A very simple agenda

- **Introduction**
  - Why is it important that NSDL has a presence in pre-service science and math teacher education?

- **Cases compiled**

- **Your cases**

- **Discussion**
  - Can we synthesize effective models or principles for including NSDL in pre-service science and math teacher education?
  - What should NSDL do to more effectively be included in pre-service science and math teacher education?
Introduction

Mid-1990s: first entire state digital libraries

Phase 1: getting it started
(growth and initial success)

Phase 2: consolidation
(transition stage)

Phase 3: sustainability
(overarching strategic plan supported by budget, marketing, projects, business, operations)

Teachers have to become a strategic focus for the success of digital libraries … [digital libraries have] to help them change the way they teach.

The school faculty needs to know how to use the electronic resources aligned with state standards

Introduction

The *incunabula* of digital material in SOE libraries

Bull & Sites (2009): Curry School of Education library of the University of Virginia is the first known instance in which a school of education made a transition from physical to digital books. It is likely the harbinger of a significant evolution that will affect both schools and society.

Why digital libraries in pre-service science and math teacher education?

A new definition of effective teachers

U.S. Secretary of Education Arne Duncan (2009): “This new report reinforces that effective teachers need to incorporate digital content into everyday classes and consider open-source learning management systems, …”

Policy and demographic perspectives

NASBE symposium (December 2009): the need for improved access to OERs is perhaps more critical than ever in light of adequate yearly progress requirements and the growing diversity of the student population, as well as the movement toward voluntary, common state standards.

Providing math & science OER’s PD for school staff is a challenge

NASBE

Speak Up 2009 survey – Project Tomorrow
Recker et al. (2005): discoverability of resources by standards
Linn (2003), the kinds of technologies that have had an advantageous impact on instruction are those that support user customization.
Introduction

Globalization/diversity/fragmentation of the educational marketplace

Accountability & standards demands (evaluation of impact)

For profit vendors, changes in publishing
New partnerships
Sustainability
Technology & pedagogy PD

Connections/blurring between personal/professional use of technology
Mobile devices
Re-packaging of materials: smaller units

Rapid change in technology

Declining budgets (institutional & personal)

Demand driven by consumers (learners & teachers)

Main drivers of the 2015 Landscape – as identified by ¾ or all breakout groups
Introduction

Other conclusions from the PW meeting – August 2010, Boulder, CO

• There is a movement toward digitalization of the curriculum

• There is a need to articulate NSDL niche/value-added/unique value propositions by looking comprehensively at systemic educational landscape (pre-service teachers explicitly mentioned)

• Focus on early adopters of instructional digital content
The SAMR Model
Cynthia Curry, Steve Garton, Jeff Mao, and Ruben PuenteDura
Leading Teachers from Substitution to Redefinition
ISTE 2010 - Denver, CO

Redefinition
Tech allows for the creation of new tasks, previously inconceivable

Modification
Tech allows for significant task redesign

Augmentation
Tech acts as a direct tool substitute, with functional improvement

Substitution
Tech acts as a direct tool substitute, with no functional change
The three cases compiled from non-NSDL community members
Strand Maps – as a planning tool

Sometimes, scientists can control conditions in order to obtain evidence. When that is not possible for practical or ethical reasons, they try to observe as wide a range of natural occurrences as possible to be able to discern patterns. (Beveridge, 1996; National Research Council, 1998)

Oracle range: 9 - 12

Top Picks  
NSES Standards  
Related Benchmarks

Results 1 - 3 out of 3

On a Wing and a Prayer
http://www.chias.org/newexplorers/advice/home.html
America’s songbirds are disappearing. But why? This episode of the popular New Explorers documentary series traces the birds’ migration route from Central America, across the Gulf of Mexico, all the way to southern Illinois. By watching the video, you and your students can join a team of researchers and ornithologists on an investigative expedition to find out why these birds are returning...

What Darwin Never Saw
http://www.chias.org/newexplorers/advice/home.html
The great biologist Charles Darwin saw many things in his lifetime. During his travels to the Galapagos Islands, 600 miles off the coast of South America, he witnessed some of the most remarkable types of life found anywhere on earth! Darwin kept detailed journals highlighting the characteristics of species which he noticed. Later, after returning to England, he started a revolution in scientific...

Insist that the key assumptions and reasoning in any argument — whether one’s own or that of others — be made...
Case 1
Daniel Timothy (Tim) Gerber: **NSDL Use in “Broader Impacts”**
Assoc. Prof., Biology Dept.
University of Wisconsin – La Crosse

**Audience:** Pre-service teachers in science methods class
(initial certification for MS and HS science, 80% undergrads, 20% grads)

**Task:** Look for science lessons (in NSDL, NetLinks, and other sources) and identify the benchmarks they address within a large printout of the NSDL science literacy maps.
Dr. Gerber developed two websites:

1) Topic of interest on the standards docs

2) On the NSDL STEM literacy maps, look at:
   • the standards in relation to one another
   • the “misconceptions” section

3) Look for lessons already developed (Science NetLinks, NSDL, TULIP, others); use Science NetLinks template

4) If they can’t find a lesson/unit plan on the topic, build your own lesson plan (smaller topic focus)

5) Build own unit plan (larger topic focus)

6) Building a Case Study: more focus on one topic

7) Building International Connections into a lesson or unit

8) Use books (novels, stories, etc.)
First, the team develops the HS lesson

Then, they develop the MS lesson
NSDL Use in “Broader Impacts”

**Audience:** PD for in-service teachers

**Objective:** to highlight the functionalities of the interactive NSDL science literacy maps and using them as a method for better understanding K-12 science both horizontally within a grade band and across grade bands.

