Using the Teaching Fractions Toolkit to Support Evidence-Based Instruction in 6th-Grade Math

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Meet the presenters

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Virtual meeting/conference recording notice

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Agenda

- Introduction
- What strategies are effective for teaching fractions?
- Learn additional evidence-based strategies
- A peek at the toolkit
- Study opportunity to gain early access to the toolkit
- Questions and answers

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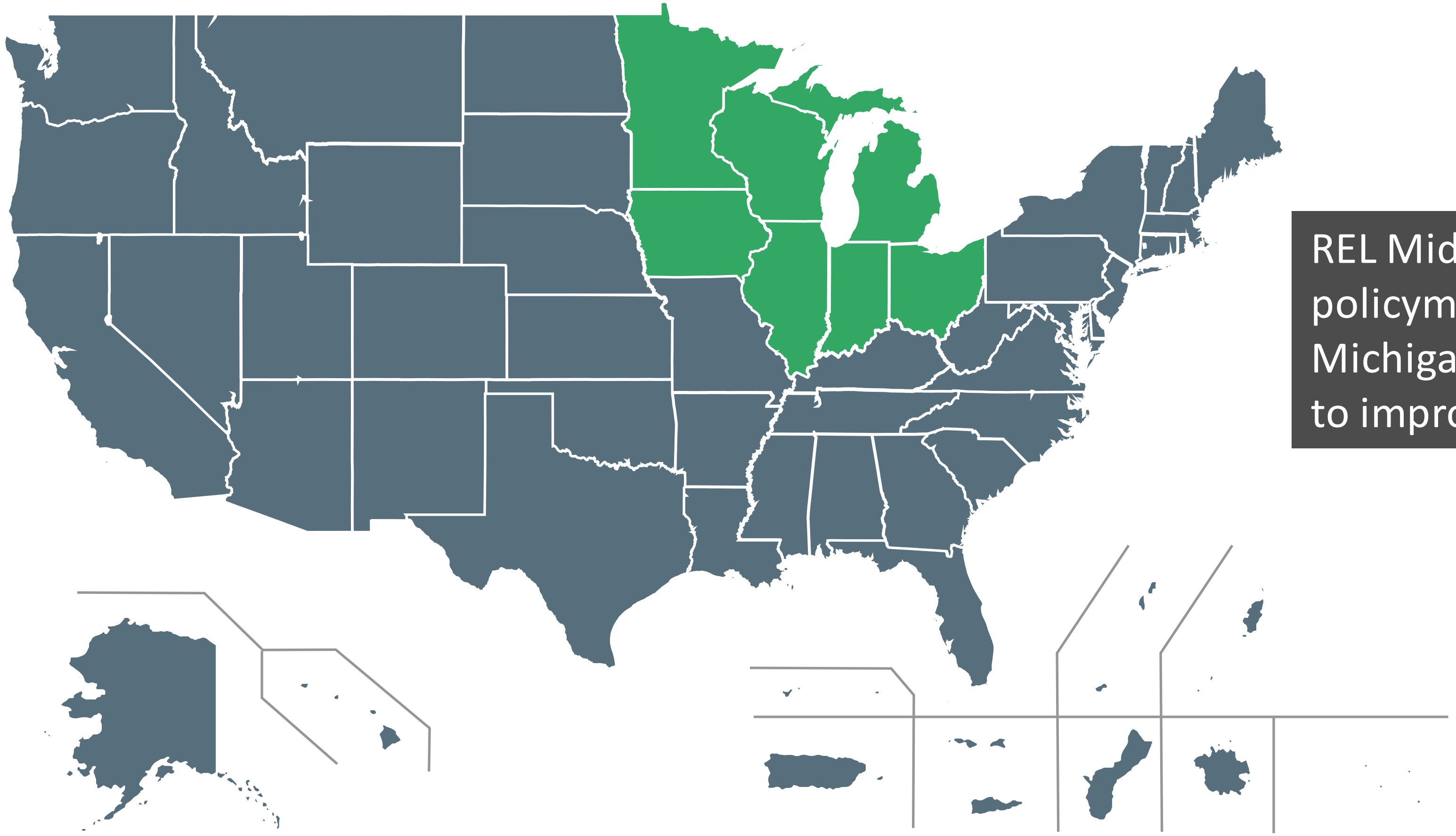


REL Midwest partners with educators and policymakers in Illinois, Indiana, Iowa, Michigan, Minnesota, Ohio, and Wisconsin to improve learner outcomes.

https://ies.ed.gov/ncee/rel/region/midwest

The RELs are funded by the U.S. Department of Education's Institute of Education Sciences (IES).

You are invited to join the Teaching Fractions Toolkit study!

Join the study to help us evaluate the efficacy of the Teaching Fractions Toolkit (TFT) professional development in improving fractions instruction and learning.

- Teachers will receive FREE professional development.
- Teachers will receive other classroom resources (free apps, assessment probes).
- Leaders will receive resources to support teachers.
- Opportunities for districts to build capacity for future professional development.

What strategies are effective for teaching fractions?

Why fractions?

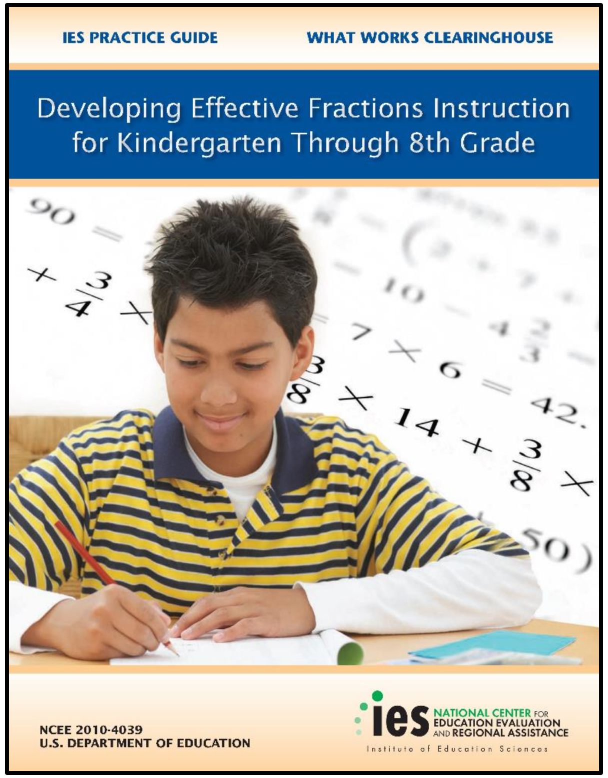
- U.S. students' math skills have fallen short for many years.
- Students need to master fractions to successfully transition into middle grades content which focuses on ratios and proportions.
- Teachers benefit from having additional strategies to teach fractions and build student understanding of how to work with them.

