

Science and Engineering Practices Organized Around Gathering, Reasoning, and Communicating

BCSSE Conference

Presenter: Brett Moulding,

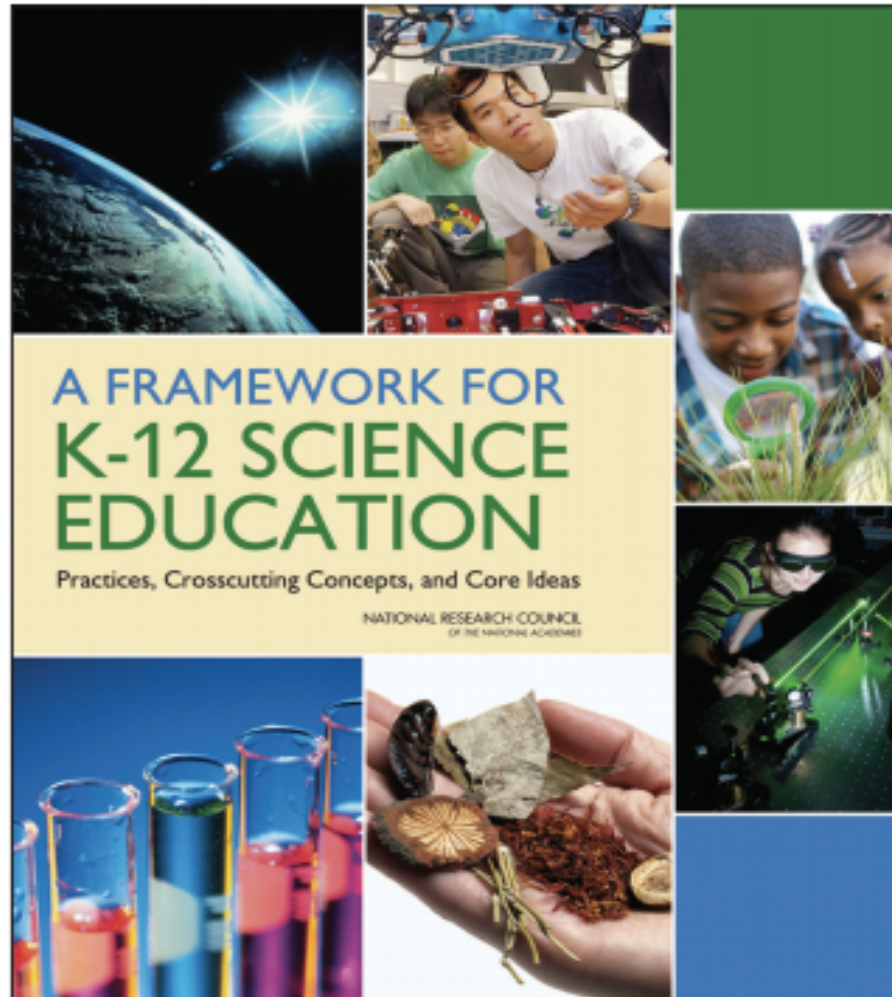
Council of State Science Supervisors (CSSS)

Partnership for Effective Science Teaching and Learning (PESTL)

