Connecting EE to Kansas College and Career Ready Standards for Science

LAURA DOWNEY, KANSAS ASSOCIATION FOR CONSERVATION AND ENVIRONMENTAL EDUCATION
Next Generation Science Standards (NGSS) Activity Map

Source: NGSS and NASBE; March 2014
How are the KCCRSS Organized?

We’ll use a visualization of constructing a building to talk about the “Three Dimensions”

*Analogy and illustrations courtesy of Dr. Karen Ostlund, Past President, NSTA
Science & Engineering Practices

1. Asking questions & defining problems
2. Developing & using models
3. Planning & carrying out investigations
4. Analyzing & interpreting data
5. Using mathematics & computational thinking
6. Constructing explanations & designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, & communicating information
Disciplinary Core Ideas

1. Physical Science
2. Life Science
3. Earth & Space Sciences
4. Engineering, Technology, & the Applications of Science
Crosscutting Concepts

1. Patterns
2. Cause and effect: mechanism and explanation
3. Scale, proportion, and quantity
4. Systems and system models
5. Energy and matter: flows, cycles and conservation
6. Structure and function
7. Stability and change
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 disciplines together.
Integration of the Three Dimensions

Crosscutting Concepts

Disciplinary Core Ideas

Science & Engineering Practices
Substantial Shifts

- K-12 Science Education Should Reflect the **Interconnected Nature of Science** as it is practiced and Experienced in the Real World (3 dimensions expressed as performance expectations)

- The Next Generation Science Standards are **student performance expectations** – NOT curriculum (Performance expectations simply clarify the expectations of what students will know and be able to do be the end of the grade or grade band).

- The Science Concepts in the NGSS **Build Coherently** from K–12 (scaffolding)

- The NGSS Focus on **Deeper Understanding** of Content as well as Application of Content (the focus is on the core ideas—not necessarily the facts that are associated with them)

- **Science and Engineering are Integrated** in the NGSS, from K–12 (accomplished by raising engineering design to the same level as scientific inquiry in classroom instruction when teaching science disciplines at all levels and by giving core ideas of engineering and technology the same status as those in other major science disciplines).

- The **NGSS and Common Core State Standards** (English Language Arts and Mathematics) are **Aligned**
Taking a Closer Look

HTTP://VIMEO.COM/41704037
MS-LS2-1 Ecosystems: Interactions, Energy, and Dynamics

Students who demonstrate understanding can:

MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. [Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.]

The performance expectation above was developed using the following elements from the NRC document A Framework for K-12 Science Education:

Analyzing and Interpreting Data
Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.
- Analyze and interpret data to provide evidence for phenomena.

L.S2.A: Interdependent Relationships in Ecosystems
- Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.
- In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction.
- Growth of organisms and population increases are limited by access to resources.

Cause and Effect
- Cause and effect relationships may be used to predict phenomena in natural or designed systems.

Connections to other DCIs in this grade-band:
MS.ESS3.A ; MS.ESS3.C

Articulation of DCIs across grade-bands:

Common Core State Standards Connections:
ELA/Literacy -
RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-LS2-1)
RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-LS2-1)
Commonalities Among the Practices in Science, Mathematics, and English Language Arts

Based on work by Tina Cheuk ell.stanford.edu
Connections to EE

WITHIN THE KANSAS COLLEGE AND CAREER READY STANDARDS FOR SCIENCE
K. Interdependent Relationships in Ecosystems: Animals, Plants, and Their Environment
1. Structure, Function, and Information Processing
2. Interdependent Relationships in Ecosystems
3. Inheritance and Variation of Traits: Life Cycles and Traits
4. Structure, Function, and Information Processing
5. Matter and Energy in Organisms and Ecosystems
6. Growth, Development, and Reproduction of Organisms
7. Matter and Energy in Organisms and Ecosystems
8. Interdependent Relationships in Ecosystems
9. Natural Selection and Adaptations
10. Structure and Function
11. Matter and Energy in Organisms and Ecosystems
12. Interdependent Relationships in Ecosystems
13. Inheritance and Variation of Traits
14. Natural Selection and Evolution
# Earth and Space Science

## Disciplinary Core Idea

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<thead>
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<th>Grades</th>
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<tbody>
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<td>K-2</td>
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<td>5</td>
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<td>Middle School (6-8)</td>
<td>Earth and Space Sciences</td>
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**K. Interdependent Relationships in Ecosystems: Animals, Plants, and Their Environment**

**K. Weather and Climate**

1. Space Systems: Patterns and Cycles
2. Earth’s Systems: Processes that Shape the Earth
3. Weather and Climate
4. Energy
5. Earth’s Systems: Processes that Shape the Earth
7. Earth’s Systems
8. MS. Space Systems
9. MS. History of Earth
10. MS. Earth’s Systems
11. MS. Weather and Climate
12. MS. Human Impacts
13. HS. Space Systems
14. HS. History of Earth
15. HS. Earth’s Systems
16. HS. Weather and Climate
17. HS. Human Sustainability

Displaying 1 - 19 of 19
A Bit on Engineering

INTEGRATED INTO KCCRSS IN SCIENCE AND ENGINEERING PRACTICES, DISCIPLINARY CORE IDEAS AND CROSS-CUTTING CONCEPTS
Engineering Design Process

1. Identify and Define the Problem/Need
2. Describe the Problem/Need
3. Describe and Analyze the System
4. Generate a Design Solution
5. Select a Design Solution
6. Develop a Model
7. Refine the Model
8. Test and Evaluate the Model
9. Optimize the Design Solution
10. Finalize and Share the Design Solution

*Courtesy of Dr. Karen Ostlund*
Biomimicry: A new science that studies nature’s models and then uses these designs and processes to solve human problems. Biomimicry.net

Bio-Engineering (e.g. rain gardens, riparian buffers)

Natural Resource Management (e.g. water treatment, energy efficiency solutions, alternative energy, etc).

Others?
What KACEE is Working On

- Correlations to activities will be insufficient
- Clustered activities to address Performance Expectations
- Enhancements to make activities more robust
- Integration of Kansas Green Schools Investigations
- Strength of EE for supporting the Science and Engineering Practices

Resource: EQuIP Rubric for Lessons and Units