Argumentation in Context to Enhance Students’ Three-Dimensional Learning

Maia Binding, SEPUP, Lawrence Hall of Science
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Implementing New Standards

Curriculum – instructional materials
Classroom Assessment – formative & summative
Instruction – teaching tools
What is 3-D Learning?

Performance Expectations

Science and Engineering Practices

Disciplinary Core Ideas

Crosscutting Concepts

Links to Common Core
What is 3-D Learning?

The **practices** are the processes of building and using the **core ideas** to make sense of the natural and designed world, and the **crosscutting concepts** hold the discipline together.
Disciplinary Core Ideas (DCIs)

- **Physical Science**
  - Matter and its interactions
  - Motion and stability: Forces and interactions
  - Energy
  - Waves and their applications in technologies for information transfer
- **Life Science**
  - From molecules to organisms: Structures and processes
  - Ecosystems: Interactions, energy, and dynamics
  - Heredity: Inheritance and variation of traits
  - Biological evolution: Unity and diversity
- **Earth and Space Science**
  - Earth’s place in the universe
  - Earth’s systems
  - Earth and human activity
- **Engineering**
  - Engineering design
Science and Engineering Practices (SEPs)

- Asking Questions and Defining Problems
- Developing and Using Models
- Planning and Carrying Out Investigations
- Analyzing and Interpreting Data
- Using Mathematics and Computational Thinking
- Constructing Explanations and Designing Solutions
- Engaging in Argument from Evidence
- Obtaining, Evaluating, and Communicating Information
Crosscutting Concepts (CCCs)

- Cause and Effect
- Energy and Matter
- Patterns
- Scale, Proportion, and Quantity
- Stability and Change
- Structure and Function
- Systems and System Models
Big Ideas & Phenomena

1. Humans can affect the relationships among organisms in an environment.
2. Natural disasters can affect the transfer of energy and the cycling of matter in ecosystems.
3. The growth of organisms and populations are limited by the available resources.
4. The introduction of a new organism can affect the stability of an ecosystem.
5. Humans are using more resources, causing the need for solutions.
Example Activity

• From a model middle school NGSS-aligned unit on Ecology
• Overarching issue in chapter: invasive species (Zebra mussel in the Hudson River)
• Final activity in the chapter
• Evaluate activity in the 5E cycle
## NGSS Alignment

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<th>DCIs</th>
<th>SEPs</th>
<th>CCCs</th>
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<td>Asking Questions</td>
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<td>Analyzing and Interpreting Data</td>
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<td>MS LS4.D.1</td>
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**PEs:** MS-LS2-4 and MS-LS2-1
Where did you see 3-D learning?

• What could you do with your students throughout a unit/school year to make 3-D learning more explicit?
Contact Info

• Maia Binding, SEPUP, Lawrence Hall of Science, mbinding@berkeley.edu

• Thank you to NSF for funding this project!
• Presentation will be available on sepuplhs.org
• Curriculum (2\textsuperscript{nd} Field Test Ed) available on nextgenscience.org (search for Disruptions in Ecosystems)
• Zebra mussel materials (graphing tool, readings) are on www.amnh.org/education/resources/rfl/web/riverecology
• If you are interested in 3-D assessments feel free to stay for one more slide
Research Study

• **Purpose of our study**

We are developing high-quality assessments to monitor students’ progress towards understanding the Next Generation Science Standards (NGSS).

**Who can participate?**

To participate, you must be currently teaching the NGSS in your middle school science classroom at a public or private school. Additionally, your principal or district must agree that we can conduct research in your classroom.

**Interested in participating?**

Please contact us!

• Sara Kolar, SEPUP Science Developer
  • Phone: (510) 642-8719
  • Email: srkolar@berkeley.edu