What’s new at DLESE

- The Earth Science Literacy Maps have been updated
- Newest Resources in DLESE

Resource of interest

Climate Change and Colorado’s Future

Climate change is real and it is occurring faster than originally predicted. In this video series, scientists explain how climate change is affecting the state of Colorado, while citizens share stories and solutions. One of the more recent videos features an interview with University of Colorado Boulder Professor Emeritus Al Bartlett on the "arithmetic of growth." A set of problem-based model lessons were developed by teams of middle and high school teachers with CU-Boulder scientists and science educators. Also available are the Colorado Science Standards for Climate and Energy.

Suggest an interesting Earth system site.

View or subscribe to all resources of interest.
Evidence for Plate Tectonics
Essentials of Weather
Feeding Frenzy: Seasonal Upwelling
Global Ups and Downs: Changing Sea Level
Living in Earthquake Country
Mountain Building

What are Teaching Boxes?
Teaching boxes are classroom-ready instructional units created by collaboration between teachers, scientists, and designers. Each box helps to bridge the gap between educational resources and how to implement them in the classroom. The Teaching Boxes contain materials that model scientific inquiry, allowing teachers to build classroom experiences around data collection and analysis from multiple lines of evidence, and engaging students in the process of science. - focusing on gathering and analyzing scientific evidence. All educators may use DLESE Teaching Boxes free of charge.

http://www.teachingboxes.org/
NSDL Science Literacy Maps are a tool for teachers and students to find resources that relate to specific science and math concepts. The maps illustrate connections between concepts as well as how concepts build upon one another across grade levels. Clicking on a concept within the maps will show NSDL resources relevant to the concept, as well as information about related AAAS Project 2061 Benchmarks and the Next Generation Science Standards.

Next Generation Science Standards corresponding to Benchmarks for Science Literacy are now available in selected SLM Benchmarks. Find out more about the crosswalk developed between AAAS benchmarks and the Next Generation Science Standards (NGSS).

Table of contents

- The Nature of Science
- The Nature of Mathematics
- The Nature of Technology
- The Physical Setting
- The Living Environment
- The Human Organism
- Human Society
- The Designed World
- The Mathematical World
- Historical Perspectives
- Common Themes
- Habits of Mind
- View All Topics

Getting started

- How to use Science Literacy Maps
- Frequently asked questions (FAQ)
- How do I... (Tutorial Videos)

For developers

- Technical training
- How to align resources to benchmarks
- Service API documentation

See Also

- Text-based Version
A Shared Vision:
DPS and CU Boulder
Science Programs Selection Criteria

• Aligned with the National Science Education Standards
• Grounded in contemporary research on learning and teaching
• Support doing science as inquiry
• Incorporate assessment, literacy, mathematics, technological design
• Based on a carefully developed conceptual framework
• Revised as a result of thoughtful and comprehensive field testing
• Include hands-on materials and kits
• Science Resource Center for kit refurbishment
In place prior to Inquiry Hub

DPS Secondary Science

- District adoption of programs using AIM process
- District-wide implementation of inquiry-based programs K-12 in Math and Science
- Ongoing professional development provided for all redesigned courses and New Users
- Implementation tools including a planning matrix, pacing guide, and Key Concepts documents including the "Big Ideas" and subconcepts that support each grade's curriculum
In place prior to Inquiry Hub

DPS Technology

District

Teacher

Longitudinal Student Tracking Systems
Approach: The Curriculum Customization Model

- Learner Achievement
- Digital Library Resources
- Contribute and Share
- Publisher Materials
- Inquiry Curriculum
- Diverse Learner Needs
Inquiry Hub Goals

Increase achievement for all students through effective STEM teaching

- Rigorous, learner-centered STEM curriculum, aligned to emerging standards
- Software services, using DLs, supporting customization for diverse learners
- Study impact on teaching and learning
- Hub Consortium: research-district-publisher partnership for systemic change
Hub Consortium