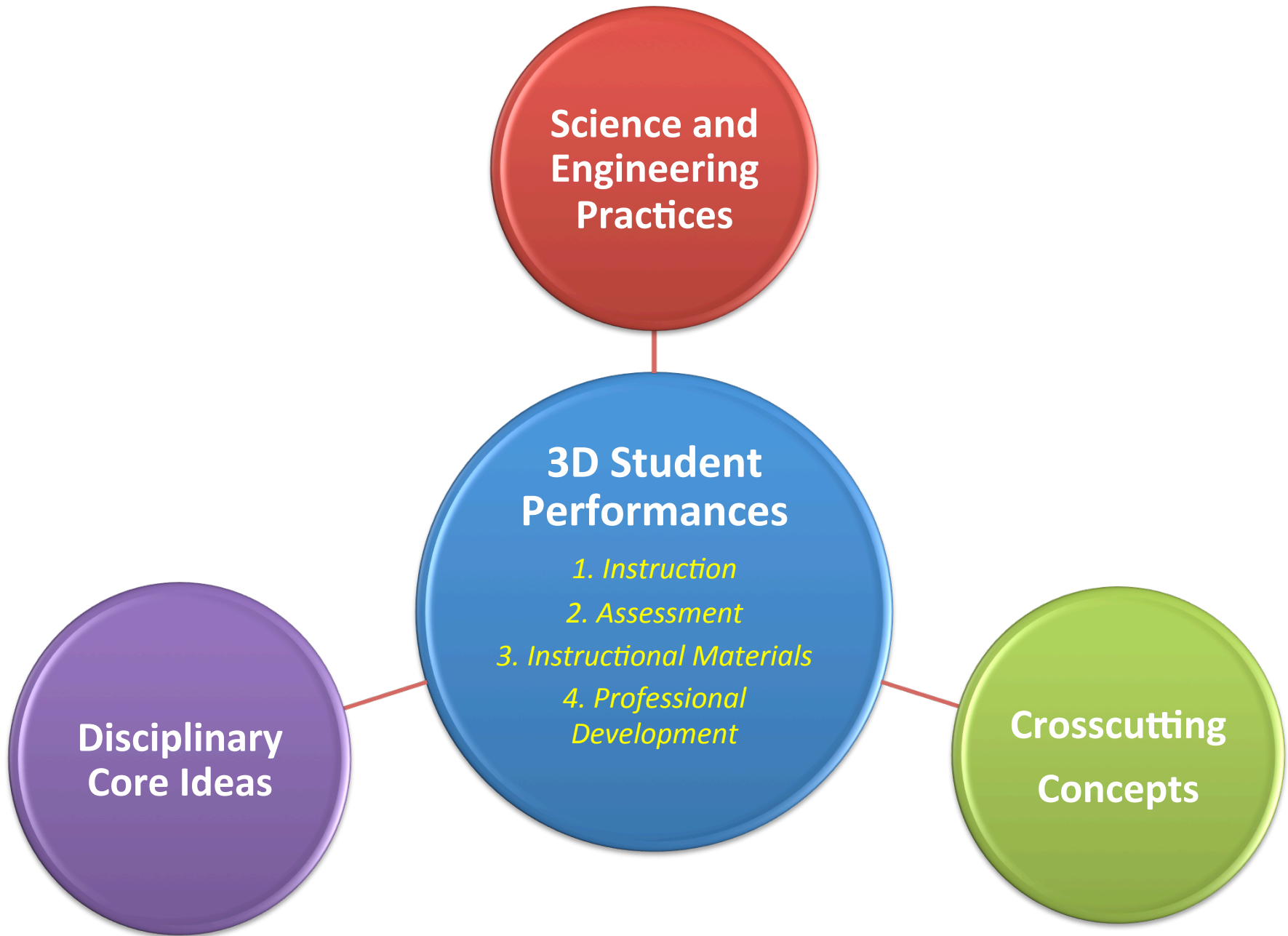
Overview

- A Shift to a New Vision for Science Education
- Science and Engineering Practices
- Gathering, Reasoning, and Communicating
- Science Performances
- Core Ideas in Performances of Science
- Discussion

