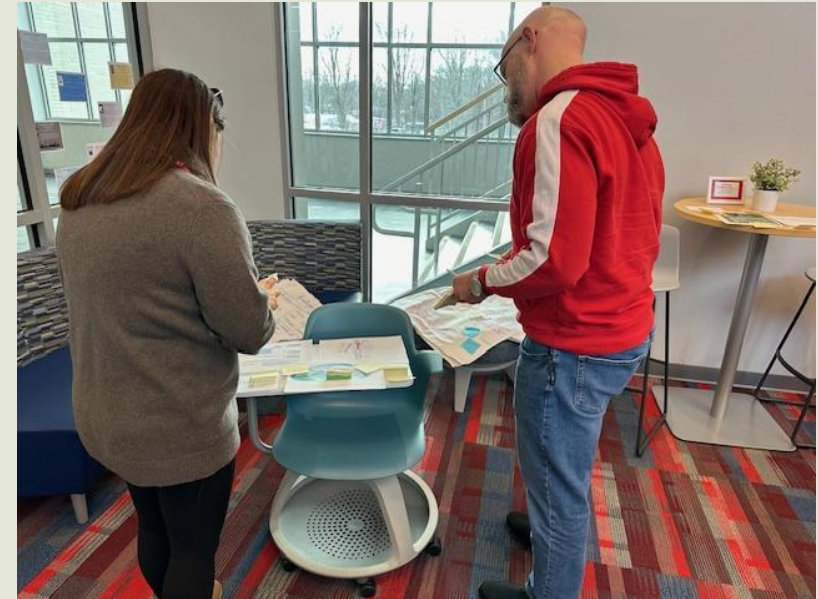


Science Vertical Articulation

February 16, 2024



NGSS Standards

Cross-cutting concepts provide students with tools to make connections between different areas of science and apply their learning to real-world phenomena.

MS-PS1-2 Matter and its Interactions		
<p>Students who demonstrate understanding can:</p> <p>MS-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. [Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride.] [Assessment boundary: Assessment is limited to analysis of the following properties: density, melting point, boiling point, solubility, flammability, and odor.]</p>		
<p>The performance expectation above was developed using the following elements from the NRC document <i>A Framework for K-12 Science Education</i>:</p>		
<p>Science and Engineering Practices</p> <p>Analyzing and Interpreting Data Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.</p> <ul style="list-style-type: none">Analyze and interpret data to determine similarities and differences in findings. <hr/> <p>Connections to Nature of Science</p> <p>Scientific Knowledge is Based on Empirical Evidence</p> <ul style="list-style-type: none">Science knowledge is based upon logical and conceptual connections between evidence and explanations.	<p>Disciplinary Core Ideas</p> <p>PS1.A: Structure and Properties of Matter</p> <ul style="list-style-type: none">Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. <p>PS1.B: Chemical Reactions</p> <ul style="list-style-type: none">Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants.	<p>Crosscutting Concepts</p> <p>Patterns</p> <ul style="list-style-type: none">Macroscopic patterns are related to the nature of microscopic and atomic-level structure.

Cross-Cutting Concepts

Identify the CCC that unifies the examples

- Patterns
- Cause and effect
- Scale, proportion, and quantity
- Systems and system models
- Energy and matter
- Structure and function
- Stability and change

Rachel was so excited to see her best friend Alex back at school. Alex had been out sick with the flu the last couple days.

While the two friends were eating lunch together in the cafeteria, Alex offered Rachel a sip of his juice, because he knew it was her favorite flavor (orange!). But because Rachel shared Alex's drink, she got the flu a week later.

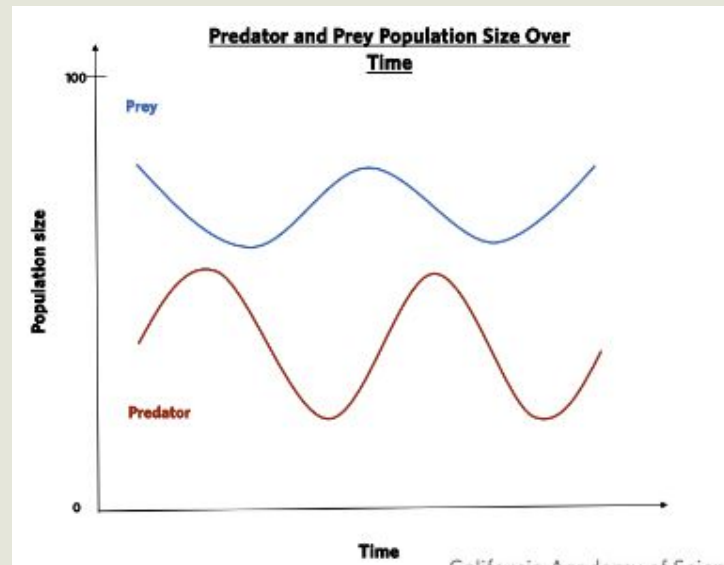
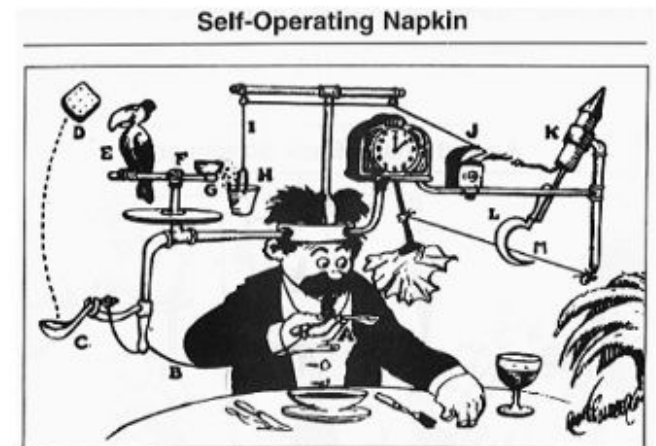


Diagram of a Rube Goldberg machine



Cause and Effect: Mechanism and Prediction – Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships and the mechanisms by which they are mediated is a major activity of science and engineering.

K-2

- Events have causes that generate observable patterns.
- Simple tests can be designed to gather evidence to support or refute student ideas about causes.

3-5

- Cause and effect relationships are routinely identified, tested, and used to explain change.
- Events that occur together with regularity might or might not be a cause-and-effect relationship.

6-8

- Relationships can be classified as causal or correlational; correlation does not necessarily imply causation.
- Cause and effect relationships may be used to predict phenomena in natural or designed systems.
- Phenomena may have more than one cause, and some cause-and-effect relationships in systems can only be described using probability.

9-12

- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.
- Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system.
- Systems can be designed to cause a desired effect.
- Changes in systems may have various causes that may not have equal effects.

How can we examine one phenomenon using one CCC through different levels?

Using Post-It notes, choose one CCC and write down how this phenomenon can be examined at the K-2, 3-5, 6-8, and 9-12 levels.



K-12 Science Team

What did vertical articulation mean to us?

- This collaboration strengthened communication and teamwork, as well as the sharing of insights and experiences among teachers.
- This time provided an opportunity for teachers to see how they are members of a team with a shared programmatic responsibility.
- Teachers spent time learning, sharing, and building relationships that will foster ongoing communication across buildings.

