Using the Practice Guide to Improve Mathematical Problem Solving in Grades 4–8

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Today's Agenda

Welcome & Introductions

Improving Mathematical Problem Solving in Grades 4 Through 8: A Practice Guide

Practitioner Perspective on Using Practice Guide Recommendations

Facilitated Q&A

Wrap-up & Evaluation

Who Are We?

REL Northeast & Islands is one of 10 Regional Educational Laboratories.

We work in partnership with educators and policymakers to develop/use research that improves academic outcomes for students.

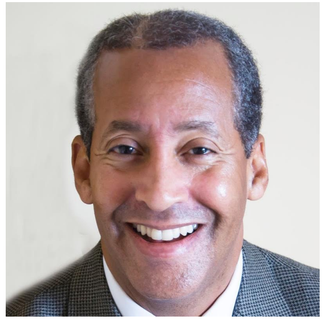
What we do:

- Conduct research studies
- Disseminate research findings to those we serve
- Strategically engage with partners to use findings
- Design and deliver technical assistance focused on the use of data and research

Today's Goals

- Learn about the information in the practice guide and the quality of evidence that supports the recommended instructional practices
- Explore how the practice guide supports professional development for mathematics teachers in grades 4–8
- Identify and discuss ways mathematics teachers in grades 4–8 can implement the practices in the guide

Today's Presenters



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Improving Mathematical Problem Solving in Grades 4 Through 8: A Practice Guide

What Is a Practice Guide?

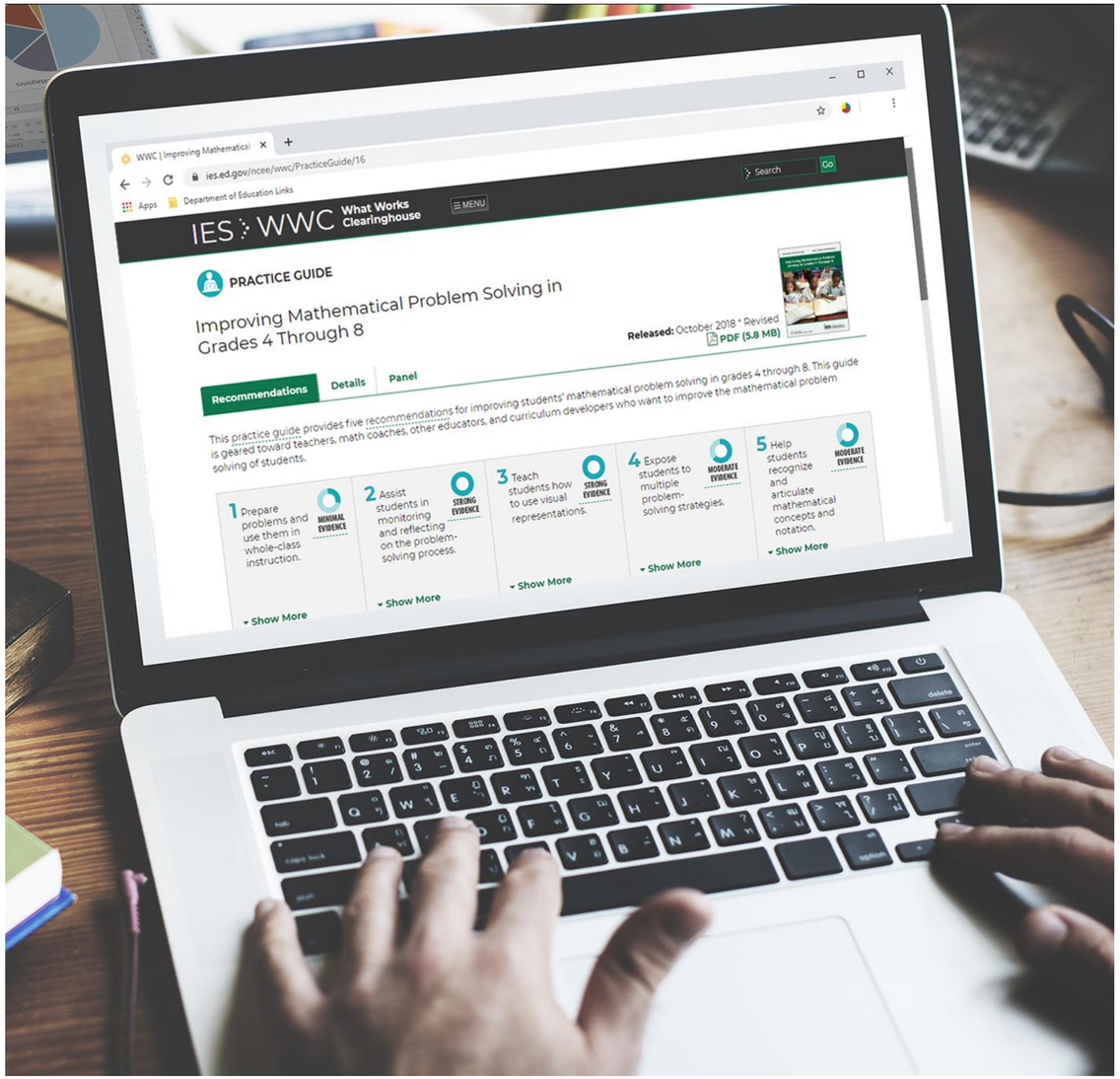
A practice guide is a publication that presents recommendations for educators to address challenges in their classrooms and schools that are based on:

