Strand Map Service

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Overview

- About Digital Learning Sciences
- Strategy using NSDL Infrastructure
- SMS – Current capabilities
- SMS – Future Use Cases

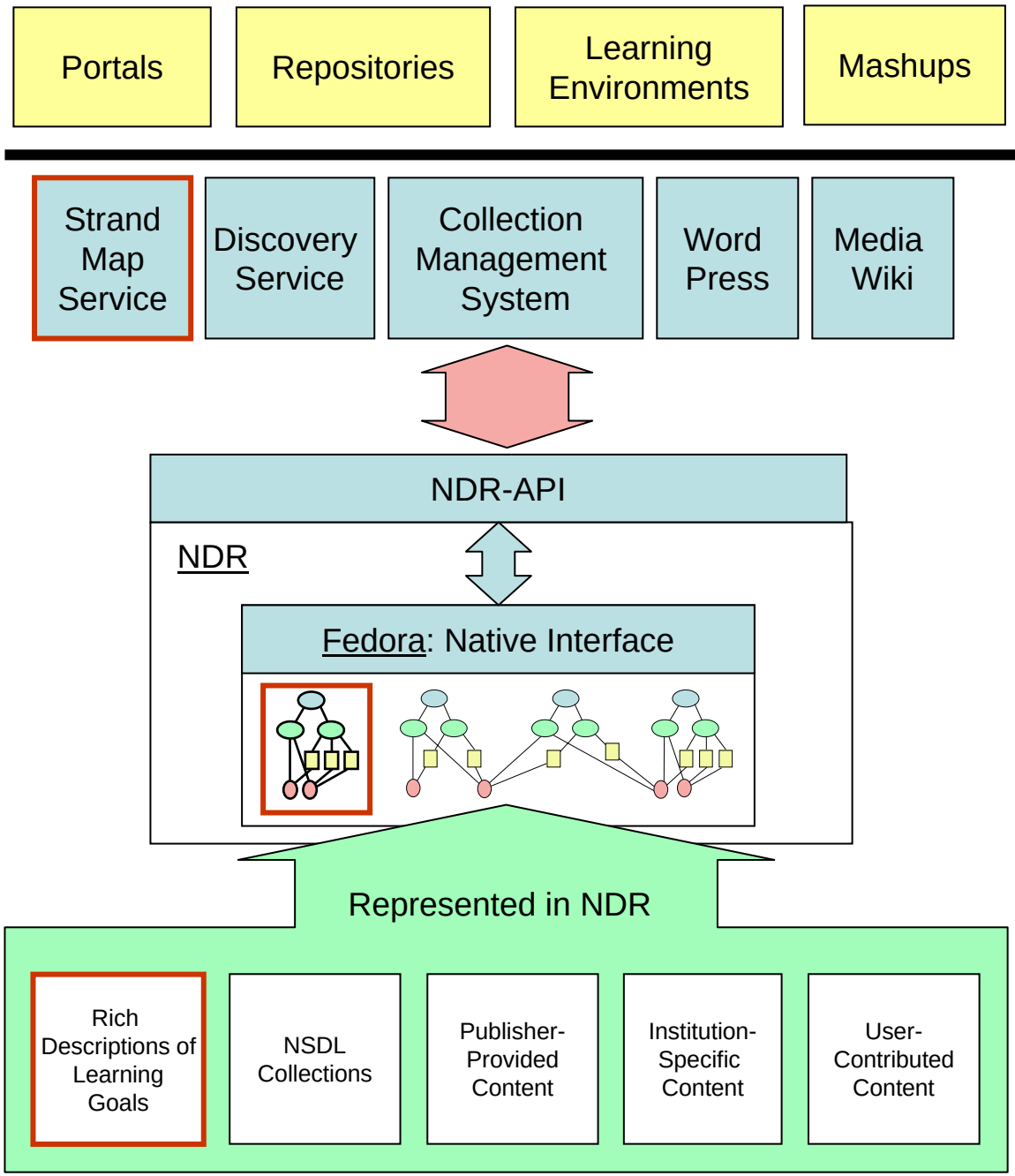
- Goals for today – your feedback, brainstorming ideas, new use cases

