

**Connecting Research
to Practice:
Connecting Science and
Engineering Practices to Early
Childhood Education**

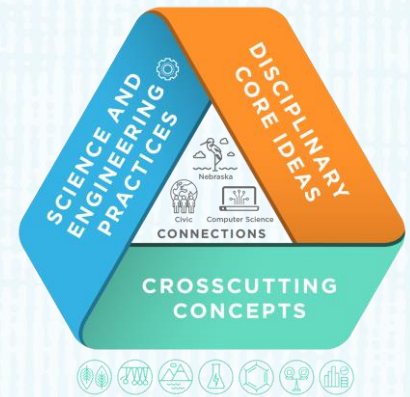
**Presented by Omaha Public Schools
Science Instructional Coaches**



Learning Goals

- I can distinguish between Science and Engineering Practices
- I can investigate examples of Cross Cutting Concepts
- I can define Disciplinary Core Ideas
- I can identify Three Dimensional Learning

Terms

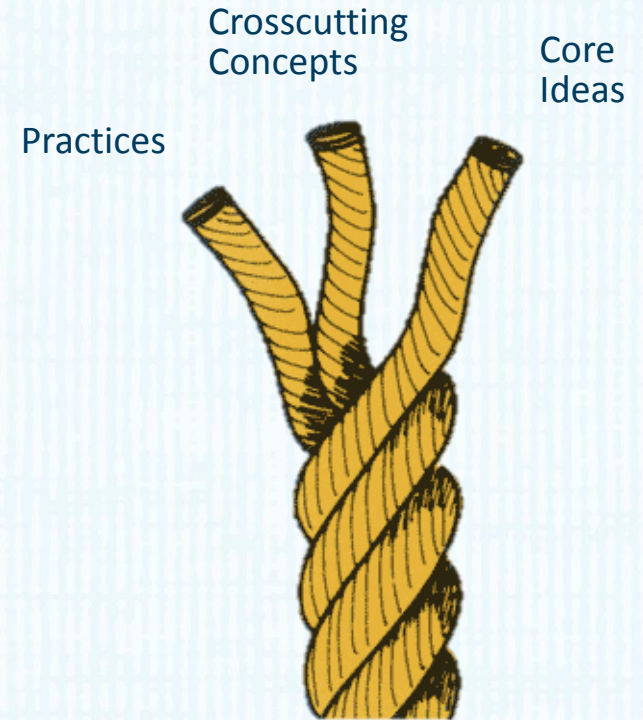


- **SEPs** – Science and Engineering Practices – What you do
- **CCCs** – Crosscutting Concepts – Connects all science domains and grade levels
- **DCIs** – Disciplinary Core Ideas – The science content being taught
- **Three Dimensional Learning** – Includes all of the items above every lesson

Content and Practice Work Together to Build Understanding: 3-Dimensional Learning

Nebraska College and Career Ready Science Standards call for students to become proficient in science and engineering:

Science & Engineering Practices, **Disciplinary Core Ideas**, and **Crosscutting Concepts** work together to form usable knowledge by building the foundation for what students will be learning in K-12.



Science & Engineering Practices

How do we engage kids?

Phenomena!

“Phenomena are observable occurrences. Students need to use the occurrence to help generate the science questions or design problems that drive learning.” From Using Phenomena in NGSS-Designed Lessons and Units



What do you notice about bubbles?

What do you wonder about bubbles?



What could children investigate with bubbles?

How big of a bubble can you blow?

How many bubbles can you blow with one breath?

If I change my bubble solution will I get more, bigger, or stronger bubbles?



Questioning engages students in purposeful learning.

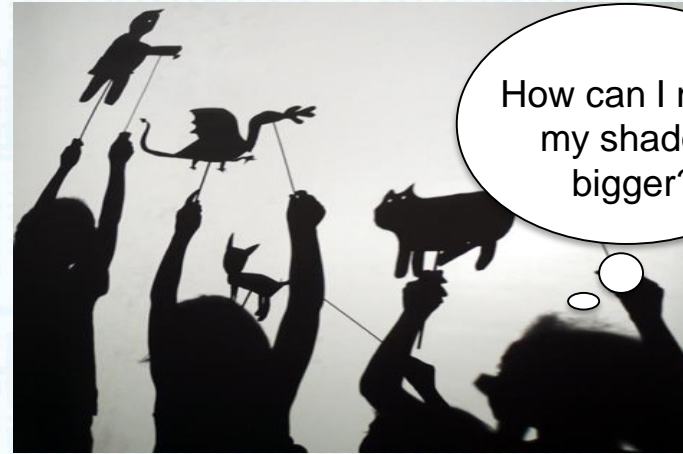
I notice the leaves I found have different colors. I wonder why some are red and some are orange?



I predict that this flower will have 10 petals. The other flowers just like this had 10 petals.



How can I make my shadow bigger?



What is in dirt? How can I find out?



Let's try it!



Soil samples



- Carefully pour your soil sample on to your paper plate.
- Use your popsicle sticks to explore your sample.
- Use your senses to generate a claim that explains where you think your sample originated.



Sample Identification:

- Write a claim based on your evidence that describes where this sample originated.
- **Start with: The sample came from**
_____ **because** _____
- Write your claim using a **blue marker** on the paper provided.



