Problem Solving
CueThinkEF+ R&D Team
Last updated 11.5.25

Problem Solving Tasks and Scoring Rubric

This measure provides insight to students' problem-solving proficiency and skills through scoring both the accuracy of their answers to a task, as well as the evidence of their mathematical thinking shown in their work.

Purpose

- This problem solving tool uses curriculum-aligned tasks to measure students' problem-solving process and the success of their process in leading to a correct answer.
- This measure was developed for use with a specific school district, and therefore offers a set of tasks and associated rubrics aligned with their scope and sequence of content standards. However, these materials can be adapted for use in additional contexts, based on their design principles and overarching structure.

Measure Details

- This measure consists of three items, unique for each grade level 6-8. Each item (a problem-solving task) was selected based on the following criteria:
    - Cognitive Demand: evaluated by the Smith & Stein (2018) and Webb's (2002) depth of knowledge frameworks
    - Standards-Aligned: determined by school district partner identification of high-priority standards for each of the three semesters in their academic year
    - Visible Student Thinking: included opportunities for students to represent their thinking throughout the problem, not just in providing their final answer
- The rubric for scoring each item attended to two facets of problem-solving proficiency:
    - Accuracy: dichotomous scoring for correctness of the final answer. A composite score is calculated across all three items.
    - Understanding: scoring the "visible student thinking" for evidence that they noticed the mathematical information, context, and concepts relevant to the task, and that they used this information appropriately across their solution process. Understanding was scored from a "partial credit" approach and was inclusive of all possible ways students made their thinking visible on the task.

Contribution to the Field

- Proficiency in mathematical problem-solving is pivotal to students' overall mathematics achievement and long-term success (e.g. English & Gainsburg, 2018). Problem-solving has been related to student dispositions and affect, their engagement of associated cognitive skills, and students' content knowledge understanding (e.g. Chapman, 2015).
- However, there are limited measures of problem-solving developed for use in classroom contexts. The existing measures may use tasks that are not aligned with content students have learned, which complicates their ability to accurately capture their problem-solving capacities as opposed to their mathematical knowledge; most existing

measures primarily measure correctness, which is only one component of student problem-solving skills.
- The measure has been used with a demographically diverse sample of middle grades students within several small-scale efficacy studies for a mathematics problem-solving learning platform, CueThinkEF+.

Accessing the Measure

- To access the measure, please contact:
    - Dr. Sam Rhodes at rhodessr2@vcu.edu

Associated Publications

Rhodes, S., Bryck, R., Gutierrez de Blume, A., Lee, A., Wang, J., Sethuraman, S. (2025). The impact of a web-based application on mathematical problem-solving proficiency in middle school students. *In Yao, X., McCloskey, A., & Zbiek, R.M. (Eds.), Proceedings of the forty-seventh annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*. Penn State University.