment, by providing interactive activities to deepen understanding of the **SOAR** rubrics.
- Scaffolds professional-learning for teachers in different grade spans (TK–2, 3–8, and 9–12) and across content areas (ELA, social studies, science, and mathematics) by providing them access to additional video examples of the practices implemented in a range of classrooms.

Conclusion

This chapter describes essential instructional practices that drive student learning as articulated in the CCSS Mathematics and state ELD Standards, as well as a framework for how these essential practices are interconnected in an effective integration of mathematics instruction and academic language development. We are currently using the protocol and corresponding online support materials in professional-growth programs for teachers, coaches, and instructional leaders in partner districts and schools. Findings from this work demonstrate that the **SOAR** Teaching Frames® for Mathematics provide a suite of powerful tools for supporting leaders', coaches', and teachers' adoption and enactment of these practices in their contexts, and ultimately for improving mathematics outcomes for all students.

Footnotes

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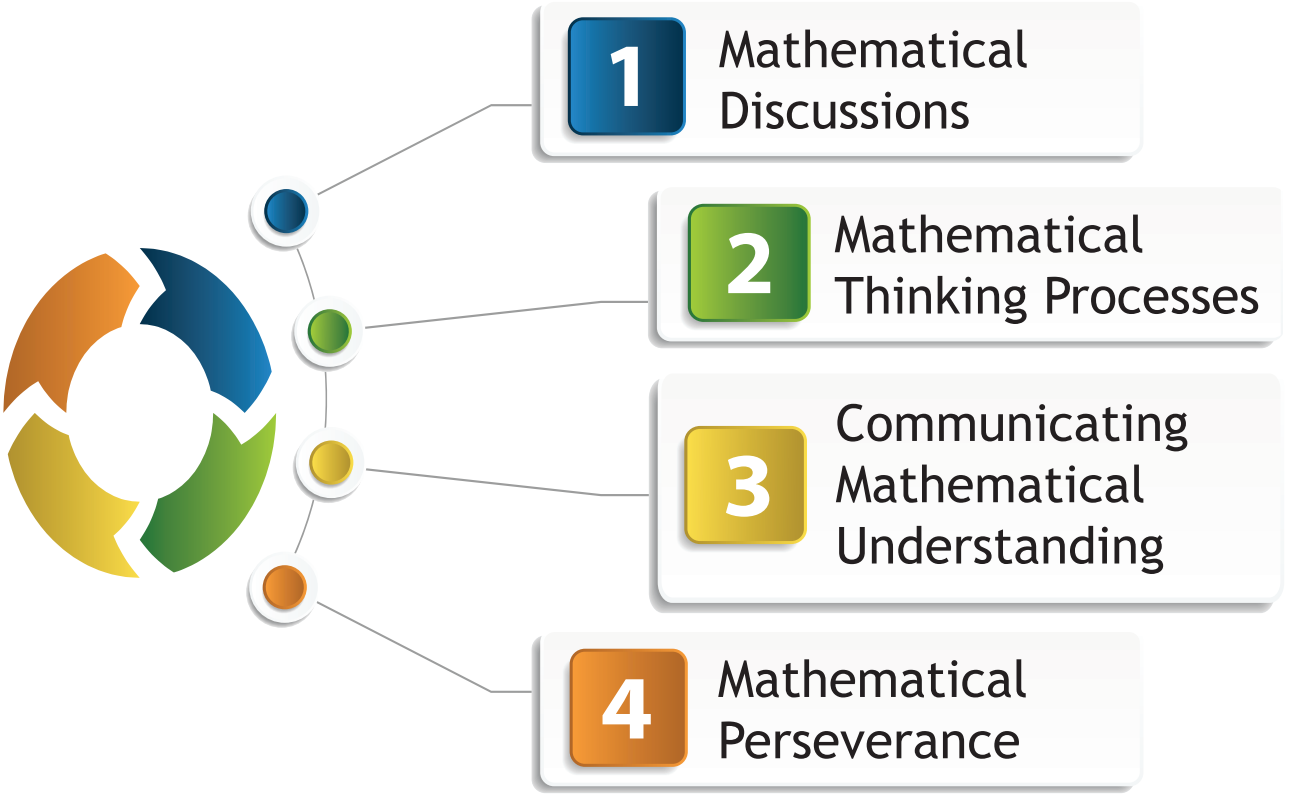
SOAR
CCSS MATHEMATICAL PRACTICES

STANDARD FOR MATHEMATICAL PRACTICE	STUDENT FRIENDLY LANGUAGE
1. Make sense of problems and perseverence 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 in repeated reasoning. 	

SOAR® High Impact Practices Mathematics



Mathematical Discussions

HIGH-IMPACT PRACTICE	• Build mathematical conversation skills • Provide extended and supported opportunities for students to engage in mathematical discussions		
CROSS-CUTTING PRACTICES	**Facilitating Acquisition of Academic Language (FAAL)** • Introduce and/or refer to academic language demands of texts and tasks • Provide extended and supported opportunities for students to acquire and use the features of academic language	**Fostering Metacognition for Mathematical Learning (FMML)** • Visibly enact metacognitive processes and/or strategies students are expected to use in support of mathematical learning • Deconstruct metacognitive processes and/or strategies that support mathematical learning	**Connecting and Guiding Mathematical Learning (CGML)** • Elicit student thinking and adjust instruction, supports, and mathematical tasks to meet student needs • Provide written and/or oral feedback during lessons to promote mathematical learning
FOUNDATIONAL PRACTICE	**Designing Instruction for Mathematical Thinking and Understanding (DI)** • Set mathematical learning targets that are aligned with the Math CCSS and the target high-impact practice • Structure and connect tasks that support the learning targets • Establish high expectations that support the learning targets and maintain the intellectual rigor of classroom activities and tasks		

Conversation Prompts and Responses

Conversation Skill	The Skill Requires:	Prompt and Response Starters
Create Ideas	• Staying on topic • Building on others' ideas • Making claims • Considering multiple points of view	A: What is your idea? B: My idea is . . .? A: What else can we say about that? B: I can add to that.
Clarify Ideas	• Elaborating on ideas • Paraphrasing what others say • Asking questions to deepen understanding	A: Can you elaborate on that idea? B: In other words, . . . A: Can you clarify that part? B: I think it is important because . . .
Fortify Ideas	• Supporting ideas with evidence • (self, world, text, research) • Identifying multiple examples of evidence • Explaining how evidence supports an idea	A: Can you give me an example? B: An example from the text is . . . A: What other evidence can we use? B: I think this evidence supports that idea because . . .
Negotiate Ideas	• Agreeing and disagreeing • Combining ideas into a new idea • Adjusting your thinking in response to others' ideas • Coming to consensus	A: Where do we agree/disagree? B: I agree/disagree because . . . A: How can we combine these ideas? B: I think we can say . . .

