Integrating Language and Mathematics

Ready® Classroom Mathematics uses the Try-Discuss-Connect instructional routine to help students engage in productive struggle, participate in mathematical discourse, and make connections between different models and solution strategies. Language plays a critical role in learning during each part of the routine.

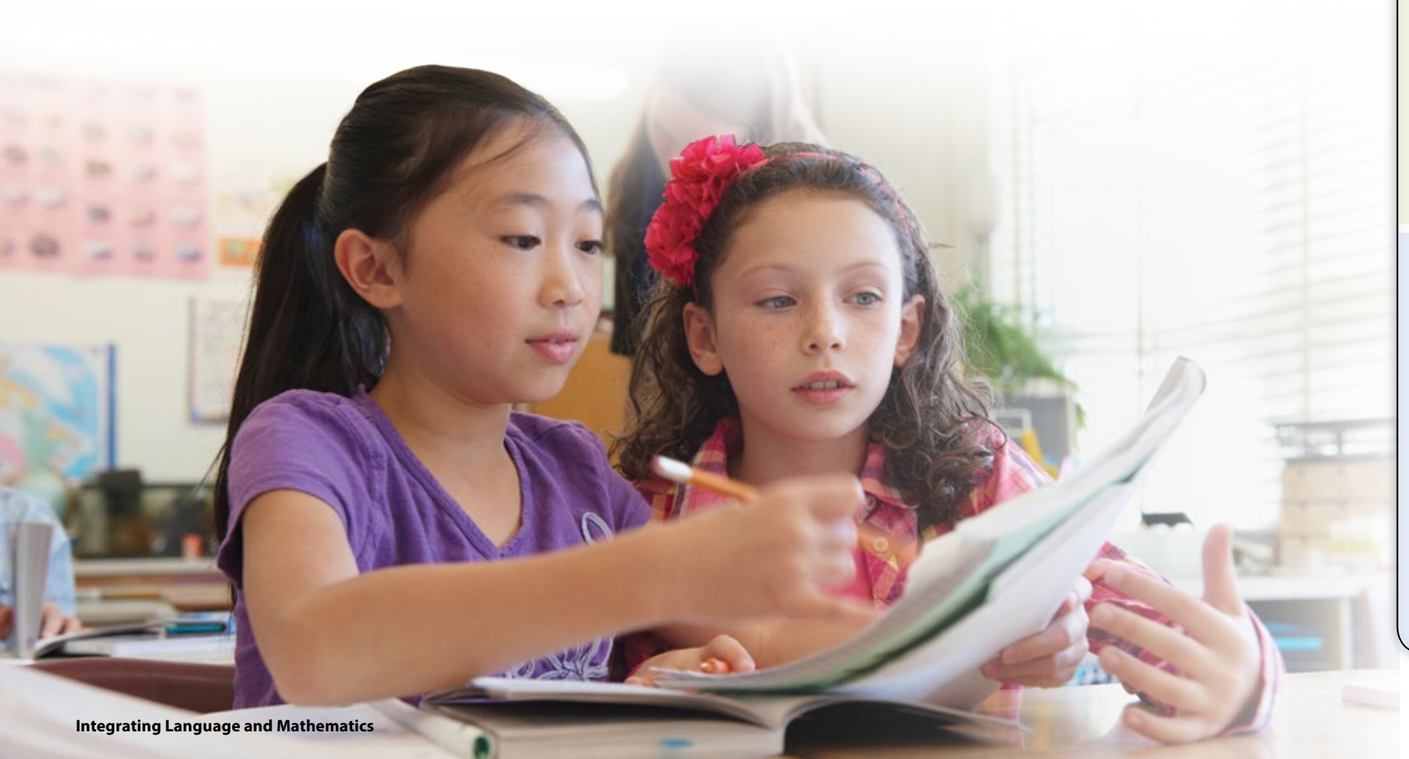
As part of Try-Discuss-Connect, teachers may guide students toward productive conversations for learning through language routines, teacher moves, and conversation tips. The chart at the right suggests where these supports may be integrated in the Try-Discuss-Connect routine.

Language routines are predictable, repeatable formats that help students process word problems and communicate their growing understanding to others.

Teacher moves are simple but powerful facilitation techniques to guide conversations in which students talk with each other rather than only responding to the teacher. Teacher moves help students to clarify their own thoughts and to hear classmates' ideas more than once, in more than one way.

Conversation tips are specific hints that show students what it means to engage in academic discourse. The tips describe six actionable steps for students when they participate in classroom exchanges: explaining ideas, listening attentively, justifying, building on the ideas of others, disagreeing respectfully, and making connections.