Siegler, R., Carpenter, T., Fennell, F., Geary, D., Lewis, J., Okamoto, Y., Thompson, L., & Wray, J. (2010). *Developing effective fractions instruction for kindergarten through 8th grade: A practice guide* (NCEE #2010-4039). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education. https://ies.ed.gov/ncee/wwc/practiceguide/15

Developing Effective Fractions Instruction for Kindergarten Through 8th Grade Practice Guide

Five recommendations, each with implementation steps and examples.

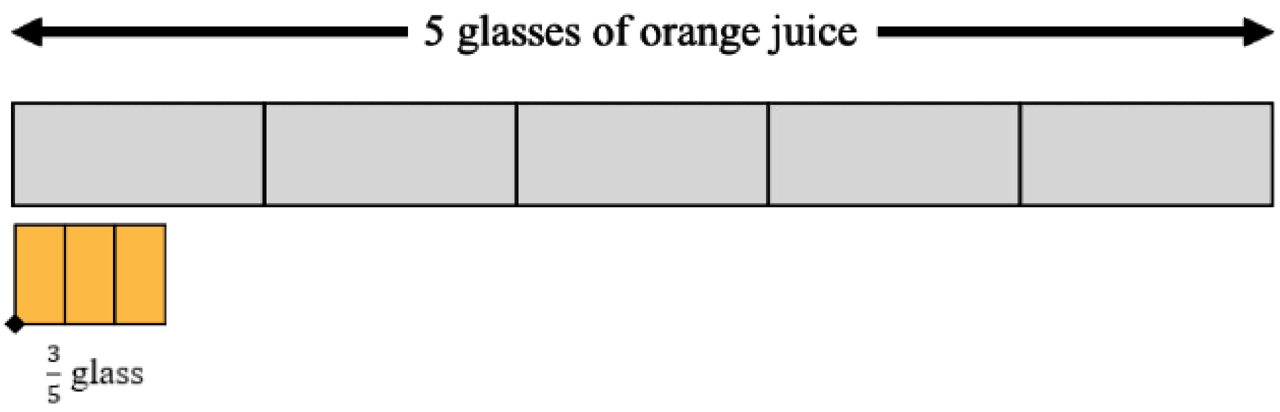
Strategies to build students' conceptual understanding of fractions, so that they better understand the procedural skills for working with fractions.



Siegler, R., Carpenter, T., Fennell, F., Geary, D., Lewis, J., Okamoto, Y., Thompson, L., & Wray, J. (2010). *Developing effective fractions instruction for kindergarten through 8th grade: A practice guide* (NCEE #2010-4039). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education. https://ies.ed.gov/ncee/wwc/practiceguide/15

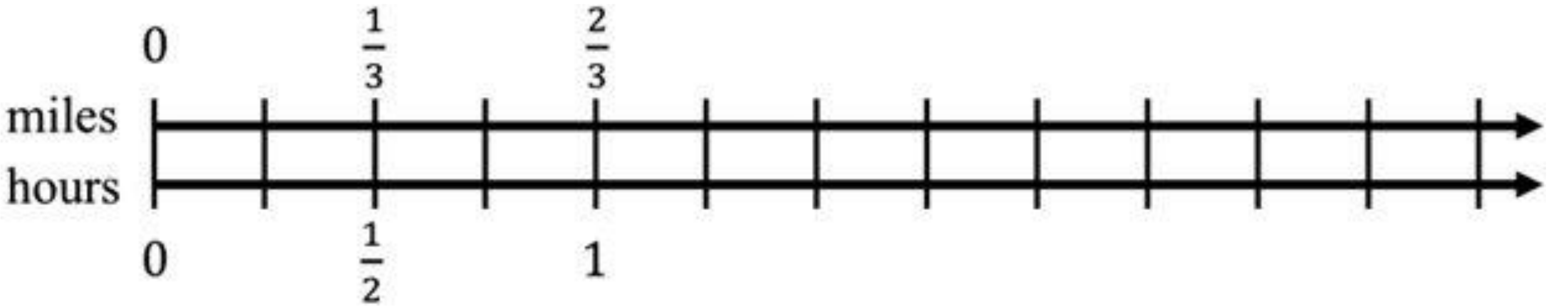
Recommendation 3: Help students understand why procedures for computations with fractions make sense.

Practical strategy: Tape diagrams are helpful when considering the whole versus part relationship found in contextual problems.



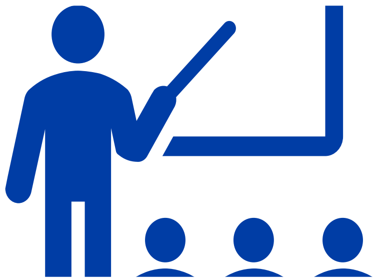
Recommendation 4: Develop students' conceptual understanding of strategies for solving ratio, rate, and proportion problems before exposing them to cross-multiplication as a procedure to use to solve such problems.

Practical strategy: When solving rate problems, use a double number line to help visualize time versus distance.



Learn additional evidence-based strategies

Toolkit components



Supports specifically for 6th-grade teachers.

Supports for leaders with fractions strategies across grade levels.

