

# iHub: A Research-Practice Partnership to Design New NGSS Curriculum

NSELA PDI 2015  
Chicago

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University of Colorado **Boulder**

## Digital Library for Earth System Education

Supported by the National Science Foundation  
and managed by the National Center for Atmospheric Research LibraryGetting started  
with DLESE ▶Browse  
the library ▶

Educational resources
  News & opportunities

Tips

A free service for learners of all ages

 What's new at DLESE

- [The Earth Science Literacy Maps have been updated](#)
- [Newest Resources in DLESE](#)

 Resource of interest
<< [Previous](#) | Next >>

## 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

Find a resource

Search

► [Educational level](#) ► [Resource type](#) ► [Subject](#)

## Explore...

# Browse Collections

Learn more about the organizations that share their resources with NSDL

Science Literacy Maps

NSDL on iTunes U

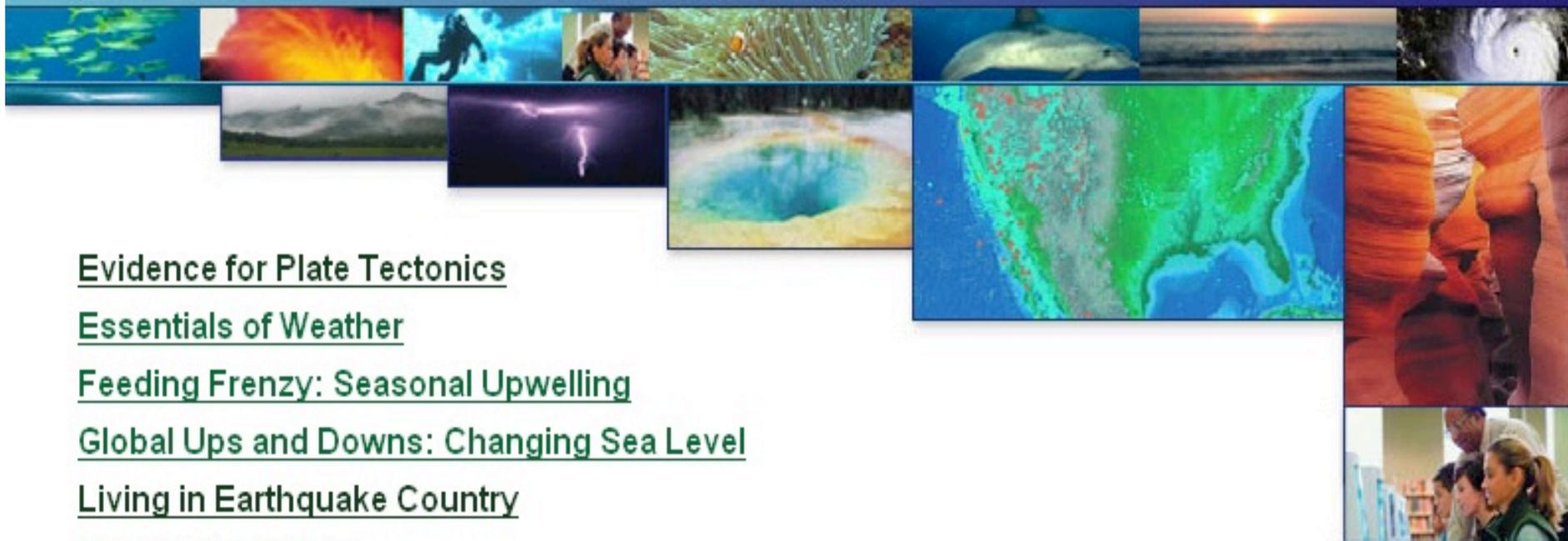
K-12 Educational Standards

Resource Categories

◀ Collections

Browse an alphabetical list of all participating collections, or explore collections devoted to a subject area of interest, or refine the list by subject matter and main audience (educators or researchers).

[Browse NSDL Collections](#)



Evidence for Plate Tectonics

Essentials of Weather

Feeding Frenzy: Seasonal Upwelling

Global Ups and Downs: Changing Sea Level

Living in Earthquake Country

Mountain Building

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## 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.

Search for maps



or

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](#)



The screenshot shows a detailed Science Literacy Map (SLM) for the topic "Changes in the Earth's Surface". The map is a network of interconnected concepts. A central pop-up window is open, displaying information for the concept "Some changes in earth's surface...".

**Current map: Changes in the Earth's Surface**

**Some changes in earth's surface...**

**AAAS Benchmark:** Some changes in the earth's surface are abrupt (such as earthquakes and volcanic eruptions) while other changes happen very slowly (such as uplift and wearing down of mountains). The earth's surface is shaped in part by the motion of water and wind over very long times, which acts to level mountains ranges.