Digital Learning Sciences

www.DLSciences.org

- Successor to DLESE Program Center – Joint non-profit center between UCAR and Institute of Cognitive Science at University of Colorado
  - Digital Library for Earth System Education
  - Strand Map Service
- We develop systems and services that enable science and educational organizations – universities, libraries, publishers, and school districts – to organize, manage, comprehend, and enrich online resources to improve learning outcomes and learner engagement.
- Partnership Strategy: Disseminate and build on NSDL Infrastructure
  - Colorado Alliance of Research Libraries Consortial Digital Repository
  - Improving K-12 Science Instruction with the Strand Map Service

Institution-Specific Services & Interfaces

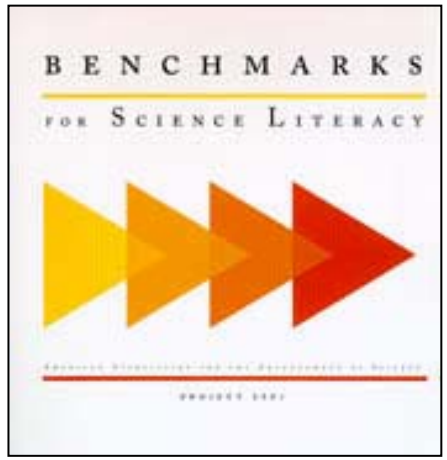


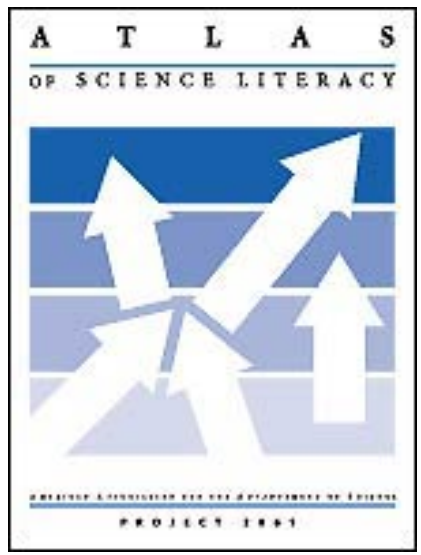
NSDL eLearning Platform

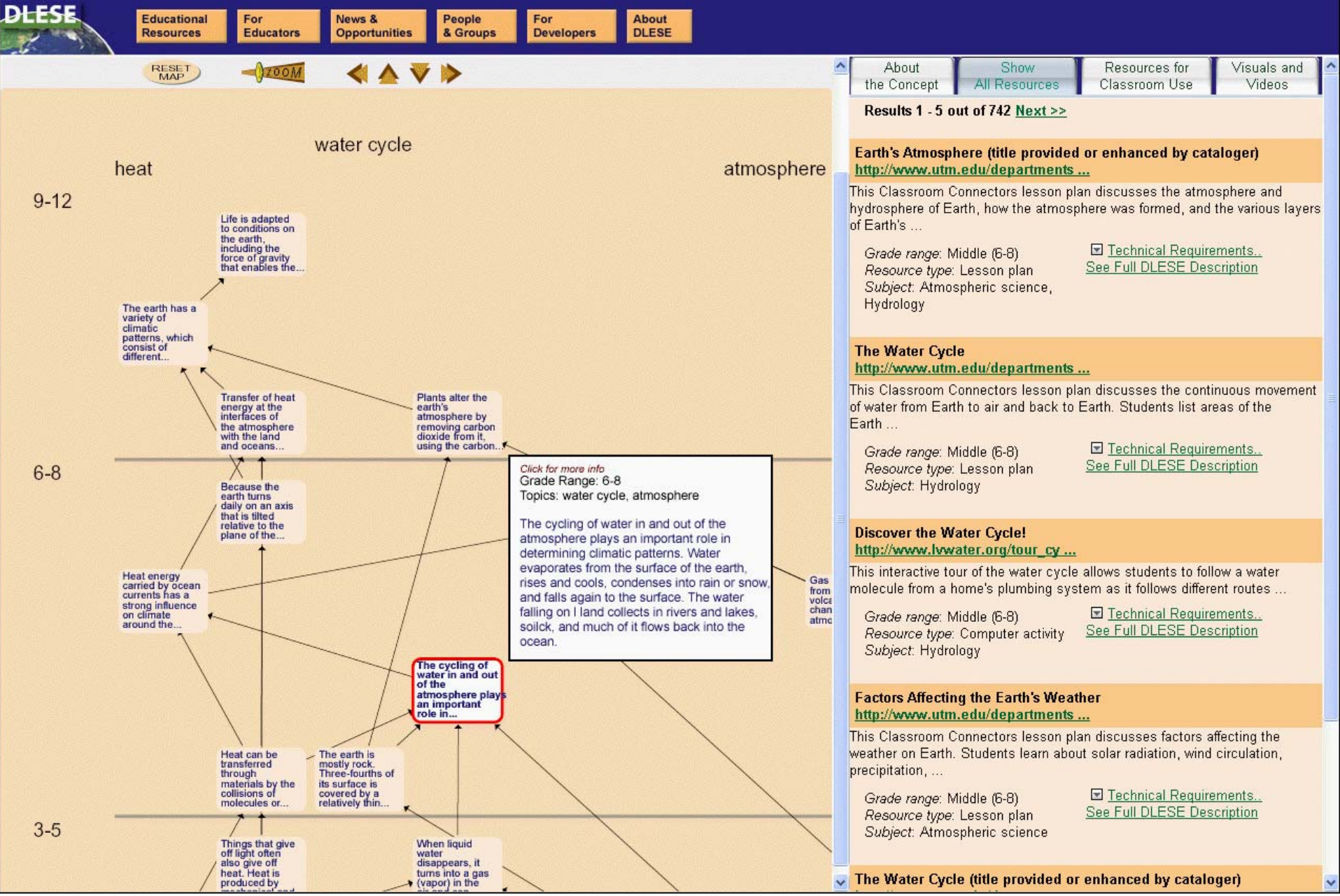
- Common Service Layer
  - Collection Tools
  - Web 2.0 Tools
  - Strand Map Service
  - Open APIs, highly customizable
- NDR + Fedora
  - Research-based, NSF-supported
  - Open Source
  - Growing Fedora community
  - Lightweight, common middleware for integrating content and services