Unpacking the Mathematical Discussions Teaching Frame - Vignette

High-Impact Practice: *Mathematical Discussions*

What it is

- This practice focuses on structuring, strengthening, and supporting students' ability to engage in student-to-student mathematical discussions.
- These can consist of face-to-face interactions, online dialogues, and student-to-student number talks.

Why it matters

- Learning to converse is an extremely important way to broaden knowledge, enhance understanding, and build community.
- Mathematical discussions involve active processing of information as well as helping to clear up misconceptions and solidify ideas.
- They also make student thinking visible, allowing for more accurate assessment and in-the-moment feedback.

Elements

This practice may be broken down into two important elements. As you review these elements, think about what they might look like when implemented in the classroom.

- Build mathematical conversation skills
- Provide extended and supported opportunities for students to engage in mathematical discussions

Step into the Classroom

Read either the kindergarten or fifth grade vignette that follows. Using the language of the practice and its elements as a guide, underline any evidence that indicates how the teacher addresses Mathematical Discussions.

Kindergarten Vignette

Mr. Ramon has been working with his kindergarten students on having discussions with each other throughout the day. He has established routines and norms where students meet up with different partners to have discussions. For their mathematical discussions, he has worked with his students to ask the question, 'How do you know?', as a way for students to begin to justify their mathematical understanding.

For this lesson, Mr. Ramon has selected the following learning targets that align with the math and ELA CCSS:

K.CC.C.6 Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies.
MP3 Construct viable arguments and critique the reasoning of others.
MP6 Attend to precision – Students accurately represent each number.
MP7 Look for and make use of structure.
CCSS.ELA-Literacy.SL.K.1: Participate in collaborative conversations with diverse partners about kindergarten topics and texts as well as with peers and adults in small and larger groups.

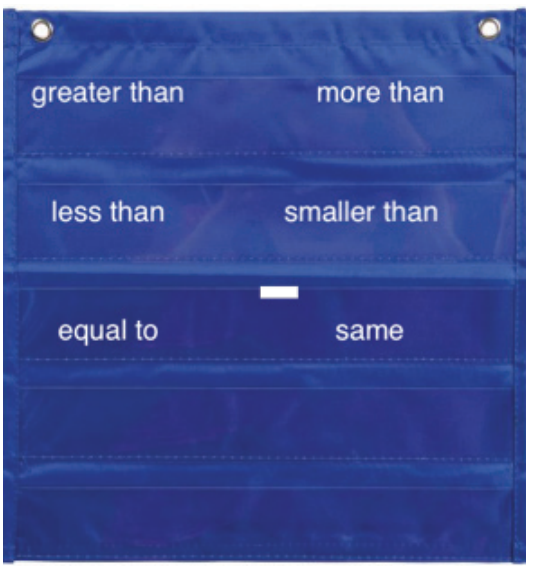
He has also identified language objectives:

Students will be able to orally identify and explain which set is greater than, less than, or equal to using the sentence frames.
Students will be able to explain the structure or strategy they used to justify their answer.

Mr. Ramon begins the math class by having students count down from ten, and skip counting by fives and tens. He reads the math standards that are on the whiteboard to the class.

- I can say which group is greater than by matching or counting the number of objects in both groups.
- I can say which group is less than by matching or counting the number of objects in both groups.
- I can say when groups are equal by matching or counting the number of objects in both groups.
- I can use the words greater than, less than, and equal to when I compare two sets.

He introduces the vocabulary for this lesson. "Today we are going to use special vocabulary to describe our mathematical thinking. (He says the words as he places them in the pocket chart.) 'Greater than.' Say it with me. Greater than. 'Less than.' Say it with me. Less than. 'Equal to.' Say it with me. Equal to. We are going to be comparing groups to see which one is greater than, less than, or equal to."



He asks six students to come to the front of the room. He splits them, four in one group, two in another. He has a student count how many are in each group. He asks the students which group has more students in it. He says, "Yes, Brooklyn's group is greater than Kelsey's group. It has more students in it. 'Greater than' means 'more than'. (He adds 'more than' next to 'greater than' on the pocket chart.) Now, which group is smaller, Brooklyn's or Kelsey's?...Yes, Kelsey's group is less than Brooklyn's group. 'Less than' means 'smaller than'. (He adds 'smaller than' next to 'less than' on the pocket chart.) Let's move people around. Now how many are in Brooklyn's group and how many are in Kelsey's group? How do we know? We know because we counted them. They both have three so we say they are equal to each other. Say that with me. Both groups have three so they are equal to each other. 'Equal' means the 'same'. (He adds that to the pocket chart.) Thank you, boys and girls, you can return to your seats."

Next Mr. Ramon explains, "We are going to play some games today to get better at comparing sets as greater than, less than, or equal to each other. First, we are going to use Legos. Let's count the number of red Legos I have. 1, 2, 3, 4. How do I know I have four red Legos? Turn and tell your triangle partner… Mario, can you tell me what your neighbor said?"
Mario answers, "I know you have four red Legos because we counted them."
"Excellent Mario. You are correct. We counted them. Also, I am very proud of you for stating your response in a complete sentence and using our sentence frame. Now let's count the blue Legos. 1, 2, 3, 4, 5, 6. So we have six blue Legos and four red Legos. How can I compare them? How can I figure out which one is greater than, which one is less than? Maria?"
"We can count them," Maria states.
"Yes, we can. Is there another strategy we can use to figure out if one set is greater than and the other set is less than?"
"You can place them next to each other and see which one is taller," responds Maria.
"Great idea. Let's place them next to one another. Here is the sentence frame we are going to use to compare them. ___ is greater than____. And ___ is less than___. Turn to your triangle partner and discuss if the blue or red Lego tower is greater than or less than using your sentence frame. Ask your partner how you know and respond using the frame, I know because___."

Mr. Ramon moves around the rug to hear students discuss the Legos. He asks some questions and provides feedback to guide the students' discussions.

