

Argumentation in Context to Enhance Students' Three-Dimensional Learning

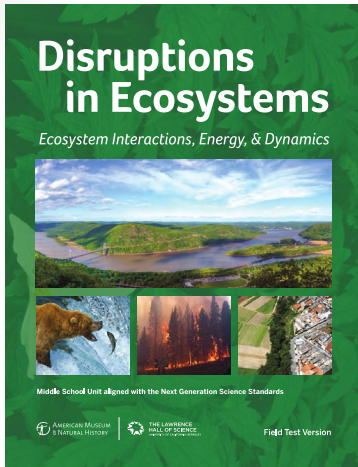
Maia Binding, SEPUP, Lawrence Hall of Science
NSTA, St. Louis, April 14, 2019

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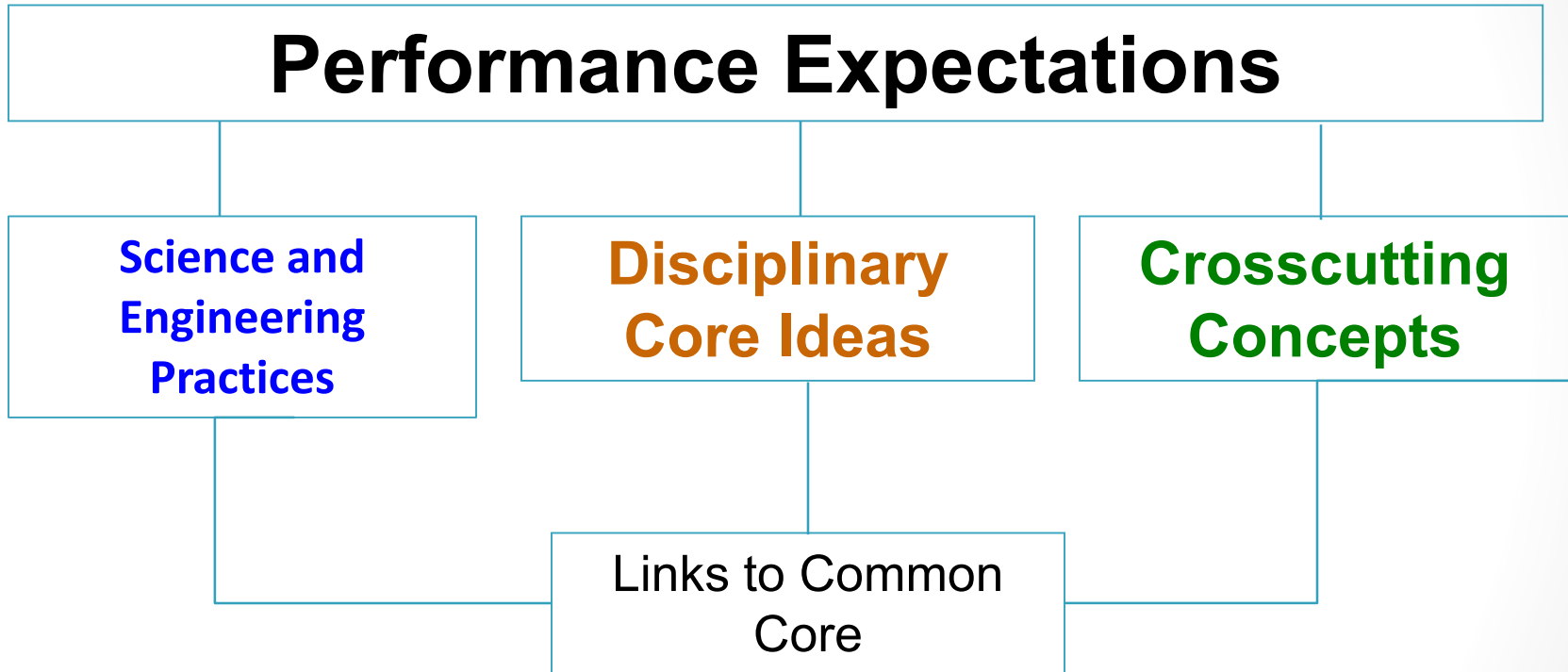
Implementing New Standards

