This project aims to conduct foundational research and development work related to the assessment of content knowledge for teaching (CKT) about matter and its interactions, as well as supporting the development of this CKT in teacher education settings.

This is a collaborative initiative between ETS and Western Washington University (WWU).

This poster focuses on Project Goal 2, which refers to developing an instrument to measure CKT for matter and its interactions and evaluating the assessment’s validity, dimensionality, and reliability.

### Field Test

- The CKT matter assessment form included 60 CKT matter items and was field tested with 822 preservice elementary teachers.
- Based on results from the item analysis, the final version of the CKT assessment included 52 items.
- Preservice teacher scores on the CKT assessment showed moderate correlations to other measures (e.g., Praxis® Science Assessment and AIM Horizon Test).
- Analysis suggested that a unidimensional model best supports the assessment’s internal structure.
- Reliability of the CKT assessment was high for the unidimensional model (0.911).

### Project Implications

- This newly-developed CKT assessment, along with teacher educator instructional support materials, can be used in teacher education settings to measure and develop elementary preservice teachers’ CKT about matter and its interactions.
- It is possible to make an automatically scoreable CKT assessment in science.
- Similar studies could be conducted in other content areas in science and mathematics.

### Project Team

- Jamie Mikeska (PI)
- Katherine Castellano (Co-PI)
- Dante Cisterna (Researcher)
- Jennifer Lentini (Project manager)

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### CKT Item Examples Focused on Matter and Its Interactions

#### Item A: Snap Blocks

During a unit on matter, Ms. Johnson asks her second-grade students to take apart a cube made of snap blocks pieces (see Image 1) and examine the number and color of the pieces.

Students are then asked to use all the pieces to make something new. After all students create their own object, they look at one another’s objects (see Image 2).

Ms. Johnson guides students to recognize that the number and color of the pieces in the new object remain the same as they try to identify what the object is. Finally, the class has a whole-group discussion that focuses on the potential of a new object being created from the original cube and the wide variety of objects created from the same starting cube.

#### Item B: Liquid Definition

In Ms. Quintana’s second-grade class, students explore the properties of different solids and liquids. Based on the exploration findings, students create definitions for solids and liquids.

While completing the definition for liquids, one student makes the claim that “all substances that look like they take the shape of their containers are liquids.” Ms. Quintana is planning to include a follow-up activity for students to collect more data and refine their ideas.

Which of the following concepts about matter does this lesson best support at a second-grade level of understanding?

- 1. Matter can undergo changes that are reversible.
- 2. Matter can be described by observable properties.
- 3. Materials have properties that make them suitable for different purposes.
- 4. Matter is made of small particles that can be arranged in different ways.

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### Item Development Process

1. Use tools to impose each topic area.
2. Gather resources to create instructional scenarios.
3. Draft initial CKT items.
4. Review and revise draft items in working groups.
5. Conduct pilot test and analyze results.
6. Revise items based on cognitive instruction and feedback.
7. Complete cognitive interview and feedback.
8. Review and revise items to project team.
9. Select and revise items for final test.
10. Conduct field test and analyze results.
11. Review items for use by teacher educators.