- **School Districts**: Denver Public Schools, St. Vrain Valley, Mapleton, Douglas County, Davis, Clark County
- **Researchers**: University of Colorado, University Corporation for Atmospheric Research, Utah State University, University of Utah
- **Curriculum Developers**: BSCS
- **Digital Libraries**: PBS LearningMedia, DLESE, comPADRE, National Science Digital Library
- **Publishers/Ed Tech**: It’s About Time, Key Curriculum Press, Kendall/Hunt, FACET Innovations
Participatory Design
Inquiry Hub (iHub): Research and Development Agenda
Development Agenda

- Curriculum Customization
- Contingent Pedagogies
- Curriculum Analytics

Integration, Implementation, & Coordination

Curriculum Services

API

Curriculum

Books:
- EarthComm
- InterActions
- BSCS Biology
- Discovering Algebra
Research Agenda

- Adoption and use of iHub Services
- Support for teachers’ planning and instruction processes, including differentiated instruction
- Use of interactive resources in the classroom
- Support for professional learning community
- Student learning outcomes
- District level factors that influence the above
Research and Development Timeline

- Field Trial - Earth Science
- CCS - Physical Science
- Replication Study - Earth Science
- iHub - Algebra and Biology
The geologic history of the Earth is determined by Earth Science principles such as differing rocks and sediments in different locations, forces inside the Earth and basic geologic principles.

**Key Concepts**

- Geologic Maps
- Rock Types
- Interpretation Principles
- Forces and Faults
- Land Use & Geology

**Forces and Faults**

Forces inside the Earth can create folds or faults over time. Different types of faults (reverse, normal and strike-slip) are formed by different forces (compression, tension or shearing).

**Bedrock Geology: Activity 5: Structural Geology and Your Community**

Students use craft clay to model how a real fold looks in map view and in cross-section view. Students use foam blocks to model faults and determine the direction of forces needed to cause normal faults, reverse faults, and strike-slip faults. Students interpret a simple map and cross section that contains folds and faults.

Keywords from Denver Public Schools: fault, fold, compression, tension, shear

+ essential learning: must grade

From: It's About Time
Customized for Each District

- District specific content
- Sequencing
- Vocabulary
- Pacing guidance
- Education standards
- Essential learning

Unit 1: Understanding Your Environment

Bedrock Geology

The geologic history of the Earth is determined by Earth Science principles such as differing rocks and sediments in different locations, forces inside the Earth and basic geologic principles.

Key Concepts
- Geologic Maps
- Rock Types
- Interpretation Principles
- Forces and Faults
- Land Use & Geology

Forces and Faults

Forces inside the Earth can create folds or faults over time. Different types of faults (reverse, normal and strike-slip) are formed by different forces (compression, tension or shearing).

Unit 1: Understanding Your Environment: Bedrock Geology » Forces and Faults
Bedrock Geology Activity 5: Structural Geology and Your Community
http://csu.dis.illustrado/protected/bedrock_geology/chap1/eq_u2...

Classroom activity
Students use craft clay to model how a real fold looks in map view and in cross-section view. Students use foam blocks to model faults and determine the direction of forces needed to cause normal faults, reverse faults, and strike-slip faults. Students interpret a simple map and cross-section that contains folds and faults.

Keywords from Denver Public Schools: fault, fold, compression, tension, shear

+ essential learning: must grade

From: It's All About Time

- My Stuff for this Activity
- Shared Stuff for this Activity
- Key Concepts for this Activity (1)
- Instructional Support Materials (6)
- Teaching Tips (7)
- Student Conceptions (1)
- Embedded Assessments (5)
Publisher Materials

Unit 1: Understanding Your Environment
Bedrock Geology
The geologic history of the Earth is determined by Earth Science principles such as differing rocks and sediments at different locations, forces inside the Earth and basic geologic principles.

Key Concepts
- a. Geologic Maps
- b. Rock Types
- c. Interpretation Principles
- d. Forces and Faults
- e. Land Use & Geology

Forces and Faults

Bedrock Geology: Activity 5: Structural Geology and Your Community
http://ccs.dls.ucar.edu/dps/protected/flat/bedrock_geology/...01/ec_u2...

