

NSDL

THE NATIONAL SCIENCE DIGITAL LIBRARY

Reverse Site Visit – National Science Foundation – April 2009




Glimpses of a Changed Environment

*From the 2008 Project Tomorrow *Speak Up* stakeholder survey:

Students, Schools and Learning —

"It is widely accepted by students that arrival at school means 'powering down' for a few hours. After leaving school, they resume their technology-infused lives and leverage a wide range of emerging technologies to fine tune their skills in communicating, collaborating, creating and contributing."

"Technology has enabled students to be not only über-communicators, but also to develop strong teamwork skills and to view the process of content development as a key part of the new learning process."

*Since 2003, more than 1.5 million K-12 students, teachers and parents from more than 14,000 schools in all 50 states have participated in the Speak Up survey

Glimpses of a Changed Environment

From the 2008 Project Tomorrow *Speak Up* stakeholder survey:

Student Suggestions for the Ultimate Digital Textbook:

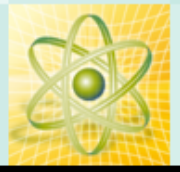
- ability to personalize their book with Electronic highlights and notes (63%)
- quizzes and tests for self-evaluation (62%) or self paced tutorials (46%)
- access to real-time data such as NASA, Google Earth (52%)
- links to power points or class lectures that support textbook content (55%)
- games (57%) or animations and simulations (55%)
- links to videoconferences (30%) or podcasts from subject experts (34%)

Glimpses of a Changed Environment

From the 2008 Project Tomorrow *Speak Up* stakeholder survey:

Free Agent Learner:

- self-directed learning
- untethered to traditional education
- expert at personal data aggregation
- knows the power of connections
- creates new communities
- not tethered to physical networks
- values experiential learning - make it real and relevant
- content developer
- process as important as knowledge



NSDL

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The NSDL Resource Center

NSDL Resource Center

Mission:

To support the NSDL community by coordinating resources, tools, information, and relationships that can enhance the quality, utility, and educational impact of NSDL projects, and ensure the long-term relevance and sustainability of the NSDL enterprise.

Resource Center Team

PIs

Kaye Howe *Director* 0.8 FTE	**Susan Van Gundy** *Deputy Director* 1.0 FTE	**Mary Marlino** *Evaluation Director* 0. 08 FTE
Donna Cummings *Office Manager* 1.0 FTE	**Eileen McIlvain** *Communications Manager* 1.0 FTE	**Digital Learning Sciences** *Evaluation Support* 0.60 FTE
Mike Luby *Scholarly Publishing Consultant*	**Robert Payo** *Outreach Manager* *1.0 FTE*	**Project Tomorrow** *Educational Technology Consultants* www.tomorrow.org

Shared Strategies with TNS

- Maintain and operate the technical infrastructure
- Mobilize the community
- Improve the NSDL.org user experience
- Support educational exemplars
- Extend strategic partnerships
- Evaluation and Analysis

Strategy: **Mobilize the Community**

"Effective ways to support users of materials developed by others remains an open question, especially given the complexities of the educational system. In thinking about the future of NSDL and the ways in which the NSDL investments can contribute to future cyberlearning programs*, it is important to recognize that NSDL is not simply an information technology system; it has, for example, invested in developing a powerful human and organizational network to address challenges*…"