What did you do?

- Now we are going to create a list of verbs that describe what you were doing while investigating the soil sample.



Let's try something different!



Challenge: Can you design and build a bridge that supports a can of food?

Materials needed:

- Lego bricks, Duplo bricks, or wooden blocks
- 1 can of food



Extra Challenges:

- Can your bridge hold two cans?
- Can your bridge hold a larger can?
- Who can make the tallest bridge that still supports a single can?

☐

Build a Bridge

Your Plan:

1. **Draw** your first design.
2. Build and test your design.
3. Based on what you noticed and wondered with your first design, draw your second design.
4. Build and test your second design.

Rules:

- Design and build a free-standing bridge that will support a can of food.
- You can only use what you are given:
 - Blocks (Lego, Duplo, wooden)
 - A can of food

When the can is placed on the bridge, it must hold the can without breaking.

Success:

- Holds the can for 30 seconds without breaking



What did you do?

- Now we are going to create a list of verbs that describe what you were doing while designing and building the bridge.



How were these two activities different?

Sample Observation

Bridge Building

*How do I explain
this
phenomenon?*

*How do I find a
solution to a
problem?*



How were these two activities different?

Sample Observation

- Characteristics of living and non-living
- Ecology
- Rock identification
- Life cycles
- Plant identification
- Structure and function
- Soil sample

Bridge Building

- Asking questions
- Defining problems
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Constructing explanations and designing solutions
- Obtaining, evaluating, and communicating information

How do I explain this phenomenon?

How do I find a solution to a problem?



	Sciences Practices	Engineering Practices
Investigating	Scientists ask questions, make observations and collect data.	Engineers define a problem's requirements and limits and collect data that informs possible solutions.
Evaluating	Scientists review and explore explanations and models. They talk about and test their claims based on their evidence and results. They offer other explanations.	Engineers review and propose solutions. They engage in discussions to evaluate solutions with the purpose of creating a design that effectively meets the problems requirements and limits.
Explaining and Solving	Scientists try to make sense of phenomena by using the evidence to create and change their explanations and models. They use results and evidence to think about new questions and hypotheses that can be tested.	Engineers identify possible solutions to a problem and develop models and prototypes that can be tested, analyzed and improved.



Crosscutting Concepts



Patterns



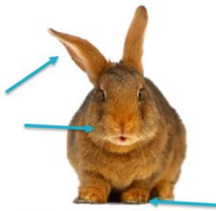
Cause and Effect



Systems & System Models



Scale, Proportion, & Quantity



Structure and Function



Energy and Matter



Stability and Change

Crosscutting Concepts

- What crosscutting concepts did we use during the sample investigation?
- What crosscutting concepts did we use for the bridge building challenge?



Disciplinary Core Ideas

What is the science content behind what you are doing?

Disciplinary Core Ideas		
Life Science	Earth & Space Science	Physical Science
<p>From molecules to organisms: Structures and processes</p> <p>LS1.A: Structure and function LS1.B: Growth and development of organisms LS1.C: Organization for matter and flow in organisms LS1.D: Information processing</p>	<p>Earth's place in the universe</p> <p>ESS1.A: The universe and its stars ESS1.B: Earth and the solar system ESS1.C: The history of planet Earth</p>	<p>Matter and its interactions</p> <p>PS1.A: Structure and properties of matter PS1.B: Chemical reactions PS1.C: Matter processes</p>
<p>Ecosystems: Interactions, energy, and dynamics</p> <p>LS2.A: Interdependent relationships in ecosystems LS2.B: Cycles of matter and energy transfer in ecosystems LS2.C: Ecosystem dynamics, functioning, and resilience LS2.D: Social interactions and group behavior</p>	<p>Earth's systems</p> <p>ESS2.A: Earth materials and systems ESS2.B: Plate tectonics and large-scale system interactions ESS2.C: The roles of water in Earth's surface processes ESS2.D: Weather and climate ESS2.E: Biogeology</p>	<p>Motion and stability: Forces and interactions</p> <p>PS2.A: Forces and motion PS2.B: Types of interactions PS2.C: Stability and instability in physical systems</p>
<p>Heredity: Inheritance and variation of traits</p> <p>LS3.A: Inheritance of traits LS3.B: Variation of traits</p>	<p>Earth and human activity</p> <p>ESS3.A: Natural resources ESS3.B: Natural hazards ESS3.C: Human impacts on Earth systems ESS3.D: Global climate change</p>	<p>Energy</p> <p>PS3.A: Definitions of energy PS3.B: Conservation of energy and energy transfer PS3.C: Relationship between energy and force PS3.D: Energy-storage processes and everyday life</p>
<p>Biological evolution: Unity and diversity</p> <p>LS4.A: Evidence of common ancestry and diversity LS4.B: Natural selection LS4.C: Adaptation LS4.D: Biodiversity and biosphere</p>		<p>Waves and their applications in technologies for information transfer</p> <p>PS4.A: Wave properties PS4.B: Electromagnetic radiation PS4.C: Information technology and communication</p>
<p>Engineering, Technology, and the Application of Science</p> <p>ETS1.A: Defining and delimiting engineering problems ETS1.B: Developing possible solutions ETS1.C: Optimizing the design solution</p>		

Questions?

Thank you!

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