

How can we leverage the coherence of mathematics to support students' unfinished learning?



As teachers plan instruction for this fall after extended remote learning, there is a lot of discussion about the best way to address students' unfinished learning. Leveraging the natural coherence of mathematics and following a coherent curriculum can be a first step in tackling this challenge.

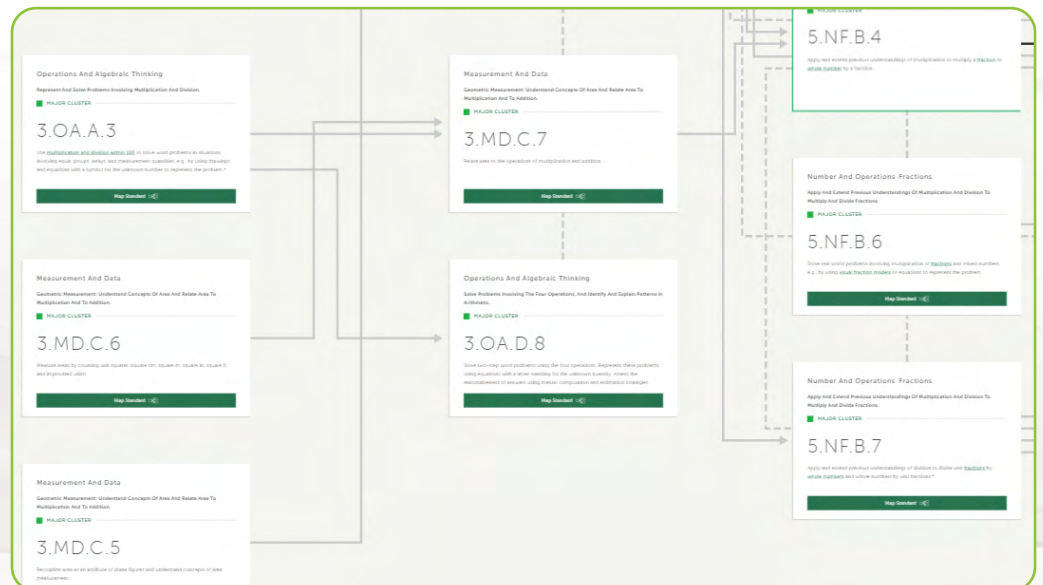


What is coherence?

Coherence is the idea that the mathematics domains are connected to one another and should be presented to students in a way that allows them to see those connections. It's thinking holistically about mathematics. Students learn new ideas, but they also see how to connect and build off the content they've learned previously.

As mentioned above, coherence is the logical progression that lays the foundations for work in later grades. For example, in Grade 4, students must apply and extend previous understandings of multiplication to multiply a fraction by a whole number. This extends to Grade 5, when students are expected to build on that skill to apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction. To see an example of a complete coherence map for a specific grade and domain, check out these [interactive coherence maps](#).

Coherence is built both vertically (i.e., topics are coherently connected across grades) and horizontally (i.e., topics students learn within a grade level are also coherently connected).



Why is coherence important (especially now)?

Coherence is an important part of mathematics education because, when done effectively, it helps students understand mathematical ideas more deeply while also making complex subjects easier to understand. With the disruption to learning during spring 2020, a coherent curriculum is even more important this school year than ever before. Teachers can take advantage of the coherence of mathematics by following the Learning Progressions to uncover and address students' unfinished learning.

