Weaving the Environment into Three-Dimensional Learning

Opportunities Provided by California's New Science Standards and Curriculum Framework
Weaving the Environment into Three-Dimensional Learning

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CalRecycle, Office of Education and the Environment

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Ten Strands
Using the environment as a context for learning creates:

- Relevance
- Readiness
Environmental Literacy for All: The Tools Are at Our Fingertips

- Next Generation Science Standards
- CA Environmental Principles & Concepts (EP&Cs)
- EEI “model” curriculum
- NEW CA Science Framework
- CA “Blueprint for Environmental Literacy”
Environment-Based Education in Action

Jim Bentley
Teacher
Foulks Ranch Elementary School
Elk Grove Unified School District
Environment-Based Education in Action

Jim Bentley’s Students
Environment-Based Education in Action

Made from Earth: How Natural Resources Become Things We Use

Teacher’s Edition
California Education and the Environment Initiative

Science Standard 6.6.4.

6

6.6.4. The process of erosion by wind and water can modify earth’s surface.

Earth as Environment Initiative

Reading Strategies

Lesson

One of the key materials in surfboards is fiberglass, a composite material made from glass fibers. These fibers are embedded in a resin matrix, which is then hardened to form a strong, lightweight material. The process of making fiberglass surfboards involves several steps:

1. Fiberglass manufacture
   - Manufacture carefully weighs each raw material to get the exact quantities needed to make fiberglass. The workers mix the ingredients together and feed the batch into a furnace to make glass fibers.

2. Glassing the surfboard
   - The machine draws the glass through the hobs, creating thin strands, or threads. These threads go into making many different fiberglass products. Workers load the products onto delivery trucks and ship them to manufacturers, such as the surfboard maker.

3. Surfboard production
   - After glassing, builders coat the board with one more layer of resin to plug any flaws on the standing surface, called the deck. They flip the board over and position the fin. Next, the builders wrap fiberglass tape around the fin and add more resin. Finally, they coat the surfboard’s underside and fit with a tail fin. The tail is made from trees. Later, when the entire surfboard is dry, the builder drills a small hole in the tail for a leash.

4. Sanding and finishing
   - A final round of sanding removes any excess resin. More dust flies as the compressed air pulls the board clean. The builders add decals and graphics before brushing a final coat of epoxy resin onto the board in the last 5 minutes before it hardens. Another coat of surfboard resin in final polishing, bulling, and polishing. Later, workers crack it with other finished surfboards, where it is to be loaded onto trucks and delivered to surf shops around California and the country.

5. Surfboard shopping
   - Two weeks later, a surfer walks into a surf shop. He tells the clerk that he wants a brand new surfboard, but one that is easy to carry. Thirty minutes later, she offers him a new surfboard, which is lighter and more flexible than the older one. He takes it home and surfs it every day. After several days, he breaks his arm and cannot surf anymore. He decides to sell the surfboard and buy a new one. The next day, he visits the same shop again, and asks, “Hey, dude, do you know how surfboards are made?”

6. Choice in action
   - The choice of materials and processes used in making surfboards is not always easy. Surfers must consider factors such as cost, durability, and environmental impact when choosing a surfboard. The choice is made by weighing the benefits and drawbacks of each option and making an informed decision.
Environment-Based Education in Action
“One day son, all of this junk will be mail!”
One Year of Junk Mail

#YearOfJunkMail

167 catalogs
357 coupons
702 flyers
339 subscriptions & offers
330 other

January 1, 2014 to December 31, 2014
180 lbs. 12 1/2 oz. junk mail
Sorting Holiday Trash, Recyclables, and Reusables
Applying an Environmental “Lens”
CA’s Environmental Principles and Concepts (EP&Cs)

PRINCIPLE I
People Depend On Natural Systems

PRINCIPLE II
People Influence Natural Systems

PRINCIPLE III
Natural Systems Change in Ways That People Benefit From and Can Influence

PRINCIPLE IV
There are no Permanent Impermeable Boundaries that Prevent Matter from Flowing Between Systems

PRINCIPLE V
Decisions Affecting Resources and Natural Systems are Complex and Involve Many Factors
Environmental Principles and Concepts (EP&Cs) As Adopted by SBE

**Principle I:** The continuation and health of individual human lives and of human communities and societies depend on the health of the natural systems that provide essential goods and ecosystem services.

