

## Problem-Solving Assessment (PSA) with Tasks and Scoring Rubrics

This assessment provides insight to students' problem-solving skills through scoring both the problem-solving process and the accuracy of their answers on a complex math task.

### Purpose

- The PSA was developed for use within two independent evaluation studies of a problem-solving platform for middle grades students. However, the assessment involves tasks aligned with content topics commonly covered in middle grades, including those addressed within Common Core Standards for Mathematics, in order for these materials to be used within contexts outside of the original studies.

### Measure Details

- This assessment consists of versions appropriate for grades 6, 7, and 8. For each grade, the assessment contains two tasks.
- The rubric for scoring each item attended to two facets of problem-solving proficiency:
  - Correctness: dichotomous scoring for correctness of the final answer
  - Process: scoring the "visible student thinking" for evidence that students were making sense of the problem (e.g. noticing the mathematical information, context, and concepts relevant to the task) and going through the process of solving it (e.g. using this information appropriately across their solution processes).
  - Total scores on the PSA were calculated by summing across all possible points for both correctness and process
- The current version of the PSA is administered using paper copies, which were then scanned into a secure portal and scored electronically using the rubric.

### Development History & Previous Uses

- The tasks were adapted from the Shell Centre for Mathematical Education's Mathematics Assessment Project and focused on math topics often covered in the respective grade level prior to the second semester.
- An earlier version of the assessment included sub-questions that scaffolded student work for each task; this version was administered as part of a small-scale independent evaluation study of the CueThinkEF+ platform. The measure performed well in terms of overall reliability and within-person separation, and was within a reasonable range of correlation with mathematics achievement scores. However, additional analyses showed that (a) the sub-questions unintentionally guided students through the problem-solving process and (b) the scoring rubric for the problem-solving assessment focused on correctness, as opposed to capturing the problem-solving process itself.
- Therefore, the interdisciplinary group of researchers, developers, and educators revised the assessment tasks to remove the scaffolding sub-questions, and we revised the

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associated rubrics to attend to the problem-solving process alongside correctness. To test the empirical question of whether scaffolding matters for scoring we created two versions of the assessment: one with a single sub-question for each task to help students “kick off” the problem-solving process, and one without.

- Both versions of the assessment were administered as part of a second independent evaluation study of the problem-solving platform, where students were randomly assigned to one of the task versions. The same rubric was used to score both versions. Analyses from this study found that the versions functioned similarly.
- The different versions of the PSA have been administered to a demographically varied sample of more than 5,000 middle grades students at multiple time points.

### **Contribution to the Field**

- There are limited measures of problem-solving developed for use in classroom contexts and available for public use. Most of the existing measures that have been used at scale in studies of students’ problem-solving feature binary scoring protocols that focus on the final answer’s correctness. That scoring approach allows for streamlined administration at scale, but does not provide nuanced insight into the ways in which students are successful throughout the problem-solving process. This PSA balances the attention to correctness and problem-solving capacities.
- Further, this assessment incorporated expertise from a multi-disciplinary group of researchers, developers, and educators, resulting in an assessment which offers usable data for both researchers and practitioners goals.

### **Accessing the Measure**

- To access the measure, please contact:
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- To discuss problem-solving measurement and scoring student thinking, please contact:
  - Dr. Sam Rhodes at [rhodessr2@vcu.edu](mailto:rhodessr2@vcu.edu) and Dr. Toni Smith at [tsmith@air.org](mailto:tsmith@air.org)

### **Associated Publications**

Smith, T., Williams, R., Cade, W., Joshi, M., Meyer, C., Dedrick, D., Margolin, J., Zhu, B., & Pruitt-Britton, T. (2025, August). CueThinkEF+ phase 4 evaluation: Final report. American Institutes for Research. 10.17605/OSF.IO/Y2WR5