Classroom activity
Students use clay to model how a real fault is in map view and in cross-section view. Students use foam to model faults and determine the direction of forces needed to cause normal faults, reverse faults, and strike-slip faults. Students interpret a simple map and cross section that contains folds and faults.

Keywords from Denver Public Schools: fault, fold, compression, tension, shear
+ essential learning: must grade

From: It's About Time

- My Stuff for this Activity
- Shared Stuff for this Activity
- Key Concepts for this Activity (1)
- Instructional Support Materials (5)
- Teaching Tips (7)
- Student Conceptions (1)
- Embedded Assessments (5)
Interactive Resources to Enhance Instruction and Support Differentiation

- From educational digital libraries - NSDL and DLESE
  - Images, Animations, Data, Visuals, etc.
Algebra Tasks

Teachers rating according to:

- Cognitive Demand
- Tasks Language
- Options for Expressing Understanding
- Technology
- CCSS – Standards for Mathematical Practice
- CCSS – Content Standards
Create Personalized Collections for Customized Instruction

“MyStuff”
- Embedded assessments
- Interactive resources
- Own materials
- Shared materials

“SharedStuff”
- Materials contributed by other teachers

“Playlist”
- Organize, sequence, annotate resources
- Create lesson plans or other new resources
Supporting Communities of Practice

- InterActions in Physical Science
- Investigating Earth Systems
- EarthComm - Earth System Science in the Community
  - Understanding Your Environment
    - Bedrock Geology
  - Earth's Dynamic Geosphere
    - Volcanoes
    - Plate Tectonics
    - Earthquakes
  - Earth's Natural Resources
    - Water Resources
    - Energy Resources

Recent Places
- Units of Study - EarthComm - Earth System Science in the Community
- Climate Change » a. Climate and Weather
- Climate Change
- Bedrock Geology » b. Rock Types

Activity Stream
- Save to My Stuff
  - Playlist Investigation #7 - Rocks and Landforms has been saved by 3 users.
  - Latest user saved in:
    - Rocks and Landforms » g. Glacial Processes
    - Investigation 7: Glaciers, Erosion and Deposition
- Save to My Stuff
  - Resource Glaciers PowerPoint has been saved by 7 users.
  - Latest user saved in:
    - Rocks and Landforms » g. Glacial Processes
    - Investigation 7: Glaciers, Erosion and Deposition
- Save to My Stuff
  - Resource Glacier Simulation has been saved by 2 users.
  - Latest user saved in:
    - Rocks and Landforms » g. Glacial Processes
    - Investigation 7: Glaciers, Erosion and Deposition

Tectonic Plates and Plate Boundaries
http://www.teachersdomain.org/resource/ess05_sci_ess_earthsys_boundaries...

Continents were once thought to be static, locked tight in their positions in Earth's crust. Similarities between distant coastlines, such as those on opposite sides of the Atlantic, were thought to be the work of a scientist's overactive imagination, or, if real, the result of erosion on a massive scale. This interactive feature shows 11 tectonic plates and their names, the continents that occupy them, and the types of boundaries between them.

From: DLSE Collection (DCC)
Outcomes: Field Trial in Denver Public Schools

124 middle and high school Earth science teachers
Study Results

- Strong uptake and adoption (68%)
- Helps them to use their time more efficiently (80%)
- Increased awareness of other teachers’ practice (61%)
- Integrated DL resources with greater frequency, confidence, effectiveness
- Teachers differentiated to support high needs learners, offer alternative representations of science concepts, and improve engagement
- Student learning outcomes increased 200+%
How well did the CCS support teachers’ to differentiate instruction?