Over time, teachers and students become comfortable with these language supports and use them naturally in productive mathematical conversations.



Supports for Language in the **Try-Discuss-Connect Routine**

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Language Routines
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Conversation Tips

Routines that Empower Students

These research-based language routines help students learn to use the specialized academic language of mathematics. While these routines are well suited for English learners, the routines promote learning in all students as they access and express their growing mathematical understanding.

Three Reads

Try

What: A routine that guides students to interpret the language in mathematical tasks or problems without oversimplifying the text or reducing mathematical rigor. A problem is read three times, each with a specific focus, to ensure that students fully understand the problem situation and what is being asked of them.

Why: Reading a problem more than once gives students the time to understand the situation and mathematical relationships without the pressure they often feel to when presented with a word problem.

How: With each read the teacher records student responses.

Read 1: The focus is on comprehending the text. The problem is read aloud and students bear in mind the question: *What is this problem about?*

Read 2: The focus is on understanding the question. The problem is read aloud while the others listen and think: *What are we trying to find out?*

Read 3: The focus is on identifying and analyzing the important information in the problem. The problem is read chorally, and students think: *What are the important quantities and how are they related?*

Co-Craft Questions

Try

What: A common adaptation of Three Reads in which teachers present the problem without the question. Students develop their own questions that can be answered with mathematics before seeing and solving the given problem.

Why: When given the time to "mathematize" a situation, students build understanding of the context and often uncover implicit relationships among quantities. Creating their own questions allows students to develop a more complete grasp of the context and to produce the language of mathematical questions. It boosts engagement and offers multiple points of entry into the problem.

How: The teacher presents a problem situation, geometric figure, or visual representation without a question. Students work with a partner or in small groups to come up with questions that could be answered using the information. Teachers may facilitate the brainstorming and recording for younger students or those for whom writing is challenging. Students discuss their questions with the class before setting to work on the question posed in the worktext. Teachers may ask students to answer the questions that they generated at a later time.

Notice and Wonder

Try

What: A routine to guide students in making meaning from a problem context or a non-contextualized display such as geometric figures, data displays, expressions, or equations.

Why: Similar to Co-Craft Questions, Notice and Wonder encourages students to think about things around them through a mathematical lens. It helps create a safe learning environment, because no response is incorrect. It removes the pressure of problem solving and allows students to make sense of the problem or display that has been presented.

How: Teachers display a problem situation, complete problem, or a mathematical or geometric task. Students respond to the question: *What do you notice?* Teachers record as many responses as time and interest allow without comment or with only encouraging comments. Students respond to the question: *What do you wonder?* or *What are you wondering that mathematics can answer?* Teachers record responses. Teachers call attention to the question of the problem or task and lead a discussion about the things students noticed and wondered that might be relevant to the problem.

Say It Another Way

Try

What: A routine to help students paraphrase as a way to process a word problem or other written text and confirm understanding.

Why: Paraphrasing helps students figure out whether they have understood something they have read or heard. It gives them the opportunity to self-correct or to ask for clarification. Say It Another Way also ensures all students in the group hear the problem more than once and in more than one way.

How: Students read or listen to a word problem or other written text. One student paraphrases the text. Other students give a thumbs-up to show that the paraphrase is accurate and complete. Students who give a thumbs-down explain their reasoning, and the group goes back to the written problem to clarify the meaning. Teachers may call on several students to "say it another way" in order to keep everyone engaged or to give the class time to think about what the problem means.

Compare and Connect

Discuss Connect

What: A routine to identify, compare, and contrast mathematical language, representations, models, and approaches.

Why: When students are provided with the opportunity and time to compare, make connections between, and reflect on mathematical ideas or strategies, their meta-awareness increases, understandings are solidified, and mathematical discourse is supported.

How: The teacher carefully selects and sequences student strategies and representations, following the suggestions in the Teacher's Guide if applicable. Students present the selected strategies one at a time. In partner, small-group, and whole-class discussion, students answer the questions: *How are they alike? How are they different?* and *How are they related?* as a way to process and discuss the connections among the strategies. The teacher asks other questions specific to the problem to help students see the underlying mathematics or formulate important generalizations.

Collect and Display

Discuss Connect

What: A routine in which teachers collect students' informal language and match it up with more precise academic or mathematical language to increase sense-making and academic language development.

Why: When teachers record student language and facilitate making connections, students develop precise academic vocabulary. The display that is created becomes a reference for students to turn to when they talk or write about mathematics throughout the lesson or unit.