Grade range: 6 - 8  
Topic areas: rates of change | earthquakes and volcanoes

**View standards**

**Resources**  
results 1 - 5 out of 92344 [View all](#)

**From UpB to Glaciation: Geological History of the Pikes Peak Region**  
<http://www.south.sdsu.edu/education/earthscience/AAASBenchmark/FromUpBtoGlaciation.pdf>  
This winning entry in the museum's Young Naturalist Awards 1999 takes a look at the geological past of Pikes Peak and its region. Sarah's essay with a field journal focus covers: how geologists divide Earth's 4.6-billion-year history into four major chronological eras (Precambrian, Paleozoic, ...)

**Explore the Deep Oceans**  
<http://www.south.sdsu.edu/education/earthscience/AAASBenchmark/ExploreTheDeepOceans.pdf>  
Following an expedition off the coast of Washington State, this six-day unit provides an in-depth look at deep sea vents. Throughout the unit, students collect their findings in a portfolio. The comprehensive curriculum materials include: Teacher tools, which include individually downloadable readings, ...

**Other concepts and resources visible in the map:**

- constitute a... several billion...
- Thousands of layers of sedimentary rock confirm the history of the changing surface.
- Some changes in earth's surface are abrupt (such as earthquakes and volcanic eruptions) while other changes happen very slowly (such as uplift and wearing down of mountains).
- The earth first formed in a molten state and then the surface cooled into solid rock.
- Eds of the earth's surface.
- Thousands of layers of sedimentary rock confirm the history of the changing surface.
- Some changes in earth's surface are abrupt (such as earthquakes and volcanic eruptions) while other changes happen very slowly (such as uplift and wearing down of mountains).

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

Longitudinal  
Student  
Tracking  
Systems

Teacher



# Approach: The Curriculum Customization Model





# 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

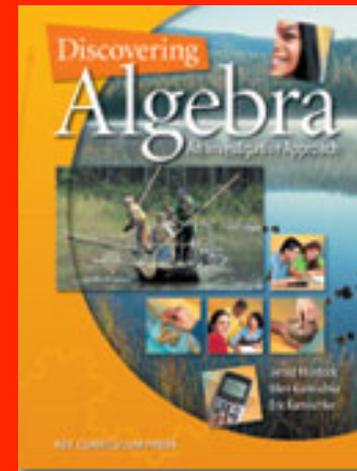
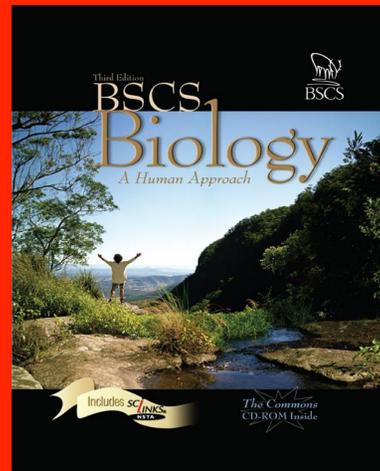
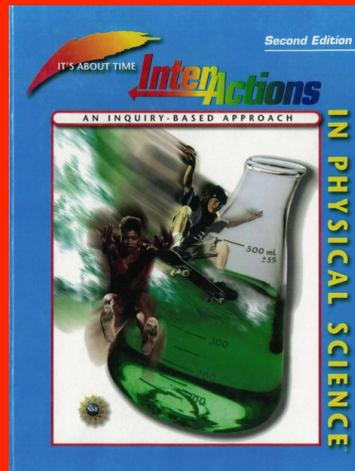
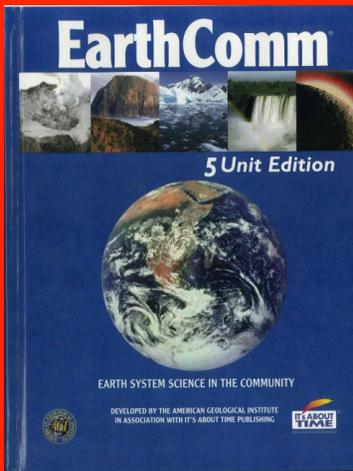
Contingent  
Pedagogies

Curriculum  
Analytics

Services

Integration, Implementation, & Coordination

API



Curriculum

# 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

# Concept-Focused Planning Tool

## Unit 1: Understanding Your Environment

Lynne Davis (lynne) | [Logout](#) | [My profile](#) | [Find people](#) | [Units of Study](#)

### 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.

**Bedrock Geology**

[Units of Study](#) » [Unit 1: Understanding Your Environment: Bedrock Geology](#) » [Forces and Faults](#)

► [View All Stuff](#)

### Key Concepts

a. [Geologic Maps](#)

b. [Rock Types](#)

c. [Interpretation Principles](#)

**d. [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).

e. [Land Use & Geology](#)

### Forces and Faults

EarthComm  
Activities

Interactive  
Resources

Education  
Standards

My Stuff for  
this Concept

Shared Stuff for  
this Concept

Activity 5 +

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

Page: U 39

[http://ccs.dls.ucar.edu/dps/protected/iat/bedrock\\_geology/chap01/ec\\_u2...](http://ccs.dls.ucar.edu/dps/protected/iat/bedrock_geology/chap01/ec_u2...)