- Reviews of research
- Experiences of practitioners
- Expert opinions of a panel of nationally recognized experts

Practice Guide Recommendations

Three examples:

- Assist students in monitoring and reflecting on the problem-solving process
- Teach students how to use visual representations
- Expose students to multiple problem-solving strategies



Why Is this Practice Guide Important?

- 3,700 citations were yielded from the initial search for literature related to problem-solving instruction over the past 20 years.
- 38 met the causal validity standards of the WWC and were related to the panel's five recommendations.
- Using these 38, the panel determined whether there was strong, moderate, or minimal evidence for each recommendation.

Math Problem Solving: Five Evidence-based Recommendations

Recommendation	Levels of Evidence		
	Strong Evidence	Moderate Evidence	Minimal Evidence
1. Prepare problems and use them in whole-class instruction.			◆
2. Assist students in monitoring and reflecting on the problem-solving process.	◆		
3. Teach students how to use visual representations.	◆		
4. Expose students to multiple problem-solving strategies.		◆	
5. Help students recognize and articulate mathematical concepts and notation.		◆	

Note: There are three levels of evidence—minimal, moderate, and strong. These levels of evidence suggest how confident we are that the recommended practice, and not something else, consistently improved outcomes for students in the studies.

Practitioner Perspective on Using Practice Guide Recommendations

Inform Professional Development Design

Example: Visual Access to Mathematics for English Learners (VAM)

Identify 2–3 targeted recommendations from the practice guide being used:

- **R2 -** Assist students in monitoring and reflecting on the problem-solving process
- **R3 -** Teach students how to use visual representations (VRs)
- **R4 -** Expose students to multiple problem-solving strategies

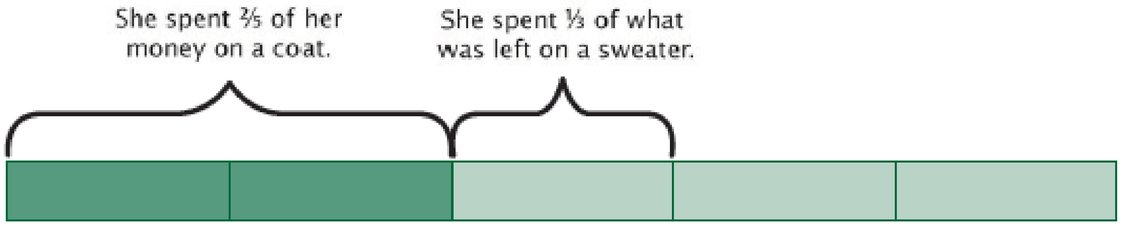
Investigate the Recommendations

- Description of the recommendation
- Definitions
- Illustrative examples
- Summary of evidence
- How to carry out the recommendation

Problem

Eva spent $\frac{2}{5}$ of the money she had on a coat and then spent $\frac{1}{3}$ of what was left on a sweater. She had $150 remaining. How much did she start with?

