Content Knowledge for Teaching about Matter:

EDUCATIVE CURRICULUM MATERIALS
FOR TEACHER EDUCATORS
Introductions

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Your name?
Institution?
Teaching context? (methods or content or combo of the two)
Level? (UG/G, elem/MS/HS)
Content Knowledge for Teaching

CKT focuses on the content knowledge used by teachers to recognize, understand, and respond to the content challenges encountered in teaching (Ball, Thames, & Phelps, 2008; National Academies, 2015; National Research Council, 2013; Shulman, 1986).

CKT goes beyond merely knowing the subject matter and includes professional knowledge that teachers draw upon as they engage in the work of teaching within a specific discipline.
CKT Task: Two Cups of Liquid

Individually, respond to the Task: Two Cups of Liquid.

With others, unpack the task:

- What are the content ideas necessary to complete the task?
- What are the teaching practices involved?
Model of Matter

Key Content Ideas (K-2)
- A material can be described by its properties (e.g., visual, textures)
- A material can be made of small units (building blocks).
- Materials can be assembled/disassembled in bigger/smaller units.

Key Content Ideas (3-5)
- Matter is made up of particles. Small particle model of matter (SPM)
- Gases are matter
- Properties of matter can be explained by the SPM
- Different states of matter (including gases) and changes of matter can be explained by the small particle model.
Science Teaching Practices: Students’ Ideas

4.1 Analyzing student ideas for common preconceptions regarding intended scientific learning

4.2 Selecting diagnostic items and eliciting student thinking about scientific ideas and practices to identify common student misconceptions and the basis for those misconceptions

4.3 Developing or selecting instructional moves, approaches, or representations that provide evidence about common student misconceptions and help students move toward a better understanding of the idea, concept, or practice
CKT lives at the intersection of science content and the work of teaching science

<table>
<thead>
<tr>
<th>Content</th>
<th>Instructional goals, big ideas, and topics</th>
<th>Scientific investigations &amp; demonstrations</th>
<th>Scientific resources</th>
<th>Students' ideas</th>
<th>Scientific language and discourse</th>
<th>Scientific explanations</th>
<th>Scientific models &amp; representations</th>
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<tr>
<td>Materials</td>
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<tr>
<td>Properties of matter</td>
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<tr>
<td>Model of matter</td>
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<td>Supporting students in conducting investigations to develop the idea that matter is made of small particles</td>
<td>Supporting students in developing scientific arguments using evidence from investigations to establish that matter cannot be created or destroyed</td>
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<td>Changes in matter</td>
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<td>Conservation of matter</td>
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Student Ideas about Two Cups of Liquid

As a group, review the student ideas about *Two Cups of Liquid*.

- What ideas did your group anticipate? Which were new to you?

Individually, draw a picture to represent the ideas of one of the students of your choice.
How might you use these CKT tasks?

Where might CKT tasks fit into your current course activities & topics?

How might you envision using them with your students?

What other resources, materials, or support would help you implement the tasks successfully?
Heuristic #1: Supporting Teacher Educators in Engaging Preservice Elementary Teachers in the Work of Teaching Science

Resource packets should provide teacher educators with productive experiences that make the work of teaching science visible to preservice teachers, and provide rationales for why this work is important. Instructional modules should help teacher educators adapt and use resources with their preservice teachers in pedagogically appropriate ways, for example by making explicit how specific science teaching practices correspond to different concepts and ideas and providing recommendations for how those might be introduced to preservice teachers in different contexts and courses.
Heuristic #2: Supporting Teacher Educators in Anticipating, Understanding, and Addressing Preservice Teachers’ Ideas about Science and Science Teaching

Resource Packets should help teacher educators understand how preservice teachers develop CKT for science. Modules should support teacher educators in anticipating, eliciting, and interpreting preservice teachers’ ideas, and provide insight into how teachers educators might address those ideas in their teaching, for example by giving 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 Preservice Teachers’ Content Knowledge

Resource Packets should provide teacher educators with tools for helping preservice teachers develop a deep conceptual understanding of science content as a foundation for building CKT. Modules 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 strong content knowledge is important for teaching. Modules should emphasize key differences between the understanding required of preservice teachers and their students.
## Contents

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<td>Describes key concepts aligned with the targeted content focus and work of teaching science emphasized in the task and module.</td>
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<tr>
<td>Identifies connections to the NGSS Performance Expectations, DCIs, SEPs, and/or CCCs as well as assessment boundaries and connections across elementary grades.</td>
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<tr>
<th>About the Packet</th>
<th>CKT Task and Answer Key</th>
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<tr>
<td>Provides an elicitation task to assess preservice teachers’ CKT, including expected incorrect/correct responses and reasoning.</td>
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<tr>
<th>Suggested Implementation</th>
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<td>Provides a suggested route and Expanded Lesson Plan for teacher educators to engage preservice teachers with the instructional materials with rationales for the activities, potential connections to other course concepts, suggestions for modifications, and representations of practice (e.g., sample preservice teacher responses).</td>
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<tr>
<th>Content Reading Pages</th>
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<td>Provides information for preservice teachers about the science ideas elementary students are intended to develop, why these are important, their developmental appropriateness (e.g., introducing the small particle model rather than atoms in the elementary grades) and what they find difficult.</td>
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<th>Additional Resources</th>
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<tr>
<td>Options for Going Further are included to allow instructors to flexibly adapt instruction to their students and context. A list of Relevant Research is included to help teacher educators expand their own understanding of the CKT ideas represented in the packet.</td>
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<td>Practitioner Articles are included that could address particular challenges and help preservice teachers deepen their CKT.</td>
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<td>Web Resources provide supplemental or alternative options for exploring CKT with preservice teachers.</td>
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How can I get access to the Packets?

Visit: http://cktscience.org

Create a user account

Packets are only accessible when logged in
Next Steps...

Current/Forthcoming Packets:
- Student Ideas about the Small Particle Model
- Investigating Conservation of Matter
- Scientific Modeling and the Small Particle Model (AVAILABLE SOON!)
- Instructional Goals and Big Ideas for Teaching about Materials (AVAILABLE SOON!)
- Scientific Discourse about Properties of Matter (IN PROGRESS)
Opportunities

- Providing feedback on Resource Packets in development
- Conducting usability testing of Resource Packets
- Attending more in-depth workshops
- Contributing to development of new Resource Packets
Thank you!

PLEASE COMPLETE & RETURN THE EVALUATION FORM IN YOUR FOLDER

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