A Vision for Science Teaching and Learning



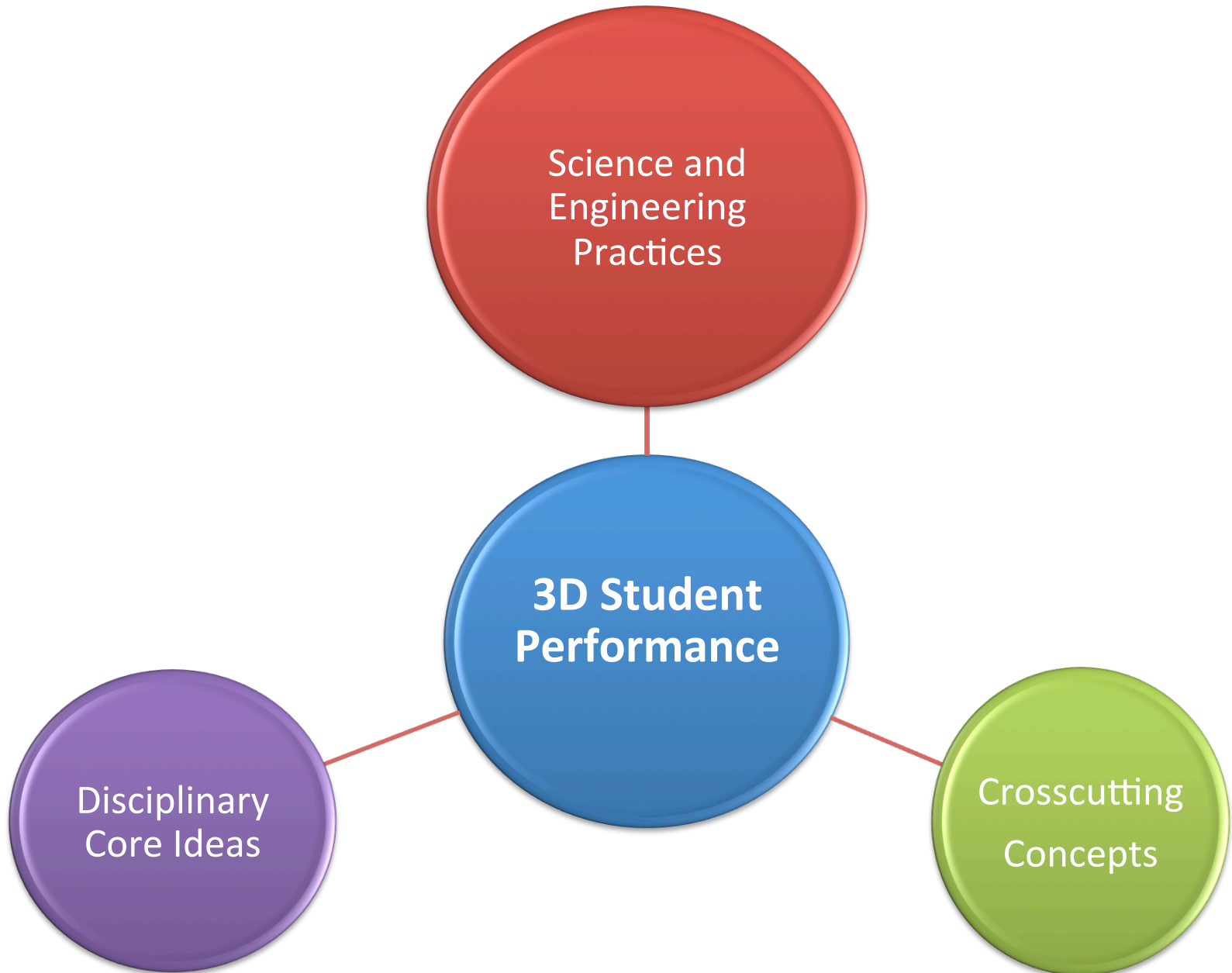
3-D Model = Science Performance at the Intersection



The *Framework* is Designed to Help Realize a Vision of Science Education

- A vision of science education in which all students' experiences over multiple years foster progressively deeper understanding of science.
- Students actively engage in scientific and engineering practices in order to deepen their understanding of crosscutting concepts and disciplinary core ideas.
- In order to achieve the vision embodied in the *Framework* and to best support students' learning, all three dimensions should to be integrated into the system of standards, curriculum, instruction, and assessment.