- Easier to Use
- Formative
- Differentiate Instruction with
- Differentiate Instruction with
- Positive Impact on My Students'
What Teacher’s Said

*I tried to use it [the CCS] with almost every lesson that I could... We have so many second-language learners that they needed the [visual] resources provided in the system.*

*I saw that some teachers had uploaded some really high-level PowerPoint [slideshows]. It made me wonder if my expectations were too low for my students.*

*It [the CCS] is a space for me to save my materials on that won’t be erased...It’s a centralized location where I can find that extra material that I know is going to be, nine times out of ten, useful for me. It actually has cut down on [my] random searching on the Internet.*
Outcomes: Replication Study with 6 School Districts
200 middle and high school Earth science teachers
Replication Study

Results

• Four categories of users
  • Power User
  • Feature Explorer
  • Specialist
  • Lukewarm

• Student assessment learning gains (pre/post)
  • Power users (ES=.44)
  • Feature explorer (ES=.29)
  • Specialist (ES=.14)
  • Compared to Lukewarm users, students of Power Users and Feature Explorers had statistically significant higher gains
Status, Next Steps, Challenges & Reflections
Status & Next Steps

• Expand to new disciplines

• Development
  • Google Apps integration
  • Student access

• NGSS and more CCSS-M alignment
Moving into new content and new subjects:
Will Inquiry Hub make a difference in instruction and student learning?

- OER
- Badges
- Gaming
- Avatars
- Open Textbooks
- MOOCs & Informal Learning
- Problem-based Learning
NGSS Core Ideas

HS-LS2 - Ecosystems: Interactions, Energy, and Dynamics

HS-LS4 - Biological Evolution: Unity and Diversity

TBD

HS-LS3 - Heredity: Inheritance and Variation of Traits

HS-LS1 - From Molecules to Organisms: Structures and Processes
DPS High School Biology: Units of Study

Choose a different organization

**NGSS High School Biology**

*Ecosystems: Interactions, Energy, and Dynamics*  
- Why Should We Care About Trees?  
- How Many Trees Can We Plant?  
- What Roles Do Trees Play in an Ecosystem?  
- How Do We Introduce Trees that Maintain Stability in an Ecosystem?

**Recent Places**

- Why Should We Care About Trees?  
- How Trees Cool the Air  
- Why Should We Care About Trees?  
- Modelling How Trees Benefit People  
- Why Should We Care About Trees?  
- Our Challenge

---

About CCS | Using CCS | FAQ | Contact Us | Project Staff | Privacy | Terms of Use

[NSDL] [NSF DLESE]
### Ecosystems: Interactions, Energy, and Dynamics

#### Why Should We Care About Trees?

**How Does Changing the Number of Trees Affect an Ecosystem?**

DPS High School Biology Units of Study » Ecosystems: Interactions, Energy, and Dynamics: Why Should We Care About Trees?

---

### Unit Overview

#### Key Concepts

<table>
<thead>
<tr>
<th>Our Challenge</th>
<th>Modelling How Trees Benefit People</th>
</tr>
</thead>
<tbody>
<tr>
<td>A key motivation for planting trees is that it can make life better for people, lowering temperature, improving air quality, and reducing flooding in the city.</td>
<td>Trees can mitigate effects of human activity at different spatial scales (both the schoolyard and at the level of the city) through the mechanisms of re-radiating heat and evapotranspiration.</td>
</tr>
<tr>
<td>• Our Challenge</td>
<td>• Building and Using a Model of How Trees Benefit People</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Urban Heat Islands</th>
<th>Increasing Biodiversity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cities create heat islands; canopy cover lowers surface temperature.</td>
<td>Biodiversity is the variability among living organisms in an ecosystem and includes diversity within species, between species, and of ecosystems.</td>
</tr>
<tr>
<td>• Analyzing Urban Heat Islands</td>
<td>• How Can Planting Trees Increase Biodiversity in a Community?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How Trees Cool the Air</th>
<th>Erosion, Runoff, and Turbidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trees cool the air through evapotranspiration and through the influence of land cover on albedo.</td>
<td>Trees influence erosion and run-off in an urban setting</td>
</tr>
<tr>
<td>• Investigating How Trees Cool the Air</td>
<td>• Urban Trees: Erosion, Runoff, and Turbidity</td>
</tr>
</tbody>
</table>
Ecosystems: Interactions, Energy, and Dynamics
How Should We Care About Trees?

