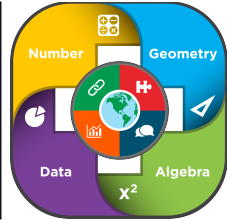


Expose students to multiple problem-solving strategies



Students who learn how to use multiple problem-solving strategies are able to approach problems with greater ease and flexibility in finding solutions. Teachers should demonstrate that problems can be solved in multiple ways and that approaches to problem-solving should be selected for their ease and efficiency. Teachers can present students with a number of problem-solving strategies and then give them the opportunity to compare, contrast, and carry out the strategies.

How to carry out the recommendation	Potential roadblocks
1. Provide instruction in multiple strategies. 2. Provide opportunities for students to compare multiple strategies in worked examples. 3. Ask students to generate and share multiple strategies for solving a problem.	1. Teachers don't have enough time in their math class for students to present and discuss multiple strategies. 2. Not all students are willing to share their strategies. 3. Some students struggle to learn multiple strategies. 4. Some of the strategies students share are not clear or do not make sense to the class.



Reference: Woodward, J., Beckman, S., Driscoll, M., Franke, M., Herzig, P., Jitendra, A., Koedinger, K. R., & Ogbuehi, P. (2018). *Improving mathematical problem solving in grades 4 through 8* (NCEE 2012-4055). U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance.
<https://ies.ed.gov/ncee/wwc/PracticeGuide/16>



Recommendation 4: Expose students to multiple problem-solving strategies

How to carry out the recommendation

1. Provide instruction in multiple strategies.

Teachers can present strategies for general use as well as those for specific problems. When demonstrating different strategies, teachers should occasionally attempt unsuccessful strategies and then change to successful ones. Doing so will show students that some problems may not be easy to solve the first time and that they may need to try more than one strategy before successfully solving a problem. Teachers should also demonstrate more than one successful approach to the same problem.

2. Provide opportunities for students to compare multiple strategies in worked examples.

Teachers should provide side-by-side examples of different problem-solving strategies and give students the opportunity to work together to compare the strategies. Teachers can prompt students to compare and contrast the strategies, to justify the approach they would choose, and to consider why two different approaches can lead to the same answer. Teachers can provide worked examples alongside problems that students are required to solve. Students can practice describing their solution paths both verbally and in writing.

Two different ways to solve a problem

Sanjin's Solution		Emily's Solution	
$7(x - 3) = 4(x - 3) - 3$		$7(x - 3) = 4(x - 3) - 3$	
$7x - 21 = 4x - 12 - 3$	Distribute	$3(x - 3) = -3$	Subtract on both
$7x - 21 = 4x - 15$	Combine	$x - 3 = -1$	Divide on both
$3x - 21 = -15$	Subtract on both	$x = 2$	Add on both
$3x = 6$	Add on both		
$x = 2$	Divide on both		
TEACHER: Sanjin and Emily used different approaches but got the same answer. Why is this? Which of their approaches would you choose? Why?			

Note. Adapted from page 35 of the practice guide referenced on the first page of this document.

3. Ask students to generate and share multiple strategies for solving a problem.

Teachers should encourage students to generate multiple problem-solving strategies and give them opportunities to share their strategies with the class. Teachers should call on students who generated strategies different from the one presented, rather than calling on students randomly. Teachers should encourage students to not only present their approach but also to explain why they chose that approach. Examples 16 and 17 on pages 36–37 of the practice guide referenced on the first page of this document provide excellent examples for teachers.

Recommendation 4: Expose students to multiple problem-solving strategies

Potential roadblocks and how to address them

Roadblock	Suggested Approach
<i>Teachers don't have enough time in their math class for students to present and discuss multiple strategies.</i>	Teachers can ask students to write out their strategies on personal whiteboards or chart paper so that they do not have to spend time rewriting them on the class whiteboard. Another approach is for teachers to document the strategies students come up with during independent or small-group work and summarize them for the class.
<i>Not all students are willing to share their strategies.</i>	Teachers should encourage students to share their strategies even if they are incorrect. They should explain to students that there may be a variety of approaches to solving most problems and that the solutions they share may not have been considered by the other students. Teachers can point out that sharing will help students learn effective problem-solving strategies from one another.
<i>Some students struggle to learn multiple strategies.</i>	If students lack or cannot retrieve necessary knowledge, they may struggle with using multiple strategies. Teachers may need to ask students to write down the facts of a problem before trying to solve it. They may need to modify a problem to make it easier to focus on problem-solving (rather than the arithmetic, for example). Teachers can also write down problem solutions side by side so that students can more easily compare the solutions.
<i>Some of the strategies students share are not clear or do not make sense to the class.</i>	Teachers can walk around the classroom and ask students to explain their approaches individually. Doing so will better prepare teachers to clarify students' thinking when they share their approaches with the class, either by asking guiding questions or by rewording the students' approaches. Teachers can also ask other students to restate what a student said.



For more information on the research evidence and references to support this recommendation, or for more detailed explanation from the What Works Clearinghouse committee who developed this recommendation, please refer to the practice guide cited at the bottom of the first page of this document.