MATHEMATICS CONTENT MODULES

Module 6: Number and Operations—Fractions: Operations With Fractions

Grades K–5

The goal of the initiative

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Improve the quality of instruction in math classrooms by developing deep mathematical content knowledge of teachers and connecting that content knowledge to the practical implementation of a quality curriculum.

Group norms

- Understand that those who work, learn.
- Look for solutions, not blame.
- Focus on systems, not people.
- Recognize that everyone has expertise.
- Be honest.
- Challenge ideas.
- Share talk time.
- Mistakes are expected, respected, and inspected.

Module 6 goals

Participants will

- Engage in a study of standards across grades K–5 related to connecting understanding of operations with whole numbers to understanding of operations with fractions.
- Identify evidence of the key shifts in the standards and how these key shifts guide decisions about teaching and learning in conjunction with the EngageNY resources.
- Use strategies from operations with whole numbers to reason about how to solve operations with fractions.
- Investigate the Louisiana Student Standards for Mathematics (LSSM) Standards for Mathematical Practice and the role these standards play in the development of mathematical thinking.

Math Content Module 6
Grades K–5

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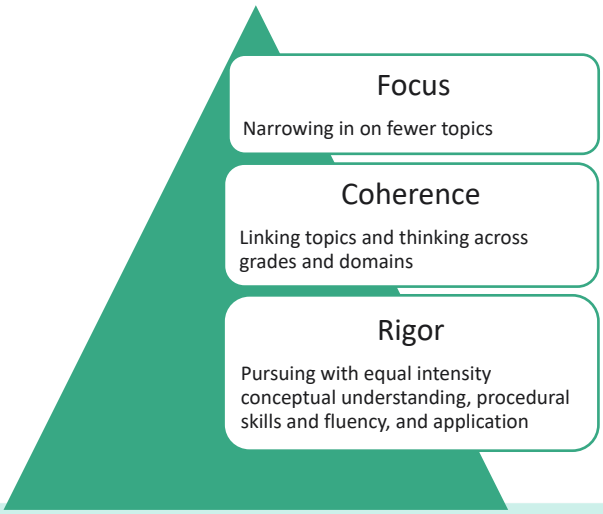
MATHEMATICS CONTENT MODULES

Module 6: Number and Operations—Fractions: Operations with Fractions
Session 1: Key Shifts in Action
Grades K–5

Key shifts of the Louisiana Student Standards for Mathematics



Math Content Module 6, Session 1
Grades K–5

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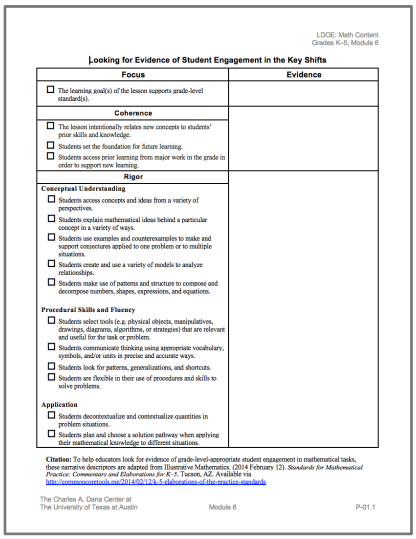
Evidence of the key shifts

Use the handout to:

- Check off student behaviors/actions that you observed.
- Record any observations you made that serve as evidence.



LDOE: Math Content
Grades K–5, Module 6

Looking for Evidence of Student Engagement in the Key Shifts

Focus	Evidence
☐ The learning goal(s) of the lesson supports grade-level standard(s).	
Coherence	
☐ The lesson intentionally relates new concepts to students' prior skills and knowledge. ☐ Students set the foundation for future learning. ☐ Students access prior learning from major work in the grade in order to support new learning.	
Rigor	
Conceptual Understanding ☐ Students access concepts and ideas from a variety of perspectives. ☐ Students explain mathematical ideas behind a particular concept in a variety of ways. ☐ Students use examples and counterexamples to make and support conjectures applied to one problem or to multiple situations. ☐ Students create and use a variety of models to analyze relationships. ☐ Students make use of patterns and structure to compose and decompose numbers, shapes, expressions, and equations. **Procedural Skills and Fluency** ☐ Students select tools (e.g. physical objects, manipulatives, drawings, diagrams, algorithms, or strategies) that are relevant and useful for the task or problem. ☐ Students communicate thinking using appropriate vocabulary, symbols, and/or units in precise and accurate ways. ☐ Students look for patterns, generalizations, and shortcuts. ☐ Students are flexible in their use of procedures and skills to solve problems. **Application** ☐ Students decontextualize and contextualize quantities in problem situations. ☐ Students plan and choose a solution pathway when applying their mathematical knowledge to different situations.	