Six professional development modules

Module 1: Fractions on a Number Line

Module 2: Understanding Fraction Addition and Subtraction

Module 3: Understanding Fraction Multiplication and Division

Module 4: Implementation of Fraction Computation

Module 5: Understanding Rate, Ratio, and Proportion

Module 6: Implementation of Rate, Ratio, and Proportion

Each module includes

- Exploration of math tasks
- Student work analysis
- Lesson planning and implementation
- Use of online interactive apps
- Teacher Reflection Tool
- Formative assessments

Module structure

Each module spans ~2 weeks and includes 2 facilitated synchronous meetings, with asynchronous activities to be completed between the meetings.

Module 1

Fractions on a Number Line focuses on recommendation 2, with an emphasis on number lines.

Meeting 1A ➔ **Module 1 interim activities** ➔ **Meeting 1B**

Supports for leaders

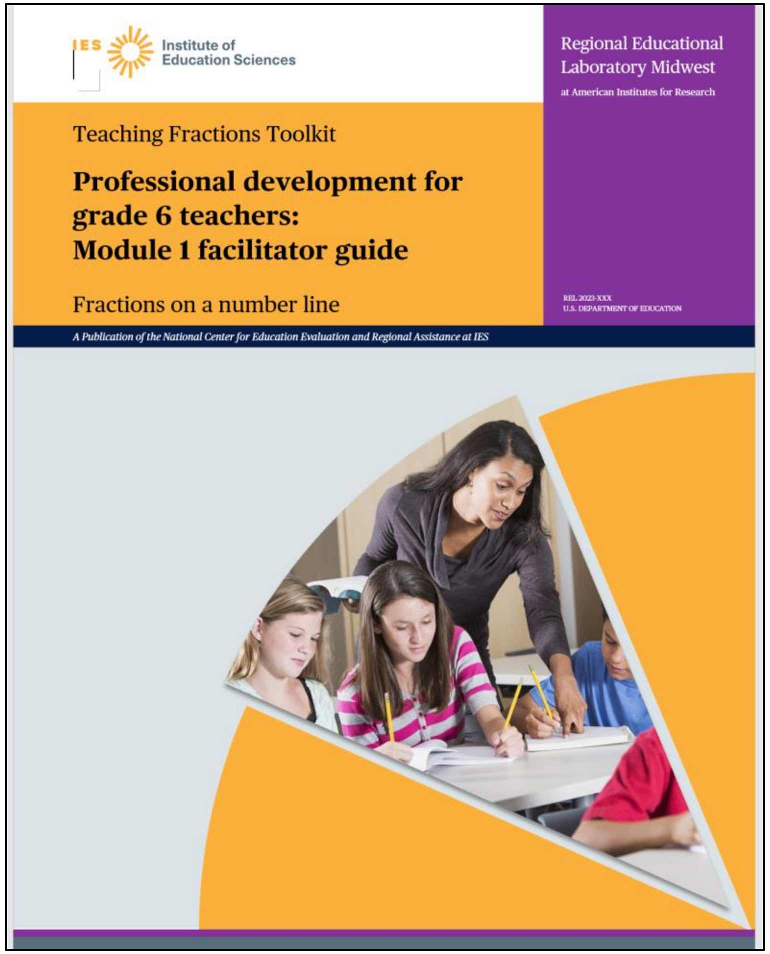
- Informational videos and handouts
- Monitoring conditions checklist
- Professional development facilitation materials

A peek at the toolkit

Professional development module components

- A detailed facilitator guide
- A participant workbook
- Two slide decks for professional meetings
- Teacher reflection tool

Facilitator guide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Teaching Fractions Toolkit

Professional development for grade 6 teachers: Module 1 facilitator guide

Fractions on a number line

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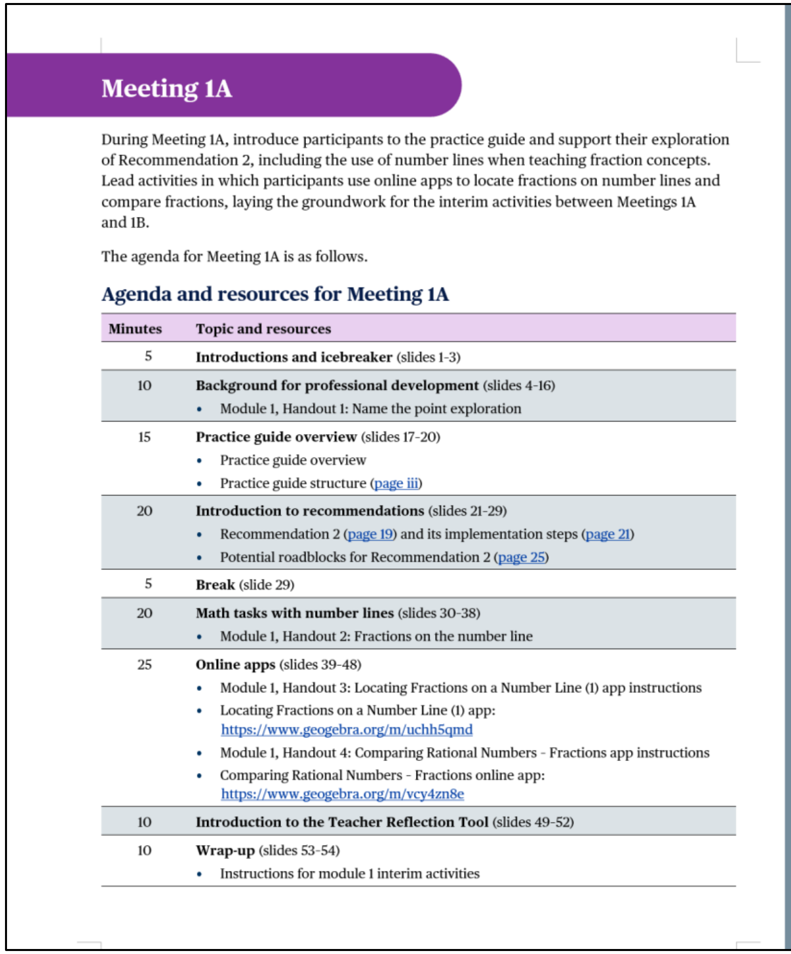
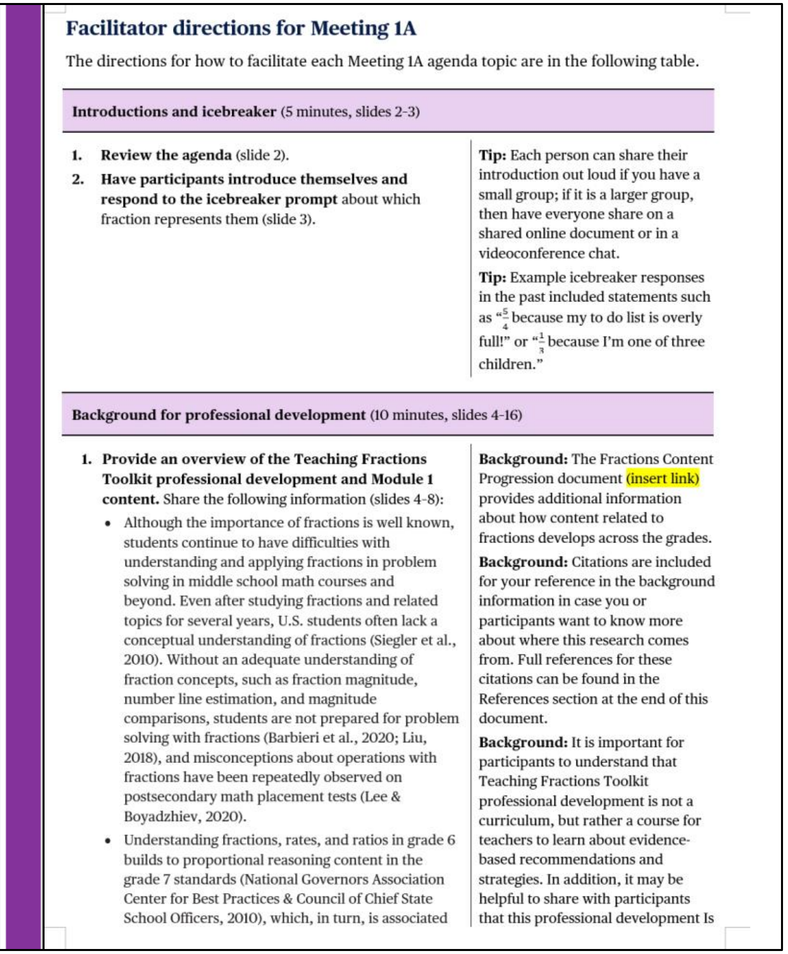