3-D Model = Science Performance at the Intersection



Science and Engineering Practices

1. Asking questions (science) and defining problems (engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics, information and computer technology, and computational thinking
6. Constructing explanations (science) and designing solutions (engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Framework Pages 41-82



Gathering

- **Obtain Information**
- Ask Questions/Define Problems
- Plan & Carry Out Investigations
- *Use Models to Gather Data*
- Use Mathematics & Computational Thinking

Reasoning

- **Evaluate Information**
- Analyze Data
- Use Mathematics and Computational Thinking
- Construct Explanations/Solve Problems
- Developing Arguments from Evidence
- *Use Models to Predict & Develop Evidence*

Communicating

- **Communicate Information**
- Using Argue from Evidence (written/oral)
- *Use Models to Communicate*

Crosscutting Concepts

1. Patterns
2. Cause and Effect
3. Scale, Proportion, and Quantity
4. Structure and Function
5. Systems and System Models
6. Matter and Energy
7. Stability and Change

Crosscutting Concepts

The *Framework* has identified seven key Crosscutting Concepts that serve a variety of purposes in science. This is one way to organize them for instruction.

Cause and Effect

Patterns

Structure
and Function

Systems

Scale

Change and Stability

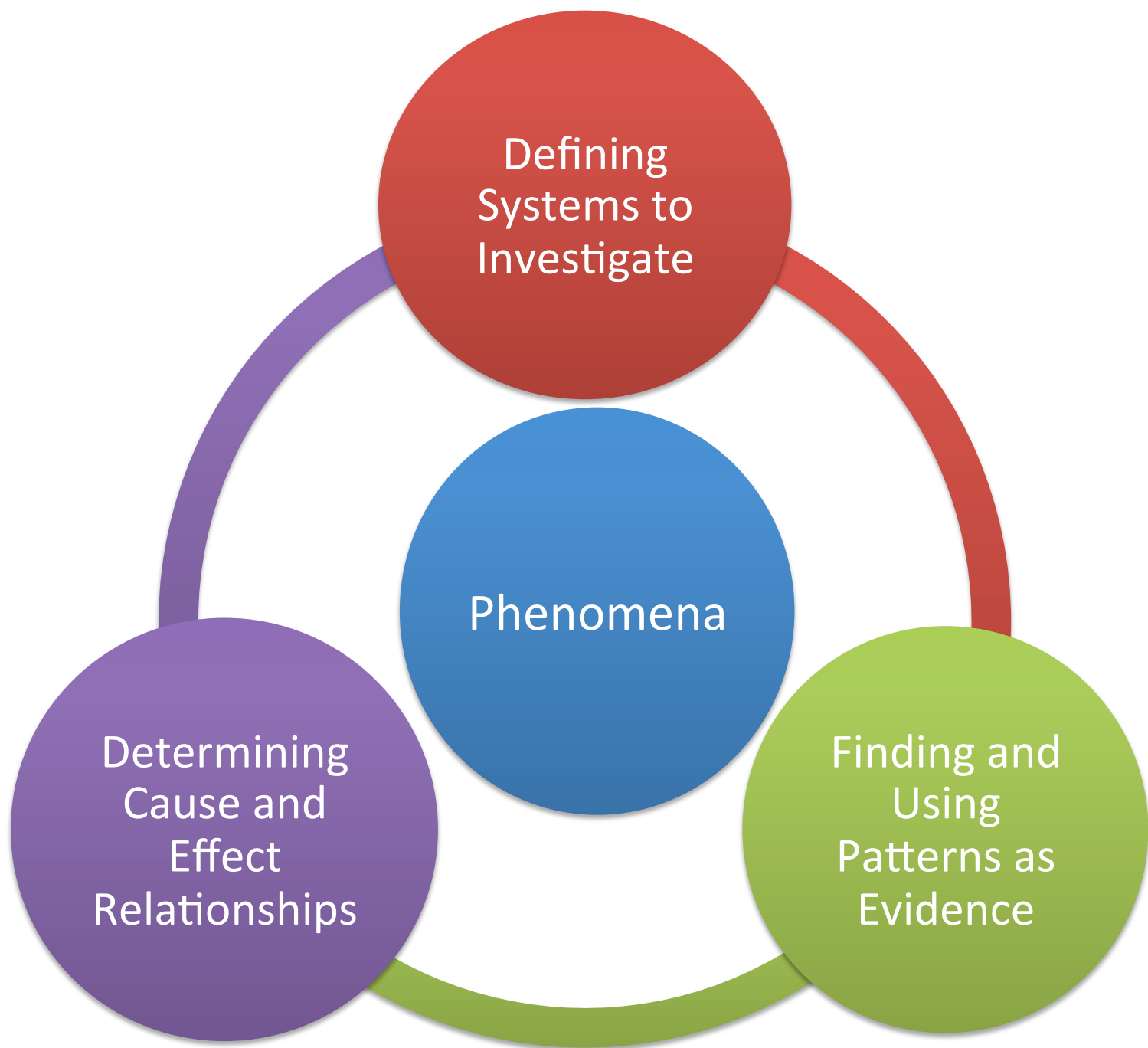
Matter and
Energy

Causality
Cause and Effect
Structure and Function

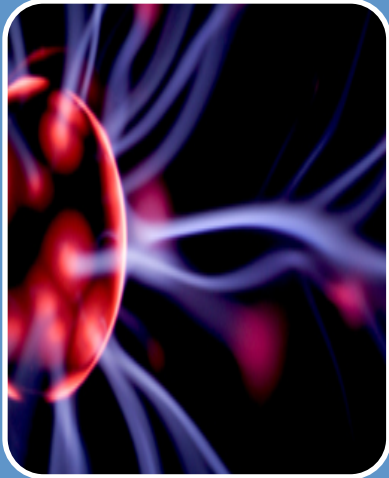
Systems

Scale and Proportion
Change and Stability
Matter and Energy

Patterns



Disciplinary Core Ideas



Physical Science

- PS1: Matter and Its Interactions
- PS2: Motion and Stability: Forces and Interactions
- PS3: Energy
- PS4: Waves and Their Applications in Technologies for Information Transfer



Life Science

- LS1: From Molecules to Organisms: Structure and Processes
- LS2: Ecosystems: Interactions, Energy, and Dynamics
- LS3: Heredity: Inheritance and Variation of Traits
- LS4: Biological Evolution: Unity and Diversity

Disciplinary Core Ideas



Earth and Space Science

- ESS1: Earth's Place in the Universe
- ESS2: Earth's Systems
- ESS3: Earth and Human Activity



Engineering, Technology, and Applications of Science

- ETS1: Engineering Design
- ETS2: Links Among Engineering, Technology, Science, and Society