Number of periods: 2

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 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 \(5\)](#)

# Customized for Each District

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

## Unit 1: Understanding Your Environment

Lynne Davis (lynne) | [Logout](#) | [My profile](#) | [Find people](#) | [Units of Study](#)

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**Bedrock Geology**

[Units of Study](#) » [Unit 1: Understanding Your Environment: Bedrock Geology](#) » [Forces and Faults](#)

[View All Stuff](#)

### Key Concepts

- a. [Geologic Maps](#)
- b. [Rock Types](#)
- c. [Interpretation Principles](#)

### d. 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).

### Forces and Faults

EarthComm Activities | Interactive Resources | Education Standards | My Stuff for this Concept | Shared Stuff for this Concept

Activity 5 +

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

[http://ccs.dls.ucar.edu/dps/protected/iat/bedrock\\_geology/chap01/ec\\_u2...](http://ccs.dls.ucar.edu/dps/protected/iat/bedrock_geology/chap01/ec_u2...)

Page: U 39  
Number of periods: 2

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- [Embedded Assessments \(5\)](#)

EarthComm	Concept	Investigation Assessments	Activity Assessments
Bedrock Geology	1	X	X
Activity 1	1	X	X
Activity 2	1	X	X
Activity 3	1	X	X
Activity 4	1	X	X
Activity 5	1	X	X
Activity 6	1	X	X
Activity 7	1	X	X
Activity 8	1	X	X
Activity 9	1	X	X
Activity 10	1	X	X
Activity 11	1	X	X
Activity 12	1	X	X
Activity 13	1	X	X
Activity 14	1	X	X
Activity 15	1	X	X
Activity 16	1	X	X
Activity 17	1	X	X
Activity 18	1	X	X
Activity 19	1	X	X
Activity 20	1	X	X
Activity 21	1	X	X
Activity 22	1	X	X
Activity 23	1	X	X
Activity 24	1	X	X
Activity 25	1	X	X
Activity 26	1	X	X
Activity 27	1	X	X
Activity 28	1	X	X
Activity 29	1	X	X
Activity 30	1	X	X
Activity 31	1	X	X
Activity 32	1	X	X
Activity 33	1	X	X
Activity 34	1	X	X
Activity 35	1	X	X
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Activity 38	1	X	X
Activity 39	1	X	X
Activity 40	1	X	X
Activity 41	1	X	X
Activity 42	1	X	X
Activity 43	1	X	X
Activity 44	1	X	X
Activity 45	1	X	X
Activity 46	1	X	X
Activity 47	1	X	X
Activity 48	1	X	X
Activity 49	1	X	X
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Activity 87	1	X	X
Activity 88	1	X	X
Activity 89	1	X	X
Activity 90	1	X	X
Activity 91	1	X	X
Activity 92	1	X	X
Activity 93	1	X	X
Activity 94	1	X	X
Activity 95	1	X	X
Activity 96	1	X	X
Activity 97	1	X	X
Activity 98	1	X	X
Activity 99	1	X	X
Activity 100	1	X	X

Denver Public Schools	
Grade 9 Earth Science Curriculum Matrix	
	FIRST SEMESTER
UNIT 1: Bedrock Geology	(EarthComm Unit 1, Chapter 1)
UNIT 2: Earth's Dynamic Geosphere	(EarthComm Unit 2, Chapters 1, 2, 3)
UNIT 3: Earth's Natural Resources	(Energy, Minerals, Water) (EarthComm Unit 3, section 1 activities)
UNIT 4: Astronomy	(EarthComm Unit 4, Chapter 1)
UNIT 5: Earth's Fluid Spheres	(Oceans, Weather) (EarthComm Unit 5, Chapters 1, 2)
UNIT 6: Climate Change	(EarthComm Unit 6, Chapter 2)
UNIFYING CONCEPTS	Abilities to do Scientific Inquiry
	Understandings about the Nature of Science
	Earth and Solar Systems
	EarthComm: Earth System Science in the Community
	Developed by the American Geological Institute, National and Science Foundation

# Publisher Materials

## Unit 1: Understanding Your Environment

Lynne Davis (lynne) | [Logout](#) | [My](#)

### 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.

[Units of Study](#) » [Unit 1: Understanding Your Environment: Bedrock Geology](#) » [Forces and Faults](#)

### Key Concepts

a. [Geologic Maps](#)

b. [Rock Types](#)

c. [Interpretation Principles](#)

**d. [Forces and Faults](#)**

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e. [Land Use & Geology](#)

### Forces and Faults

EarthComm  
Activities

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Education  
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this Concept

Shared Stuff for  
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### Bedrock Geology: Activity 5: Structural Geology and Your Community

[http://ccs.dls.ucar.edu/dps/protected/iat/bedrock\\_geology/c/01/ec\\_u2...](http://ccs.dls.ucar.edu/dps/protected/iat/bedrock_geology/c/01/ec_u2...)

