

Using Issues as a Context to Enhance Students' Three-Dimensional Learning

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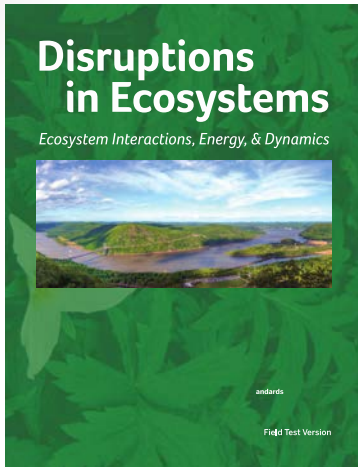
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OF NATURAL HISTORY



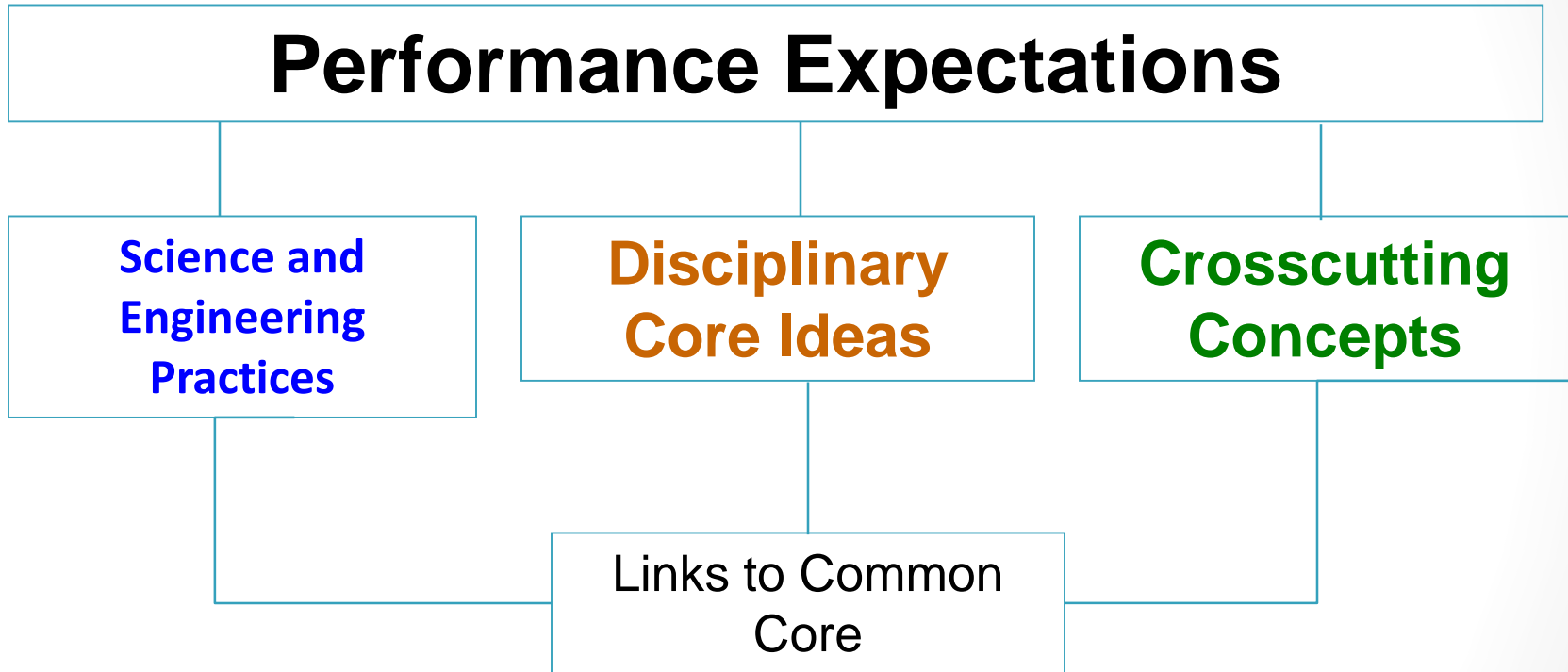
Implementing New Standards

Curriculum – instructional materials

Classroom Assessment – formative & summative

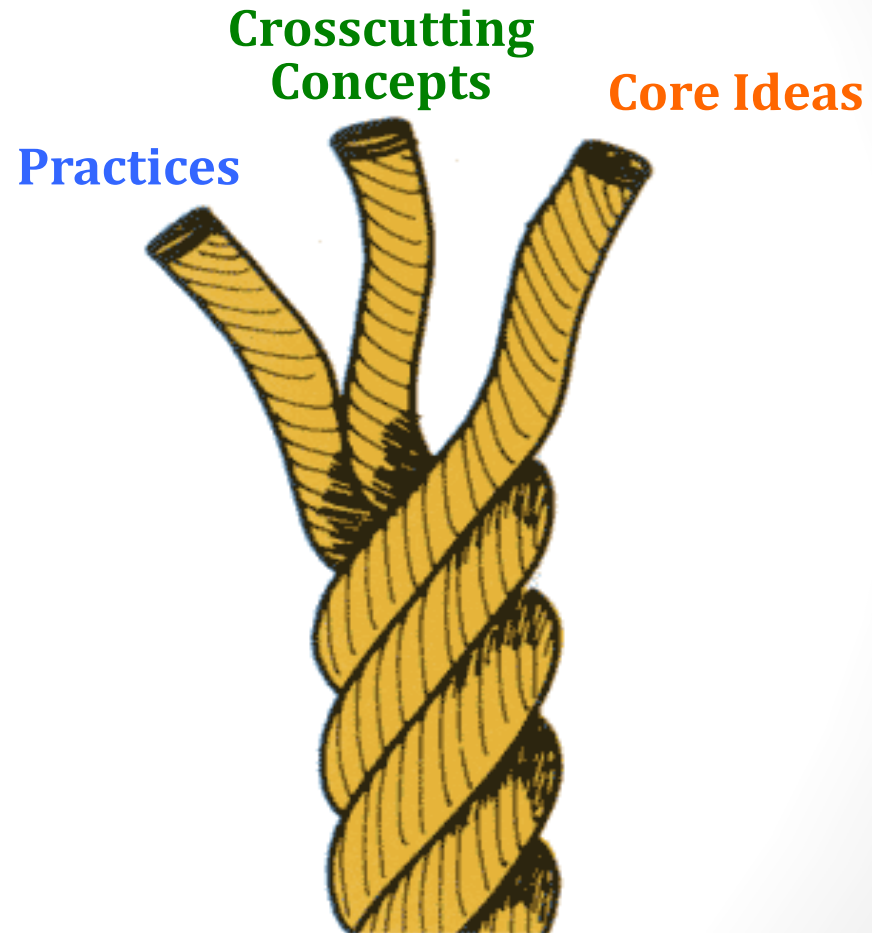
Instruction – teaching tools

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

Why Issues?

In order for students to develop a sustained attraction to science and for them to appreciate the many ways in which it is pertinent to their daily lives, classroom learning experiences in science need to connect with their own interests and experiences.

Next Generation Framework
National Research Council, 2011

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
1.4 Biotic and Abiotic Factors in Ecosystems	20
1.5 Analyzing Patterns in Ecosystems	26
1.6 Disrupting Ecosystems with Wolves	30



CHAPTER 2

Ecosystem Models 38

2.1 Ecosystem Changes	40
2.2 Life and Death in an Ecosystem	44
2.3 Matter in Ecosystems	48
2.4 Energy Flow in Ecosystems	56
2.5 Energy Tracking	60
2.6 Modeling Energy Flow and Matter Cycling in an Ecosystem	64



CHAPTER 3

Interactions Between Populations and Resources 68

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3.2 Going Fishin'	72
3.3 Three Fisheries	76
3.4 Dead Zones	82
3.5 Chesapeake Bay Oysters	88



CHAPTER 4

Zebra Mussels 94

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4.4 The Zebra Mussel Problem: 20 Years of Data	114
4.5 A New Mussel in Town	120



CHAPTER 5

Designing Solutions 126

5.1 Solving a Problem	128
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5.5 Coral Reefs	146



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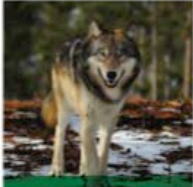






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Big Ideas & Phenomena

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

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- Thank you to NSF for funding this project!
- Presentation will be available on sepuplhs.org
- Zebra mussel materials (graphing tool, readings) are on www.amnh.org/education/resources/rfl/web/riverecology