Sample strip diagram

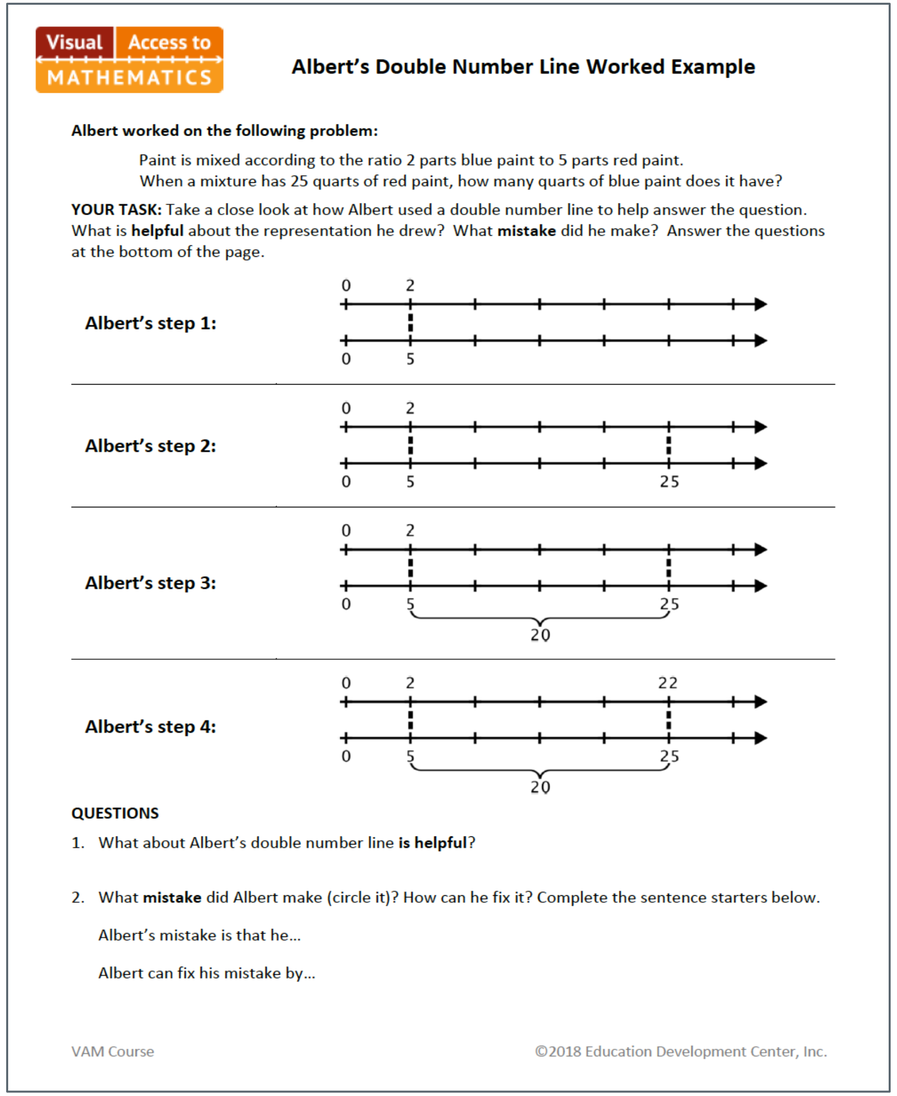


This strip diagram depicts the money Eva spent on a coat and a sweater. It shows how the amount of money she originally had is divided into 5 equal parts and that 2 of the 5 parts are unspent. The problem states that the unspent amount equals $150. Several strategies can then be employed to make use of this information in an equation, such as $\frac{2}{5} \times x = 150$, to determine the original amount.

Integrate the Recommendations

Example: Integrate a visual representation into a worked example.

- Expose students to a problem-solving strategy.
- Analyze the worked example.



