IES Institute of Education Sciences

Evidence-Based Recommendations for Remote Math Instruction in the Secondary Grades
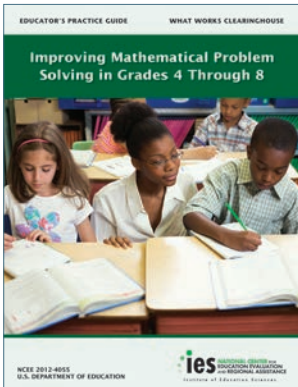
A Publication of the National Center for Education Evaluation at IES

The What Works Clearinghouse (WWC) maintains a library of practice guides (https://ies.ed.gov/ncee/wwc/PracticeGuides) for educators and school officials to use to address challenges in their classrooms and schools. These guides synthesize WWC research reviews, the experience of educators, and expert advice into recommendations that can be implemented in the classroom. **Many of these recommendations can be implemented for free or at a low cost in remote learning settings by making only small adaptations.**

The examples below come from three practice guides about middle and secondary school instruction in math. **Each original practice guide contains more details as well as additional recommendations.**

EDUCATOR'S PRACTICE GUIDE   WHAT WORKS CLEARINGHOUSE

Improving Mathematical Problem Solving in Grades 4 Through 8

NCEE 2012-4055
U.S. DEPARTMENT OF EDUCATION

IES NATIONAL CENTER FOR EDUCATION EVALUATION AND REGIONAL ASSISTANCE
Institute of Education Sciences

Improving Mathematical Problem Solving

Explore the guide at https://ies.ed.gov/ncee/wwc/PracticeGuide/16.
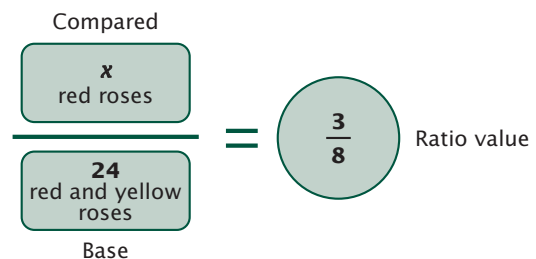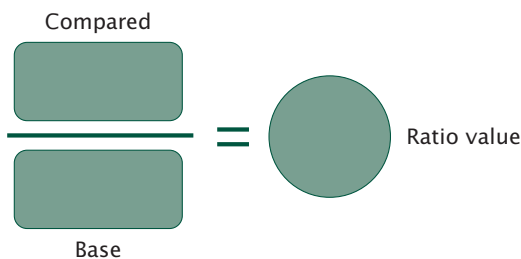
Use **think-alouds and discussions** to teach students how to **represent problems visually**. Explain how you identified the type of problem–such as proportion, ratio, or percent–and why you think a certain visual representation is most appropriate. Demonstrate to students how to represent the information in a problem visually and teach them to identify what information is relevant or critical to solving the problem.
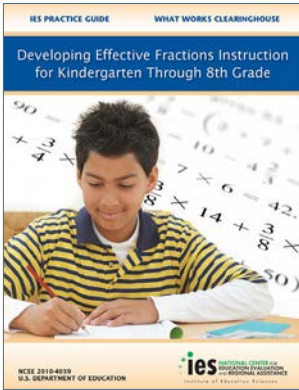
During remote learning sessions, carefully explain each step needed when solving a problem visually. First, explain how you know this is a ratio problem. Also identify which information is needed (Monica's bouquet) and which is not important (Bianca's). Then, set up a diagram to better understand the problem. Lastly, translate the diagram into an equation and solve for x.

Also promote discussions during practice by pausing to ask students guiding questions like, "What kind of problem is this?," "How do you know?," and "What would you do next?"

Problem

Monica and Bianca went to a flower shop to buy some roses. Bianca bought a bouquet with 5 pink roses. Monica bought a bouquet with two dozen roses, some red and some yellow. She has 3 red roses in her bouquet for every 5 yellow roses. How many red roses are in Monica's bouquet?