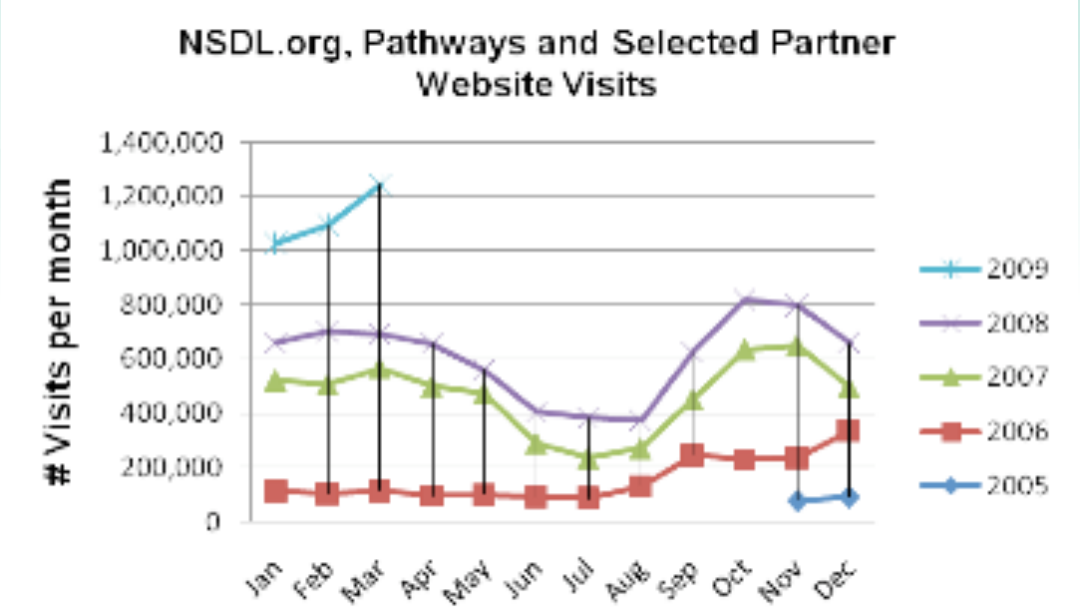
NSF Cyberlearning Report, 2008 p.45

Applied Math and Science Education Repository (AMSER) University of Wisconsin, Madison FY05, FY09	Community Colleges	Applied Mathematics & Science
BioSciEdNet (BEN) AAAS, plus >20 professional societies FY06	Undergraduate & High School	Biology
ChemEd DLib Journal of Chem Ed, ACS, ChemCollective FY07	High School & Above	Chemistry
ComPADRE AAPT, APS, AIP/SPS & AAS FY06	Undergraduate & High School	Physics & Astronomy
Computational Science Education Reference Desk (CSERD) Shodor Education Foundation FY05	Undergraduate & High School	Computational Science
Engineering Pathway UC Berkeley, University of Colorado FY06	Undergraduate & K-12	Engineering
ENSEMBLE Villanova, Virginia Tech FY09	Undergraduate & High School	Computing Sciences
Materials Digital Library Kent State University FY06	Undergraduate & Above	Materials Science
Math Gateway Mathematical Association of America FY05	Undergraduate	Mathematics
Middle School Portal Ohio State University (FY03), FY09	Middle Grades	Science, Mathematics, & Technology
Quantitative Social Sciences Digital Library University of Michigan FY09	Undergraduate & High School	Demographics and Statistics
Science and Math Informal Learning Educators (SMILE) Lawrence Hall, Exploratorium, NYHS, ASTC FY08	Informal Education	Science and Math
Teachers' Domain WGBH Public Television FY05, FY09	K-12	Life, Earth, Space, & Physical Sciences

Community Working Groups

- Represent RC, TNS, Pathways, and other projects
- 2008 Metadata Working Group created new guidelines and vocabularies
- Newly launched Metrics Working Group is examining:
  - *What are common usage and success metrics that can be tracked across projects' websites and educational activities?*
  - *What metrics tracking tools and processes can be implemented to improve efficiency?*
  - *How to identify best practices and sustain dialogue as practices evolve?*
- Launching a Collections Task Force
  - *To further develop criteria for inclusion in the NSDL Collection and recommendations for educational contextualization*

Strategy: **Improve the User Experience**



NSDL.org
ComPADRE
SERC
DLESE
CSERD
Teachers' Domain
MSP

Visits for March 2009:
1,244,646

Visits for 12 months ending March 30, 2009:
8,664,923

Other Web Stats for NSDL.org

- Overall Internet traffic ranking (as calculated by Alexa.com) is consistently higher than NSTA.org, AAAS.org, science.gov
- 80,000 downloads from *NSDL on iTunes U*
- Beginning to track # of bookmarks to NSDL, use of NSDL's Google gadget, Twitter followers, and other Web 2.0 activity

Strategy:
Support Educational Exemplars

"It is imperative that NSF establish a coherent approach to cyberlearning to enable the transformational promise of technology for improving educational opportunity."