Citation: To help educators look for evidence of grade-level-appropriate student engagement in mathematical tasks, these narrative descriptors are adapted from Illustrative Mathematics. (2014 February 12). *Standards for Mathematical Practice: Commentary and Elaborations for K–5*. Tucson, AZ. Available via http://commoncortools.me/2014/02/12/k-5-elaborations-of-the-practice-standards

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Multiply unit fractions by unit fractions

Jan has 4 pans of crispy rice treats. She sends ½ of the pans to school with her children. How many pans of crispy rice treats does Jan send to school?

- Solve the problem with numbers, pictures, and words.
- Write a multiplication sentence that explains your thinking.
- Be prepared to share.

Multiply unit fractions by unit fractions

Jan has 2 pans of crispy rice treats. She sends ½ of the pans to school with her children. How many pans of crispy rice treats does Jan send to school?

- Solve the problem with numbers, pictures, and words.
- Write a multiplication sentence that explains your thinking.
- Be prepared to share.

Multiply unit fractions by unit fractions

Jan has 1 pan of crispy rice treats. She sends ½ of the pan to school with her children. How many pans of crispy rice treats does Jan send to school?

- Solve the problem with numbers, pictures, and words.
- Write a multiplication sentence that explains your thinking.
- Be prepared to share.

Multiply unit fractions by unit fractions

Jan has ½ pan of crispy rice treats. She sends ½ of the pan to school with her children. How many pans of crispy rice treats does Jan send to school?

Multiply unit fractions by unit fractions

Jan has $\frac{1}{3}$ pan of crispy rice treats. She sends $\frac{1}{2}$ of the pan to school with her children. How many pans of crispy rice treats does Jan send to school?

- Will she send a greater amount or a smaller amount than she sent in the last problem?

Multiply unit fractions by unit fractions

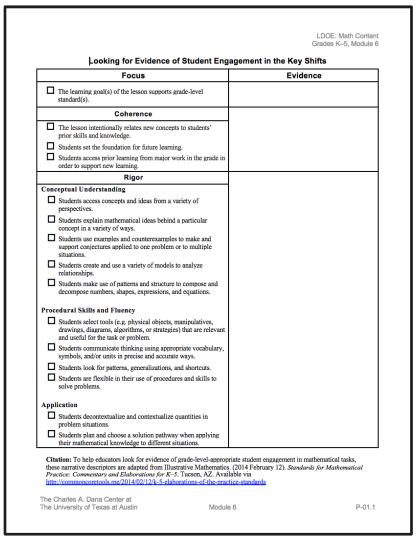
$$\frac{1}{4} \times \frac{1}{3} =$$

$$\frac{1}{3} \times \frac{1}{4} =$$

Evidence of the key shifts

Use the handout to:

- Check off student behaviors/actions that you observed.
- Record any observations you made that serve as evidence.



LDOE: Math Content
Grades K–5, Module 6

Looking for Evidence of Student Engagement in the Key Shifts

Focus	Evidence
☐ The learning goal(s) of the lesson supports grade-level standard(s).	
Coherence	
☐ The lesson intentionally relates new concepts to students' prior skills and knowledge. ☐ Students set the foundation for future learning. ☐ Students access prior learning from major work in the grade in order to support new learning.	
Rigor	
Conceptual Understanding ☐ Students access concepts and ideas from a variety of perspectives. ☐ Students explain mathematical ideas behind a particular concept in a variety of ways. ☐ Students use examples and counterexamples to make and support conjectures applied to one problem or to multiple situations. ☐ Students create and use a variety of models to analyze relationships. ☐ Students make use of patterns and structure to compose and decompose numbers, shapes, expressions, and equations. **Procedural Skills and Fluency** ☐ Students select tools (e.g. physical objects, manipulatives, drawings, diagrams, algorithms, or strategies) that are relevant and useful for the task or problem. ☐ Students communicate thinking using appropriate vocabulary, symbols, and/or units in precise and accurate ways. ☐ Students look for patterns, generalizations, and shortcuts. ☐ Students are flexible in their use of procedures and skills to solve problems. **Application** ☐ Students decontextualize and contextualize quantities in problem situations. ☐ Students plan and choose a solution pathway when applying their mathematical knowledge to different situations.	

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Session 1 reflection

Points to ponder

- How is solving for the product of whole numbers the same as, or different from, solving a fraction of a fraction?
- Is it possible to use the same strategies you use when multiplying whole numbers to multiply fractions?
- How do the models help with understanding when multiplying fractions?