Visual Access to MATHEMATICS

Albert's Double Number Line Worked Example

Albert worked on the following problem:

Paint is mixed according to the ratio 2 parts blue paint to 5 parts red paint.
When a mixture has 25 quarts of red paint, how many quarts of blue paint does it have?

YOUR TASK: Take a close look at how Albert used a double number line to help answer the question. What is **helpful** about the representation he drew? What **mistake** did he make? Answer the questions at the bottom of the page.

Albert's step 1:

Albert's step 2:

Albert's step 3:

Albert's step 4:

QUESTIONS

1. What about Albert's double number line **is helpful**?

2. What **mistake** did Albert make (circle it)? How can he fix it? Complete the sentence starters below.

   Albert's mistake is that he...

   Albert can fix his mistake by...

VAM Course

Integrate the Recommendations

- Review and consider the evidence.
- Consider roadblocks and possible solutions.
- Consider suggested approaches.
- As needed, deepen understanding of the evidence base (Appendix D).

Roadblock 3.2. *The class text does not use visual representations.*

Suggested Approach. Teachers can ask colleagues or math coaches for relevant visual representations, or they can develop some on their own. Teachers also can look through professional-development materials they may have collected or search the Internet for more examples […]

Teach Students to Use Visual Representations (VRs): Polls

Example Problem:

Gus ran **3 times as far as** Ike ran.

Gus and Ike ran a **combined** distance of 48 total miles.

Which VR accurately represents the problem of Gus and Ike?

- Figure A.
- Figure B.
- Figure C.
- All VRs
- None of the VRs

Figure A

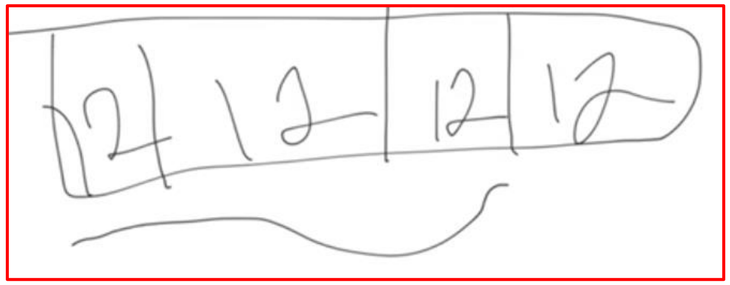


Figure B

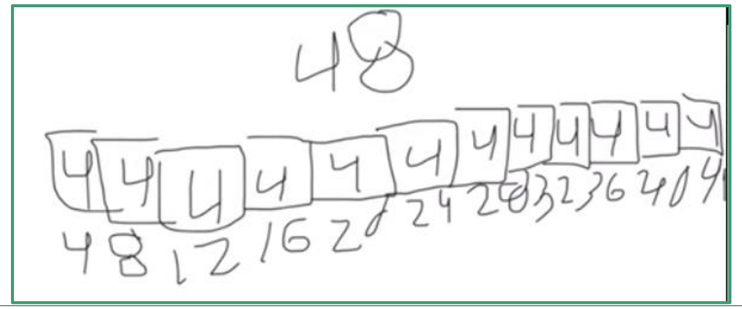
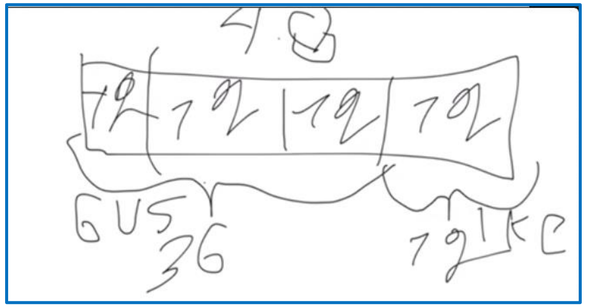