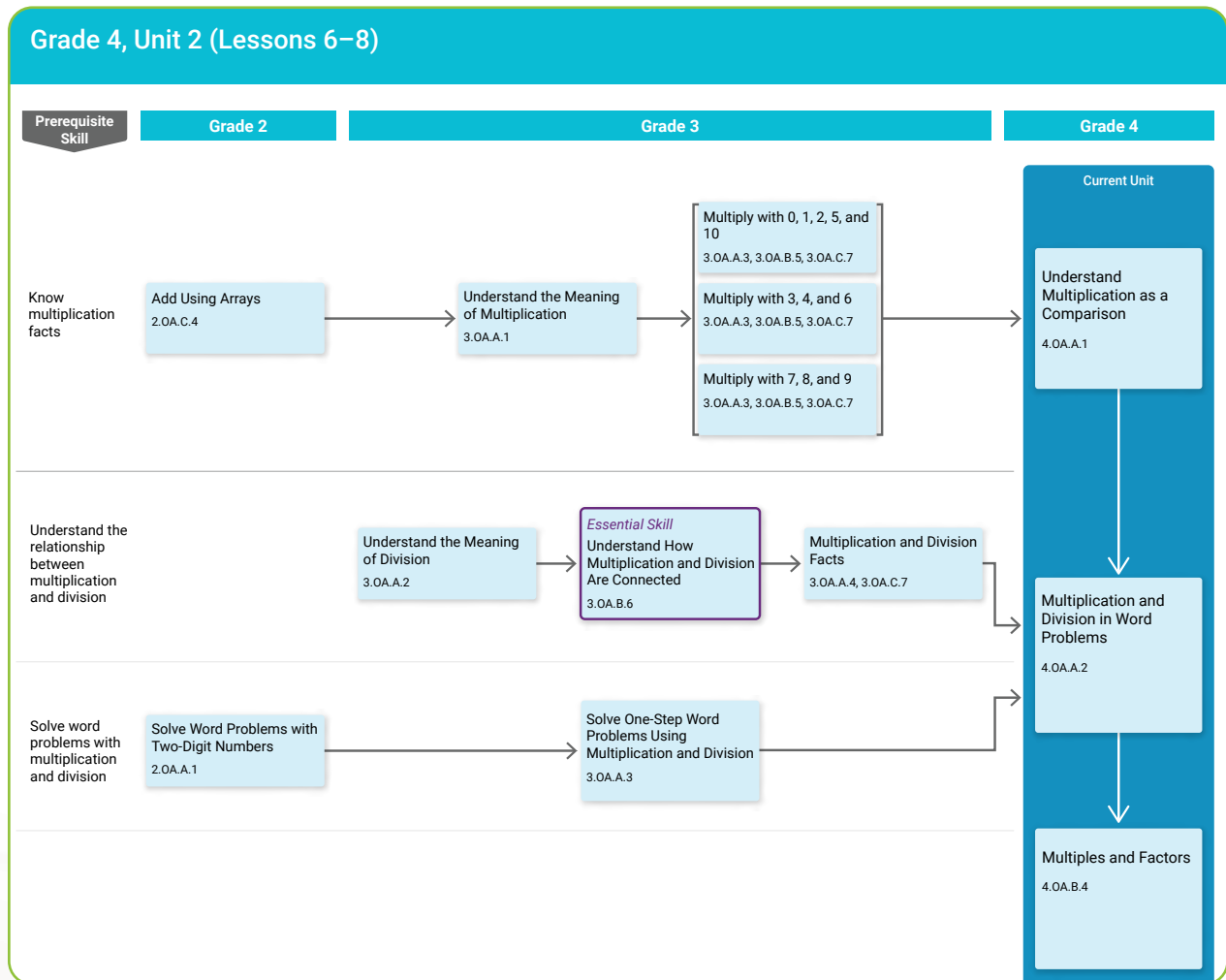


Figure 1: Learning Progression from i-Ready Classroom Mathematics Prerequisites report

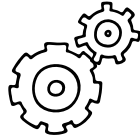
Learning Progressions, like the one shown in Figure 1 from *i-Ready Classroom Mathematics Grade 4*, help teachers understand the coherence of standards across earlier grade levels. Looking at Figure 1, you see that to be successful in the lesson “Multiply by Two-Digit Numbers,” students need to be proficient on previously taught Grades 2–4 skills. By tracing a standard back to its logical prerequisites, teachers can see how the concepts were addressed in preceding standards and find any content limits, such as what numbers or models were used by students in previously learned standards. From this, teachers can adapt grade-level lessons to determine appropriate places to integrate those prerequisites to support on-grade level instruction. Teachers can incorporate the prerequisites that students are missing and still address grade-level content in the same lesson.

How can teachers use coherence to adapt their lessons to address unfinished learning?