How: The teacher collects students' informal, oral language during partner, small-group, and whole-class discussions. The teacher organizes the words and key phrases, adds diagrams or pictures when helpful, and helps students explicitly connect their informal language to more precise academic and mathematical language. The display is posted for students to refer during academic discussions or when writing about the lesson. The display may be updated and revised throughout the unit.

Support for Academic Discourse

Academic Vocabulary Development

Engaging in academic discourse requires students to communicate with academic and math-specific vocabulary and language, a challenging task for many students. The Academic Vocabulary routine provides instruction and active engagement with academic language for all learners.

1. Assess prior knowledge.
- Present the words or phrases. Assess prior knowledge by asking students to rate their knowledge of each term.
- Provide a scale and ask students to write or signal their rating of each word.:
  - **1** Never heard it.
  - **2** Not sure what it means.
  - **3** Have an idea about what it means.
  - **4** Know what it means and can use it.
- If students are speakers of Spanish or other Latin-based languages, use the Cognate Support routine.

2. Pronounce the words or phrases.
- Say each term and have students repeat it.

3. Define the words.
- Ask students to share the meanings of terms they know. Note which terms need more instruction or modeling.
- Model using the terms in familiar contexts.
- Provide the meaning of the terms. See the Academic Vocabulary Glossary on the Teacher Toolbox.

4. Use the words.
- Have students write the terms with descriptions or examples and a picture or graphic representation.
- Encourage students to use the terms in writing and discussion during the lesson and unit.

Cognate Support Routine
- Ask students to identify terms that look or sound similar to words in their first language.
- Check to see if the identified terms are cognates.
- Write the cognates and have students copy them next to the English terms.
- Pronounce the English term and its cognate or ask a volunteer to do so. Have students repeat.

Teacher Talk Moves

Mathematical discourse is a powerful sense-making tool, but it doesn't just *happen*. Students must develop both the inclination and habit of attending to each other's mathematical ideas, and they must have the time and space to make sense of, critique, and develop those ideas. Teacher "talk moves" are crucial supports to guide students in productive mathematical discussions.

Individual Think Time Individual Think Time provides students a short time—typically 10 seconds to 2 minutes—to think about a question or problem before discussing with a partner, a small group, or the whole class. This private processing time significantly increases both the quantity and quality of student talk because it gives students time to make sense of the question or problem and begin to gather their thoughts and questions.

Turn and Talk Turn and Talk gives students an opportunity to share their thinking or ideas with a partner. Teachers often use this teacher move to prepare students for a full-group conversation or when students go silent during a whole-class discussion. It provides a safe space for students to work through ideas, questions, and language, and it ensures all students have opportunities to "talk math," not just the fraction of students who speak in a whole-class conversation.

The Four Rs The Four Rs—repeat, rephrase, reword, and record—is a strategy that strings together discrete talk moves in order to support students in processing information shared in classroom conversations and to help them develop mathematical understanding and the language to communicate it. Teachers use one or a combination of a few of the Rs to facilitate classroom discussions.

Student Conversation Tips

Talk moves are tools for teachers to facilitate mathematical conversations, and conversation tips are tools for students to engage in them. These six conversation tips show students what it means to engage in academic discourse.

Listen
- Show that you are listening. Face the speaker and nod when you understand.
- Try to paraphrase the speaker's ideas.
- Ask questions when you don't understand or want to know more.

Explain
- Speak so that everyone can hear. Pause and ask for questions.
- Tell what you noticed or assumed about a problem and what you did as a result.
- Be precise by using complete sentences and math vocabulary.

Justify
- Give reasons that your idea or solution strategy makes sense.
- Use a model or diagram to support your explanation.
- Rate your confidence in your idea and explain your choice.
- Use definitions and properties to explain why your ideas are correct.

Agree and Build On
- Explain why another person's ideas make sense.
- Add another example that helps show why the idea is reasonable.
- Add details that help explain more about the strategy or solution.
- Explain whether a strategy will always work or only work sometimes.

Disagree and Explain
- Disagree with the idea, not the person. Mistakes are part of learning.
- Be specific about the part you think is not correct and why.
- Show a model or diagram to explain why you disagree.
- Give a counterexample. Use different numbers or models to show why a strategy or solution doesn't work.

Make Connections
- Tell how strategies are the same and different.
- Explain how each representation shows an important quantity in the problem.
- Use models or logic to explain why two different strategies give the same solution.
- Explain how one problem is like or different from another problem you've solved.