Practices Crosscutting Concepts Core Ideas

Gathering

Reasoning

Communicating



Gathering

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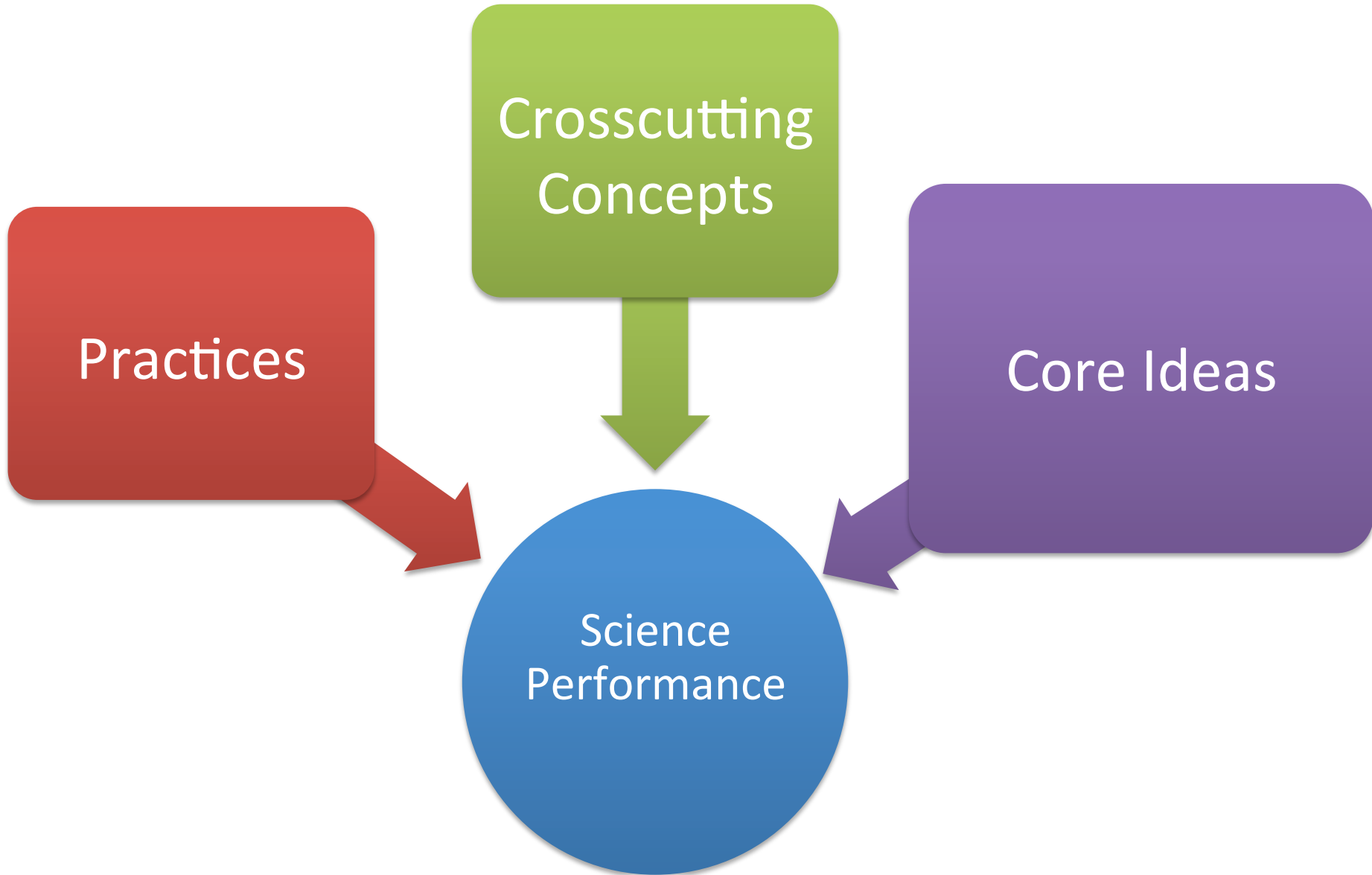
Models Across GRC

1. Phenomenon – Phase of Moon
2. System model of Earth, moon, and sun
 - a. Using this model to gather
 - b. Using this model to reason
 - c. Using this model to communicate
3. Other models across the GRC practices
 - a. Find a develop models PE from NGSS
 - b. Develop an instructional sequence that engages student in GRC
4. Discussion

Student Science Performances

Science Phenomenon	Gathering Performances	Reasoning Performances	Communicating Performances
	Practices	Practices	Practices

Student Science Performance



Student Science Performances

Science Phenomenon	Gathering Performances	Reasoning Performances	Communicating Performances
	Practices	Practices	Practices
	Crosscutting Concepts	Crosscutting Concepts	Crosscutting Concepts

Student Science Performances

Science Phenomenon	Gathering Performances	Reasoning Performances	Communicating Performances
	Practices	Practices	Practices
	Crosscutting Concepts	Crosscutting Concepts	Crosscutting Concepts
	Core Ideas	Core Ideas	Core Ideas