He has students go back to their seats and distributes Legos to each pair. He provides four more comparison sets to be sure students are understanding the concept. He asks students three questions using their sentence frames to answer. Which set is greater than? Which set is less than? How do you know? On the last example he adds the question, How can we make the sets equal to each other? He has students discuss with their partners using the sentence frame: I can make the set equal to each other by_____.

Mr. Ramon collects the Legos and restates that students were able to know which were greater than and which were less than by counting them and by stacking each Lego tower next to each other. "Now we are going to use our counters to do the same thing we did with the Legos. We are going to figure out which set is greater than, less than, or equal to each other. And we are going to use a strategy to show how we know."

He distributes the colored counters, a die, and a recording sheet. "I am going to model what we are now going to do. I am with my triangle partner. I roll the die. I get a 4. I take four red counters out of the bag and place them on my desk. My partner, Maria, rolls the die and she gets a 3. She takes out three yellow counters. Now we need to answer the questions using our sentence frame. I think the red counters are greater than the yellow counters. Maria, what do you need to ask me?"
"How do you know?" Maria asks.
"I counted," says Mr. Ramon.
Maria says, "Mr. Ramon, is there another strategy we could use to figure it out?"

"We could place the set of yellow counters above the set of red counters and see which is longer. Let's do that. Place your yellow counters above of my red counters. Which is greater? Which is less?" Mr. Ramon asks.

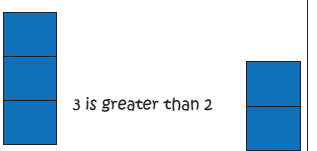
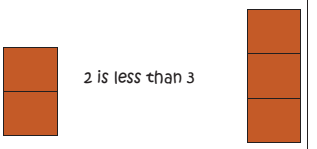
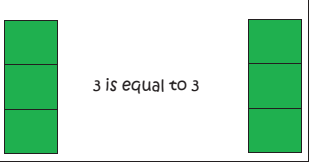
Maria says, "Look, there are more red counters, so the red counters are greater than the yellow counters."

Mr. Ramon says, "And the yellow counters are less than the red counters. Can we make them equal? What would we have to add to the yellow counters to make them equal to the red counters?"

Maria says, "One?"

Mr. Ramon asks, "How do you know?"

"Because if I add one more yellow counter, they will be even. They will be the same," Maria says.

Greater Than • The first set has more than the other set. • The first number is larger than the other number.	
Less Than • The first set has less than the other set. • The first number is smaller than the other.	
Equal to • Both sets or both numbers are the same.	

Mr. Ramon explains that by putting one set above the other, we are able to match them. "You could also stack them like the Legos to see which stack is taller. Or you can play the game take away. I take one of my red counters away and you take a yellow counter away. We keep doing that until one of the stacks is all gone. Then we can ask, Were there more yellow counters or red counters? How do you know?"

"Ok, I'm going to be walking around listening to how you are using less than, greater than, and equal to in your discussions with your partners as you play the game. Remember, if you get stuck you can ask your partner for help or you might ask your partner to clarify what they mean. If your partner gets stuck, you can help guide them and maybe say what you think in a different way. And if you both get stuck, you could look at the chart on your desk, or look at your sentence frames to see if they can help. You could also ask me for help."

Mr. Ramon walks around monitoring students. He stops at one pair and sees they are not discussing but just rolling the die and getting their counters. He asks Kelsey what she could ask Brooklyn to find out if her counters are more or less than Kelsey's. "Brooklyn, are the red counters greater than or less than the yellow counters?"

Mr. Ramon says, "Yes, that is exactly the correct question. So Brooklyn, what is your response?"

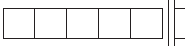
Brooklyn says, "The yellow counters are greater than the red counters. I am going to stack the yellow counters on top of each other and the red counters on top of each other to show that the yellow counters are greater."

"Kelsey, can you show another way that the yellow counters are greater than the red counters?" Mr. Ramon asks.

"We can take one off of each stack to see how many are left. That will also show which one is greater," said Kelsey.
"Brooklyn, is that another way?" Mr. Ramon asks.
"Yes", says Brooklyn. "Let's do that."

He concludes the lesson by asking students to turn to their partners and explain what each of the three terms means. They then complete an assessment where they draw to represent greater than, less than, and equal to.

Name _____Date_____

Draw a tower that is greater than the tower below. _____ is greater than____.	Draw a tower that is less than the tower below. _____ is less than_____.	Draw a tower that is the equal to the tower below. _____ is equal to _____.
		

Instructional Strategies that Support the Implementation of Mathematical Discussions

FOCUS QUESTIONS

- What are some examples of instructional strategies teachers can use to implement the teaching practices in the *Mathematical Discussions Teaching Frame*?
- How are these strategies similar to or different from ones you currently use in your teaching?
- What is one way you could use one of these strategies in your classroom?

Instructional Strategies

The Common Core Standards for Mathematical Practice describe the ways in which mathematicians engage with mathematics. These standards are often referred to as "habits of mind," and they must be taught and applied as often and with as much intensity as grade level mathematical content. The following strategies are designed to support diverse learners with mathematical discussions that engage students in applying the Standards for Mathematical Practice during problem solving. Each strategy is intended to explicitly teach or externalize the mathematical "habits of mind" students require to develop critical thinking skills and deep conceptual understanding in mathematics. These strategies are especially useful in supporting English learners with additional opportunities to participate in language-based activities in the mathematics classroom.

Mathematical Discussions—Element 1: Build Mathematical Conversation Skills

Instructional Strategy—*Introducing Conversation Skills*

Students need conversation skills in order to engage in productive discussions in all discipline areas, including in mathematics. We define these skills as Create, Clarify, Fortify, and Negotiate meaning in student-to-student interactions. The strategy shared here promotes explicit introductions for each skill and provides graphics teachers and students can refer to as they build and apply the conversation skills during math lessons. The strategy for introducing the conversation skills could be implemented during a math lesson, or it could be introduced during a lesson in ELA, social studies, or science. Whichever content area you choose for introducing the conversation skills, you should refer to them and support their use during mathematical discussions.

Why Use This Strategy: Conversation skills are essential for student success in CCSS classrooms and for mathematical learning. It is important for students to understand that engaging in mathematical conversations is necessary for them to be successful in school. An awareness of these skills and the ability to use them effectively help students hold purposeful conversations in which they deepen their thinking and co-construct meaning through multiple exchanges with peers. These skills are also necessary across contexts and disciplines and are ones students will draw on for the rest of their lives.