Classroom activity

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+ 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 \(5\)](#)

- Student textbook
- Embedded assessments
- Teaching tips
- Instructional support materials
- Student conceptions

Opens full text

## Activity 5 Structural Geology



Goals

Think about It

# Instruction and Support Differentiation

**Earth's Dynamic Geosphere** Holly Devaul (holly) | [Sign off](#) | [My profile](#) | [Manage people](#) | [Reports & admin](#) | [DPS Units of Study](#)

## Plate Tectonics

Plate Tectonics is the result of matter and energy flow in the Earth which causes specific topography.

[Volcanoes](#) [Plate Tectonics](#) [Earthquakes](#)

[DPS Units of Study](#) » [Earth's Dynamic Geosphere: Plate Tectonics](#) » [Plate Boundaries](#) ► [View All Stuff](#)

### Key Concepts

- a. [GPS Technology](#)
- b. [Modern Theory](#)
- c. [Plate Boundaries](#)**
  - There are three main types of plate boundaries, divergent, convergent and transform. Convergent is further classified as ocean-ocean, ocean-continent and continent-continent.
- d. [Earth's Layers](#)
- e. [Plate Motion](#)
- f. [Interactions of Plates](#)

### Plate Boundaries

[EarthComm Activities](#) [Interactive Resources](#) [Education Standards](#) [My Stuff for this Concept](#) [Shared Stuff for this Concept](#)

[Top Picks \(5\)](#) [Images / Visuals](#) [Animations](#) [Inquiry With Data](#)

#### Tectonic Plates and Plate Boundaries

<http://www.teachersdomain.org/resource/ess05.sci.ess.earthsys.boundari...> [Save](#)

Computer activity  
Map  
Rating: ★ ★ ★ ★ ★  
Saved by 6 users  
Tags: At grade 9 (2)  
5-15 min. (2)  
ELA (1)  
[» more](#)

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: DLESE Community Collection (DCC)

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

# Algebra Tasks

**Algebra 1**  
**Proportional Reasoning**

DPS Algebra 1 Units of Study » Algebra 1: Proportional Reasoning » 2.1 Proportions

**Key Concepts**

**2.1 Proportions**

- Rename fractions as decimal numbers.
- Write ratios and proportions that express relationships in data.
- Solve proportions by multiplying to undo division and by inverting both ratios.
- Solve problems using proportions.
- Review skills in working with percents.

**2.2 Capture-Recapture**

**2.3 Proportions and Measurement Systems**

**2.4 Direct Variation**

**2.5 Inverse Variation**

**2.1 Proportions**

DPS Algebra 1 Curriculum | Tasks and Resources | Education Standards | My Stuff for this Concept | Shared Stuff for this Concept

**Tasks(2)** | Resources

**Leaky Faucet**  
[http://ccs.dls.ucar.edu/home/protected/algebra/ch2/leaky\\_faucet\\_combined...](http://ccs.dls.ucar.edu/home/protected/algebra/ch2/leaky_faucet_combined...) Save

Please rate: ☆☆☆☆  
Saved by 2 users

If a faucet drips every 2 seconds, how many drips in a week, and how much wasted water in a year? Students use proportional reasoning to solve.  
See also: <http://map.mathshell.org/materials/tasks.php?taskid=267>  
From: Mathematics Assessment Project

► **Task Ratings**

► **Education Standards**

**Yogurt**  
[http://ccs.dls.ucar.edu/home/protected/algebra/ch2/yoqurt\\_combined.pdf](http://ccs.dls.ucar.edu/home/protected/algebra/ch2/yoqurt_combined.pdf) Save

Please rate: ☆☆☆☆  
Saved by 1 user

Students use proportional reasoning to calculate profit and weekly factory output for half-cup yogurt containers.  
See also: <http://map.mathshell.org/materials/tasks.php?taskid=272>  
From: Mathematics Assessment Project

▼ **Task Ratings**

Cognitive Demand	Task Language	Options for Expressing Understanding	Technology
Procedures with connections	Low	Implicit, limited	Not Present

See task rating rubric

▼ **Education Standards**

**CCSS > Math > Grades 0 - 12**  
Standards for Mathematical Practice  
Attend to precision. (MP.6)

**CCSS > Math > Grades 9 - 12**  
Reason quantitatively and use units to solve problems.  
Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (N.Q.1)

**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

**d. Volcano Formation/Lava**

EarthComm Activities | Interactive Resources | Education Standards | **My Stuff for this Concept** | Shared Stuff for this Concept

Activity 2 | Activity 3

**Volcanoes: Activity 2: Volcanic Landforms** Page: G 14  
Number of periods: 2

[http://ccs.dls.ucar.edu/home/protected/iat/earth\\_dynamic\\_geosphere/cha...](http://ccs.dls.ucar.edu/home/protected/iat/earth_dynamic_geosphere/cha...)

Classroom activity Students construct a topographic map from a model of a volcano. Through this activity they understand the meanings of contour line, contour interval and relief and use this knowledge to interpret topographic maps in the context of volcanic landforms and lava flow. The relationship between magma composition and type of volcano is presented, including image of general types.