**Principle II:** The long-term functioning and health of terrestrial, freshwater, coastal and marine ecosystems are influenced by their relationships with human societies.

**Principle III:** Natural systems proceed through cycles that humans depend upon, benefit from and can alter.

**Principle IV:** The exchange of matter between natural systems and human societies affects the long-term functioning of both.

**Principle V:** Decisions affecting resources and natural systems are based on making processes.
California’s Blueprint for Environmental Literacy

- Superintendent’s Environmental Literacy Task Force
- +45 members
- Environmental literacy for all
- Recommends using environment as context for learning whenever feasible
- Implementation Team forming soon
Opportunities Provided by California’s New Science Standards and Curriculum Framework
The Opportunities

Next Generation Science Standards:
• Widespread inclusion of the environment in Kindergarten through High School

California Science Curriculum Framework:
• Included the environment in the State Board of Education’s guidelines for development

California Environmental Principles and Concepts (EP&Cs) and EEI Curriculum
• Required by the State Board of Education’s science instructional materials adoption criteria
The Opportunity #1

Next Generation Science Standards

The 3 dimensions of NGSS-based science instruction all present connections with the environment:

- Disciplinary Core Ideas
- Crosscutting Concepts
- Science and Engineering Practices

As demonstrated by students through the Performance Expectations
Disciplinary Core Ideas and the Environment

**Kindergarten**: “Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things.”

**Middle School**: “Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth’s mean surface temperature.”

**High School**: “Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species.”
Crosscutting Concepts Connect to the Environment

• **Kindergarten**: “Systems in the natural and designed world have parts that work together.”

• **Middle School**: “Cause and effect relationships may be used to predict phenomena in natural systems.”

• **High School**: “Feedback (negative or positive) can stabilize or destabilize a system.”
Science and Engineering Practices Involved in Studying the Environment

• **Kindergarten**: “Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions.”

• **Middle School**: “Engaging in argument from evidence... constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed worlds.”

• **High School**: “Make and defend a claim based on evidence about the natural world that reflects scientific knowledge, and student-generated evidence.”
Performance Expectations and the Environment

• **Kindergarten**: “Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.”

• **Middle School**: “Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.”

• **High School**: “Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.”
The State Board of Education approved guidelines for implementing state standards by teachers and direct the development of instructional materials by publishers include specific references to the environment. The most important of these is incorporated into the:

- **Category 1 Adoption Criteria**: All programs must include... “Instructional resources, where appropriate, examine... the necessity for the protection of the environment. Resources include instructional content based upon the Environmental Principles and Concepts.
The Opportunity #2

New Science Curriculum Framework

- **Introduction**: Presents the Environmental Principles and Concepts and introduces the EEI Curriculum

- **Vignettes**: Kindergarten-high school exemplify teaching the NGSS through an environmental lens which integrates instruction in the NGSS with content related to the EP&Cs and models of lessons making use of the EEI Curriculum

- **Appendix of Connections Between EP&Cs & NGSS**

- **Recommended Literature**: Lists all EEI reading materials and identifies connections to DCIs
The Opportunity #3

California’s EP&Cs and EEI Curriculum

Have an important role in the new Science Framework because:

• Environmental content is integral to the NGSS

• The Environmental Principles and Concepts encompass the “big environmental ideas” California wants all students to understand and be able to apply

• The EEI Curriculum offers many resources that can bring the EP&Cs and NGSS to life in K-12 classrooms
Weaving the Environment into Implementation of the NGSS

The key to connecting the EP&Cs and EEI Curriculum to California’s new science standards and framework is to build bridges to the 3 dimensions of science instruction:

- Science and Engineering Practices
- Crosscutting Concepts
- Disciplinary Core Ideas
There are environmental connections to the DCIs, CCCs, and SEPs, thus the PEs throughout the NGSS.
Weaving the Environment into Implementation of the NGSS

The connections between the NGSS, EP&Cs, and EEI Curriculum are presented in an appendix to the new Science Framework.
### A Middle School Example from the Appendix to the Framework