When to Use This Strategy: Teachers make use of this strategy when they want to introduce students to a new conversation skill or when they want to remind students of skills they have previously taught. This strategy can be useful when teachers want to provide prompts and responses associated with each skill or highlight its purpose in a discussion. The visuals included with this instructional strategy can be helpful reminders for students before they engage in mathematical discussions.

How to Use This Strategy: Begin by introducing conversation norms. With your students create an anchor chart that illustrates your expectations. These norms could include "sit knee-to-knee," "listen to each other," "stay on topic," "use a quiet voice," and "one person talks at a time." After norms are established, introduce each of the conversation skills using prompt and response starters to help students acquire these skills.

Primary Grade Example Lesson: *Introducing Conversation Skills*

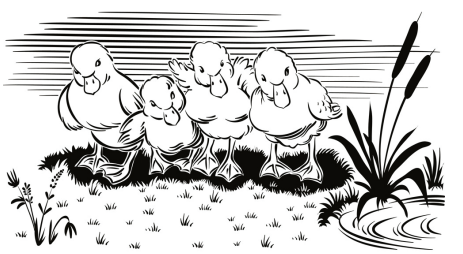
1. Establish one norm at a time and when students have mastered that norm, add another one. Model each of these expectations by using puppets, students, or other adults. It is also effective to demonstrate a non-model, have students identify how it affected the conversation, and discuss why that norm is important to maintaining a mathematical discussion. To help students take turns, you can use talking sticks or rocks that are passed to a student when it is his or her turn to talk.

2. Have students practice the conversation norms by posing questions for students to ask and answer. An example is after reading Quack and Count, ask the students to ask each other questions.

    Student A: Did you notice any math in the book?
    Student B: Yes, I noticed there were seven ducklings, 6 +1
    Student B: What math did you notice?
    Student A: I noticed 5 + 2.

    A higher expectation would be to have them build on each other's ideas.

    Student A: Can you name one way to make the number 7?
    Student B: One way could be 6 + 1.
    Student A: How do you know?
    Student B: I have seven counters. I put 1 in the pond and I have 6 in the grass.
    Student A: I agree. Let's write the number sentence, 6 + 1 + 7. I have one. 4 + 3.
    Student B: How do you know?
    Student A: I can take my seven counters and move 3 to the pond and have four in the grass.



3. Introduce one Conversation Skill at a time. Begin with Create. Write the prompts and responses on colored sentence strips using one color for the prompt "What do you notice?" and another color for the response "I noticed…" Begin with a visual mathematical text. Create a model and non-model conversation. Have students discuss the effectiveness of each. Develop your own hand motion or use this one: Starting on each side of the head with fingers closed, make an exploding motion with hands and fingers, and finish with them spread wide on each side in the air. This demonstrates "creating" an idea.

4. As students master the Conversation Skill Create, move to Clarify, and continue introducing the other Conversation Skills. You can use sentence strips or an anchor chart as a point of reference. Here is an example of the introduction.
    - "Next, we clarify our idea, and it starts to come into focus. We can see the image change from blurry to clear. This hand signal is cupping your hands over your eyes as if you were focusing binoculars."
    - "Then, we fortify our idea with supporting evidence. The graphic shows our idea propped up and gives examples of where we might find evidence to support it, such as from text, media, and our knowledge about the world or ourselves. The hand signal for this one is placing three fingers of one hand below the palm of the other as support."
    - "Finally, we negotiate with our discussion partner regarding the strength of each of our ideas so we can reach consensus or construct a new idea. The graphic represents the ideas of two heads. The final hand signal is extending your fists in front of you and bringing them together interlacing the fingers."

5. Have students reflect on their use of the Conversation Skills by asking these questions. "How did I state my ideas and understanding? How did I take turns sharing my ideas? How did I stay on topic? How did I build on my partner's ideas?" Share examples of students using the skills well.

Intermediate Grade Example Lesson: *Introducing Conversation Skills*

1. In their groups have students discuss norms that are effective for a conversation. Ask the groups to share out and create an anchor chart for the classroom.

2. Have the groups discuss what a mathematical discussion would look like. Create a T-chart on chart paper with one side "looks like" and the other side "sounds like." Have students share out their ideas. Ask probing questions to clarify any generalizations. Then have students discuss what a discussion would sound like and record it on the T-chart. The goal is to get students to understand that mathematical discussions are different than the way they typically talk to their friends. They should be very explicit and intentional about the outcome.

3. Process the T-chart by asking students to answer and discuss these questions: Why are mathematical discussions important? How do mathematical discussions help us learn? What makes a mathematical discussion a good mathematical discussion?

4. Now introduce the four conversation skills by asking students to read and annotate the one-and-a-half-page description of the skills on page 75-76. When they have finished, have students meet with a partner and discuss what they learned about Create. Have them create a one to two sentence definition and complete this sentence frame: "According to the text, the skill of create is…" Call on some students to share out their definition and sentence frame. Create your anchor chart for the conversation skills based on the agreed definition. Have students move to another partner and discuss Clarify. Write a one to two sentence definition and complete this sentence frame: "According to the text, the skill of clarify is …" Have students share out and add to the Anchor Chart. Have students move to a new partner and follow the same steps for Fortify. And move again to a fourth partner and follow the same steps for Negotiate.
5. Once students have an understanding of the conversation skills, have them apply them one at a time. Project a visual text and provide a model and non-model of how you could create an idea with this visual text. Then have students work with a partner and create an idea using the sentence stem, "I noticed…" Practice this skill for a few days until you feel they have grasped this skill. Follow the same process for the other three conversation skills.
6. You can also use the Conversation Prompts and Responses.

Mathematical Discussions—Element 2: Provide extended and supported opportunities for students to engage in mathematical discussions

Instructional Strategy—*Three Listens*

The *Three Listens* strategy is designed for students to listen to the problem three times, each time with a different purpose, in order to make sense of the various layers of language (context and content) and discuss possible solution pathways. Word problems present a real challenge because students are tasked with making sense of the mathematics, which is often embedded within various layers of complex language. In a word problem, both the context (story) and content (math) of the word problem can pose a challenge.