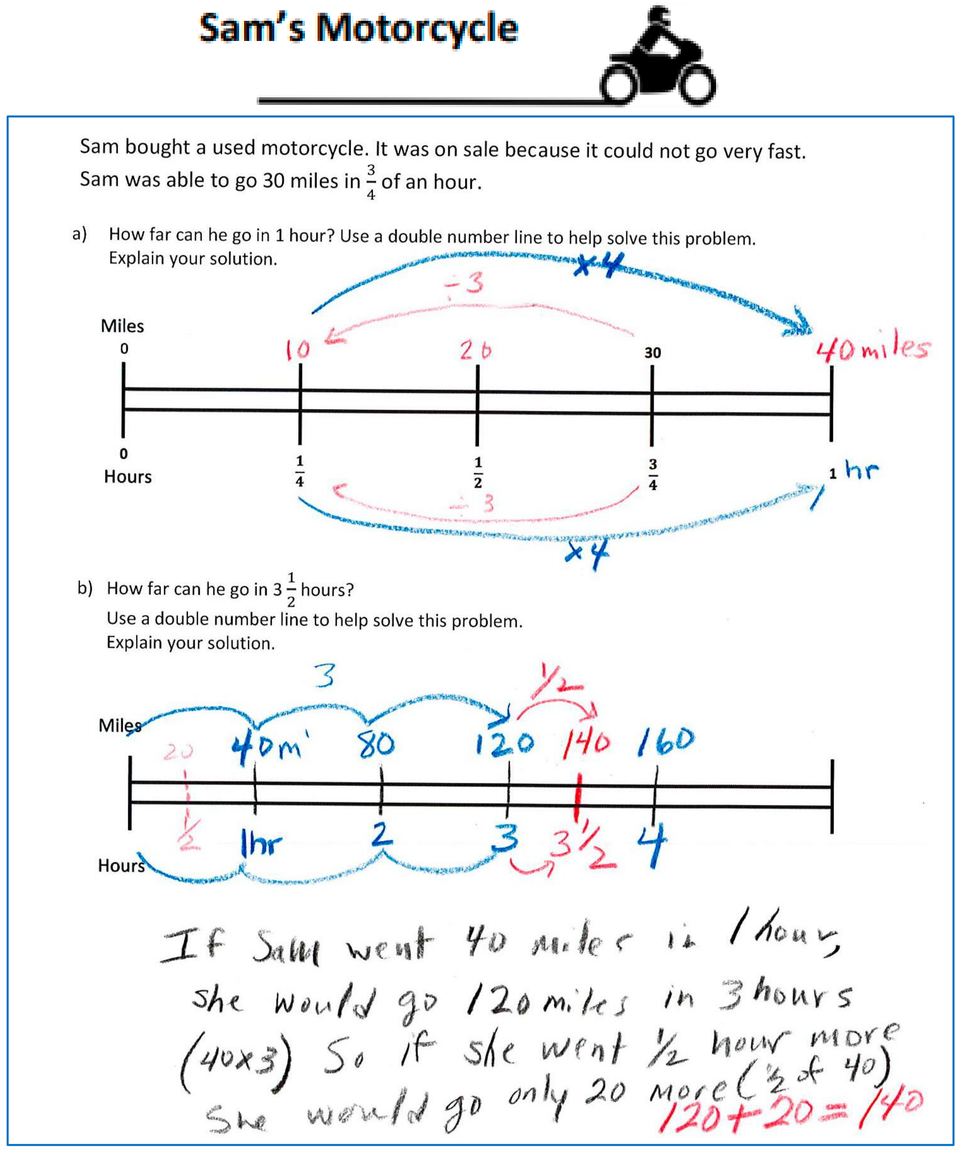
Figure C



Examples from Practice: Mathematics Coach

Use of resources with practice guide recommendations integrated:

- Provide examples of visual representations to mathematics teachers.
- Provide opportunities to review examples.
- Model and/or co-teach to illustrate recommendation in practice.



Examples from Practice: Mathematics Teacher

Select visual representations that are appropriate for students and the problems they are solving.

Use think-alouds and discussions to teach students how to represent problems visually (3-Reads).