Keywords from Denver Public Schools: shield, composite, cinder cone, caldera, contour line

Keywords from IAT EarthComm Version 3: contour lines, contour interval, topographic map, relief, igneous rock, silica, shield volcano, composite cone (stratovolcano), caldera

DPS guideline: Focus on Digging Deeper  
From: IAT Activities

▼ **My Stuff for this Activity**

All resources  Search **Create Playlist | Upload File | Add Link**

Resources 1 - 2 out of 2

**Lava Flow Types** Edit Delete

[http://www.geology.sdsu.edu/how\\_volcanoes\\_work/Lavaflows.html](http://www.geology.sdsu.edu/how_volcanoes_work/Lavaflows.html)

DL Resource Reference, Photograph This site describes lava flows in terms of the composition of the lava. It discusses compositional types such as basaltic and andesite, and briefly covers effusion rates. The effusion rates (volume of magma generated over a given amount of time)

## “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

3 hours ago

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

3 hours ago

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

3 hours ago

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.boundari...>

Save

Computer activity

Map

Rating:



Saved by 6 users

Tags:

At grade 9 (2)

5-15 min. (2)

ELA (1)

» [more](#)

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: DLESE Community Collection (DCC)

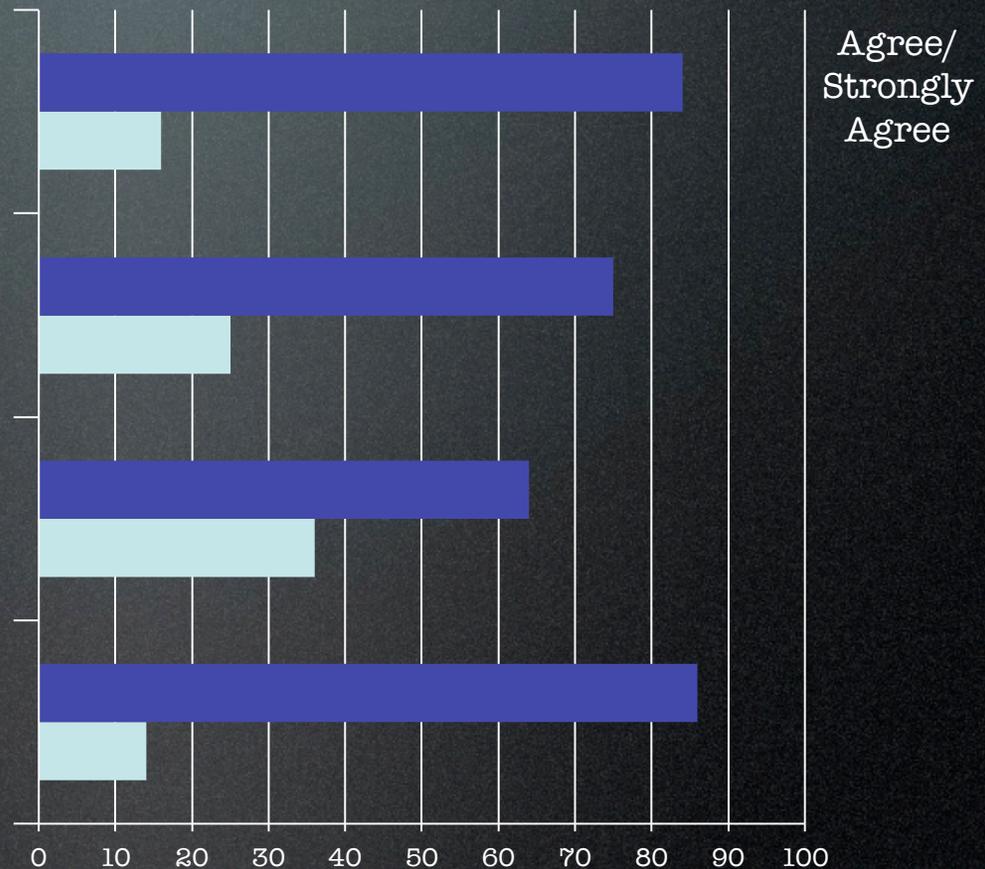
Outcomes: Field Trial in  
Denver Public Schools  
124 middle and high school Earth  
science teachers