MATHEMATICS CONTENT MODULES

Module 6: Number and Operations—Fractions: Operations with Fractions
Session 2: Exploring Coherence in the LSSM
Grades K–5

Investigating vertical alignment in the LSSM

As a group…

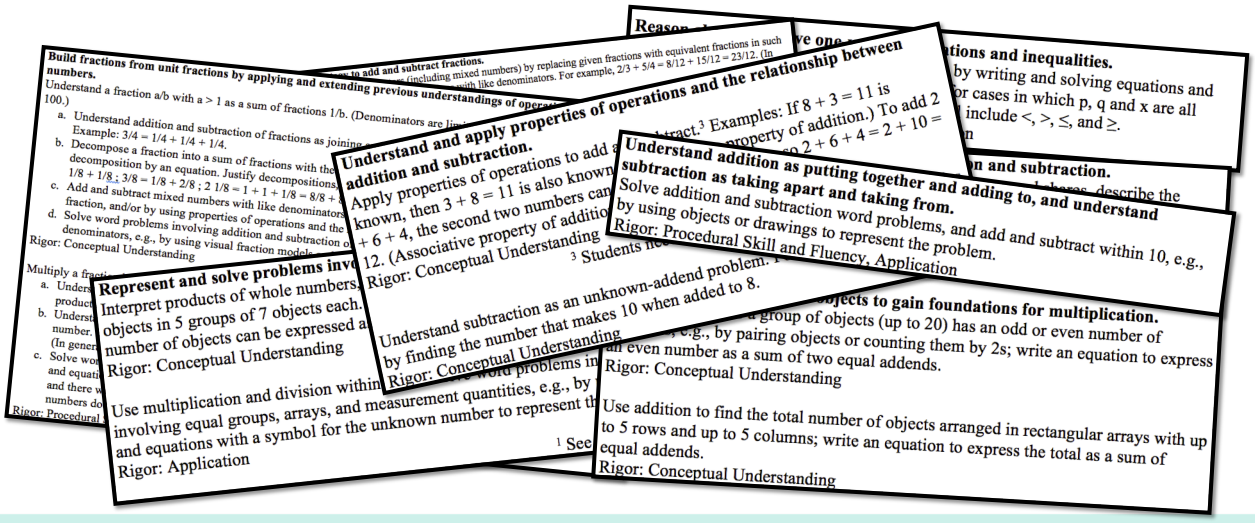
1. Select a big idea for your group to investigate.

Using previous understanding of operations with whole numbers to solve operations with fractions

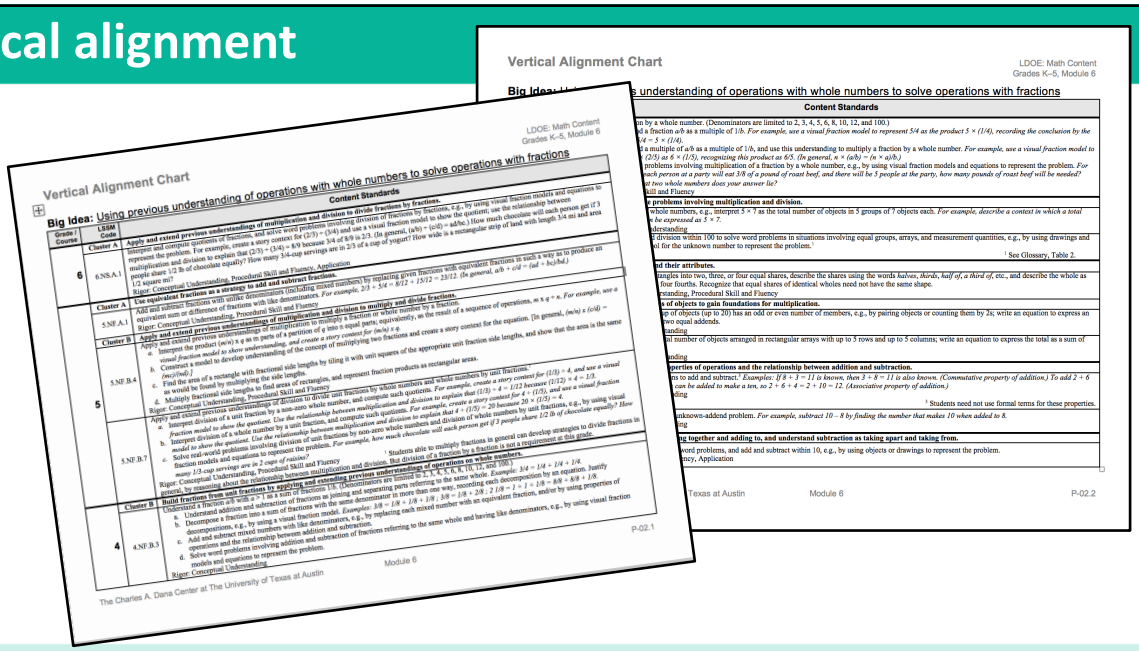
2. Determine what your big idea means.