Why Use This Strategy: The *Three Listens* strategy is a way to socially enact the metacognitive processes by which a mathematician approaches problem solving and specifically targets MP1 – Make sense of problems and persevere in solving them. The strategy helps diverse learners (struggling readers, ELs, SWDs, etc.) to make sense of challenging word problems by focusing on one feature at a time—context and its vocabulary and content and its vocabulary. Each listen unpacks a layer of understanding, allowing students to build layers of meaning, and enough understanding to approach the problem with determination and find an entry point for solving.

When to Use This Strategy: This strategy is meant to be used to present and unpack a challenging word problem before students begin to solve it. It should be used only when a problem is challenging beyond productive struggle due to difficult/confusing language and/or when it introduces new content you anticipate students will find difficult. For example, you may be utilizing larger numbers, introducing a new problem type (e.g. start unknown, multiplicative comparison), or a new concept (e.g., time, money, fractions, volume).

How to Use This Strategy: Select a challenging and grade-level appropriate problem that you will unpack together as a class using the strategy. Analyze the language in the problem and solve it in as many ways as you can before you present it to the students, so that you may anticipate what students may have trouble with for each listen. Provide prompt and response starters and the graphic organizer to support students' thinking and conversations. Guide students as they make sense of the problem and develop a plan to solve it by following the steps below. Once they have made sense of the problem and have found an entry point for solving it, students should then work on their own or collaboratively to solve the problem. The lesson should culminate with the class sharing, discussing, and analyzing one or two solutions.

	Teacher Facilitation	Strategic Questions
1st Listen – (Listen & Discuss the Story)	• Teacher presents the problem as if telling a story, pausing to check for understanding and making sure to exclude any numbers or quantities • Teacher asks students strategic questions to help them understand the important contextual language of the problem • Teacher prompts students to discuss each question with a partner; teacher refers to poster and reviews prompt and response starters as needed • Teacher monitors partner discussions and strategically selects one or two students to share with the whole group • Students document their responses using the graphic organizer	• What is the story? • What are some important details? • What is the problem?
2nd Listen – (Listen & Discuss the Math)	• Teacher states the problem, this time including the numbers or quantities • Teacher asks strategic questions to help students understand the math • Teacher prompts students to discuss each question with a different partner; teacher refers to poster and reviews prompt and response starters as needed • Teacher monitors partner discussions and strategically selects one or two students to share with the whole group • Students document their responses using the graphic organizer	• What does the math vocabulary mean? • What do the numbers mean? • What is the unknown?

3rd Listen – (Listen & Discuss a Plan)	• Teacher states the problem again • Teacher uses the questions to model a think aloud that demonstrates the process by a mathematician uses to approach the problem • Teacher prompts students to discuss each question with a different partner; teacher refers to poster and reviews prompt and response starters as needed • Teacher monitors partner discussions and strategically selects one or two students to share with the whole group • Students document their responses using the graphic organizer	• What is the best way to solve this problem? • How will I show my thinking? • How do I know my thinking makes sense?
After the *Three Listens*	• Students work independently or cooperatively to solve the problem; they may show their thinking using manipulatives, drawings, numbers, and words • The lesson culminates with the class sharing, discussing, and analyzing one or two solutions led by the teacher	

Supporting Materials for Three Listens Prompt and Response Starters

SOAR Three Listens Prompt & Response Starters

	Prompt Starters	Response Starters
1st Listen **Listen & Discuss the Story**	• What is the story? • What are some important details? • Who or what is the story about? • What is the problem? • What do we need to find out?	• The story is about… • One important detail is… • In the story… • The problem is… • We need to find out…
2nd Listen **Listen & Discuss the Math**	• What does the math vocabulary mean? • What do you think the word/phrase … means? • What do the numbers mean? • What does the number … represent? • What is the unknown?	• One math vocabulary word in the problem is… • I think … means …. • One number in the problem is… • The number … represents? • I think … is the unknown because…
3rd Listen **Listen & Discuss a Plan**	• What is the best way to solve this problem? • Have I solved a similar problem? Will the same approach work with this one? • How will I show my thinking? • Which model or tool can I use? • How do I know my thinking makes sense?	• I think … is the best approach because… • This problem reminds me of… • Last time I used… • I can use/draw … to show… • This makes sense because….

Graphic Organizer

SOAR Three Listens Graphic Organizer

Name: _____ Date: _____

1st Listen Partner: _____
- What is the story?
- What are some important details?
- What is the problem?

2nd Listen Partner: _____
- What does the math vocabulary mean?
- What do the numbers mean?
- What is the unknown?

3rd Listen Partner: _____
- What is the best way to solve this problem?
- How will I show my thinking?
- How do I know my thinking makes sense?

Lesson Example: Grade 1, Operations and Algebraic Thinking

(1OA.1) Represent and solve problems involving addition and subtraction. 1. Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.

Problem Type: Take From, Start Unknown

There were some students sitting at the rug with the teacher. Then, 5 of the students went back to their seats to do their work. Now, there are still 7 students working with the teacher at the rug. How many students were working with the teacher before?

1st Listen

- Teacher presents the problem as if telling a story, pausing to check for understanding and making sure to exclude any numbers or quantities.
- Teacher asks students strategic questions to help them understand the important contextual language of the problem.
    - o Teacher: I have a challenging problem and I need your help to solve it. Let's try to make sense of it together using our *Three Listens* strategy. There were some students working with the teacher at the rug. Try to visualize the students. Do you see them?
    - o Students: We see them.
    - o Student 1: How many were at the carpet?
    - o Teacher: Don't worry about the numbers right now. Focus on the story. We can visualize some students sitting at the rug with the teacher. Then some went back to their seats to do some work. What happened?
    - o Student 2: Some left the rug.
    - o Teacher: That's right. There were some students at the rug with the teacher and then some of them left the rug. So, now are there more or less students?
    - o Students: Less!
    - o Teacher: How do you know?
    - o Student 3: Because there were some students with the teacher and then some of them left and that means now there aren't so many. There are less.
    - o Teacher: Yes. So, we know there were some on the rug, and we know that some left, which means now there are less on the rug. What I want your help with is finding out how many were there at the rug from the beginning.
- Teacher prompts students to discuss each question with a partner; teacher refers to poster and reviews prompt and response starters as needed.
    - o Teacher: Find your first partner. I will repeat the story (points to charted problem with blanks instead of numbers) and then you will discuss these questions (points to *Three Listens* poster). Use your prompt and response starters to help you.
    - o Teacher: There were some students sitting at the rug with the teacher. Then, _____ of the students go back to their seats to do their work. Now, there are still _____ students working with the teacher at the rug. How many students were working with the teacher before?