<table>
<thead>
<tr>
<th>Environmental Principles</th>
<th>Connections Among PEs, DCIs, CCCS, and EP&amp;Cs</th>
<th>Relevant EEI unit materials</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MS-LS1</strong> From Molecules to Organisms: Structures and Processes</td>
<td><strong>Principle II:</strong> The long-term functioning and health of terrestrial, freshwater, coastal and marine ecosystems are influenced by their relationships with human societies.</td>
<td>As they learn that animals engage in characteristic behaviors that increase the odds of reproduction; and that genetic factors as well as local conditions affect the growth of the adult plant, students should be developing an understanding “that the expansion and operation of human communities influences the geographic extent, composition, biological diversity, and viability of...”</td>
</tr>
<tr>
<td><strong>Performance Expectations</strong></td>
<td><strong>Principle IV:</strong> The exchange of matter between natural systems and human societies affects the...</td>
<td><strong>Responding to Environmental Change</strong></td>
</tr>
<tr>
<td><strong>MS-LS1-4</strong></td>
<td></td>
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</tr>
<tr>
<td><strong>MS-LS1-5</strong></td>
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</tbody>
</table>
Developing an NGSS-Based Green Schools Audit

There are environmental connections to the DCIs, CCCs, and SEPs, thus the PEs throughout the NGSS.
Campus green schools audits can be easily connected to the three dimensions of NGSS-based science instruction:

- Disciplinary Core Ideas
- Crosscutting Concepts
- Science and Engineering Practices
Developing an NGSS-Based Green Schools Audit

Work together to get you started on designing an NGSS-based campus audit.

1. Grade-level groups
2. Sample of environment-focused NGSS standards
3. Identify some grade-level connections to the environment and/or human actions
4. Discuss campus audits
5. Develop an outline for an NGSS-centered campus audit
Highlight words/phrases that connect to the environment and/or human actions

For example:

• Waste
• Water
• Energy
• Human impacts
Developing an NGSS-Based Green Schools Audit

Grade: ____________________________

Domain (Life, Earth and Space, and/or Physical Science): ________________________________

Disciplinary Core Ideas (DCIs): ______________________________________________________

Crosscutting Concepts (CCCs): ______________________________________________________

Science and Engineering Practices (SEPs): ____________________________________________

Performance Expectations (PEs): ____________________________________________________

California's Environmental Principles and Concepts (EP&Cs): ___________________________
Developing an NGSS-Based Green Schools Audit

NGSS-centered outline for a campus audit:
• Environmental focus (related to DCI)
• Location(s) for audit
• Types of data will be collected (related to DCI)
• Procedures for data collection (related to SEP)
• Data analysis plan (related to CCSS Math)
• Data reporting/communication plan (related to SEP and/or CCSS ELA)
• Environmental Service-Learning
Developing an NGSS-Based Green Schools Audit

Grade: __________________________

Environmental focus (related to DCI): ______________________________________

Location(s) for audit: _______________________________________________________

Types of data will be collected (related to DCI): ________________________________

________________________________________________________________________

Procedures for data collection (related to SEP): ________________________________

________________________________________________________________________

Data analysis plan (related to CCSS Math): __________________________________

________________________________________________________________________

Data reporting/communication plan (related to SEP and/or CCSS ELA):
(Note: As part of their reporting out, students should identify connections to both the CCCs and EP&Cs)

________________________________________________________________________

Environmental Service-Learning
(Note: Initial plans for student participation in resolving identified environmental issues or problems)

________________________________________________________________________
Developing an NGSS-Based Green Schools Audit

Discuss
Karen Cowe, CEO

kcowe@tenstrands.org
After reading about the decline of the wolverine population in California, students construct a partial food web of the wolverine’s ecosystem.

Students work in groups, using maps and readings, to gather, summarize and record information about California’s diverse natural regions.

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A Blueprint For Environmental Literacy

Educating Every California Student In, About, and For the Environment

Future Goal: Environmental Literacy for All

Environmental literacy embedded into formal instruction for History-Social Science standards, and as part of CA CCSS and CA NGSS implementation. This is strengthened by meaningful learning experiences that build environmental literacy in nature; on school grounds; in the local community; in residential outdoor science programs; and in museums, aquariums, science centers, etc.
Summer Institute Opportunity for San Mateo K-8 Teachers

Professional Learning Collaborative for K-8 Educators:
Succeeding with NGSS Using Your Local Environment