Vertical alignment

Using previous understanding of operations with whole numbers to solve operations with fractions



Vertical alignment



Math Content Module 6, Session 2
Grades K–5

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Vertical alignment discussion questions

- What content changes occur from grade to grade?
- Where are concepts introduced, developed, and finalized?
- Does an idea or skill get more complex, and if so, how?
- How are the components of *rigor* (conceptual understanding, procedural skills and fluency, and application) evident in the standards?
- How do the components of rigor change as the big idea is developed across the grades?

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Reflection

How do students use what they know about operations with whole numbers to develop an understanding of operations with fractions?

How does the learning from the primary grades support an understanding of operations with fractions in the intermediate grades?

MATHEMATICS CONTENT MODULES

Module 6: Number and Operations—Fractions: Operations with Fractions
Session 3: Deepening Mathematical Content Knowledge for Effective Instruction
Grades K–5

Number and operations—Fractions

$$5 + 9 =$$

$$\frac{5}{10} + \frac{9}{10} =$$

$$\frac{3}{4} + \frac{3}{4} =$$

Number and operations—Fractions

$$\frac{1}{4} + \frac{1}{2} =$$

$$\frac{5}{6} + \frac{1}{3} =$$

$$\frac{1}{12} + \frac{1}{12} + \frac{1}{2} + \frac{1}{4} =$$

Number and operations—Fractions

The language of operations helps you to make sense of what you need to do.

$$\frac{5}{8} - \frac{3}{8} =$$

$$\frac{1}{2} - \frac{1}{4} =$$

$$\frac{1}{2} - \frac{1}{3} =$$

Number and operations—Fractions

$$\frac{1}{2} \times \frac{1}{2} =$$

$$\frac{2}{3} \times \frac{3}{4} =$$

$$\frac{2}{3} \times \frac{5}{2} =$$

Number and operations—Fractions

$$6 \div 3 =$$

$$3 \div 6 =$$

$$\frac{1}{6} \div 3 =$$

$$3 \div \frac{1}{6} =$$

Number and operations—Fractions

What role does the primary teacher play in preparing students to understand operations with fractions?

What responsibility does the intermediate teacher have when teaching operations with fractions?

What role do the Key Shifts of *focus*, *coherence*, and *rigor* play in teaching operations with fractions?

MATHEMATICS CONTENT MODULES

Module 6: Number and Operations—Fractions: Operations with Fractions
Session 4: Instructional Strategies
Grades K–5

Standards for Mathematical Practice K–12

The Louisiana Student Standards for Mathematics consist of two corresponding and connected sets of standards:

1. Standards for Mathematical Practice
   – Apply to all grade levels
   – Describe the practices of mathematically proficient students

2. Standards for Mathematical Content
   – K–8 standards presented by grade level
   – High school standards presented by high school course

Math Content Module 6, Session 4
Grades K–5

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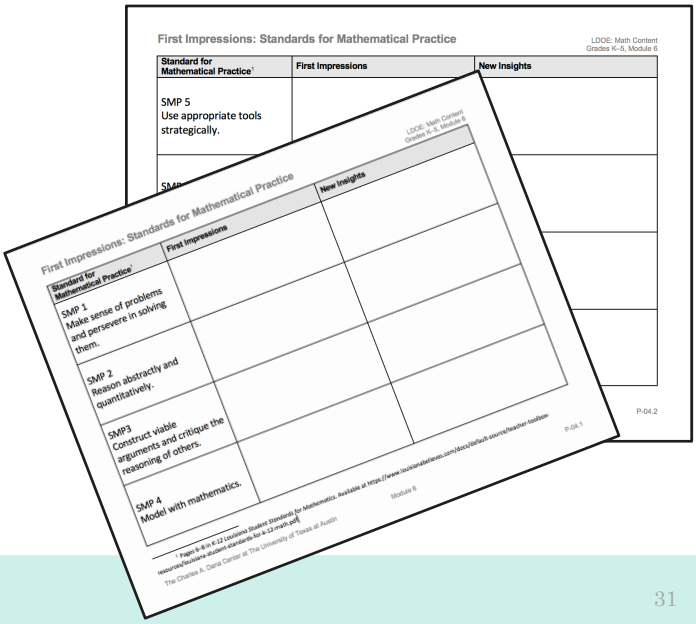
8 Standards for Mathematical Practice

"You never have a second chance to make a first impression."


First Impressions: Standards for Mathematical Practice

LDOE: Math Content
Grades K–5, Module 6

Standard for Mathematical Practice[1]	First Impressions	New Insights
SMP 5 Use appropriate tools strategically.		

First Impressions: Standards for Mathematical Practice

LDOE: Math Content
Grades K–5, Module 6

Standard for Mathematical Practice[1]	First Impressions	New Insights
SMP 1 Make sense of problems and persevere in solving them.		
SMP 2 Reason abstractly and quantitatively.		
SMP3 Construct viable arguments and critique the reasoning of others.		
SMP 4 Model with mathematics.		