# 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

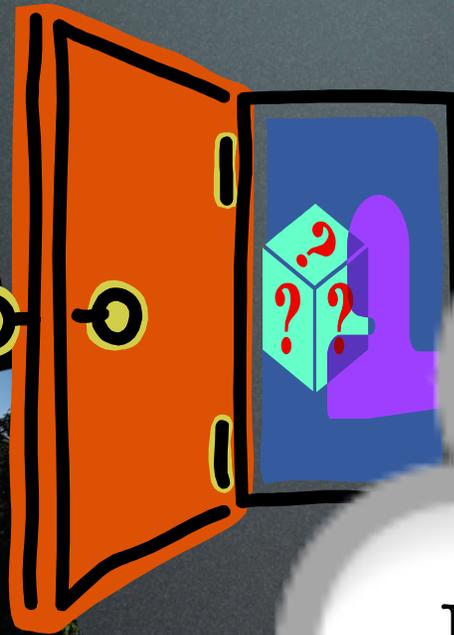
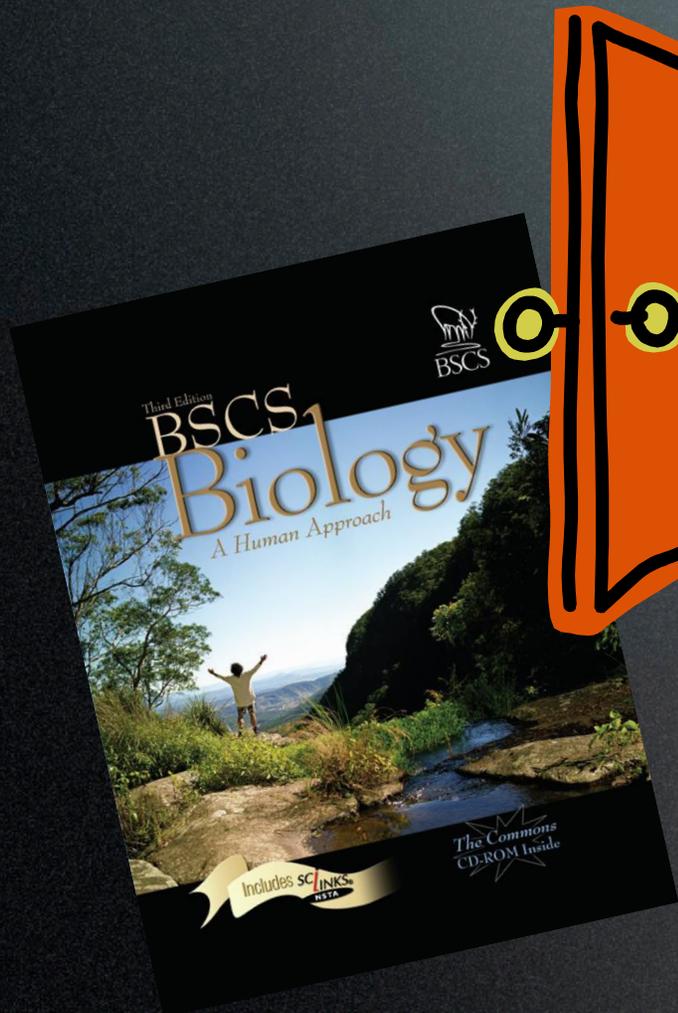
- Four categories of users
  - Power User
  - Feature Explorer
  - Specialist
  - Lukewarm
- Student assessment learning gains (pre/post)
  - Power users (ES=.44)
  - Feature explorer (ES=.29)
  - Specialist (ES=.14)
  - Compared to Lukewarm users, students of Power Users and Feature Explorers had statistically 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

[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](#)
- [Why Should We Care About Trees?](#)



## Why Should We Care About Trees?

How Does Changing the Number of Trees Affect an Ecosystem? Why Should We Care About Trees?

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

### Unit Overview

#### Key Concepts

##### Our Challenge

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.

- [Our Challenge](#)

##### Urban Heat Islands

Cities create heat islands; canopy cover lowers surface temperature.

- [Analyzing Urban Heat Islands](#)

##### How Trees Cool the Air

Trees cool the air through evapotranspiration and through the influence of land cover on albedo.

- [Investigating How Trees Cool the Air](#)

##### Modelling How Trees Benefit People

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.

- [Building and Using a Model of How Trees Benefit People](#)

##### Increasing Biodiversity

Biodiversity is the variability among living organisms in an ecosystem and includes diversity within species, between species, and of ecosystems.

- [How Can Planting Trees Increase Biodiversity in a Community?](#)

##### Erosion, Runoff, and Turbidity

Trees influence erosion and run-off in an urban setting

- [Urban Trees: Erosion, Runoff, and Turbidity](#)

# 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? » Our Challenge [View All Stuff](#)

### Key Concepts

**Our Challenge**

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.

- [Urban Heat Islands](#)
- [How Trees Cool the Air](#)
- [Modelling How Trees Benefit People](#)
- [Increasing Biodiversity](#)
- [Erosion, Runoff, and Turbidity](#)

### Our Challenge

NGSS High School Biology | Interactive Resources | Education Standards | My Stuff for this Concept | Shared Stuff for this Concept

Lesson 1.1

**Our Challenge**  
<https://drive.google.com/open?id=1SeAYCNuyOOwSEbaufwF3jT1dU1aet9a5Dp53...>

Classroom activity

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

- ▶ [My Stuff for this Activity](#)
- ▶ [Shared Stuff for this Activity](#)
- ▶ [Instructional Support Materials \(5\)](#)

# Ecosystem Unit Lesson Plan Template

## Section 1 - Outline of Lesson

<b>Lesson Author</b> <i>What is your name, position, and organization?</i>	
---	--

<b>Essential Question of Unit</b>	
-----------------------------------	--

<b>Unit Phenomenon</b>	
------------------------	--

<b>Your Group's Driving Question</b> <i>See green boxes in <a href="#">Unit Storyline</a>.</i>	
---	--