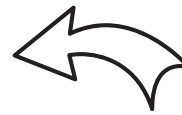
Teachers may consider various way to integrate unfinished learning into grade-level instruction. Some ideas include:



Adding a warm-up activity that connects to prior learning



Integrating some prerequisite instruction into a grade-level lesson

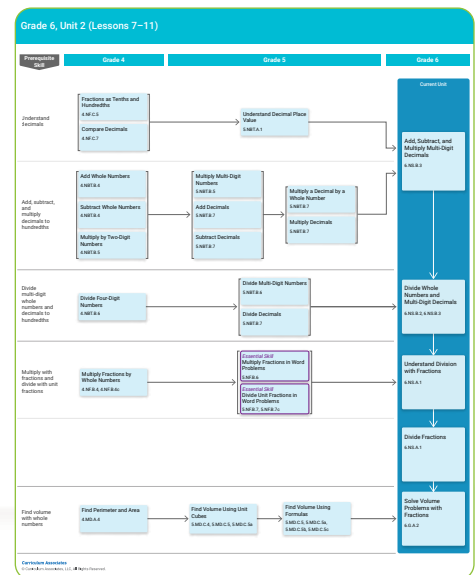


In specific instances where some students need more support with prerequisite learning, **integrating a lesson on prior-grade skills before the grade-level lesson** in which those skills will be applied

Providing additional support to students by using activities, games, and practice that focus on prerequisite skills and concepts using coherent curriculum materials, such as *i-Ready Classroom Mathematics*, makes it easy to adapt lessons to address students' learning needs, including unfinished learning. Below are a few examples of how the coherent structure and design of *i-Ready Classroom Mathematics* help teachers address students' prerequisite and grade-level needs.

Learning Progressions: Visual Learning Progressions, available in the Prerequisites report and in the Teacher's Guide, help teachers identify the coherence of standards across grade levels and provide a visual representation of how previous concepts are built upon and related to the grade-level concepts being taught. Because teachers using *i-Ready Classroom Mathematics* can access content from multiple grade levels, they can use the information in the Learning Progression to see how the prior standards and lesson(s) are built upon and support what students are learning now. Based on the learning needs of their students, teachers are directed to resources they can use to address prerequisite skills and concepts in small groups or with the whole class.

If teachers need to teach Prerequisite Lessons during whole class instruction, the additional guidance in the Prerequisites report helps them determine how to consolidate other lessons across the units to keep pacing on track.



Building on Prior Knowledge: Most sessions in *i-Ready Classroom Mathematics* begin with a Start activity to engage students in previous learning that is directly related to the problems in the day's instruction. This intentional choice of content for the Start activities provides students with an opportunity to feel successful as they begin the lesson and understand how content they learned previously relates to new skills or concepts.

Start

Connect to Prior Knowledge

Why Reinforce that equal groups are needed in order to multiply.

How Have students solve a word problem about 3 equal groups of 5.

You have 3 equal groups of 5 pencils.
How many pencils do you have in all?

Solution
15 pencils

Instructional Design: Each *i-Ready Classroom Mathematics* lesson kicks off with an Explore session and ends with a Refine session. The Explore session allows students to explore a new concept and always connects to prior learning, so students can see connections between what they know and what they are learning. The Refine session provides in-class time for practice and differentiation, allowing students to refine their understanding of the concept. The Refine session often includes questions that ask students to make connections between content addressed or between the current lesson content and previously learned content.



LESSON 20 Explore Adding and Subtracting Fractions

Learning Targets

- Decompose a fraction into a sum of fractions with the same denominator to solve problems involving addition and subtraction of fractions referring to the same whole and fractions like $\frac{a}{b}$.
- Solve word problems involving addition and subtraction of fractions referring to the same whole and fractions like $\frac{a}{b}$.

LESSON 20 Refine Adding and Subtracting Fractions

EXAMPLE

Jessica hikes $\frac{2}{3}$ of a mile on a trail before she stops to get a drink of water. After her drink, Jessica hikes another $\frac{1}{3}$ of a mile. How far does Jessica hike in all?

Look at how you could show your work using a number line.

Solution

PAIR/SHARE

The student used labels and "jump" arrows to show each part of the hike on a number line. It is just like adding whole numbers!

PAIR/SHARE

How else could you solve this problem?

APPLY IT

1 Ruth makes 1 fruit smoothie. She drinks $\frac{1}{3}$ of it. What fraction of the fruit smoothie is left? Show your work.

PAIR/SHARE

How did you and your partner decide what fraction to start with?

Solution

Addressing students' unfinished learning this fall will be no easy task, but the coherence of mathematics is an important starting point for this work. By following a coherent curriculum, teachers can more easily adapt lesson content to address prerequisites during on-grade level instruction.

Discover how the coherence of *i-Ready Classroom Mathematics* can help address unfinished learning.

i-Ready® Classroom Mathematics

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