

Background & Rationale

- The concept of **matter** is central to understanding many scientific ideas (NRC, 2012). While more is known about student learning relevant to matter, there is currently a lack of content-specific teaching knowledge about matter in the elementary years (Smith & Plumley, 2016).
- Therefore, this is an important area in which teacher educators can support the development of elementary teachers' **content knowledge for teaching (CKT)**.
- Curriculum materials are a means of supporting teacher learning (Ball & Cohen, 1996; Davis & Krajcik, 2005), and **educative curriculum materials (ECM)** are specifically designed to help develop knowledge to improve instructional decision making (Davis & Krajcik, 2005).
- Curriculum materials can be educative for teachers by offering support in thinking about:
 - content beyond the level suggested for students
 - underlying pedagogy
 - developing content and community across time
 - Students and the broader community (Ball & Cohen, 1996)
- Educative curriculum materials for teacher educators** might similarly support preservice teachers' learning and we ask, *How might curriculum materials be designed to support preservice teachers' learning, and what might those curriculum materials look like?*

CKT about Matter and its Interactions

- CKT lives at the intersection of the Content topic being taught and the Work of Teaching Science tool that the teacher employs.
- Educative Curriculum materials were developed at specific intersections to target individual content and Work of Teaching Science areas.

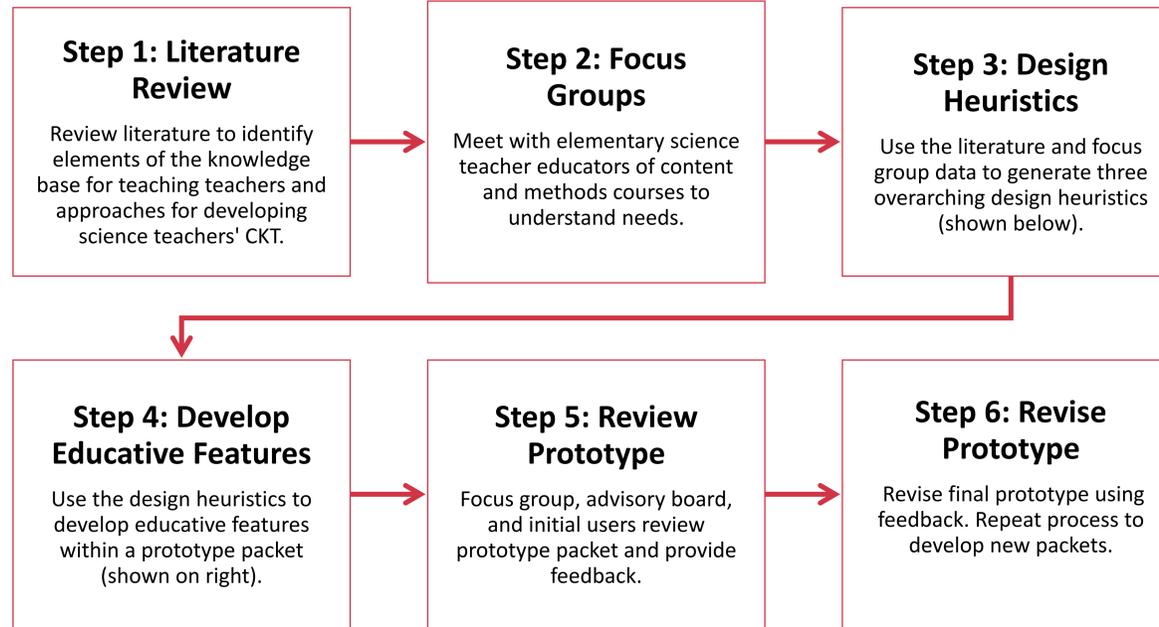
Work of Teaching Science Instructional Tools

	Instructional goals, big ideas, and topics	Scientific investigations & demonstrations	Scientific resources	Students' ideas	Scientific language and discourse	Scientific explanations	Scientific models & representations
Materials							
Properties of matter							
Model of matter							
Changes in matter							
Conservation of matter							

Supporting students in conducting investigations to develop the idea that matter is made of small particles

Supporting students in developing scientific arguments using evidence from investigations to establish that matter cannot be created or destroyed

An Empirically and Theoretically Grounded Design Process



Design Heuristics

Heuristic #1: Support Teacher Educators in Engaging Elementary Teachers in the Work of Teaching Science

- CKT Resource Packets should help teacher educators adapt and use resources appropriately.
- Packets can make explicit how specific science teaching practices correspond to different concepts and ideas and provide recommendations for how those might be introduced to preservice teachers in different contexts and courses.

Heuristic #2: Support Teacher Educators in Anticipating, Understanding, and Addressing Elementary Teachers' Ideas about Science and Science Teaching

- CKT Resource Packets should support teacher educators in anticipating, eliciting, and interpreting preservice teachers' ideas, and provide insight into how teachers educators might address those ideas.
- Packets can give suggestions of assessment probes, discussion questions, and activities likely to confront preservice teachers' initial thinking about teaching science in productive ways.

Heuristic #3: Support Teacher Educators in the Development of Elementary Teachers' Content Knowledge

- CKT Resource Packets should help teacher educators support preservice teachers in assessing their own understanding, confronting gaps in their understanding or misconceptions, making connections across concepts, and understanding why CKT is important.
- Materials should emphasize differences between the understanding required of teachers and students.

CKT Packets: Sample Educative Features

About the Task

Background information for the targeted content and work of teaching science categories, NGSS connections, assessment boundaries and potential grade-level alignment.

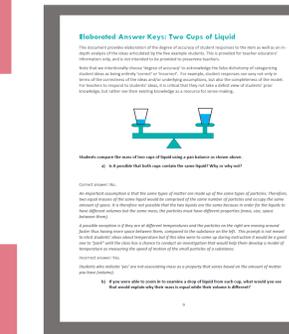


Elaborated Answer Key

An elicitation task to assess preservice teachers' CKT, including incorrect/correct responses and reasoning that might support different responses.

Lesson Plans

Annotated and extended lesson plans outline how to engage preservice teachers with the CKT tasks.



Reading Pages

Information about the science content and work of teaching science ideas elementary students are intended to develop.

Next Steps

Design & Development

- Develop a total of 6-8 packets that target various intersections of the Work of Teaching Science and Science Content Ideas.

Efficacy Study

- Implement a quasi-experimental design utilizing a cohort-control model to study efficacy of the materials.

Dissemination

- CKT resource packets and a CKT assessment tool will be available for use in preservice teacher education programs and in-service teacher professional development.