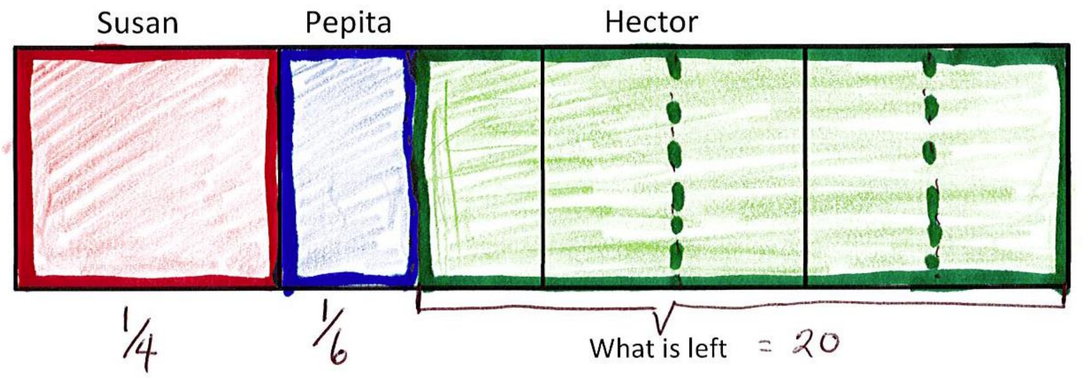
Hector had a bag of jelly beans.

He gave ¼ of the jelly beans to Susan.

Then Hector gave $\frac{1}{6}$ of the jelly beans he had left to Pepita.

After giving jelly beans to Susan and Pepita, Hector had 20 jelly beans left in his bag.

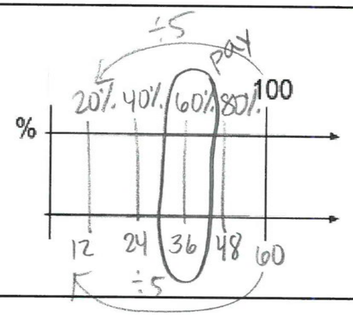
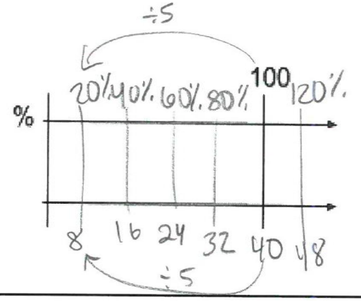
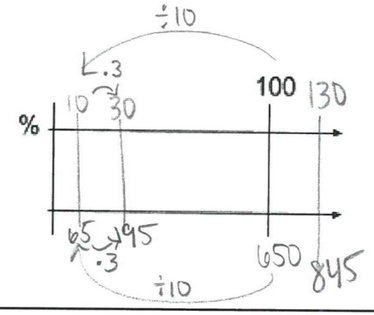
How many jelly beans did Hector have at the beginning?



Examples from Practice: Mathematics Teacher

Elicit visual representations that are appropriate for students and the problems they are solving.

Connect visual representations to algorithms to deepen conceptual understanding and procedural fluency.