<b>Lesson Title / Main Phenomena</b> <i>See your <a href="#">Question Storyline</a>. Phenomena are observable and foster enaacement with <a href="#">science</a></i>	
---	--

<b>NGSS Disciplinary Core Ideas addressed</b> <i>Review the <a href="#">NGSS DCIs</a>.</i>	
<b>NGSS Crosscutting Concepts addressed</b> <i>See <a href="#">NGSS Appendix on Cross-Cutting Concepts</a>.</i>	
<b>NGSS Practices addressed</b> <i>See <a href="#">NGSS Appendix on Practices</a>.</i>	
<b>Colorado Academic Standards addressed</b> <i>See <a href="#">CAS</a>.</i>	
<b>Common Core State Standards in Math and ELA addressed</b> <i>See <a href="#">CCSS</a>. If no obvious links, leave blank.</i>	
<b>Lesson Objectives</b> <i>List objectives for students for this lesson. See gold and blue boxes in your <a href="#">Question Storyline</a>.</i>	

<b>Opening Procedure</b> <i>How will you meaningfully begin the lesson?</i>	
<b>Body of Lesson Procedure</b> <i>Write detailed instructions for what you and students will do during the lesson. See <a href="#">example</a>. Note any possible <a href="#">talk moves</a> and differentiation strategies.</i>	
<b>Closing Procedure</b> <i>How are you going to conclude the lesson (e.g. review, discussion, update rules for the class "Model Board")?</i>	
<b>Assignment(s) / Homework</b> <i>Provide meaningful and engaging activities that reinforce or synthesize the day's or week's learning.</i>	
<b>Safety Concerns</b> <i>List all of the lab safety</i>	

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:

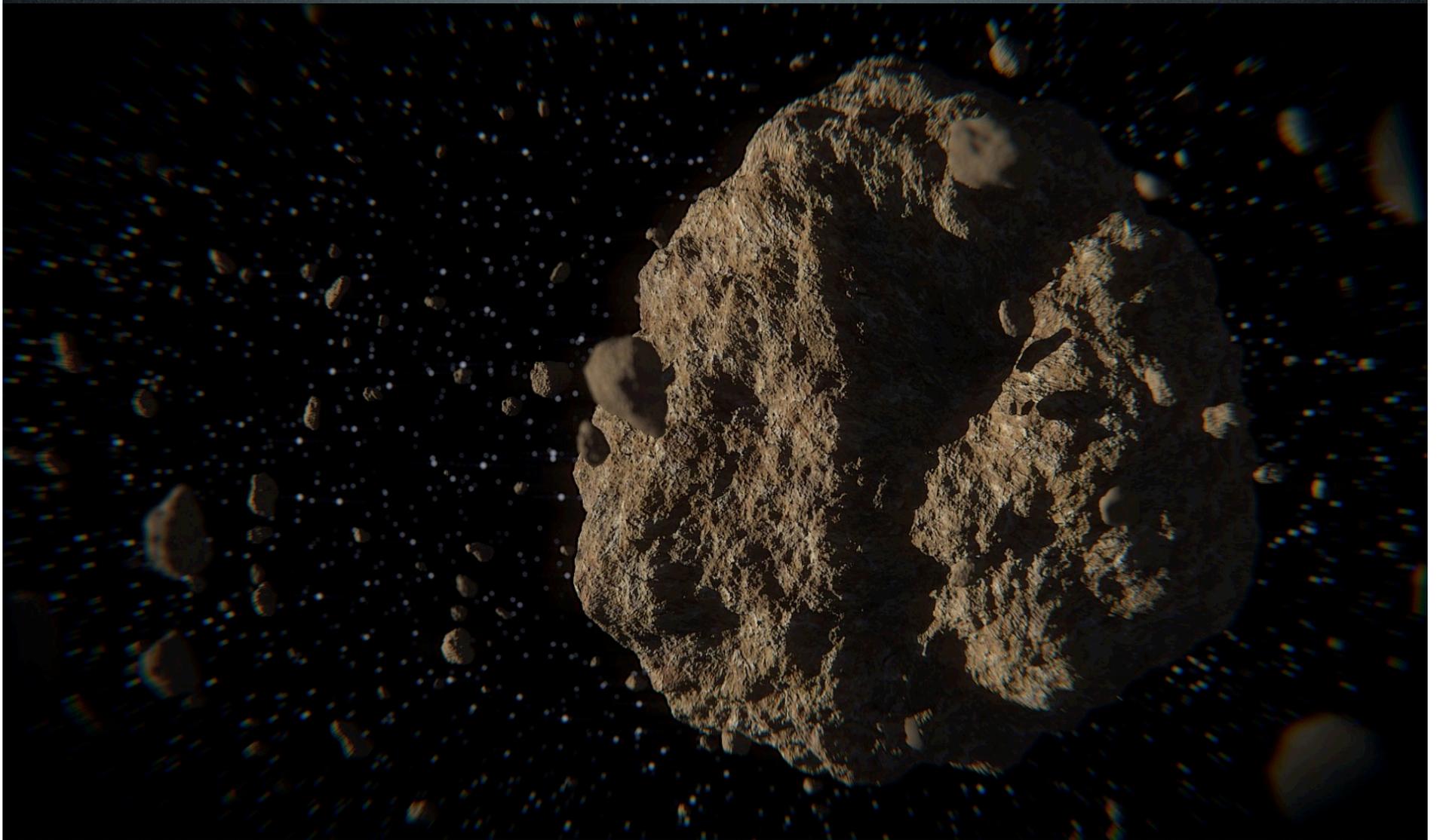
If link to instructional improvement is clear, many teachers are ready and willing to use new technology; need buy-in from all (district leaders and teachers)