NSF Cyberlearning Report, 2008 p.13

Science Literacy Maps

- Emerged from an NSDL Services Grant (Univ. of CO, UCAR, AAAS, UCSB)
- Integrated as browse interface at NSDL.org
- Maps now one of most popular sections of NSDL.org
- Core of NSDL strategy for standards alignment
- Basis for partnership with Georgia University System, Public Libraries, and Georgia State Dept. of Ed to provide customization of maps that include state standards
- Discussions with state of Massachusetts are in progress.
- Basis for partnership with NOAA, CIRES, others to use as base map for resources aligned to new Climate Literacy Frameworks

Classic Articles in Context / Timely Teaching

- Model for new relationship with scholarly publishers
- Increasing value of NSDL resources for Higher Ed audiences through additional contextualization
- Partnering with Pathways, publishers, others
- Creating packages of resources and essays centered on keystone articles and other works within a discipline (Classic Articles in Context)
- Creating ready-to-use modules and teaching tips centered on current events and articles in popular media (Timely Teaching)

Beyond Penguins and Polar Bears

- Funded through NSF- IPY
- Leverages partnership between RC/TNS and Middle School Pathway, and external organizations
- Model for contextualization of NSDL resources that connects research to classroom
- Online magazine for K-6 educators focused on polar science and early childhood literacy
- Built with NSDL tools (OnRamp, Expert Voices, NSDL Collection System)
- Testing new models for content creation, dissemination, and user engagement via Web 2.0, including original podcast series at *NSDL on iTunes U*

Strategy: **Extend Strategic Partnerships**

"We recommend that NSF develop a program that will advance seamless cyberlearning across formal and informal settings by galvanizing public-private partnerships and creating a new interdisciplinary program focused on establishing seamless cyberlearning infrastructure and supports."

NSF Cyberlearning Report, 2008 p.36

Leveraging Trusted Networks

GALILEO
An Initiative of the University System of Georgia

NSTA WEB SEMINARS

Project Tomorrow
www.tomorrow.org
Speak Up

American Museum of Natural History

ELSEVIER

npg
nature publishing group

McGraw Hill Macmillan/McGraw-Hill
Building Brighter Futures

APS physics

Project 2061
AAAS

SREB

Member States

Alabama	Mississippi
Arkansas	North Carolina
Delaware	Oklahoma
Florida	South Carolina
Georgia	Tennessee
Kentucky	Texas
Louisiana	Virginia
Maryland	West Virginia

Leveraging the NSDL Network

- Pathways and their immediate partners represent:
  - 25 universities
  - 39 professional societies
  - 6 science centers
  - 3 educational foundations
  - 27 educational organizations
  - 8 research organizations
  - 1 public television station
- Pathways collaborate, advise, and share tools and technologies with each other and other NSDL projects (inventory underway)
- Resource Center brokers partnerships and opportunities with external entities for the benefit of the whole NSDL community

Leveraging Across NSF Programs

Examples:

- NSDL in CCLI solicitation as recommended dissemination channel
- AMSER as ATE Resource Center
- CSERD as TerraGrid outreach
- ComPADRE cataloging CCLI materials
- SMILE connected to CAISE (ISE Resource Center)
- Collaborations with OLPA, NSF Research Center Educators Network (NRCEN)
- Awareness building with Einstein Fellows, CAREER, ITEST, HBCU, MSP, others

Leveraging Across NSF Programs

Benefits:

- Continuity of NSDL supports use as an educational research platform
- Return on investment in NSDL technical and social infrastructures
- Knowledge and expertise of NSDL staff and projects' community
- Domain PIs not always skilled at outreach planning
- Coordinated approaches toward broader impacts

Considerations:

- Scalability given current resources
- Processes and standards to be established
- Selection and review criteria to be established
- Resource maintenance and persistence

Strategy: **Evaluation and Analysis**

"Cyberlearning has tremendous potential right now because we have powerful new technologies, increased understanding of learning and instruction, and widespread demand for solutions to educational problems."