Meeting 1A

During Meeting 1A, introduce participants to the practice guide and support their exploration of Recommendation 2, including the use of number lines when teaching fraction concepts. Lead activities in which participants use online apps to locate fractions on number lines and compare fractions, laying the groundwork for the interim activities between Meetings 1A and 1B.

The agenda for Meeting 1A is as follows.

Agenda and resources for Meeting 1A

Minutes	Topic and resources
5	**Introductions and icebreaker** (slides 1-3)
10	**Background for professional development** (slides 4-16) • Module 1, Handout 1: Name the point exploration
15	**Practice guide overview** (slides 17-20) • Practice guide overview • Practice guide structure (page iii)
20	**Introduction to recommendations** (slides 21-29) • Recommendation 2 (page 19) and its implementation steps (page 21) • Potential roadblocks for Recommendation 2 (page 25)
5	**Break** (slide 29)
20	**Math tasks with number lines** (slides 30-38) • Module 1, Handout 2: Fractions on the number line
25	**Online apps** (slides 39-48) • Module 1, Handout 3: Locating Fractions on a Number Line (1) app instructions • Locating Fractions on a Number Line (1) app: https://www.geogebra.org/m/uchh5qmd • Module 1, Handout 4: Comparing Rational Numbers - Fractions app instructions • Comparing Rational Numbers - Fractions online app: https://www.geogebra.org/m/vcy4zn8e
10	**Introduction to the Teacher Reflection Tool** (slides 49-52)
10	**Wrap-up** (slides 53-54) • Instructions for module 1 interim activities


Facilitator directions for Meeting 1A

The directions for how to facilitate each Meeting 1A agenda topic are in the following table.

Introductions and icebreaker (5 minutes, slides 2-3)

1. **Review the agenda** (slide 2).
2. **Have participants introduce themselves and respond to the icebreaker prompt** about which fraction represents them (slide 3).

Tip: Each person can share their introduction out loud if you have a small group; if it is a larger group, then have everyone share on a shared online document or in a videoconference chat.

Tip: Example icebreaker responses in the past included statements such as "$\frac{5}{4}$ because my to do list is overly full!" or "$\frac{1}{3}$ because I'm one of three children."

Background for professional development (10 minutes, slides 4-16)