Strand Map Service - Current

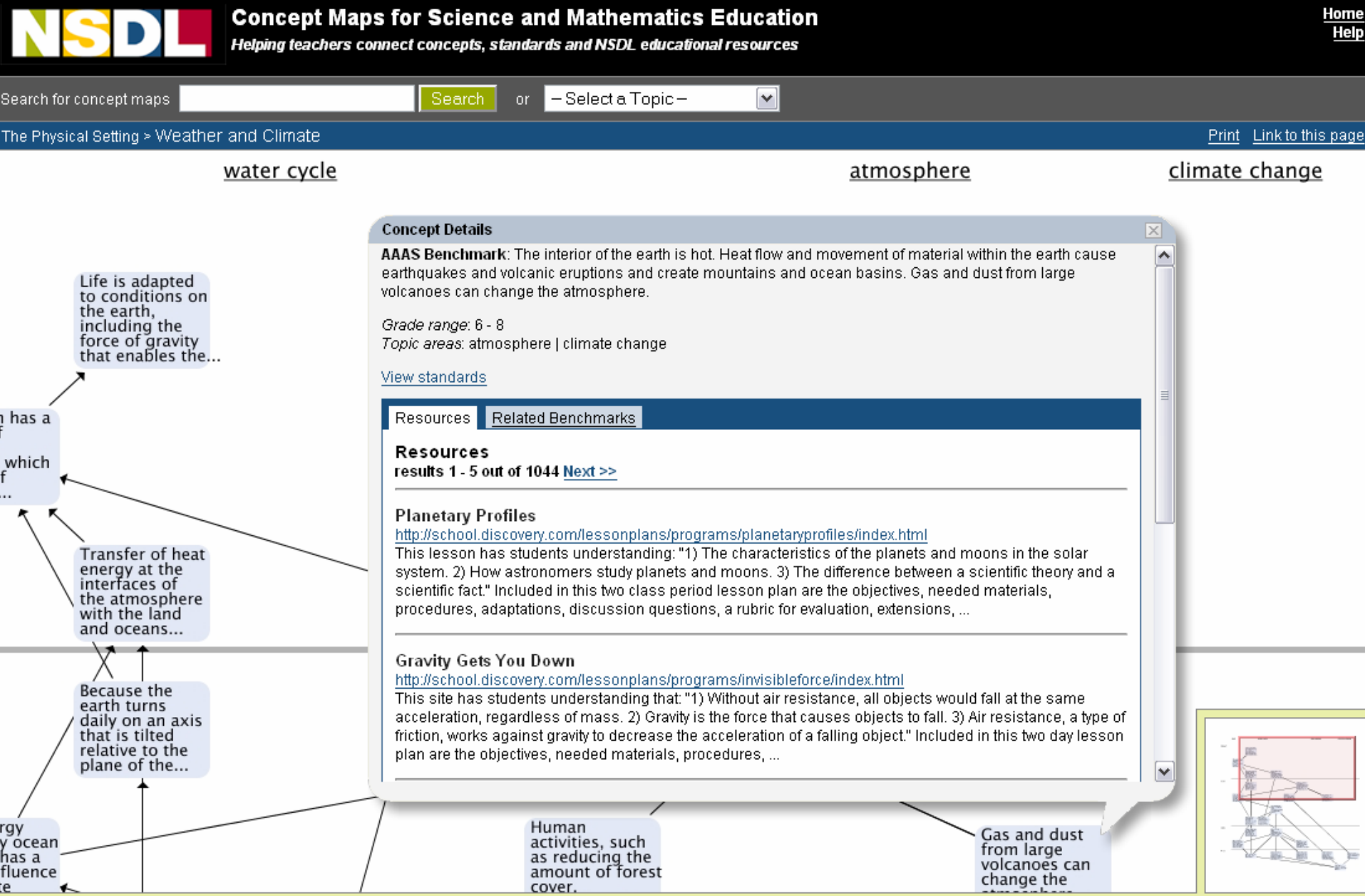
- Computational model of interconnected learning goals or concepts
  - Progressions and Maps: How ideas change over time
  - Pedagogically-rich descriptions: knowledge propositions, rationale, learning resources, standards, misconceptions, assessments
- Visualization algorithms based on Project 2061 graphical conventions
- Content based on AAAS internationally-recognized science learning goals
- XML and SVG Web service API for deployment through own portal and look-and-feel
- Query registry to customize searching over your collections







Strand Map Service in DLESE



Strand Map Service in NSDL.org

Strand Map Service – Future Addition

- JavaScript API
  - API version 1.0 available November 2007
  - Features will include:
    - Inserting and reusing AAAS benchmarks and strand maps in web pages and portals
    - Modify or add new tabs to bubble to insert custom content, forms, or services in the bubble related to the concepts
    - Examples: View state standards, View pathway-specific collections, Enable users to add resources or annotations associated with a specific concept

More information

- View interactive SMS concept maps in NSDL: http://strandmaps.nsdl.org/
- Current API documentation available at: http://www.dlese.org/dds/services/cms1-0/index.jsp
- Future JavaScript API documentation will be posted at: http://strandmaps.nsdl.org/ (Nov. 2007)
- Provide feedback at: http://strandmaps.nsdl.org/
- Additional Reading:
  - Butcher, K, S. Bhushan, and T. Sumner (2005). “Multimedia displays for conceptual search processes: Information seeking with strand maps.” ACM Multimedia Systems Journal (Special issue on Multimedia in Education and eLearning).
  - Sumner, T., F. Ahmad, et al. (2005). “Linking Learning Goals and Educational Resources through Interactive Concept Map Visualizations.” International Journal on Digital Libraries 5(1 (March), Special Issue on Information Visualization Interfaces for Retrieval and Analysis): 18-24.