NSF Cyberlearning Report, 2008 p.5

Evaluation Challenges

Dual world of defining impact

Particular: Individual disciplines and audiences

General: Seeking commonalities to help focus priorities for assessing the overall impact of NSDL

Diverse use environments

- Use of NSDL largely unstructured
- Individual projects more likely to include testable educational interventions – but often small scale and idiosyncratic
- Learner vs. practitioner vs. developer, formal vs. informal
- Use of digital materials in classrooms is rapidly evolving
- Tension between authority-driven and self-directed use of digital materials

Coherency of evaluation across multiple scales

- NSDL as an NSF program
- NSDL as a community of projects
- NSDL as a technical platform
- NSDL as a digital learning environment
- NSDL.org as a website
- NSDL as a collection of resources
- RC and TNS as coordinating entities
- Individual NSDL projects, tools, services

Diverse projects with different degrees of readiness

- Varying audiences, goals, purposes, resource offerings, levels of staffing, levels of funding, stages of maturity, prospects for sustainability

Resource Center Evaluation Efforts

Focused on community mobilization, facilitation, and synthesis rather than conducting program-wide evaluation…

- Audit of Pathways' current and planned evaluation efforts
- Audit of collaborations among Pathways and other projects
- Metrics Working Group
- Roll-up report of RC outreach and dissemination data
- Project Tomorrow as partner for understanding user needs
- Facilitating community dialogue and resource sharing
- Emphasis for next annual meeting and potential future workshops

Examples of Projects Current' Evaluation Efforts

SMILE

- Understanding user needs

Middle School Portal 2

- Implementing a formal logic model; social networking analysis

Teacher's Domain

- Leveraging other funding sources to address impact on teachers and students

Curriculum Customization Service

- Evaluating impact of NSDL at the scale of a large urban school district (Denver Public Schools)

Analysis - Lessons Learned

- Start where users are, understand that, and stay responsive to changing needs and realities
- Be cognizant of where NSDL projects are, and build structures that support their forward movement
- Leverage trusted systems and capitalize upon trusted brands
- Leverage the NSDL community
- There are still significant technical and policy barriers to the use of technology in K-12

- K-12 teachers and university faculty need continuing support in the volatile world of digital resources and approaches to today's learners
- Neither an abundance of resources nor one gateway portal are the point – transformation depends on quality, contextualized resources, and feedback loops on use and effectiveness
- To have genuine impact, digital resources should be imbedded in educational work flow
- NSDL is well positioned as a link and broker between K-12 and higher education

Open Questions

- How to increase significant usage and adoption
- How to scale contextualization
- Ubiquity of web + realities of distributed and complex education system – how to achieve excellence
- Sustainability

  "Recommendation 5 – Take responsibility for sustaining NSF-sponsored cyberlearning innnovations" (p.7, NSF Cyberlearning Report, 2008)
- Connecting to the learning sciences research community

  "Both Cyberinfrastructure and the learning sciences are areas of high priority and significant investment for NSF, yet little attention has been paid to the productive intersection between them." (p. 13)
- Evaluating Impact

"Many of these challenges [facing NSDL] arise from juxtaposing the formal education system, which is shockingly resistant to change, with the Internet, which is shockingly able to undergo radical transformations on a moment's notice. Life at the interface of these differently-paced worlds can instill a professional version of manic depression. Ideas intended to radically improve education most often end up having incremental impacts."

David Yaron, 2008

ChemEd DL Co-PI

Associate Professor of Chemistry, Carnegie Mellon University



NSDL

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Technical Network Services




Role of Technical Network Services

From the Solicitation…

- Maintain and upgrade NSDL infrastructure and NSDL.org (with RC)
- Provide technical support for NSDL tools, services, and collections accessioning
- Support *Pathways, Integrated Services*, and other projects to contribute
- Facilitate discussions to identify priorities for new services
- Marshal “collective intelligence” of larger community
- Develop business model to sustain infrastructure after grant ends

PI Team

- Carl Lagoze (PI, Cornell): Digital library architectures, eScience repositories, interoperability protocols
- Michael Wright (UCAR): Led technical development and operations for DLESE and strategic initiatives for NCAR Library
- Tamara Sumner (U of Colorado): Educational technology, cognitive and learning science, user-centered design

First 6 Months Accomplishments

- Ramp up new TNS organization (contracts and people) – *still underway*
- Understand existing infrastructure and processes – Technical Audit, TNS All Hands Retreat (with RC), Collections Audit
- Initiate strategic planning with RC
- Initiate technical services to be provided

Big Picture for TNS

- New organization, new circumstances
- Now
  - Streamlining operations
  - Ramping up community services and collaborative development processes
- Next
  - Enhanced educational services driven by grantees, RC, exemplars