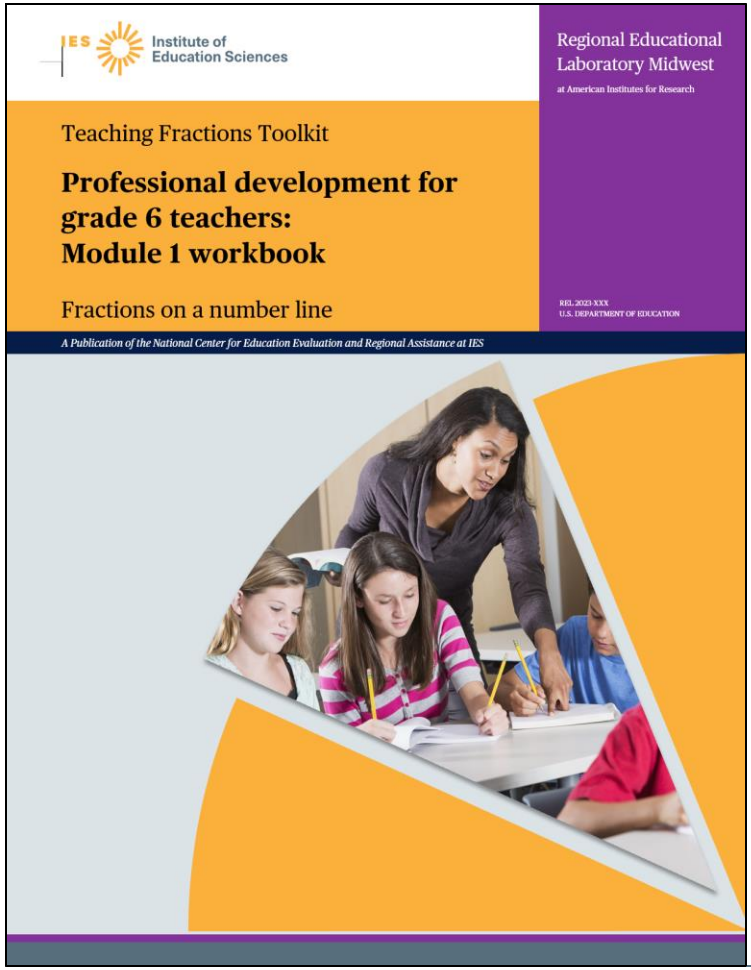
1. **Provide an overview of the Teaching Fractions Toolkit professional development and Module 1 content.** Share the following information (slides 4-8):
   - Although the importance of fractions is well known, students continue to have difficulties with understanding and applying fractions in problem solving in middle school math courses and beyond. Even after studying fractions and related topics for several years, U.S. students often lack a conceptual understanding of fractions (Siegler et al., 2010). Without an adequate understanding of fraction concepts, such as fraction magnitude, number line estimation, and magnitude comparisons, students are not prepared for problem solving with fractions (Barbieri et al., 2020; Liu, 2018), and misconceptions about operations with fractions have been repeatedly observed on postsecondary math placement tests (Lee & Boyadzhiev, 2020).
   - Understanding fractions, rates, and ratios in grade 6 builds to proportional reasoning content in the grade 7 standards (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010), which, in turn, is associated

Background: The Fractions Content Progression document (insert link) provides additional information about how content related to fractions develops across the grades.

Background: Citations are included for your reference in the background information in case you or participants want to know more about where this research comes from. Full references for these citations can be found in the References section at the end of this document.

Background: It is important for participants to understand that Teaching Fractions Toolkit professional development is not a curriculum, but rather a course for teachers to learn about evidence-based recommendations and strategies. In addition, it may be helpful to share with participants that this professional development Is

Participant workbook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Teaching Fractions Toolkit

Professional development for grade 6 teachers: Module 1 workbook

Fractions on a number line

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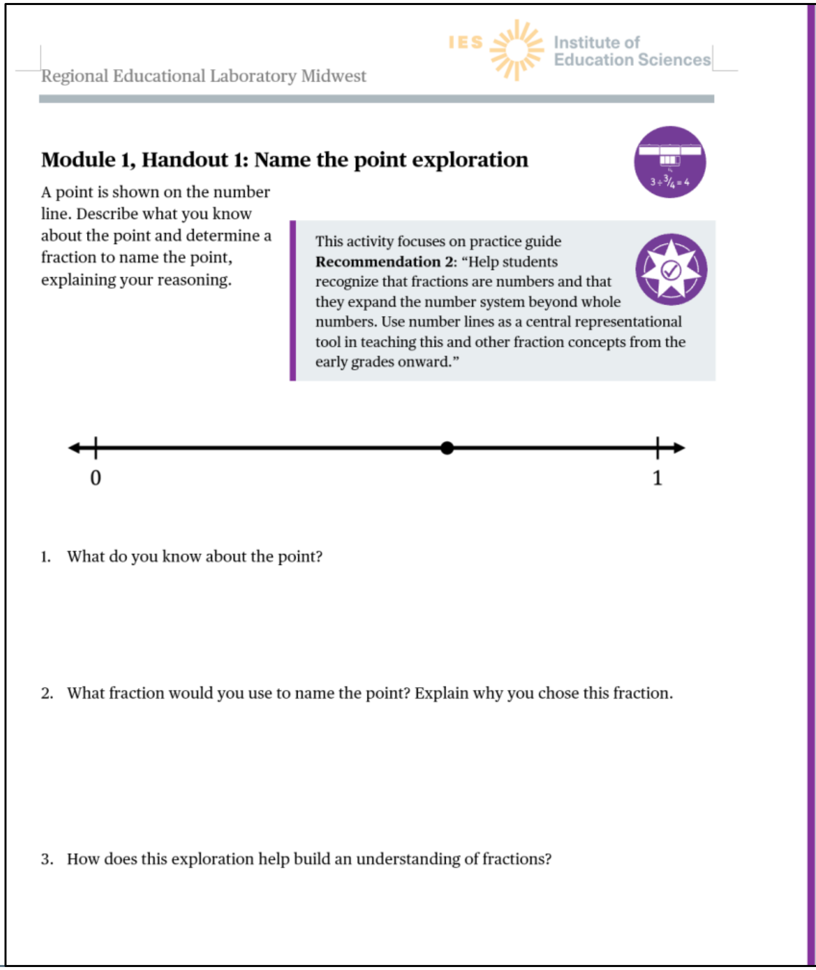
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Module 1, Handout 1: Name the point exploration

A point is shown on the number line. Describe what you know about the point and determine a fraction to name the point, explaining your reasoning.

This activity focuses on practice guide **Recommendation 2:** "Help students recognize that fractions are numbers and that they expand the number system beyond whole numbers. Use number lines as a central representational tool in teaching this and other fraction concepts from the early grades onward."