Why Should We Care About Trees?

Our Challenge

In this lesson, students will learn about the challenge they are being asked to address and define a set of benefits of planting trees that are important to them. Students engage in a warm-up activity in which they develop ideas about why people have planted so many trees in Denver since Anglos began settling in the region. Then, the teacher will provide a definition of ecosystems and show a brief video that introduces them to the challenge. Students will work in small groups out what they know already that might help them solve the challenge and what they need to figure out. The lesson closes with students working to define why, if at all, trees might matter to them.

From: NGSS Biology Activities
# Ecosystem Unit Lesson Plan Template

## Section 1 - Outline of Lesson

<table>
<thead>
<tr>
<th>Lesson Author</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>What is your name, position, and organization?</em></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Essential Question of Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit Phenomenon</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Your Group’s Driving Question</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>See green boxes in Unit Storyline.</em></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lesson Title / Main Phenomena</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>See your Question Storyline. Phenomena are observable and foster engagement with science.</em></td>
</tr>
<tr>
<td>NGSS Disciplinary Core Ideas addressed</td>
</tr>
<tr>
<td>---------------------------------------</td>
</tr>
<tr>
<td>Review the NGSS DCIs.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NGSS Crosscutting Concepts addressed</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>See NGSS Appendix on Cross-Cutting Concepts.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NGSS Practices addressed</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>See NGSS Appendix on Practices.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Colorado Academic Standards addressed</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>See CAS.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common Core State Standards in Math and ELA addressed</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>See CCSS. If no obvious links, leave blank.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lesson Objectives</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>List objectives for students for this lesson. See gold and blue boxes in your Question Storyline.</td>
<td></td>
</tr>
</tbody>
</table>
Opening Procedure
How will you meaningfully begin the lesson?

Body of Lesson Procedure
Write detailed instructions for what you and students will do during the lesson. See example. Note any possible talk moves and differentiation strategies.

Closing Procedure
How are you going to conclude the lesson (e.g. review, discussion, update rules for the class “Model Board”)?

Assignment(s) / Homework
Provide meaningful and engaging activities that reinforce or synthesize the day’s or week’s learning.

Safety Concerns
List all of the job safety...
Why do you think CCS/iHub is working?
Reflections – What We’ve Learned

Embedded in Curriculum and Easy-to-Use:
Design matters and teacher expertise in the design process crucial for creating something that can be integrated into their workflow

Differentiation and Effective Teaching:
If link to instructional improvement is clear, many teachers are ready and willing to use new technology; need buy-in from all (district leaders and teachers)
More Lessons Learned

- Rethinking technology development processes
  - Learn to be agile
  - Minimum viable product is ok
  - Iterative testing, smaller releases of the tool features
  - Self-crafted development vs. using third party resources
- Technology is and will continue to be radically disruptive (+/- of state, local assessment requirements)
- Curation of resources is still a challenge
- Each district has its own culture
  - Challenges our notions of scalability
- Element of luck should not be understated
  - Engagement of districts as coPIs on projects
  - Publishers full engagement
  - Mature technological infrastructure in DPS
DPS Now...When
DPS: Where are we now?
10 yr + old curricula / not @ top of multi-year queue
State STEM push / State NGSS stall
Teacher Enthusiasm / Professional learning required
NGSX – iHub courses / Development time
We have some work to do
Questions

Patty Kincaid:
patricia_kincaid@dpsk12.org

Jeffrey Miller: Jeffrey_Miller@dpsk12.org

CCS Help: ccshelp@dls.ucar.edu


Saldivar, M. G. (2011) Report 4: Teacher Integration of Digital Resources into Instructional Practice, Pages: 26, Available at: https://wiki.ucar.edu/display/dlsccs/Publications+and+Presentations