A unique opportunity for teachers

1. Participate in a Professional Learning Collaborative
2. Focus on the core concepts in the Next Generation Science Standards
3. Explore the systems thinking embedded in California’s Environmental Principles and Concepts (EP&Cs)
4. Create and implement NGSS units of study using existing resources
5. Learn how to use the environment as a context for learning with the support of nonformal provider partners

Participants will receive

1. A stipend of $500
2. Up to 3 Education and the Environment Initiative Curriculum units per teacher—including all student materials!
3. Instructional resources from nonformal provider partners
5. CEUs available

Two sessions available: July 20-22 or August 10-12, 2015
SMCOE STEM Center

Lead presenter: Dr. Gerald Lieberman

Dr. Gerald A. Lieberman is an internationally recognized authority on school improvement using natural and community surroundings as interdisciplinary contexts. Over the past 30 years, Dr. Lieberman has created and conducted professional development programs for over 9,000 educators and formal education systems at local, state, national, and international levels.

Offered by: Open Stacks in partnership with
exploring the three dimensions of NGSS
OBSERVATIONS

Natural Systems
- birds
- algae
- snails
- lagoon
- butterflies

human social systems
- succulents
- flowers
- tree
- mushroom
- grass
- honeybees
- rails
- boats
- steps
- houses
- lake
- office buildings
- Watering grass

COMPONENTS, PROCESSES, AND CYCLES
- wetland
- garden/trees
- runoff (storm)
- planted/brings creatures

INTERACTIONS
- manmade lagoon/natural habitat
- grass + trees planted and maintained by humans

hands-on learning
combining standards, curriculum, and environment
STEM exploration
expanding into service learning
creating and sharing units of study
Welcome to the
San Mateo Environmental Learning Collaborative
(San Mateo ELC)
Online Collaboration System!

Professional Learning Collaborative for K-8 Educators:
Succeeding with NGSS Using Your Local Environment

This is Canvas, the online tool for teachers and provider partners to collaborate on environment- and NGSS-based units from teacher institutes all the way through implementation—and beyond!

This course contains files used to support your learning and implementation, links to important resources and interesting videos, a collaborative platform to share your learning and provider liaison, as well as discussion forums for posing questions and answering thought provoking questions designed to guide your continued growth.

Click on these videos to learn how to navigate the most-used components of the online course:
1. Canvas Overview
2. Whole Course Navigation
3. Dedicated Group Work Area
Hello SMELC Teachers, As promised- we are offering a followup workshop that will give you a full day of engaging activities from EEI,

ongoing connections and resources
Post-Institute Survey

Your feedback is really important to us, and we want to know your thoughts about the August institute.

Please take a few minutes to complete the post-institute survey.

I have been doing project based learning involving environmental education for a few years now. I think if I was part of the study, I would get support in becoming stronger as a teacher that guides students to become more socially responsible, to become better at encouraging students with their own investigations, and to create an educational environment that sparks interest and creativity in students.
“The main highlights for me were learning about NGSS and how we can transition from current standards. I loved Jerry and Grace’s presentations and expertise as they truly understood how we work and think as educators. Having the providers there to present and speak to us individually or in small groups was very valuable. Everything about the institute was fabulous but those were the areas that stood out for me.”

~San Mateo Environmental Learning Collaborative Teacher
Karen Cowe, CEO

kcowe@tenstrands.org
What is the Education and the Environment Initiative (EEI) and why does it exist?

- Created by law
- EP&Cs + standards = “environment-based education”
- State Board of Education approved
- Model for future adoptions
- Reflects State’s vision of environmental literacy for all
EEI Curriculum
As Approved by SBE

• K-12
• 85 curriculum units
• 40 science units (45 HSS)
• ~5 lessons per unit
• Select standards (i.e., not comprehensive)
EEI Curriculum
As Approved by SBE

Teacher's Edition
Changing States: Water, Natural Systems, and Human Communities

Life on California's Channel Islands

Student Workbook
Flowering Plants in Our Changing Environment

Teacher's Masters

Big Book

Dictionaries

Information Cards

NGS Wall Maps

Teacher's Masters

Visual Aids

Word Wall Cards

Vocabulary & Alphabet Cards
EEI Curriculum

- Local connections
- Builds relevance
- NGSS real time context
- Phenomena
Weaving the Environment into Three-Dimensional Learning

Questions
Weaving the Environment into Three-Dimensional Learning

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