SMS – Future Use Cases

- NDR/Fedora-enabled enhancements to improve extensibility and portability
- Goals for today – exploring use cases
  - Example use cases from Denver Public Schools
  - Break-outs: your feedback, brainstorming ideas, new use cases
- Rationale for impact on teaching and learning

From Libraries to Learning

- Measurable impact on learning outcomes and learner engagement through “improved science instruction”
  - Conceptual approach: Curriculum customization central to cycle of continuous instructional improvement
  - Technical approach: Enhanced Strand Map Service, NSDL eLearning Platform, NSDL collections

Example DPS Use Cases

- **District-level Use Case:** Denver Public Schools wants teachers to focus on conceptual learning goals while still supporting the CO standards. They also want teachers to incorporate formative assessments, interactive resources, and literacy strategies for LEP students into classroom instruction

- **Professional Develop Use Case:** A team of physics teachers are completing Professional Development Units by reviewing student work to identify common misconceptions and selecting hands-on, interactive NSDL resources that could help to address these misconceptions. The misconception descriptions, student work illustrating the misconceptions, and the NSDL resources will be incorporated into the Curriculum Implementation Guide.

- **Teacher Customization Use Case:** An middle school Earth science teacher wants to customize the standard curriculum on “Climate and Weather” to support students with advanced math skills and students with little math or science background. The concept being covered is the relationship between heat energy and the different components of the water cycle.

Excerpts from Investigating Earth Systems Curriculum Implementation Guide currently in use at DPS

Big Ideas in 6th Grade Earth Science — Implementation Guidelines

Key Concepts	Descriptions	Sub-Concepts
1. Rocks and landforms are part of the geosphere but are changed over time by interaction with the hydrosphere, atmosphere, and biosphere through constructive and	There are three types of rock: sedimentary, igneous, and metamorphic. Sedimentary rocks form from the lithification of various types of sediment. Igneous rocks form by the solidification of magma. Metamorphic are rocks that have been changed by heat or pressure while remaining solid. Rock bears evidence of the minerals, temperatures, and forces that created it.	a) The Earth's crust is made of rocks, which can be igneous, sedimentary, or metamorphic. (Benchmark 4.1.1) b) Different types of rocks occur in different regions. (Benchmark 4.1.1) c) Rocks form and break down by processes collectively known as the "rock cycle." (Benchmark 4.1.1)

Images courtesy of Denver Public Schools

UNIT 1: Rocks and Landforms		Sub-Concepts					Embedded Assessments
Big Idea #1: Rocks and landforms are part of the geosphere but are changed over time by interaction with the hydrosphere, atmosphere, and biosphere through constructive and destructive forces. **Activity**		1a	1b	1c	1d	1e	
Introduction	Introducing Rocks and Landforms						
Investigation 1	Different Types of Rocks	X					p6 #3
Investigation 2	Rocks and Landforms in Your Region		X				p14 #2
Investigation 3	Rocks and Weathering			X	X		p28 #1, #4, #6
Investigation 4	Rock Abrasion					X	p33 #1, #4
Investigation 5	Erosional Landforms					X	p44 #1, #5, #7

'Big Ideas' adapted from National Science Education Standards.National Research Council (1996)

Potential New Capabilities

- Support for maps and benchmarks in Volume 2
- Deliver to point of need: district or institution portal
- Customizable by school districts or institutions
  - Custom concepts or standards, such as state or district standards
  - Institutional-specific content and curriculum
- Customizable by individual teachers and learners
  - Personal concept sketchpad for storing, sharing, and retrieving notes, lesson plans, and other personalized content about concepts
- Interoperate with other NDR-enabled applications and services

Rationale for Impact

Hypothesis: Curriculum customization central to cycle of continuous instructional improvement

Prior Research	Implications
Effective instruction builds on, and targets, an individual's current knowledge and conceptions	Customize instruction to learners' prior knowledge, context, locale - Ensure fidelity to standards - Scalable approaches
Large differences in teachers' abilities to tailor classroom instruction to specific student needs	Support customization processes - Pedagogical content knowledge - Formative assessments - Professional development
Instructional reform strategies at district level can be effective, sustainable, and scalable	Partner with school districts - PD processes and incentives - Technical infrastructure and point-of-need delivery

Break-out Sessions

- Short demo if desired, discussion and questions
- Using the AJAX API and combining it with a search service
- Making your collections more accessible
- Brainstorm new use cases
- Identify necessary capabilities