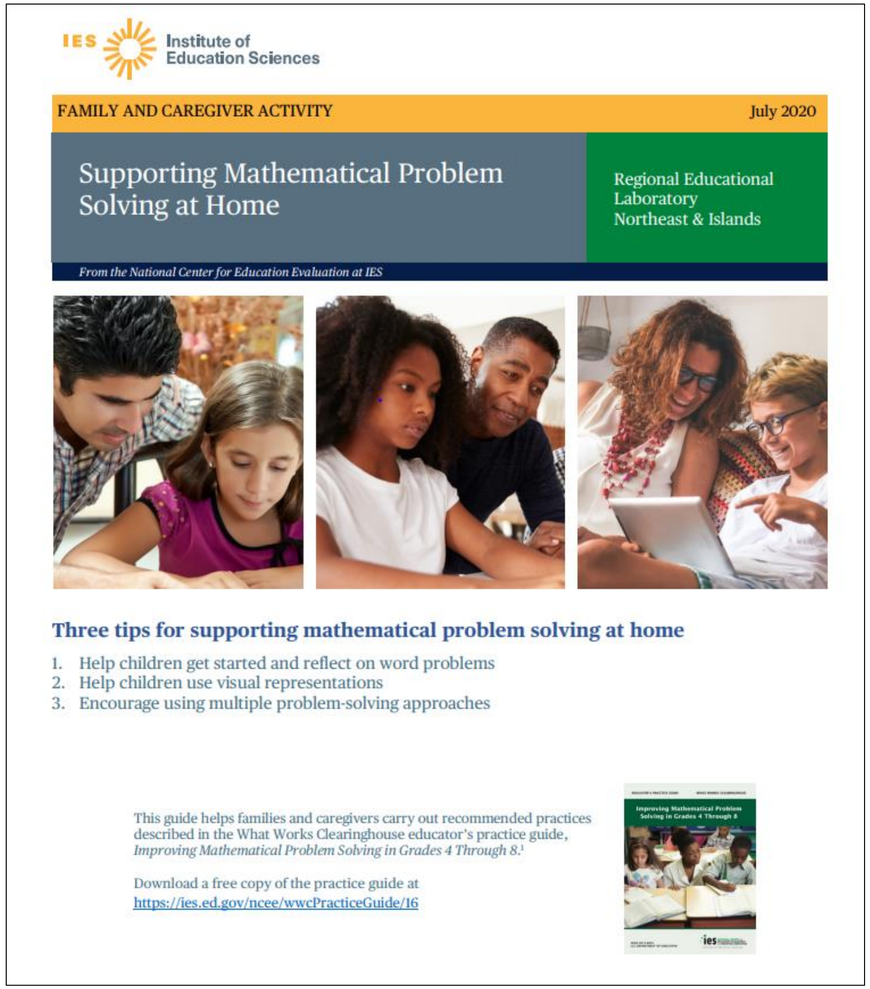
Words	DNL	Proportions	Decimal Equivalent
A $60 pair of Vans is on sale for 40% off.		$\frac{x}{60}=\frac{40}{100}$ $100x=2400$ $x=24$ $24 off 100−40=60 $\frac{x}{60}=\frac{60}{100}$ $100x=3600$ $x=36$ pay $36	60·0.4=24 off 60−24=36 paid 1−0.4=0.6 60·0.6=36 $36 paid
The dinner bill at the 99 Restaurant was $40. Tip is 20%.		$\frac{x}{40}=\frac{20}{100}$ $100x=800$ $x=8$ $\frac{x}{40}=\frac{120}{100}$ $100x=4800$ $x=48$	40·0.2=8 $8 tip 40+8=$48 total 40·1.2=48 $48 total
There are 650 students at Walsh. Next year the number of students will increase 30%.		$\frac{x}{650}=\frac{30}{100}$ $100x=19500$ $x=195$ 195 more $\frac{x}{650}=\frac{130}{100}$ $100x=84500$ $x=845$ 845 total next year	650·0.3=195 650+195=845 total 650·1.3=845 845 total students

New Companion Family and Caregiver Activity Guide

Supporting Mathematical Problem Solving at Home

- This guide helps families and caregivers carry out recommended practices described in the What Works Clearinghouse educator's practice guide, *Improving Mathematical Problem Solving in Grades 4 Through 8*.

- It provides families with three tips for supporting students' mathematical problem solving, accompanied by example problems and how to solve them.


IES Institute of Education Sciences

FAMILY AND CAREGIVER ACTIVITY July 2020

Supporting Mathematical Problem Solving at Home

Regional Educational Laboratory Northeast & Islands

From the National Center for Education Evaluation at IES

Three tips for supporting mathematical problem solving at home

1. Help children get started and reflect on word problems
2. Help children use visual representations
3. Encourage using multiple problem-solving approaches

This guide helps families and caregivers carry out recommended practices described in the What Works Clearinghouse educator's practice guide, *Improving Mathematical Problem Solving in Grades 4 Through 8*.[1]

Download a free copy of the practice guide at https://ies.ed.gov/ncee/wwcPracticeGuide/16

Facilitated Q&A

Questions?

Please add them to the chat.

Five Other Guides for Mathematics Educators

- Teaching Strategies for Improving Algebra Knowledge in Middle and High School Students
- Teaching Math to Young Children
- Assisting Students Struggling with Mathematics: Response to Intervention (RtI) for Elementary and Middle Schools
- Encouraging Girls in Math and Science
- Using Student Achievement Data to Support Instructional Decision Making

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