# More Lessons Learned

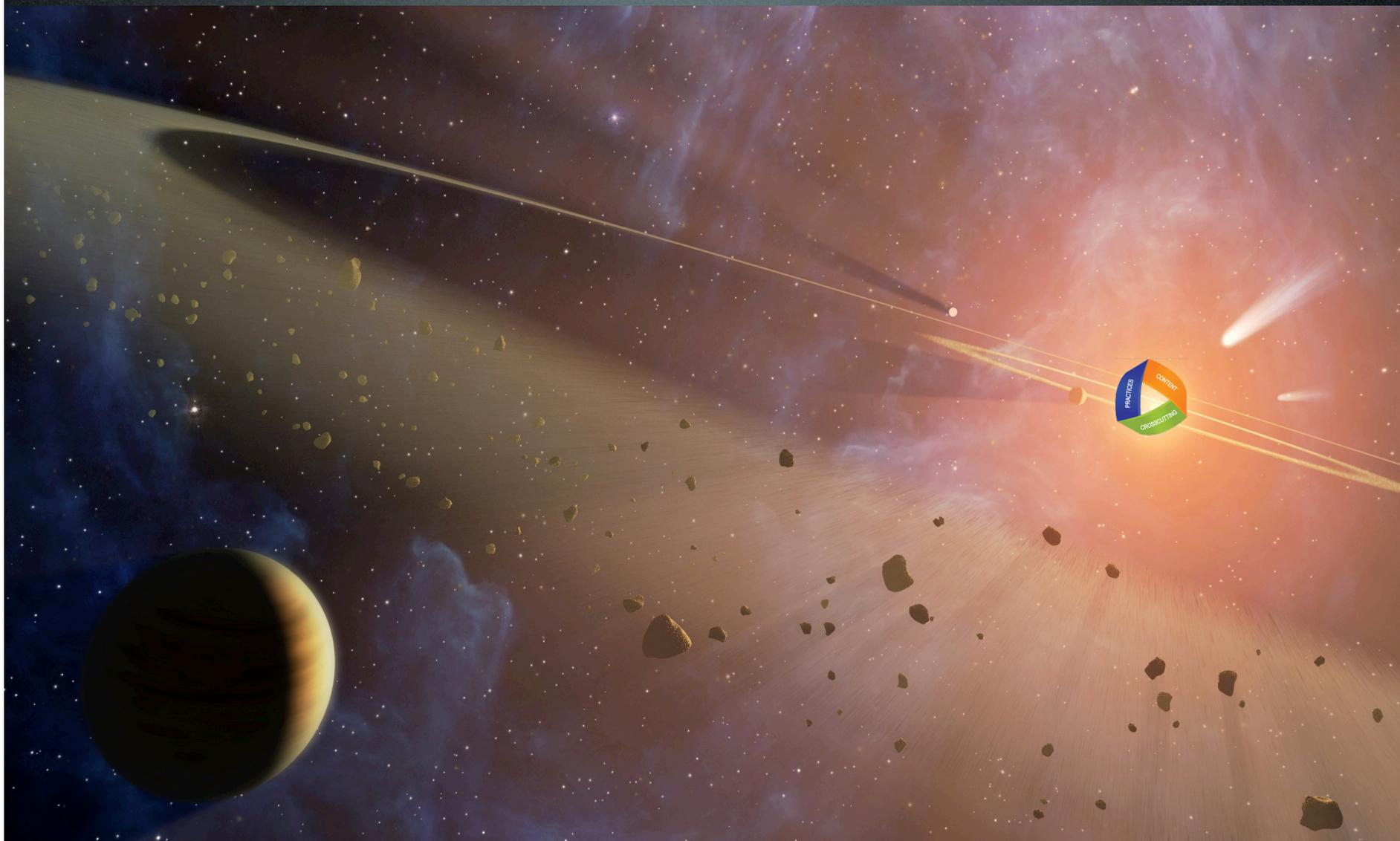
- Rethinking technology development processes
  - Learn to be agile
  - Minimum viable product is ok
  - Iterative testing, smaller releases of the tool features
  - Self-crafted development vs. using third party resources
- Technology is and will continue to be radically disruptive (+/- of state, local 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?



# Destination





## Opportunity/Constraint

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

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CCS Help: ccs-help@dls.ucar.edu

Miller, Jeffrey (2011) Customizing Curriculum With Digital Resources, The Science Teacher, Vol. 078, Issue 07, Pages: 5.

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