Strategies & Resource Alignments

Project management and administration	1.5 FTEs
1) Maintain and operate the technical infrastructure	**4.7 FTEs**
2) Mobilize the community	**3.5 FTEs**
3) Support educational exemplars	**2 FTEs**
4) Improve NSDL.org user experience	0.5 FTE
5) Evaluation	0.3 FTE
6) Extend strategic partnerships	As needed

1) Technical Infrastructure Operations

- What is the “data center” infrastructure?
  - HW/SW Stack underpinning NSDL.org and hosted community services
  - Technical components of collection accessioning, aggregation, and curation
- Objectives
  - Lower operating costs
  - Improve maintainability and scalability

Operations: Action items

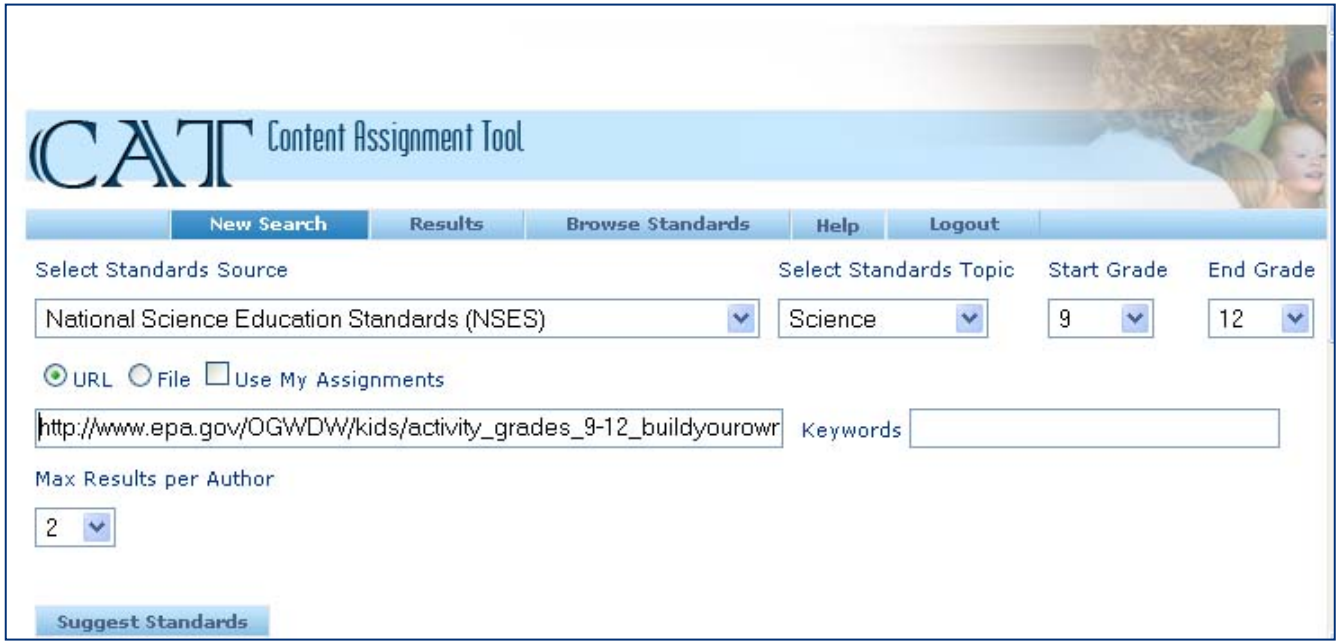
Simplification, streamlining, virtualization

- From 20+ servers down to 6 or 7
- Reduce supported software components
  - Shibboleth single sign-on to be phased out
- Refocus collections aggregated for NSDL.org
  - Current: 165 collections with 2.1 million items
  - Proposed: 96 collections with 100,000 items
- “Spin up the cloud” for hosting services
  - Instructional Architect, Strand Map Service, CAT
  - MSP2, SMILE

Operations: Action items continued

Rethink the current “handover” model for supporting community developed software

- Code
- License
- Training
- Updates
- Strategic Alignment

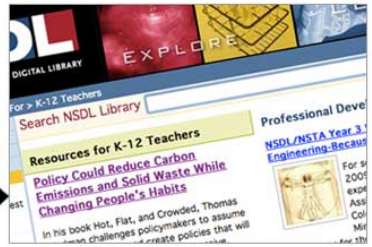


2) Mobilize the Community

- Who is the TNS community?
  - New NSDL Grantees; the Resource Center
  - Legacy Pathways and other NSDL projects
  - Other NSF grantees such as CCLI, ATE
  - Other: Fedora, larger ed tech community
- Objectives
  - Support cyberlearning platform vision
  - Build active developer and prosumer community