- Teacher: Take some time to think and begin discussing with your partner. Remember, you can use your prompt and response starters if you need them. For example, if someone asks, "What are some important details?" how might you respond?
- Student 4: I can say, "One important detail from the story is…"

- Teacher monitors partner discussions and strategically selects one or two students to share with the whole group.
- Students document their responses using the graphic organizer. (Note: In this example, the teacher charts on a class graphic organizer as the students respond.)
  - Teacher: What is the story? Camila, please share what you discussed with your partner.
  - Camila: The story is about there are some students at the rug…and then some go to their desks and now there are still some at the rug.
  - Teacher: Good. I'll add your ideas to the chart. What are some important details? Gabriel, please share your ideas.
  - Gabriel: One detail from the story is that we know there were some before and only some left. Not all of them left the rug, but now there are less because some left.
  - Teacher: Ok. I will add that to our chart. What is the problem? Susan…
  - Susan: The problem is how many were there before…we need to know how many were at the rug at the start.
  - Teacher: I will chart, "The problem is we need to know how many students were at the rug at the beginning."

2nd Listen

- Teacher states the problem, this time including the numbers or quantities.
  - Teacher: Now that we understand the story, we will focus on the math. I will read the problem. Focus on listening for math vocabulary and the numbers. There were some students sitting at the rug with the teacher. Then, (teacher writes number) 5 of the students go back to their seats to do their work. Now, there are still (teacher writes number) 7 students working with the teacher at the rug. How many students were working with the teacher before?
- Teacher asks strategic questions to help students understand the math.
- Teacher prompts students to discuss each question with a different partner; teacher refers to poster and reviews prompt and response starters as needed.
  - Teacher: What does the math vocabulary mean? What do the numbers mean? What is the unknown? Find your second partner and discuss these questions (points to *Three Listens* poster). Use your prompt and response starters to help you.
- Teacher monitors partner discussions and strategically selects one or two students to share with the whole group.
- Students document their responses using the graphic organizer. (Note: In this example, the teacher charts on a class graphic organizer as the students respond.)
  - Teacher: What does the math vocabulary mean? Is there any math language? Jose?
  - Jose: I think "some" is math language. It means that there is a number. Like there are some students.

- Teacher: Good, Jose. Maya, can you share what you discussed?
- Maya: I agree with Jose and I would like to add that going back to their seats means minus like take away because some of them left the rug.
- Teacher: Maya, I heard you say that we need to subtract to show that some of them left the carpet. Good work friends. Let's add this information to our chart. What do the numbers mean? Ana?
- Ana: The 5 represents the students who left the rug and the 7 is how many were still at the rug at the end.
- Teacher: I see that many of you agree. Ok. Let's add that to our chart. Amy, what is the unknown? What are we trying to find out?
- Amy: We are trying to find how many students were there at the beginning.
- Teacher: Great. So, the unknown is how many were there at the start. And, is that number going to be less or more than 5?
- Students: More!
- Teacher: How do you know?
- Ximena: Because it has to be bigger at the start than 5 because there were some at the start and then 5 went to their chairs and still there were 7 at the rug at the end.
- Teacher: Ximena, I think you are saying that the students who were at the rug at the beginning is bigger because it is the total or the whole amount. The 5 students who left are one part and the 7 who remained at the carpet is the other part. Let's add this to our chart.

3rd Listen

- Teacher states the problem again.
- Teacher uses the questions to model a think aloud that demonstrates the process a mathematician uses to approach the problem.
    - Teacher: I will say the problem one more time. This time I want you to listen and focus on thinking of how you plan to solve the problem. Think…There were some students sitting at the rug with the teacher. Then, 5 of the students went back to their seats to do their work. Now, there are still 7 students working with the teacher at the rug. How many students were working with the teacher before?
    - Teacher: Hmmm. What is the best way to solve this problem? This problem is tricky just like the one we solved last week. I remember Ximena used a number sentence to show the parts and the whole and that helped us understand the problem better. I will try that today. But, how can I show the unknown? Oh, yeah, I can put an empty box and that will represent the unknown or what we are trying to find out. To show my thinking I can use counting cubes. I can use the cubes to model what happens in the story. Then, I can draw circles on my paper to show the story. How will I know if my thinking makes sense? I can check explain my thinking to myself, or a partner, or solve the problem in a different way.

- Teacher prompts students to discuss each question with a different partner; teacher refers to poster and reviews prompt and response starters as needed.
    - Teacher: Now, it's your turn. Find a new partner. Use the questions to discuss how you plan to solve the problem.
- Teacher monitors partner discussions and strategically selects one or two students to share with the whole group.
- Students document their responses using the graphic organizer. (Note: In this example, the teacher charts on a class graphic organizer as the students respond.)
    - Teacher: Gloria and Carlos, please tells us about your plan.
    - Gloria: I will use the counters to tell the story and I will draw the counters on the paper, too.
    - Carlos: I agree with Gloria. I will use the yellow counters to show 5 students who left the rug and the red counters to show the 7 students who were still there.

Instructional Strategies - Resources

Teaching SOAR Conversation Skills

Introduction. What we call disciplinary discussions is back-and-forth talk between students where they use conversation skills to build ideas and construct new knowledge. When an idea emerges, you need to build it as much as possible before moving on to new ideas. You can use several conversations skills to help yourself do this building: creating, clarifying, fortifying, and negotiating.

Creating Ideas. You need multiple opportunities to surface and express original ideas about discipline specific content. In science and math, for example, you can converse to create ideas about your observations, patterns, problem-solving strategies, and hypotheses. In history, you can co-analyze primary sources to create novel perspectives on a famous historical figure. Highly effective content learning often comes from tasks that are designed to foster your creation and synthesis of ideas. The skill of creating ideas requires you to articulate your initial thinking and listen to the initial thinking of others. Asking you to express original ideas also helps you tap your prior knowledge and understanding.