Curriculum – instructional materials

Classroom Assessment – formative & summative

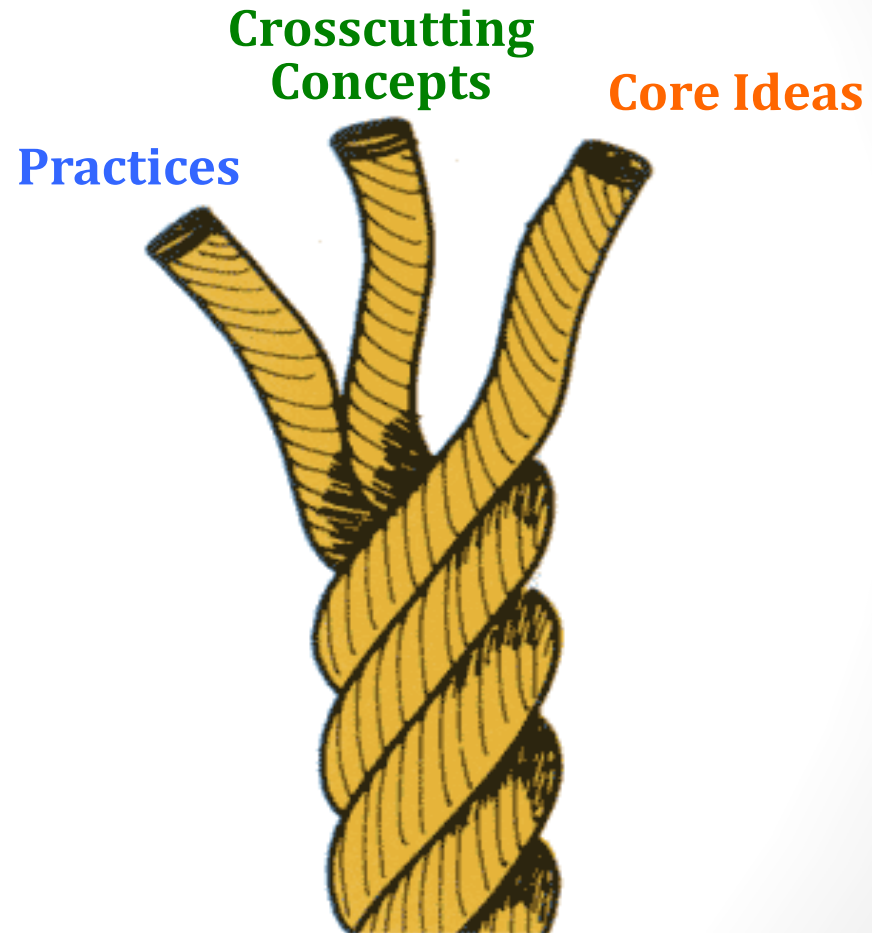
Instruction – teaching tools

What is 3-D Learning?



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

Disruptions in Ecosystems

Ecosystem Interactions, Energy, & Dynamics



Middle School Unit aligned with the Next Generation Science Standards



Second Field Test Version

CHAPTER 1

Wolves in Yellowstone

2

1.1 People and Animals Interacting	4
1.2 Ecological Interactions	10
1.3 Patterns of Interaction Among Organisms	14
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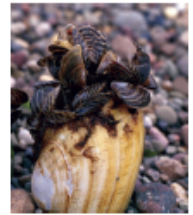


CHAPTER 4

Zebra Mussels

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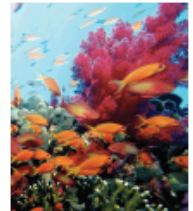


CHAPTER 5

Designing Solutions

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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.

Disruptions in Ecosystems
Ecosystem Interactions, Energy, & Dynamics

 CHAPTER 1	 CHAPTER 2	 CHAPTER 3	 CHAPTER 4	 CHAPTER 5
Wolves in Yellowstone	Ecosystem Models	Interactions between Populations & Resources	Zebra Mussels	Designing 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

DCIs	SEPs	CCCs
MS LS2.C.1	Asking Questions	Stability and Change
MS LS2.A.1	Analyzing and Interpreting Data	Cause and Effect
MS LS2.A.2	Engaging in Argument from Evidence	Patterns
MS LS4.D.1		

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 (2nd 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!

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