[1] Pages 6–8 in K-12 Louisiana Student Standards for Mathematics. Available at https://www.louisianabelieves.com/docs/default-source/teacher-toolbox-resources/louisiana-student-standards-for-k-12-math.pdf

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Module 6

P-04.1

P-04.2

Math Content Module 6, Session 4
Grades K–5

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8 Standards for Mathematical Practice

Standards for Mathematical Practice

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.

Math Content Module 6, Session 4
Grades K–5

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Standards for Mathematical Practice

SMP 2: Reason abstractly and quantitatively

Must contextualize and decontextualize.

Creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them.

Teachers	Students

- Rotate around the room to revisit each SMP.
- Discuss with your group, and write:
  - What can be seen as the *teachers* incorporate this SMP?
  - What can be seen as the *students* incorporate this SMP?
- You will have 3 minutes at each chart.

Math Content Module 6, Session 4
Grades K–5

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Take a few minutes to think about and answer the following questions:

- **How can we ensure that the Standards for Mathematical Practice are being implemented in our classrooms?**
- **Do the Standards for Mathematical Practice look the same in all grade levels?**

Standards for Mathematical Practice

The Standards for Mathematical Practice are seamlessly woven into each lesson through various components of delivery that require the level of thinking and behaviors that the practices embody. Here are some examples:

- Carefully crafted fluency activities engage students in looking for and making use of structure, as well as looking for and expressing regularity in repeated reasoning.
- The read, draw, write sequence upon which problem-solving is based naturally provides opportunities for students to select appropriate tools, model word problems using mathematics, and reason abstractly and quantitatively.
- Concept Development consistently invites students to make sense of problems and persevere in solving them as they grapple with new learning through increasingly complex concrete, pictorial, and abstract applications.
- Each lesson's Student Debrief, as well as ongoing debrief embedded within each lesson component, requires students to construct viable arguments and critique the reasoning of others. Questioning and dialogue throughout the lessons ensures that students are not only engaging in the standards, but also that they are explicitly aware of and reflecting on those behaviors.

Each topic has the potential to integrate most (if not all) mathematical practice standards into the lessons. So that teachers are able to see the Standards for Mathematical Practice expressed just as clearly as the writers, at least one mathematical practice standard is chosen per topic to be exemplified with more detail and explanation. The mathematical practice standard chosen is annotated in the left margin and is announced in the "Mathematical Practices Brought to Life" section at the beginning of the topic. For example, a "MP.7" indicated in the left margin alerts the teacher that the purpose of the questions and/or vignette is to develop students' ability to look for and make sense of structure. As teachers give lessons, they should modify the materials or develop their own talking points. The annotation supports planning and delivery that emphasizes implementation of the Standards for Mathematical Practice. It signifies additional importance for lesson delivery and also indicates where teachers can find ways to model the standards for the plans they author.

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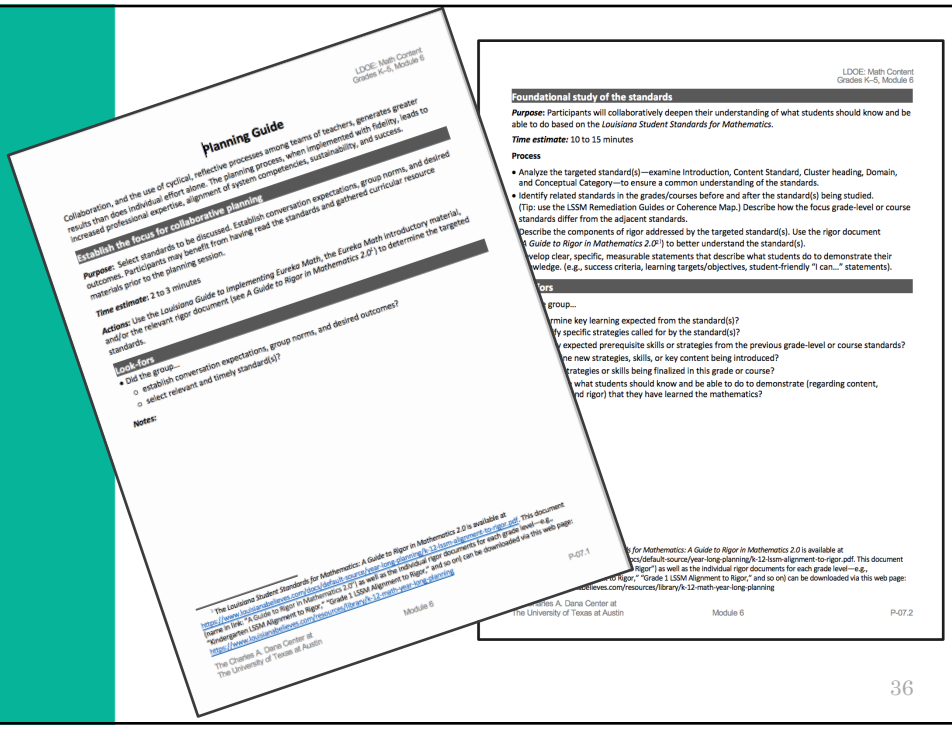
MATHEMATICS CONTENT MODULES