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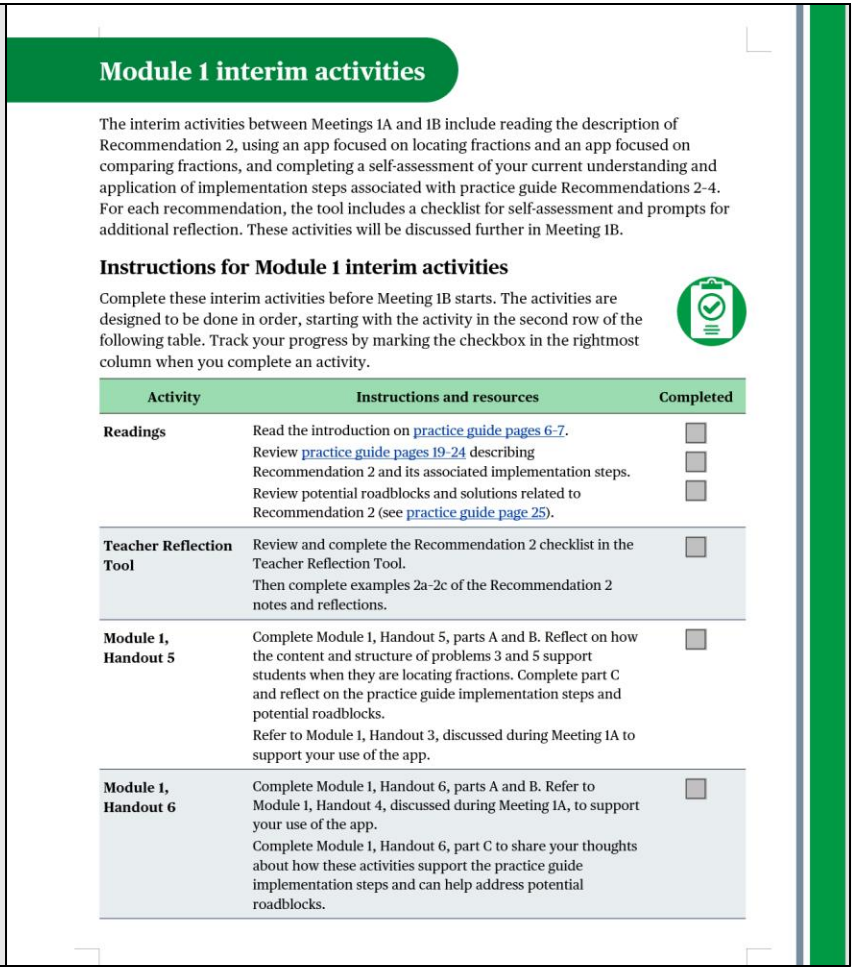
1. What do you know about the point?
2. What fraction would you use to name the point? Explain why you chose this fraction.
3. How does this exploration help build an understanding of fractions?


Module 1 interim activities

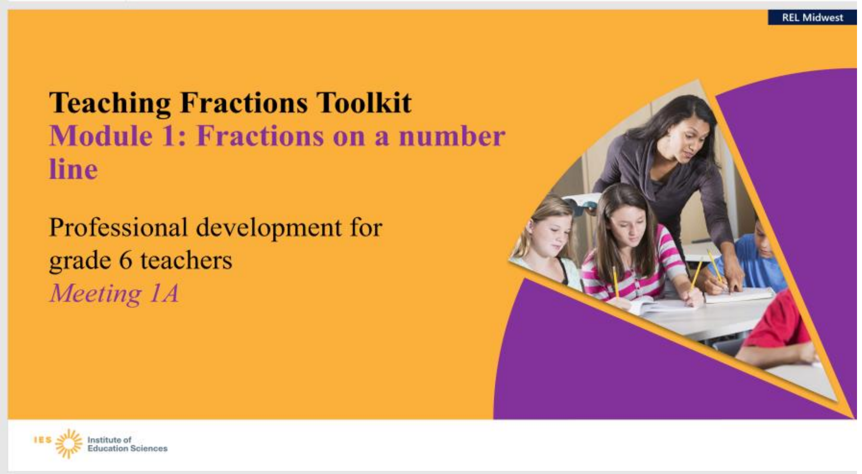
The interim activities between Meetings 1A and 1B include reading the description of Recommendation 2, using an app focused on locating fractions and an app focused on comparing fractions, and completing a self-assessment of your current understanding and application of implementation steps associated with practice guide Recommendations 2-4. For each recommendation, the tool includes a checklist for self-assessment and prompts for additional reflection. These activities will be discussed further in Meeting 1B.

Instructions for Module 1 interim activities

Complete these interim activities before Meeting 1B starts. The activities are designed to be done in order, starting with the activity in the second row of the following table. Track your progress by marking the checkbox in the rightmost column when you complete an activity.

Activity	Instructions and resources	Completed
Readings	Read the introduction on practice guide pages 6-7. Review practice guide pages 19-24 describing Recommendation 2 and its associated implementation steps. Review potential roadblocks and solutions related to Recommendation 2 (see practice guide page 25).	☐ ☐ ☐
Teacher Reflection Tool	Review and complete the Recommendation 2 checklist in the Teacher Reflection Tool. Then complete examples 2a-2c of the Recommendation 2 notes and reflections.	☐
Module 1, Handout 5	Complete Module 1, Handout 5, parts A and B. Reflect on how the content and structure of problems 3 and 5 support students when they are locating fractions. Complete part C and reflect on the practice guide implementation steps and potential roadblocks. Refer to Module 1, Handout 3, discussed during Meeting 1A to support your use of the app.	☐
Module 1, Handout 6	Complete Module 1, Handout 6, parts A and B. Refer to Module 1, Handout 4, discussed during Meeting 1A, to support your use of the app. Complete Module 1, Handout 6, part C to share your thoughts about how these activities support the practice guide implementation steps and can help address potential roadblocks.	☐

