

A Model of the Three Dimensions of Science Learning

Adapted from: Houseal, A. (2015). A visual representation of three-dimensional learning: A tool for evaluating curriculum. Science Scope 39 (1): 58-62.

Disciplinary Core Ideas CONTENT

- Life Sciences
- Physical Sciences
- Earth and Space Sciences
- Engineering, Technology, and Applications of Science

Disciplinary Core Ideas (DCIs)

DCIs without CCCs and SEPs
Is a collection of scientific content without an understanding of how science is done or connected to or framed within unifying themes

Cross Cutting Concepts (CCCs)

CCCs without SEPs and DCIs
The CCCs alone are unifying themes that lack disciplinary content or an understanding of how science is conducted

Science content with connections to unifying themes, but without the ability to explore or further scientific knowledge

Cross Cutting Concepts BIG IDEAS

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

Engagement in practices within science content, but without connection to unifying themes

NGSS Performance Expectations (PEs)

Scientific practices connected to CCCs but not to discipline-based content

THIS IS WHERE WE WANT TO BE!

Scientific and Engineering Practices PROCESS

- Asking questions/Defining problems
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematical and computational thinking
- Constructing explanations/Designing solutions
- Engaging in arguments from evidence
- Obtaining, evaluating and communicating information

Scientific and Engineering Practices (SEPs)

SEPs without CCCs and DCIs
Is the scientific process without connections to specific content or connections to unifying themes

Example Performance Expectations (PEs):

Students who demonstrate understanding can:

2-PS1-1.

Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

5-PS1-1.

Develop a model to describe that matter is made of particles too small to be seen.

MS-PS1-1.

Develop models to describe the atomic composition of simple molecules and extended structures.

HS-PS1-1

Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.

References:

- National Research Council [NRC]. (2012). *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Washington, DC: The National Academies Press.
- NRC. (2013). *Next Generation Science Standards: For States, By States*. Washington, DC: The National Academies Press.