Module 6: Number and Operations—Fractions: Operations with Fractions
Session 5: Purposeful Planning of the EngageNY Curriculum
Grades K–5

Tool that promotes effective collaborative planning:

The Planning Guide



LDOE: Math Content
Grades K–5, Module 6

Planning Guide

Collaboration, and the use of critical, reflective processes among teams of teachers, generates greater results than does individual effort alone. The planning process, when implemented with fidelity, leads to increased professional expertise, alignment of system competencies, sustainability, and success.

Establish the focus for collaborative planning

Purpose: Select standards to be discussed. Establish conversation expectations, group norms, and desired outcomes. Participants may benefit from having read the standards and gathered curricular resource materials prior to the planning session.

Time estimate: 2 to 3 minutes

Actions: Use the *Louisiana Guide to Implementing Eureka Math*, the Eureka Math introductory material, and/or the relevant rigor document (see *A Guide to Rigor in Mathematics 2.0*[1]) to determine the targeted standards.

Look-fors

- Did the group…
  - establish conversation expectations, group norms, and desired outcomes?
  - select relevant and timely standard(s)?

Notes:

[1] The *Louisiana Student Standards for Mathematics: A Guide to Rigor in Mathematics 2.0* is available at https://www.louisianabelieves.com/docs/default-source/year-long-planning/k-12-lssm-alignment-to-rigor.pdf. This document (name is link "A Guide to Rigor in Mathematics 2.0") as well as the individual rigor documents for each grade level—e.g., "Kindergarten LSSM Alignment to Rigor," "Grade 1 LSSM Alignment to Rigor," and so on) can be downloaded via this web page: https://www.louisianabelieves.com/resources/library/k-12-math-year-long-planning

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Module 6

P-07.1

LDOE: Math Content
Grades K–5, Module 6

Foundational study of the standards

Purpose: Participants will collaboratively deepen their understanding of what students should know and be able to do based on the *Louisiana Student Standards for Mathematics*.

Time estimate: 10 to 15 minutes

Process

- Analyze the targeted standard(s)—examine Introduction, Content Standard, Cluster heading, Domain, and Conceptual Category—to ensure a common understanding of the standards.
- Identify related standards in the grades/courses before and after the standard(s) being studied. (Tip: use the LSSM Remediation Guides or Coherence Map.) Describe how the focus grade-level or course standards differ from the adjacent standards.
- Describe the components of rigor addressed by the targeted standard(s). Use the rigor document (*A Guide to Rigor in Mathematics 2.0*[1]) to better understand the standard(s).
- Develop clear, specific, measurable statements that describe what students do to demonstrate their knowledge. (e.g., success criteria, learning targets/objectives, student-friendly "I can…" statements).

Look-fors

- Did the group…
  - determine key learning expected from the standard(s)?
  - identify specific strategies called for by the standard(s)?
  - identify expected prerequisite skills or strategies from the previous grade-level or course standards?
  - identify new strategies, skills, or key content being introduced?
  - identify strategies or skills being finalized in this grade or course?
  - identify what students should know and be able to do to demonstrate (regarding content, and rigor) that they have learned the mathematics?

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Module 6

P-07.2

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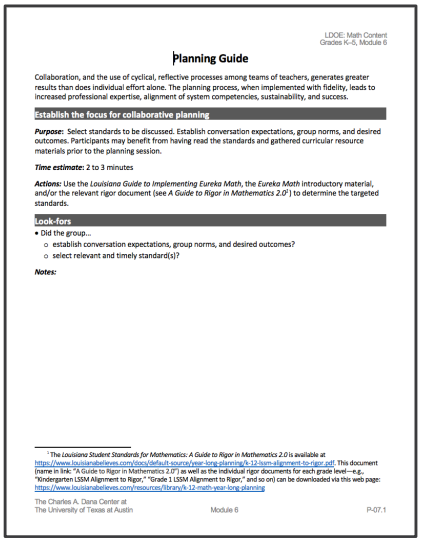
Collaborative planning conversation

Focus Standards: Using previous understanding of operations with whole numbers to solve operations with fractions

- Kindergarten: K.OA.A.2
- Grade 1: 1.OA.B.3, 1.OA.B.4
- Grade 2: 2.OA.A.1, 2.OA.C.3, 2.OA.C.4
- Grade 3: 3.OA.A.1, 3.OA.A.3
- Grade 4: 4.NF.B.3, 4.NF.B.4
- Grade 5: 5.NF.A.1, 5.NF.B.4, 5.NF.B.7



