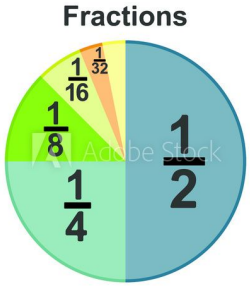
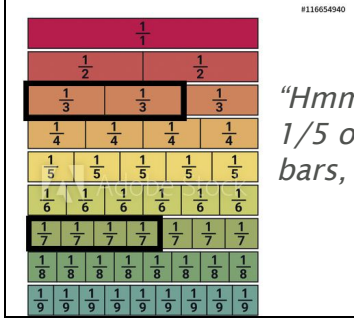
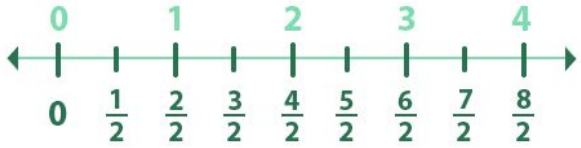
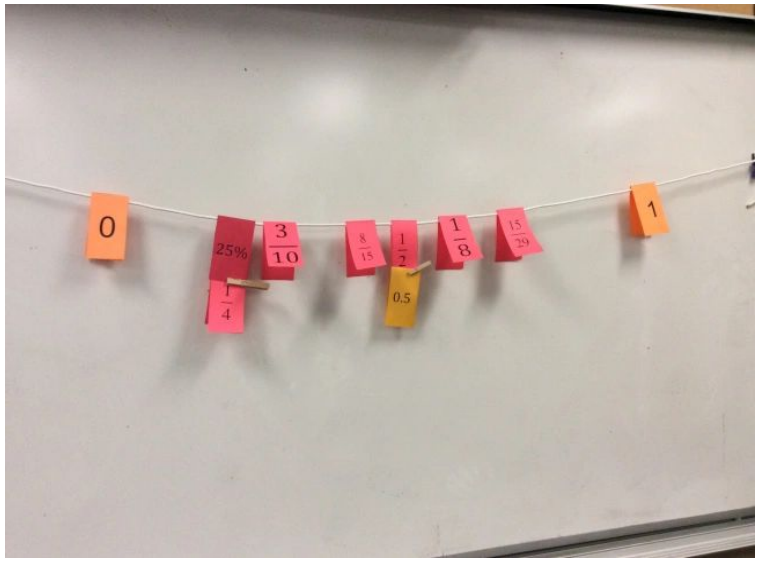
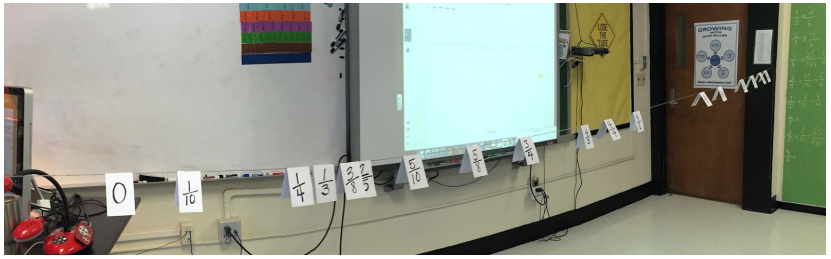
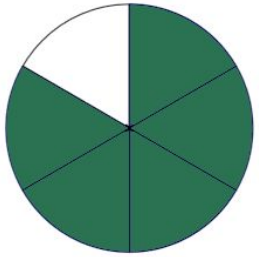
Guidance for Educators: The Teaching and Learning of Fractions

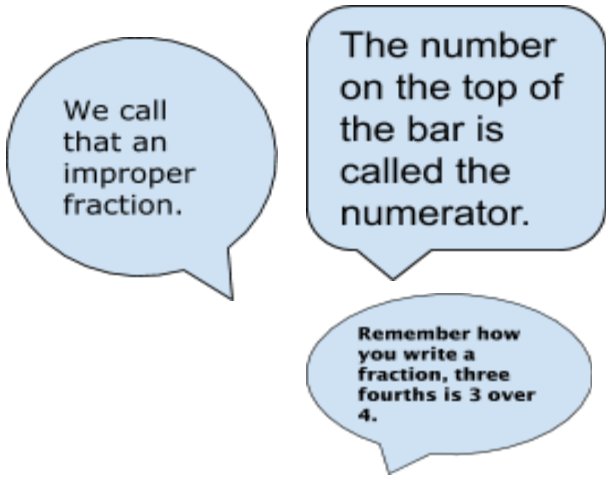
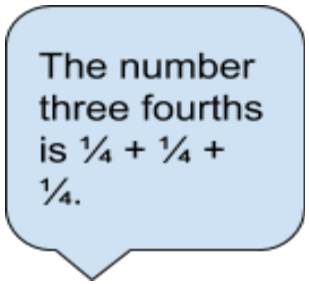
The teaching of fraction content across individual classrooms and schools can vary dramatically from class-to-class, school-to-school, and district-to-district. If your students seem to stumble when working with fractions, they might be missing some foundational fractions concepts. Below are some suggestions to support their development. The guidance below has been designed to help you identify some traditional practices that may in fact be impeding student learning, and provide ideas for alternate approaches.