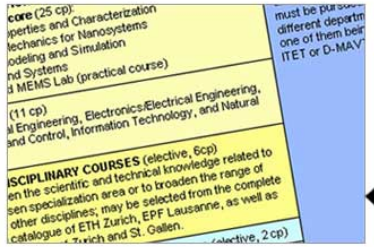
User services and applications

Example: NSDL.org



Example: Beyond Penguins & Polar Bears

Example: Curriculum Customization Service

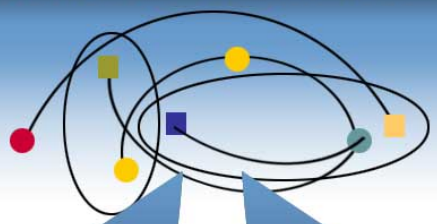


Browse | Discover | Manage | Create | Share | Blog

- Strand Maps
- NSDL Search
- Digital Discovery Service
- NSDL Collection System
- OnRamp Content Management and Distribution System
- NSDL Media Wiki
- Expert Voices Word Press Multi-user Blogging system

NDR API

Native Fedora Interface



TNS services:
- share a common service layer
- feature open APIs
- are highly customizable
- are scalable

Community content and collections

A platform comparison

Cyberlearning Report

- Centralized cloud
- Open APIs
- Gold-standard open source components
- Vibrant developer community
- Robust data mining services
- Well-defined standards for plugging data into apps

NSDL Platform

- Distributed
- Open APIs
- Gold-standard open source components
- Emerging developer community
- Data mining research beginning to take off
- Scientific data plug-n-play research in Pathways

Mobilizing: Action Items

- Training Program – Use cases and individual platform components
- Open Solution Community approach – Invest *all* TNS platform development resource in a collaborative, co-development model
- Partner with Fedora Commons – Leverage their community and open source knowledge and cache

Co-Development Example with SMILE

Widget
activates
boundingBox Tool

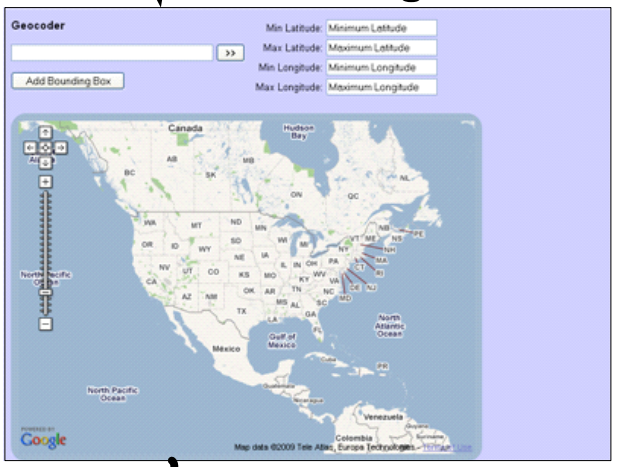
NCS Metadata Editor

coordinates remove
best practices

Bounding box tool

westCoord	-107.14
eastCoord	-104.86
northCoord	40.26
southCoord	39.03

BoundingBox Tool



Callback
inserts values from
BoundingBox tool
into metadata

Open Solution Community

- Roadmap Process – collaborative development of priorities and collective resource allocation
  - Nucleate around *core* capabilities
  - EduPak released with Fedora Commons
  - Series of mini-Technical Summits to engage NSDL developers
- Contributor Process – mechanisms for integrating community-developed software into codebase