LDOE: Math Content
Grades K–5, Module 6

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- Did the group…
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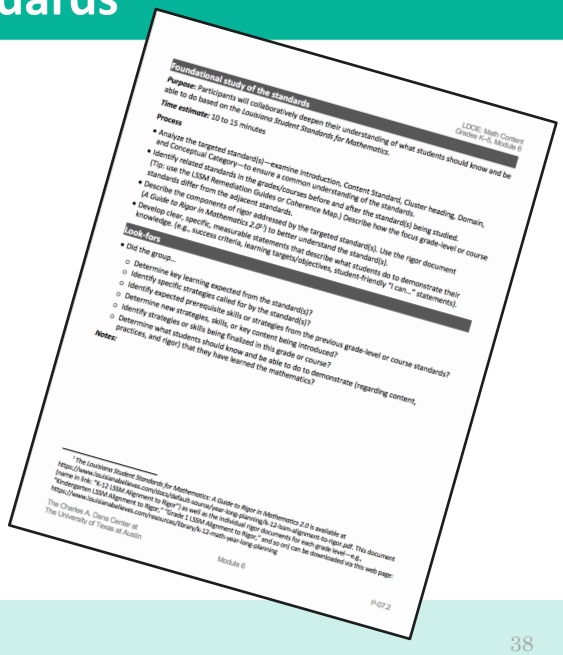
Foundational study of the standards

- ***Purpose:*** Participants will collaboratively deepen their understanding of what students should know and be able to do based on the *Louisiana Student Standards for Mathematics*.
- ***Time estimate:*** 10 to 15 minutes



LDOE: Math Content
Grades K–5, Module 6

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Time estimate: 10 to 15 minutes

Process

- Analyze the targeted standard(s)—examine Introduction, Content Standard, Cluster heading, Domain, and Conceptual Category—to ensure a common understanding of the standards.
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- Develop clear, specific, measurable statements that describe what students do to demonstrate their knowledge: (e.g., success criteria, learning targets/objectives, student-friendly "I can…" statements).

Look-fors

- Did the group…
  - Determine key learning expected from the standard(s)?
  - Identify specific strategies called for by the standard(s)?
  - Identify expected prerequisite skills or strategies from the previous grade-level or course standards?
  - Determine new strategies, skills, or key content being introduced?
  - Identify strategies or skills being finalized in this grade or course?
  - Determine what students should know and be able to do to demonstrate (regarding content, practices, and rigor) that they have learned the mathematics?

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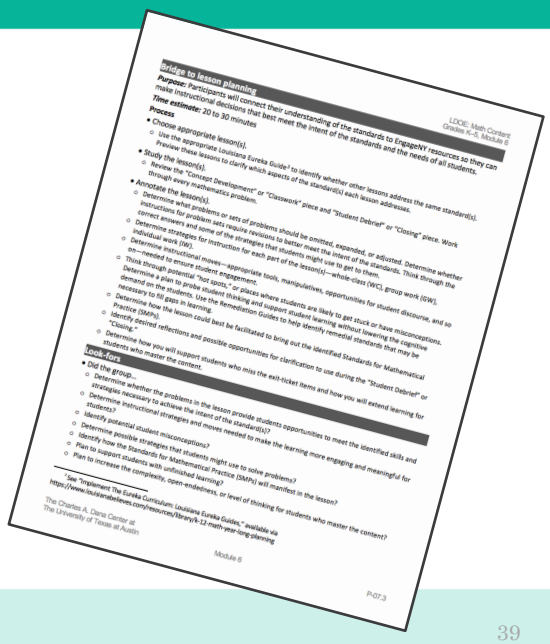
Bridge to lesson planning

- ***Purpose:*** Participants will connect their understanding of the standards to EngageNY resource materials so they can make instructional decisions that best meet the intent of the standards and the needs of all students.

- ***Time estimate:*** 20 to 30 minutes



Bridge to lesson planning

LDOE: Math Content
Grades K–5, Module 6

Purpose: Participants will connect their understanding of the standards to EngageNY resources so they can make instructional decisions that best meet the intent of the standards and the needs of all students.

Time estimate: 20 to 30 minutes

Process

- Choose appropriate lesson(s).
  - Use the appropriate Louisiana Eureka Guide[1] to identify whether other lessons address the same standard(s). Preview these lessons to clarify which aspects of the standard(s) each lesson addresses.
- Study the lesson(s).
  - Review the "Concept Development" or "Classwork" piece and "Student Debrief" or "Closing" piece. Work through every mathematics problem.
- Annotate the lesson(s).
  - Determine what problems or sets of problems should be omitted, expanded, or adjusted. Determine whether instructions for problem sets require revisions to better meet the intent of the standards. Think through the correct answers and some of the strategies that students might use to get to them.
  - Determine strategies for instruction for each part of the lesson(s)—whole-class (WC), group work (GW), individual work (IW).
  - Determine instructional moves—appropriate tools, manipulatives, opportunities for student discourse, and so on—needed to ensure student engagement.
  - Think through potential "hot spots," or places where students are likely to get stuck or have misconceptions. Determine a plan to probe student thinking and support student learning without lowering the cognitive demand on the students. Use the Remediation Guides to help identify remedial standards that may be necessary to fill gaps in learning.
  - Determine how the lesson could best be facilitated to bring out the Identified Standards for Mathematical Practice (SMPs).
  - Identify desired reflections and possible opportunities for clarification to use during the "Student Debrief" or "Closing."
  - Determine how you will support students who miss the exit-ticket items and how you will extend learning for students who master the content.

