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Validating a Content Knowledge for Teaching Science Assessment for Preservice Elementary Teachers

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OVERVIEW: To address the need for assessing and developing teachers' content knowledge for teaching (CKT) in science, we examine validity evidence to support the future use of a CKT about matter assessment.

AUDIENCE: Assessment developers, Professional development providers, Researchers/Researcher supervisors, Science education leaders, Teacher educators, Elementary science teachers

KEY POINTS

- Teachers' content knowledge for teaching (CKT)—the integration of subject matter knowledge and pedagogical content knowledge—is critical in science teacher education.
- There is a need for easily administered and scored assessments to assess and monitor preservice elementary science teachers' CKT.
- The developed CKT about matter and its interactions assessment fills that need.
- Preservice elementary teachers' performance on the assessment indicates that CKT about matter is a single, integrated domain focused on teachers' use of their subject matter knowledge to engage in the work of teaching science.
- This study finds strong evidence that the assessment supports valid and reliable inferences about preservice elementary teacher's CKT about matter and its interaction.

INTRODUCTION: Research suggests that effective science teaching requires content knowledge for teaching (CKT), which includes subject matter knowledge and pedagogical content knowledge. However, there are limited CKT instruments that can be easily administered and scored on a large scale. To address this gap, we conducted a field test of our newly developed CKT instrument in one high-leverage content area: matter and its interactions. We examined validity evidence using test data from 822 preservice elementary teachers (PSETs), addressing questions about (1) item functioning, (2) the nature of the CKT construct, (3) the relationship between the test scores and background variables and external measures of science content knowledge, and (4) the PSETs' perception of the items.

FINDINGS Classical item analyses revealed that 52 of the 60 items on the field test form functioned well. Each item was developed to assess the integration of one of five sub-content areas about matter and its interactions and one of seven instructional practices defined by the instructional tools of the Work of Teaching Science framework. Neither exploratory factor analysis or multidimensional item response theory (MIRT) models indicated strong evidence of differing dimensions across or between content sub-areas or instructional tool categories. The test supported a single score assessing the integrated CKT about matter construct. Generally, test scores correlated with background variables as expected, such as PSETs with higher undergraduate GPAs performing better than those with lower GPAs. The CKT matter scores were moderately correlated with *Praxis*® Science and the Horizon AIM test on matter, indicating that CKT is similar to but distinct from pure subject matter knowledge. PSETs rated the importance, clarity, rigor, and relevance of the items highly, providing an endorsement of these items by the very audience for whom they were developed.

TAKEAWAYS

Study results suggest the viability for developing automatically scorable CKT science assessments that target how science teachers leverage their usable knowledge to engage in the work of teaching science. Findings also suggest that CKT assessment response data and scores can provide useful information about science teachers' CKT. The hope is that such information could be used for monitoring the impact of or making decisions about the focus of teachers' professional development—although future research will need to examine this claim empirically.

Full Title: Developing and Using a Scalable Assessment to Measure Preservice Elementary Teachers' Content Knowledge for Teaching about Matter