Slide decks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Teaching Fractions Toolkit
Module 1: Fractions on a number line
Professional development for grade 6 teachers
Meeting 1A
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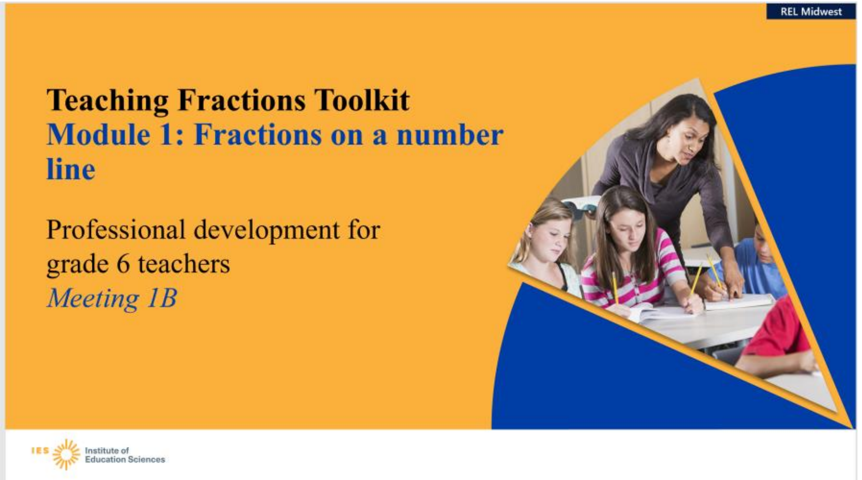
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Module 1: Fractions on a number line
Professional development for grade 6 teachers
Meeting 1B
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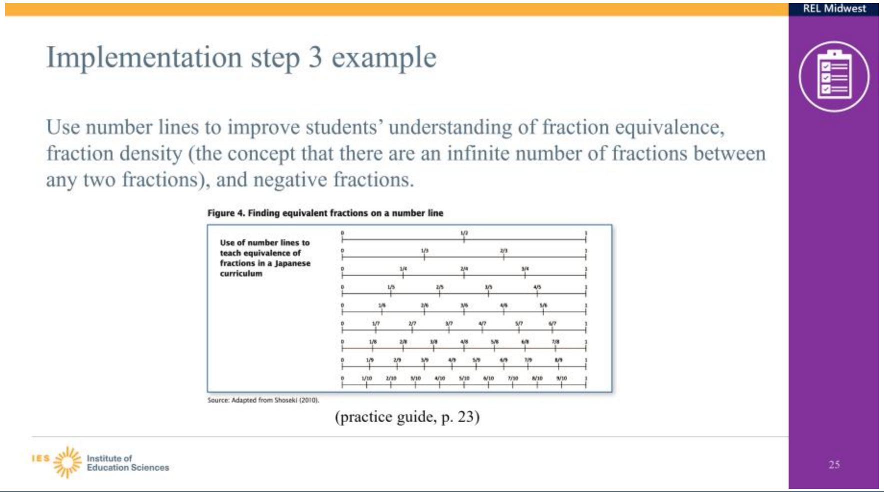
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Implementation step 3 example
Use number lines to improve students' understanding of fraction equivalence, fraction density (the concept that there are an infinite number of fractions between any two fractions), and negative fractions.
Figure 4. Finding equivalent fractions on a number line
Use of number lines to teach equivalence of fractions in a Japanese curriculum
Source: Adapted from Shoseki (2010).
(practice guide, p. 23)
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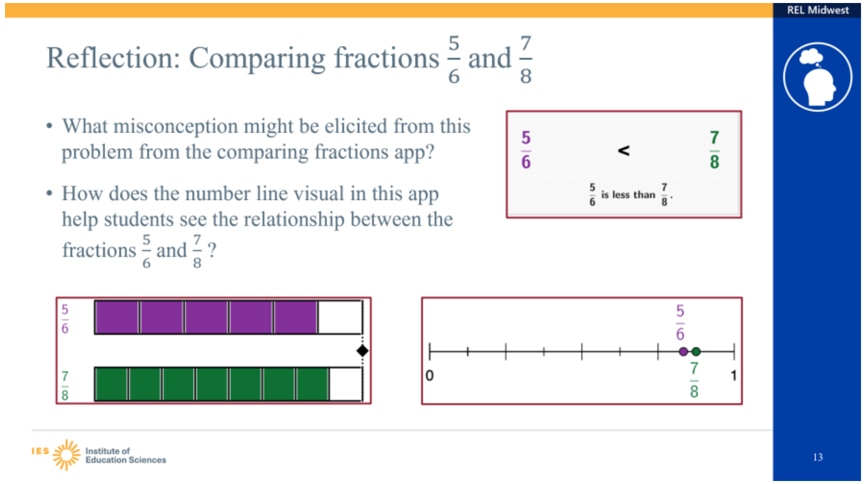
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Reflection: Comparing fractions $\frac{5}{6}$ and $\frac{7}{8}$
• What misconception might be elicited from this problem from the comparing fractions app?
• How does the number line visual in this app help students see the relationship between the fractions $\frac{5}{6}$ and $\frac{7}{8}$?
$\frac{5}{6}$ < $\frac{7}{8}$
$\frac{5}{6}$ is less than $\frac{7}{8}$.
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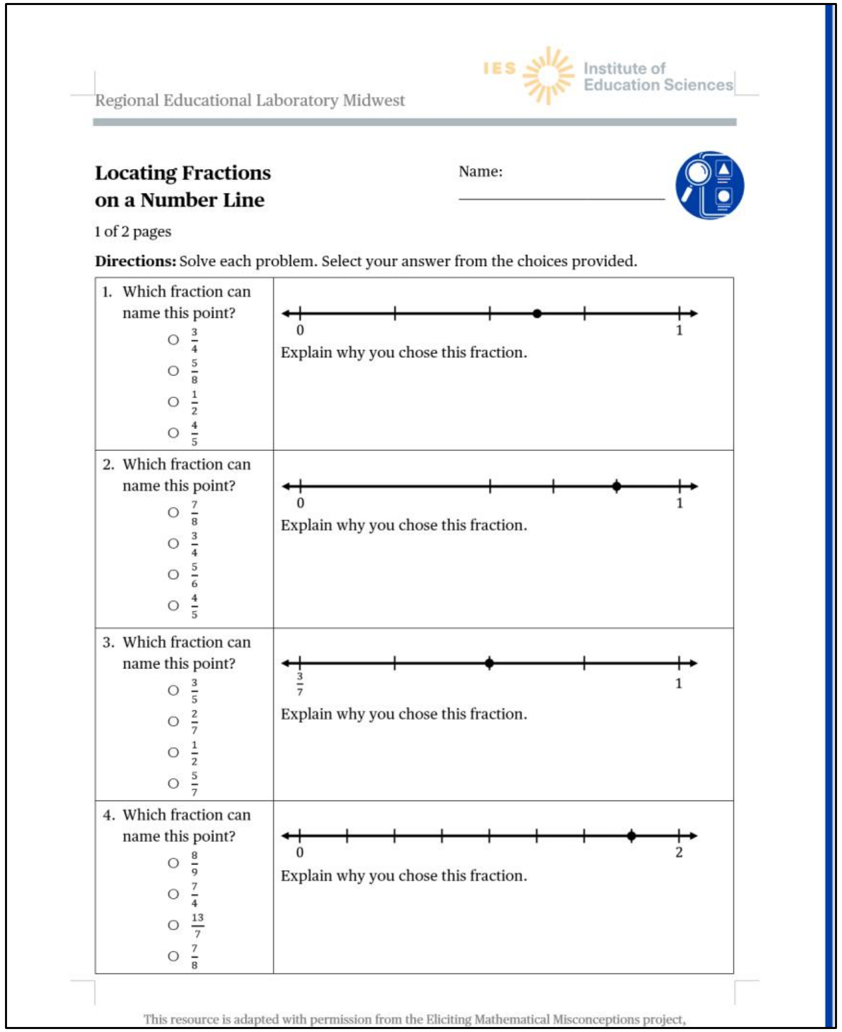
Formative assessment handouts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Locating Fractions on a Number Line