Look-fors

- Did the group…
  - Determine whether the problems in the lesson provide students opportunities to meet the identified skills and strategies necessary to achieve the intent of the standard(s)?
  - Determine instructional strategies and moves needed to make the learning more engaging and meaningful for students?
  - Identify potential student misconceptions?
  - Determine possible strategies that students might use to solve problems?
  - Identify how the Standards for Mathematical Practice (SMPs) will manifest in the lesson?
  - Plan to support students with unfinished learning?
  - Plan to increase the complexity, open-endedness, or level of thinking for students who master the content?

[1] See "Implement The Eureka Curriculum: Louisiana Eureka Guides," available via https://www.louisianabelieves.com/resources/library/k-12-math-year-long-planning

The Charles A. Dana Center at
The University of Texas at Austin

Module 6

P-073

Math Content Module 6, Session 5
Grades K–5

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Collaborative planning

Work with your grade-level group to…

- Study your grade level's focus standards using the **Foundational study of the standards** (15 minutes).
- Connect your standards conversation to an EngageNY lesson and discuss instructional decisions regarding that lesson using the **Bridge to lesson planning** (30 minutes).

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Math Content Module 6, Session 5
Grades K–5

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Reflecting on purposeful planning

Points to Ponder

How does purposeful planning help you attend to the components of *rigor*?

What specific instructional strategies did you focus on?

What changes did you make to the EngageNY lesson(s)? Why?

How did your conversation help determine a plan to fill gaps in learning?

MATHEMATICS CONTENT MODULES

Module 6: Number and Operations—Fractions: Operations with Fractions Closing and Participant Evaluation Survey Grades K–5

References

Key resources available via the **Louisiana Department of Education** web page — K-12 Math Planning Resources, https://www.louisianabelieves.com/resources/library/k-12-math-year-long-planning — include the following:

- *K–12 Louisiana Student Standards for Mathematics (LSSM)*
- *Teachers Companion Documents*
- *Implement The Eureka Curriculum: Louisiana Eureka Guides*
- *Help Students Who Struggle: Remediation Guides*
- *The Louisiana Student Standards for Mathematics: A Guide to Rigor in Mathematics 2.0*, at https://www.louisianabelieves.com/docs/default-source/year-long-planning/k-12-lssm-alignment-to-rigor.pdf This document (name in link: "K-12 LSSM Alignment to Rigor") as well as the individual rigor documents for each grade level — e.g., "Kindergarten LSSM Alignment to Rigor," "Grade 1 LSSM Alignment to Rigor," and so on) can be downloaded via this web page: https://www.louisianabelieves.com/resources/library/k-12-math-year-long-planning

Other resources referenced include:
EngageNY, from the New York State Department of Education. Various curriculum resources, available via https://://www.engageny.org

- Pre-Kindergarten-Grade 5 Mathematics: Curriculum Map and Guiding Documents. EngageNY. Available via https://www.engageny.org/resource/pre-kindergarten-grade-5-mathematics-curriculum-map-and-guiding-documents
- (2013 July 4). How to Implement A Story of Units. Available at https://www.engageny.org/sites/default/files/resource/attachments/how_to_implement_a_story_of_units.pdf
- (2014). Lesson: "Grade 5 Mathematics Module 4, Topic E, Lesson 13: Objective: Multiply unit fractions by unit fractions." Available via https://www.engageny.org/resource/grade-5-mathematics-module-4-topic-e-lesson-13 | These curriculum resources are shared under the EngageNY terms of use (https://www.engageny.org/terms-of-use) and the Creative Commons license—Attribution-NonCommercial-ShareAlike 3.0 Unported (CC BY-NC-SA 3.0)—mentioned therein: https://creativecommons.org/licenses/by-nc-sa/3.0

Illustrative Mathematics. (2014, February 12). Standards for Mathematical Practice: Commentary and Elaborations for K–5. Tucson, AZ. Available at http://commoncoretools.me/wp-content/uploads/2014/02/Elaborations.pdf

Module evaluation

Your feedback and comments are important to us. Please complete the module evaluation found at:

http://www.utdanacenter.org/ldoe/surveys