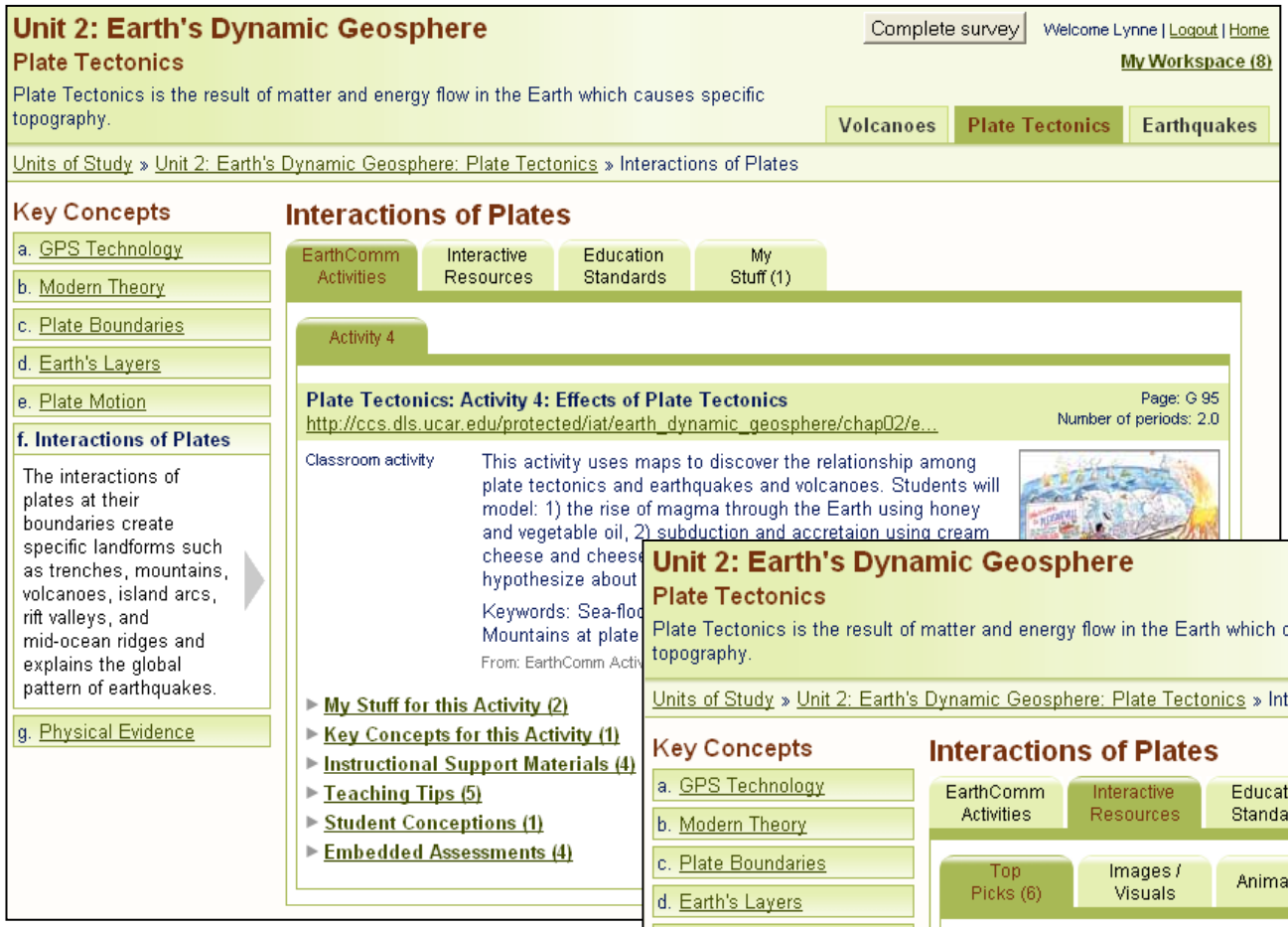
Emerging Roadmap Areas

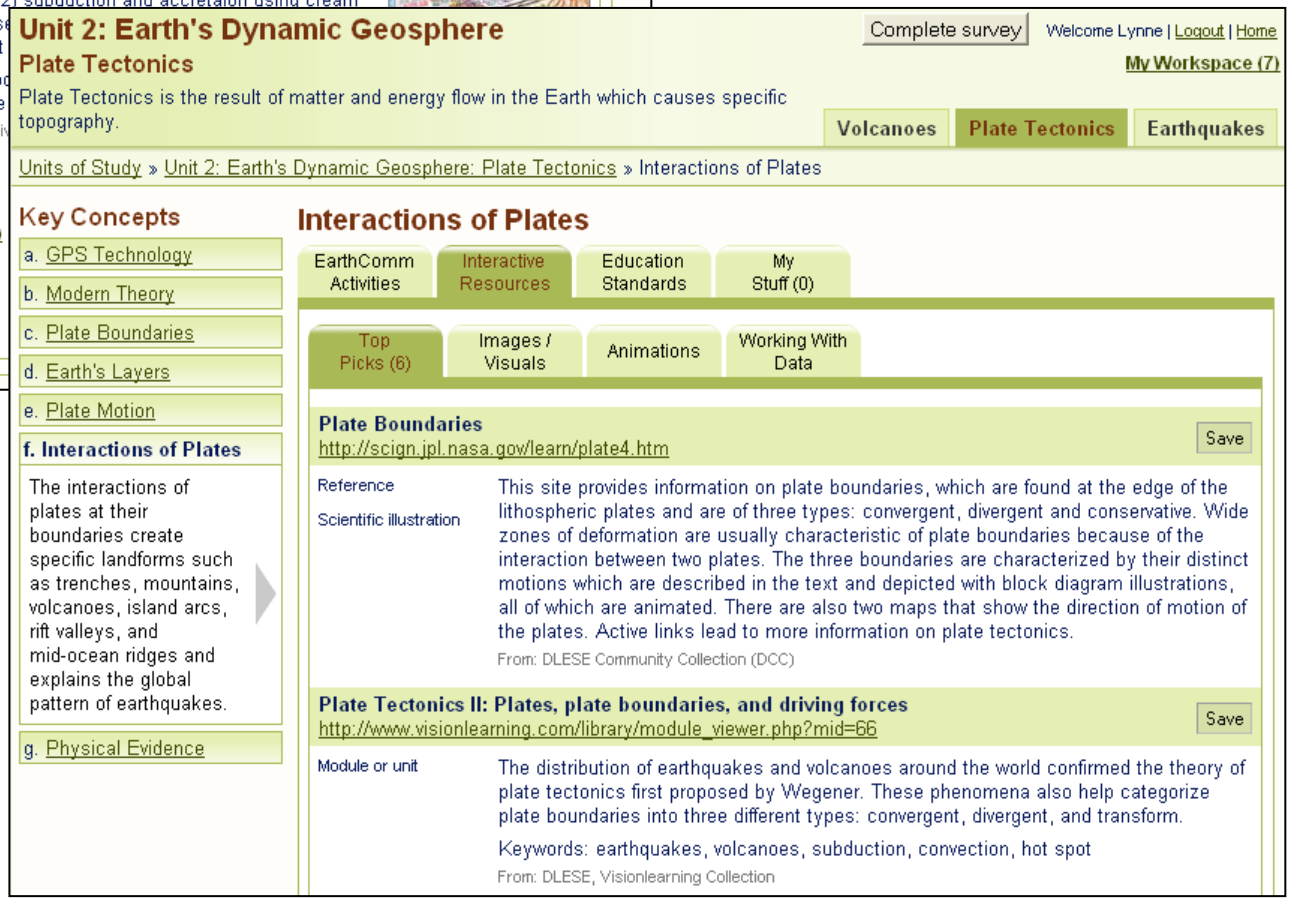
- Phase 1 priorities (2009): NCS hosting and customization; custom framework consulting; custom metadata in NDR; configuring search services; web feed ingest; automated collection monitoring and reporting

- Phase 2 topics (09/10): Extensions to Strand Map Service to support state standards, annotations, and custom maps; widgets/tools to enable faculty to create and share instructional activities; interoperability via OAI-ORE or SIF; state standards mappings and standards interoperability

3) Support Educational Exemplars

- Objectives
  - Use NSDL infrastructure and collections to create and evaluate a small number of exemplars
  - Support NSDL grantees, NSF grantees, and other community members in this endeavor
- Criteria for selecting exemplars
  - Potential for increasing usage and/or demonstrating impact





Curriculum Customization with Denver Public Schools

Created with EduPak

What will success look like for TNS?

- Contribute to shared NSDL goals
  - Technical advances and operations to increase usage and demonstrate impact
- TNS-specific goals
  - **NSDL infrastructure and collections used in new teaching and learning experiences**
  - Vibrant community of co-developers and contributors
  - Business model to sustain “data center” technical operations

Several Major Challenges

- Shifting from an R&D shop to a technical service provider organization
- Streamlining the organizational footprint for sustainability
- Rethinking the current “handover” model
- Balancing short-term community service efforts with long-term strategic goals