**Task:** Examine the structure of the map and its content, find resources that address a given sequence of benchmarks, and discuss the resources and their sequences.

http://nsdl.org
Case 2
Ted Fowler, Professor Emeritus
Kathie Maynard, Visiting Assist. Prof. in Teacher Ed.
CECH, University of Cincinnati

“Re-calibration”

**Audience:** pre-service and in-service teachers

**Re-calibration** main features:

- Focus on a particular part, topic, or process of curricular and instructional planning
- Aim at establishing a habit of mind that gets a teacher to engage with rather than side-step weak areas of content
- Teachers need to reflect in a structured manner on what they know themselves and what is known about a topic as they plan and execute instruction

While recalibration can be accomplished in many ways (such as reading or discussing with colleagues), NSDL and the interactive NSDL science literacy maps facilitate this process.

http://nsdl.org
“Re-calibration”

1. Content coherence through "learning progressions"
2. Missing or mis-understandings
3. Deeper accessing of NSDL resources
4. Deeper Inquiry
5. Richer Design Process
6. Structuring of Project/Problem-Based Learning actives
7. Considering Social Justice

1. Identify target benchmark on NSDL science literacy map
2. Identify related benchmarks looking for necessary pre-requisite knowledge or analogous knowledge.
3. Identify benchmarks on the NSDL science literacy maps that could be contributing to the mis-understanding
4. Assemble relevant instructional activities, using NSDL and other resources that could be contributing to the mis-understanding.
5. Access the instructional resources for the primary, pre-requisite, and following benchmarks to address mis-understandings.
6. Select an inquiry lesson and identify what the lesson is trying to accomplish
7. Using the Atlas Nature of Science map, choose one “big idea” that could improve this lesson and reflect on how it could be accomplished.
8. Using the Atlas Designed World map, choose one "big idea" that could improve this lesson and reflect on how it could be accomplished.
9. Using the Atlas Energy Resources map, identify a big idea that could be used to frame a PBL.
10. Paraphrase the idea into a PBL Driving Question.
11. Identify sub-questions to get at the details.
12. Using the Human Society map, choose one “big idea” that could be used to teach the societal implication of the topic being studied.

http://nsdl.org
“Re-calibration”

1. Content coherence through "learning progressions"

2. Missing or mis-understandings

3. Deeper accessing of NSDL resources

4. Deeper Inquiry

5. Richer Design Process

6. Structuring of Project/Problem-Based Learning actives

7. Considering Social Justice

1. Identify target benchmark on NSDL science literacy map
2. Identify related benchmarks looking for necessary pre-requisite knowledge or analogous knowledge.
3. Assemble relevant instructional activities, using NSDL and other resources.

1. Identify mis-understandings
2. Identify benchmarks on the NSDL science literacy maps that could be contributing to the mis-understanding
3. Assemble relevant instructional activities, using NSDL and other resources to address mis-understandings.

1. Access the instructional resources for the primary, pre-requisite, and following benchmarks
2. Gather a sample that has coherence and is rich in examples and applications.
3. Select an inquiry lesson and identify what the lesson is trying to accomplish
4. Using the Atlas Nature of Science map, choose one “big idea” that could improve this lesson and reflect on how it could be accomplished.
5. Select a design challenge lesson and identify what the lesson is trying to accomplish
6. Using the Atlas Designed World map, choose one “big idea” that could improve this lesson and reflect on how it could be accomplished.
7. Using the Atlas Energy Resources map, identify a big idea that could be used to frame a PBL.
8. Paraphrase the idea into a PBL Driving Question.
9. Identify sub-questions to get at the details
10. Select a lesson or unit that could be extended by connecting the topic with an appropriate societal implication strand.
11. Using the Human Society map, choose one “big idea” that could be used to teach the societal implication of the topic being studied.

http://nsdl.org
Case 3
Steven Haderlie: **NSDL Use in HS, College Freshman Chem., & Teacher Ed.**

Springville High School  
Brigham Young University (BYU)  
Chemistry Dept.  
Provo, UT 84602

**Audience:**

*High School:*
- Regular Chemistry and AP Chemistry high school students
- On-line high school chemistry class for BYU Independent Study (asynchronous class that enrolls 1,500 students world-wide)

*College:*
- Second semester freshman chemistry at BYU in the summer

*Teacher Ed.:
- Chemistry teaching methods for Chem Ed majors (3-5 students) in winter

http://nsdl.org
Case 3
Steven Haderlie: NSDL Use in HS, College Freshman Chem., & Teacher Ed.

Mr. Haderlie’s UT Education Network webpages

In both sites, Mr. Haderlie includes links for students to use

http://nsdl.org

Mr. Haderlie’s HS webpage
They see videos (for example diamond and graphite structures) as part of regular school work, not a separate task. They also see the graphs of atomic properties.
High School and College freshman classes

Molecules 360 in regular Chemistry high school classes as a visualization tool for molecular geometry

In AP Chemistry and College freshman classes, they also use Molecules 360 to demonstrate how entropy increases with increasing molecular complexity and add vibrational modes linked to IR.
Students learn to use the Moodle page and upload to ChemPrime.