Clarifying Ideas. Each response in a conversation usually tells you if your partner understood what you said or not. So, the skill of clarifying is as much on the listener as it is on the speaker. The listener must show, in a respectful and interested manner, the need for clarity. If two partners don't clarify what is being discussed, they don't have enough shared understanding to build an idea. Therefore, clarifying is a multi-faceted skill. You have to know when to prompt your partner to clarify, when to clarify your own ideas, and how to do so with different partners. Clarification also involves both partners figuring out ways to represent the idea, such as analogies and metaphors. This skill includes elaboration, explanation, and paraphrasing, all of which make the current ideas clearer for all involved in the discussion.

Fortifying ideas. Another skill that is strongly emphasized in the Common Core and other standards is supporting or fortifying ideas with evidence. In conversations, you should be able to identify and evaluate multiple examples of evidence that fortify ideas. In essence, this is training yourself to see how knowledge in a discipline is structured and valued. Even when you do understand how to find sufficient evidence, you may sometimes lack the vital sub-skill of explaining how the evidence supports the idea. Without this explanation you cannot show that you have a solid grasp of the effectiveness of an idea and its support.

Negotiating ideas. Often, ideas are put to the test and even strengthened with opposing ideas, in which case partners need to negotiate the ideas. Negotiating ideas means proposing a second or third idea that opposes or competes with the first idea. This might mean combining ideas into a new one. It might mean coming to a compromise, agreeing to disagree, or conceding to the new idea. You should have the academic attitude that all ideas, even if they are contrasting perspectives, are to be explored and even valued by both partners by the end of the conversation. This is how you come to own ideas and the language of them.

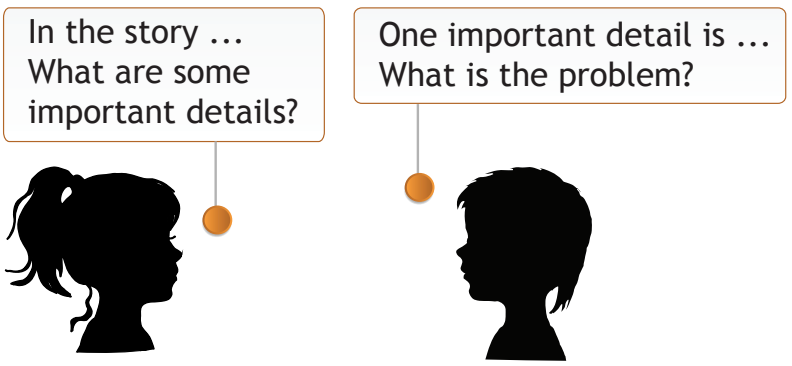
Conclusion. These skills can be used in conversations across disciplines and grade levels as long as you learn how and when to use them as you talk. You must also learn how and when to prompt your partner to use them. For example, you need to recognize a quizzical expression on your partner's face and clarify what you are saying. You also need to know how to ask your partner for clarification when you don't see how her ideas are related to the question the teacher asked.

SOAR
THREE LISTENS

Today we do it together so that tomorrow I can do it on my own.

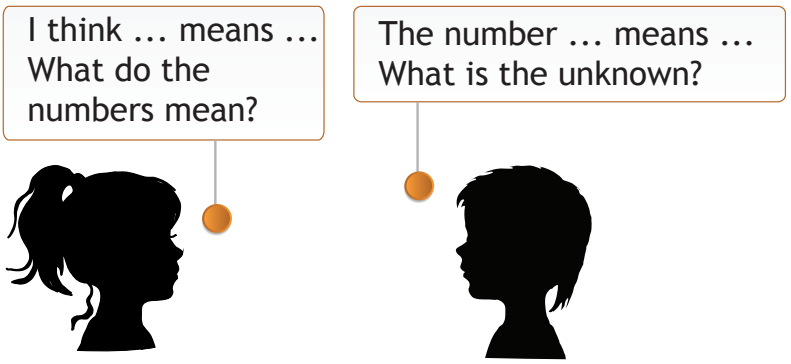
1st LISTEN — LISTEN & DISCUSS THE STORY

- What is the story?
- What are some important details?
- What is the problem?



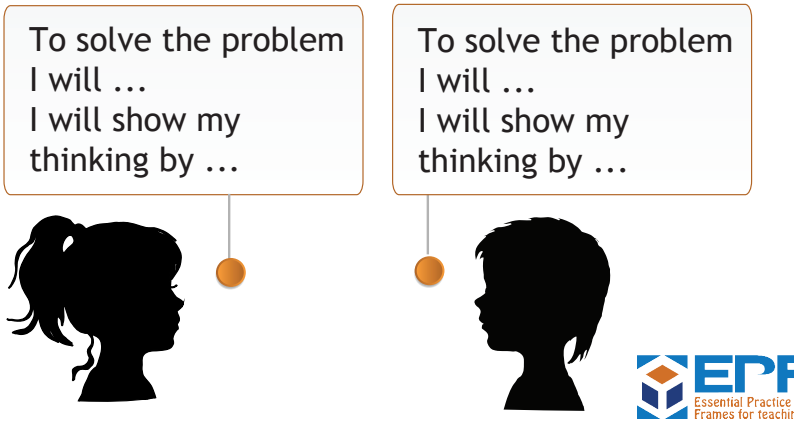
2nd LISTEN — LISTEN & DISCUSS THE MATH

- What does the math vocabulary mean?
- What do the numbers mean?
- What is the unknown?



3rd LISTEN — LISTEN & MAKE A PLAN

- What is the best way to solve the problem?
- How will I show my thinking?
- How do I know my thinking makes sense?