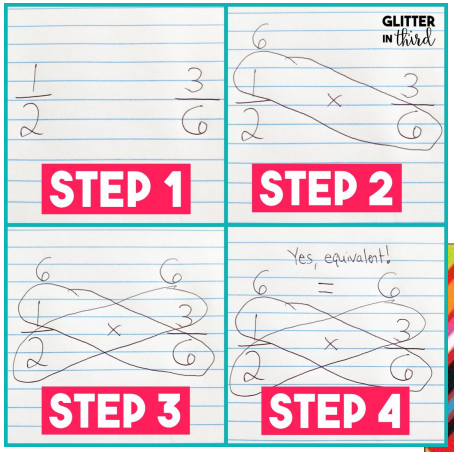
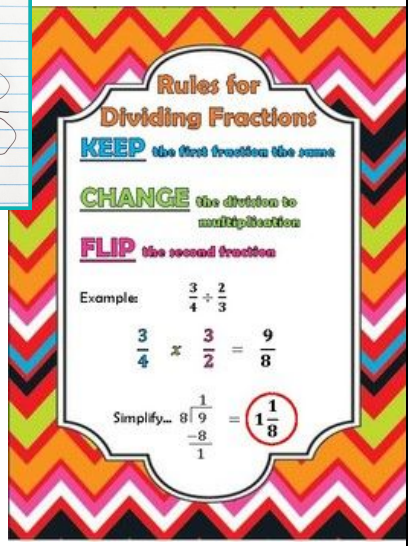
Review the "Try This Best Practice Instead" column below to see how you might disrupt standard practices to demonstrably boost your students' achievement and allow more of your students to become more confident as they develop and apply their understanding of fractions. Each characteristic described in the left-hand column presents an opportunity to redesign, adjust, or even radically alter instruction, and replace it with a new practice in the right hand column.

If you find…	**Try this best practice instead…**
You are questioning the usefulness of the geometric visual representations meant to support student understanding.  *"The thirty-second is so small. Students couldn't partition much more on this circle."*  *"Hmmm….1/3 is not equivalent to 1/5 or 1/7 but, halfway across their bars, they almost measure up?"*	Emphasize measurement representations (number lines and tape diagrams) of fractions. The number line supports the development of the understanding that a fraction is a number: it helps students see the magnitude of a fraction, and, that as a number, any fraction can be located on the number line. A number line can also be extended and partitioned into smaller pieces easily, which can't be said for all models. For example, at a certain point it gets more difficult to use a circle model. Similarly, tape diagrams help visualize the magnitude of a fraction and justify the location of a fraction on the number line, particularly when the tape diagram is shown above the number line. 

If you find…	Try this best practice instead…
The manipulatives and hands on materials students are using are not supporting their understanding of fraction concepts,especially in lessons about unit fractions, equivalence, magnitude or ordering, and composition and decomposition. 	Replace materials with those that show fractions on a number line.  In the picture above, students have placed equivalent fractions,decimals and percents and are able to see equivalence in a visual format.  Look at the ordering of fractions between 0 and 1 and then beyond 1. Students see an enlarged section of the whole number line they've been familiar with since Kindergarten. Now they see fractions larger than one, fractions in order of magnitude and the relative sizes of different fractions.

If you find…	Try this best practice instead…
You are using colloquial language when teaching and discussing fractions with students. Imagine this problem is posed, *"Five-sixths of the pie was eaten. How many pieces were eaten?"* The students answer with "5" (the whole number), but it is paired with this image.  How do students make sense of the numbers they hear? Do they think that a fraction is a part of a number? What about when students are told to "double a fraction" to find a common denominator, as in 1/3 to 2/6? Do students incorrectly assume that one fraction is double the size of the other rather than equivalent?	Pay careful attention to the way fractions are discussed in conversation around young learners and learners with tentative fraction understanding. • Keep units consistent when talking about fractions. • Equivalent fractions don't double, and if something is cut in half, you can not give a bigger piece to a partner.

You are searching for words to describe fractions in different forms, or you have difficulty explaining fractions in ways that support the true meaning of the mathematics. Sometimes this can be in conversation, and sometimes the language is shown in materials. 	Attend to the precise language of fractions. Use fraction language that emphasizes the idea that fractions are composed of unit fractions; for example, use “three fourths” instead of “three over four” or “three out of four.” 

If you find…	Try this best practice instead…
Lessons in your instructional materials use mnemonics and tricks instead of building conceptual understanding. Relying on tricks and catchy phrases often backfires for students when they do not remember when to use the trick or for what special case they might work for. Some phrases like, “Ours is not to reason why, just invert and multiply,” even remove students as mathematicians and thinkers and doers of the content. This math slogan does not help build student agency or create a culture of productive struggle and understanding.   	Use high-quality instructional materials to build understanding of fractions. The materials should attend to the aspect of rigor called for in the standards that the unit, lesson, and problems are focused on. Instruction should be centered on building meaning and developing student understanding. If you do not have access to quality materials, study the grade-level standards and plan and select tasks that will help bring students into the learning of grade-level fraction content, while supporting their identity as mathematicians.

Resources

- Article: 13 Rules That Expire
- Article: 12 Rules That Expire in the Middle Grades
- Video: Phil Daro on Focus in Math; watch the video to see why that butterfly method to add fractions with unlike denominators doesn't hold up!
- Article: Nix the Tricks
- Blog Post: Focus on Relational Understanding
- Blog Post: Say What You Mean and Mean What You Say
- Article: Creating, Naming, and Justifying Fractions