Name: ____________

1 of 2 pages

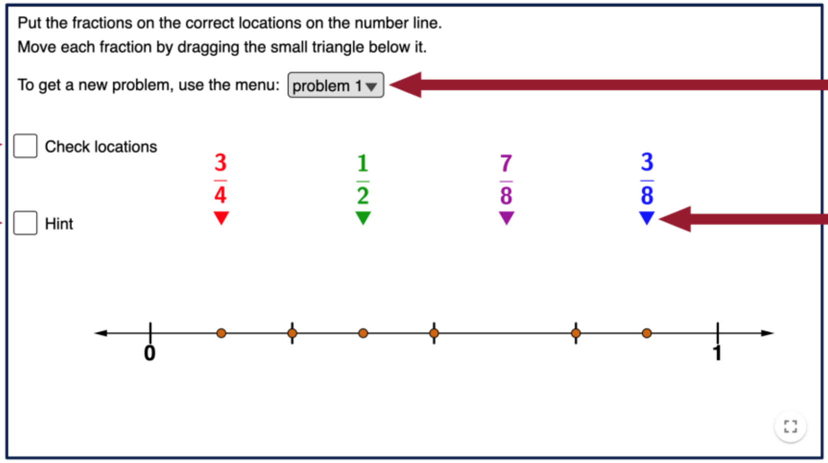
Directions: Solve each problem. Select your answer from the choices provided.

1. Which fraction can name this point? ○ $\frac{3}{4}$ ○ $\frac{5}{8}$ ○ $\frac{1}{2}$ ○ $\frac{4}{5}$	0 1 Explain why you chose this fraction.
2. Which fraction can name this point? ○ $\frac{7}{8}$ ○ $\frac{3}{4}$ ○ $\frac{5}{6}$ ○ $\frac{4}{5}$	0 1 Explain why you chose this fraction.
3. Which fraction can name this point? ○ $\frac{3}{5}$ ○ $\frac{2}{7}$ ○ $\frac{1}{2}$ ○ $\frac{5}{7}$	$\frac{3}{7}$ 1 Explain why you chose this fraction.
4. Which fraction can name this point? ○ $\frac{8}{9}$ ○ $\frac{7}{4}$ ○ $\frac{13}{7}$ ○ $\frac{7}{8}$	0 2 Explain why you chose this fraction.

This resource is adapted with permission from the Eliciting Mathematical Misconceptions project,

Interactive apps

Locating Fractions on a Number Line (1) app exploration



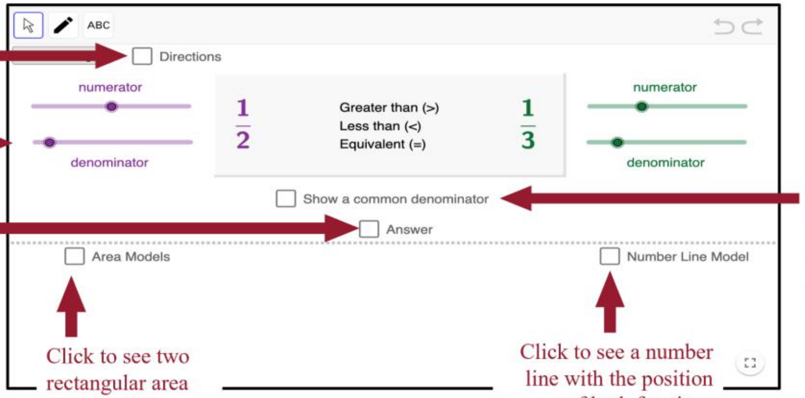
Click to check placement on the line.

Click for help.

Drop down menu for different problems.

Click and hold on the triangle under a fraction to drag it down to the line.

Comparing Rational Numbers – Fractions app exploration



Click for directions.

Use sliders to create fraction.

Click to see the symbol showing the relationship between the fractions.

Click to see two rectangular area models of the fractions.

Click to see a number line with the position of both fractions designated and labeled.

Click the check box to compare using common denominators.

Testimonials from 6th-grade math teachers in Illinois

“This experience was like a go-to guide for the best ways to teach fractions concepts to 6th graders. Everything in here was valuable and usable.”

“Very well worth it! You will get amazing insight into teaching various math concepts and interactive tools to help your students understand the why behind what they are learning. Highly recommend.”

“The TFT experience deepened my understanding of how I can utilize multiple tools to help students show their understandings.”

Study opportunity to gain early access to the toolkit

You are invited to join the Teaching Fractions Toolkit study!

Benefits for participating teachers

Training on using evidence-based practices in fractions instruction.

Resources to use in their classrooms to improve student outcomes.

Tasks and assessment probes to use with students with **interactive apps.**

Compensations of up to **$150** in gift cards for participating in the study.

Benefits for participating schools and districts

Resources to facilitate the professional development.

Resources to support teachers in improving their fraction instruction.

Summaries of **research findings** specific to their school and district.

Questions?

More about this opportunity?

- Scan the QR code
- Contact Jennifer Anthony (janthony@air.org)
- Visit our website or watch this short video

Thank you!