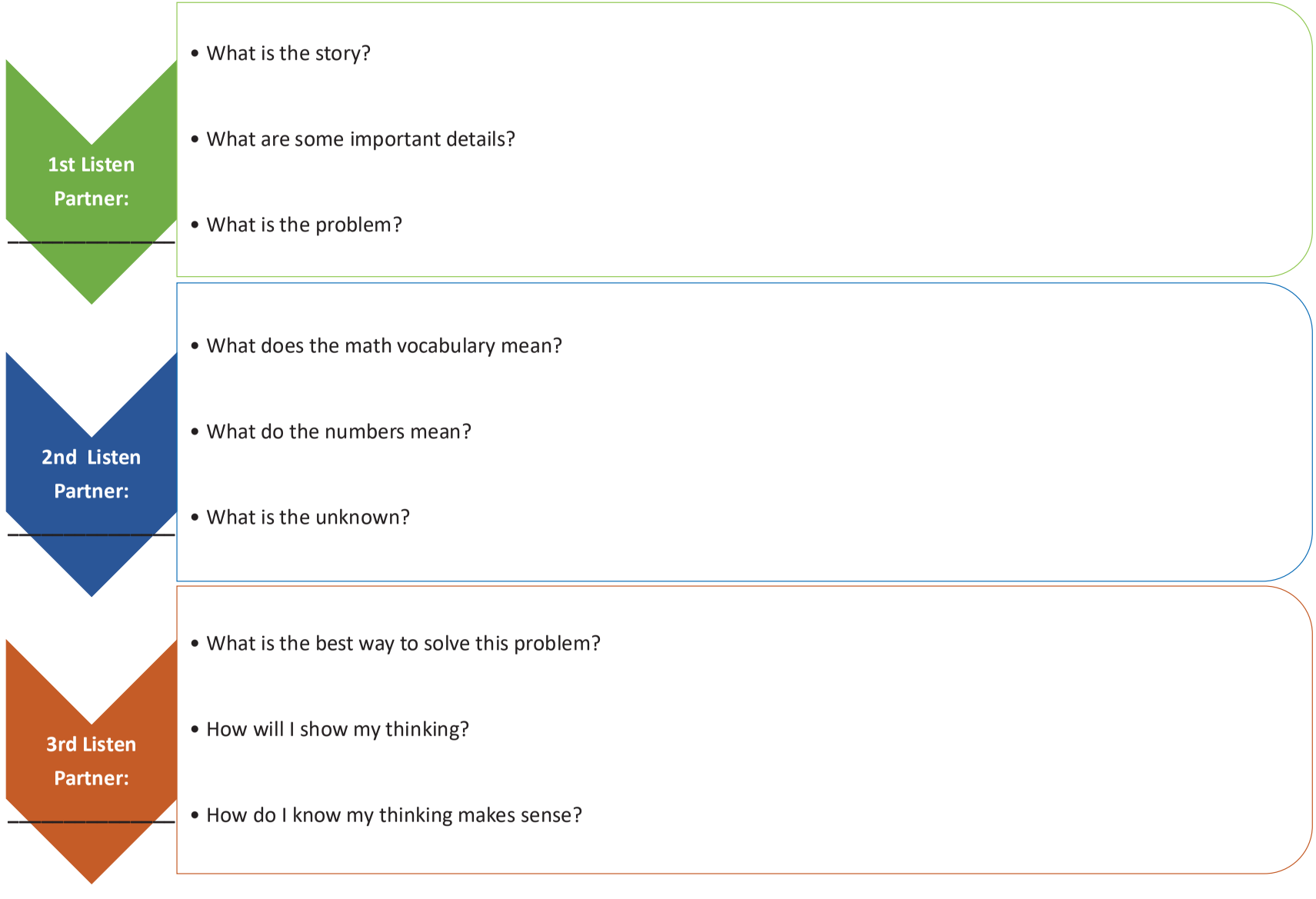


EPF Essential Practice Frames for teaching

	Prompt Starters	Response Starters
1st Listen **Listen & Discuss the Story**	• What is the story? • What are some important details? • Who or what is the story about? • What is the problem? • What do we need to find out?	• The story is about… • One important detail is… • In the story… • The problem is… • We need to find out…
2nd Listen **Listen & Discuss the Math**	• What does the math vocabulary mean? • What do you think the word/phrase … means? • What do the numbers mean? • What does the number … represent? • What is the unknown?	• One math vocabulary word in the problem is… • I think … means … . • One number in the problem is… • The number … represents? • I think … is the unknown because…
3rd Listen **Listen & Discuss a Plan**	• What is the best way to solve this problem? • Have I solved a similar problem? Will the same approach work with this one? • How will I show my thinking? • Which model or tool can I use? • How do I know my thinking makes sense?	• I think … is the best approach because… • This problem reminds me of… • Last time I used… • I can use/draw … to show… • This makes sense because….

SOAR Three Listens Graphic Organizer

Name: _____ Date: _____



The SOAR Teaching Frames® are based on a decade of research and help teachers, coaches, and administrators drive student learning by focusing on the most effective teaching practices aligned with the College and Career Readiness Standards. This manual is to be used in conjunction with a two-day Deep Dive designed to deepen understanding of the Mathematical Discussions Teaching Frame.

"The SOAR teaching frames provide my teachers with support for planning rigorous and socioculturally relevant instruction for our diverse population of students. Problem solving and mathematical discourse have been a focus at our school and the SOAR Teaching Frames for Mathematics in particular are helping my teachers attend to the linguistic demands of the Common Core Standards for Mathematical Practice. More specifically, when considering the learning needs of English Learners, the frames help my teachers focus on teaching students the language required to comprehend and communicate their mathematical thinking effectively."

Michelle R. Staine, Assistant Principal
Esperanza Elementary School
Los Angeles Unified School District, Los Angeles, CA

"At the Center for Teacher Innovation we have used The Strategic Observation and Reflection (SOAR) Teaching Frames in training our reflective coaches to support teachers in implementing the California Content Standards. Our coaches are learning how to use the SOAR tools to identify and support a set of dynamic instructional moves effective teachers use to support student learning in Common Core classrooms that span grade levels and content areas. This suite of tools can be used to gather evidence and provide actionable feedback that will drive both teacher and student growth. The Frames are aligned to the California Standards for the Teaching Profession and have given our coaches an understanding of high-impact instructional practices and the capacity to coach beginning teachers in cultivating these practices."

Barbara Howard, Executive Director
Center for Teacher Innovation
Riverside County Office of Education, Riverside, CA

"SOAR is the convergence of long-term projects developed and implemented in California that position learning and professional growth at the center of teacher effectiveness and evaluation. The program provides a process for teachers and administrators to establish shared goals and objectives, instructional trust, and tools to calibrate their collective expectations of effective teaching. SOAR would be a significant help to any district looking for a professional growth model focused on improving the instructional and leadership practices of each educator."

Marcia G. Trott, Improving Teacher Quality State Grants Administrator
California Department of Education, Sacramento, CA

"The SOAR frames have been the foundation for our current work in the district to transform our instructional practice. Not only do the frames provide us with common language and specific definitions of effective teaching practices, but they have also served as a detailed model for teachers, principals, and coaches. The frames have given our teachers specific strategies to implement and refine, which more actively engage students in their learning."

Ruben Reyes, Superintendent
Robla School District, Sacramento, CA

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