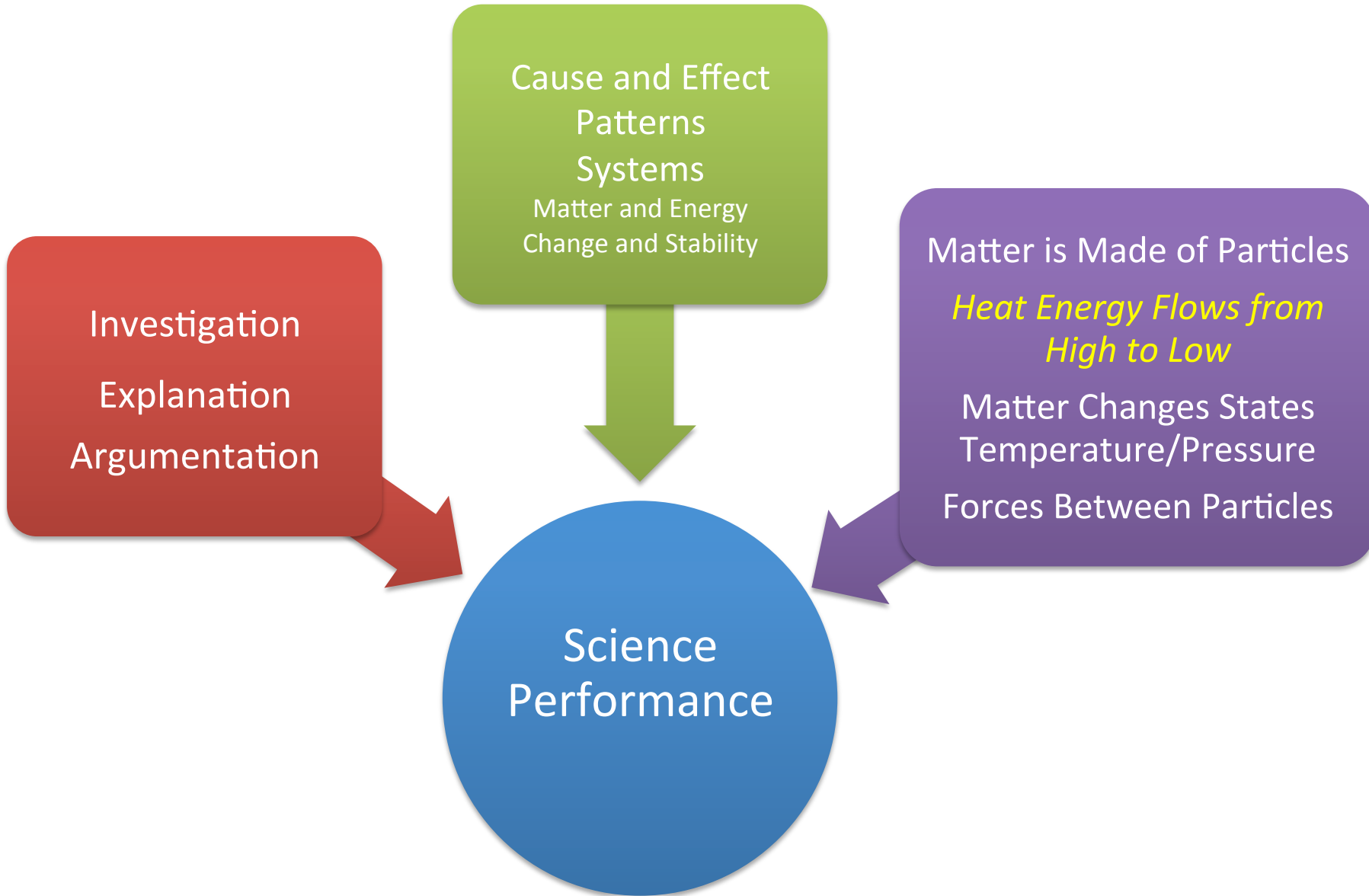
Student Science Performances

Science Phenomenon	Gathering Performances	Reasoning Performances	Communicating Performances
	Practices	Practices	Practices
	Crosscutting Concepts	Crosscutting Concepts	Crosscutting Concepts
	Core Ideas	Core Ideas	Core Ideas
Nature of Science	NOS Practices NOS Concepts		

Student Science Performances

Science Phenomenon	Gathering Performances	Reasoning Performances	Communicating Performances
	Written as a Performance Expectations across three dimensions	Written as a Performance Expectations across three dimensions	Written as a Performance Expectations across three dimensions

Performance – Water Condensing on Bottle



Student Science Practices Focus on Evidence

Student Science Performances Engage Students
in Student Science Performances

- Gathering
 - Developing Evidence
- Reasoning
 - Using Evidence
- Communicating
 - Presenting Arguments Supported by Evidence

Discussion

Thank you,

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