Compared

$$\frac{\boxed{}}{\boxed{}} = \bigcirc \quad \text{Ratio value}$$

Base

Compared

$$\frac{\boxed{\begin{array}{c} x \\ \text{red roses} \end{array}}}{\boxed{\begin{array}{c} 24 \\ \text{red and yellow roses} \end{array}}} = \frac{3}{8} \quad \text{Ratio value}$$

Base

Developing Effective Fractions Instruction

Explore the guide at https://ies.ed.gov/ncee/wwc/PracticeGuide/15.

Use **area models**, **number lines**, and **other visual representations** to help students understand the **intuition behind computations** with fractions. Students do best using computational procedures when they understand why they should use them. Therefore, it is important to both explain how or why the procedures work to transform the fractions and emphasize the connection between conceptual understanding and the procedures.

In a remote learning lesson, use a short slide presentation to show students a visual representation that demonstrates how to multiply fractions by redefining the unit. Multiplying two fractions requires finding a fraction of a fraction. For example, when multiplying ¼ by ⅔, students could start with ⅔ of the original unit and find ¼ of this fractional amount. Pictures, like this example, can help students visualize this process to improve their understanding of the multiplication procedure. Use each slide to show a step in solving the problem.

> Lori is icing a cake. She knows that 1 cup of icing will cover ⅔ of a cake. How much cake can she cover with ¼ cup of icing?

⅔ of a cake   ¼ of ⅔ of a cake

¼ × ⅔ = 2/12 of a cake
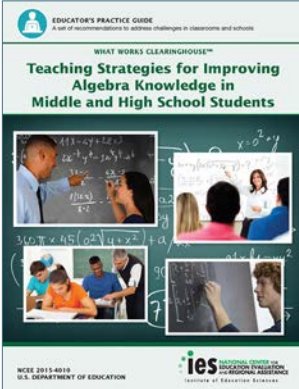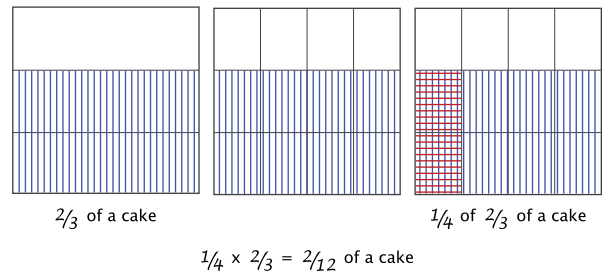
Teaching Strategies for Improving Algebra Knowledge

Explore the guide at https://ies.ed.gov/ncee/wwc/PracticeGuide/20.

Teach students to **intentionally choose from alternative algebraic strategies** when solving problems. By learning from and having access to multiple algebraic strategies, students learn to **approach algebra problems with flexibility**, recognizing when to apply specific strategies, how to execute different solution strategies correctly, and which strategies are more appropriate for particular tasks. This can help students develop beyond memorizing one approach, allowing them to extend their knowledge and think more abstractly.

Use a virtual whiteboard, if available, to work through a conventional and alternative method of getting to the correct answer. If a virtual whiteboard is not available, show each equation line by line virtually. Use this approach to begin a whole-class discussion of how students used different approaches to solve a homework problem. This can help students understand how they can employ different strategies for the same problem and that certain strategies might be more appropriate or effective in solving a specific problem.

Solution via conventional method	Solution via alternative method
Evaluate $2a + 4b - 7a + 2b - 8a$ if $a = 1$ and $b = 7$	
$2a + 4b - 7a + 2b - 8a$ $2(1) + 4(7) - 7(1) + 2(7) - 8(1)$ $2 + 28 - 7 + 14 - 8$ 29	$2a + 4b - 7a + 2b - 8a$ $-13a + 6b$ $-13(1) + 6(7)$ 29
Our restaurant bill, including tax but before tip, was $16.00. If we wanted to leave exactly 15% tip, how much money should we leave in total?	
$16.00 * 1.15 = x$ $x = \$18.40$	10% of $16.00 is $1.60, and half of $1.60 is $0.80, which totals $2.40, so the total bill with tip would be $16.00 + $2.40 or $18.40.