The Development of a National Science, Mathematics, Engineering and Technology Education Digital Library: Lessons Learned from NEEDS

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Outline

• What is a National SMETE Digital Library?
• NEEDS—The National Engineering Education Delivery System
• Prototype: www.smete.org
• Lessons Learned
  – Partnerships
  – Standards and protocols
  – Community development
Vision...

“... a network of learning environments and resources for Science, Mathematics, Engineering and Technology education, will ultimately meet the needs of students and teachers at all levels—K-12, undergraduate, graduate, and lifelong learning—in both individual and collaborative settings.”

National Science Foundation
Our Goals

- Establish a national digital library for SMETE that is a dynamic learning community
  - To promote and support SMET education in the 21st century
  - To provide educators and learners with seamless access to partner collections and shared services to improve learning
  - To support educators and learners in K-12, higher education and life-long learning
Towards A National SMETE Digital Library...

NSF should establish and fund a National Science, Mathematics, Engineering and Technology Education Digital Library

• **April 1996 - NSF Committee Meeting (LIBUSE)**
  – “Towards a National Library for Undergraduate Science Education Resources in Science, Mathematics, Engineering and Technology”

• **August 1997 National Research Council**
  – Digital National Library for SME&T Education Workshop

• **July 1998 National Science Foundation**
  – SMETE-Lib Workshop

• **January 1999 National Science Foundation**
  – Digital Libraries and Education Workshop
National SMETE Digital Library Program

- Test-bed funding under the Digital Libraries Initiative—Phase 2, 1998-2001
- Demonstration and full scale development, 2000-2006?
  - Four focus areas
    - Core Integration System
    - Collections
    - Services
    - Targeted Research
NEEDS—The National Engineering Education Delivery System
www.needs.org
NEEDS is the foundation for the National SMETE Digital Library at www.smete.org.
What Is NEEDS?

• Digital Library of Multimedia Engineering Courseware
  – Bibliographic records with downloadable courseware
  – Multimedia elements—downloadable movies, images, and text

• Multilevel Courseware Evaluation System
  – Peer and user review mechanisms
  – *Premier Award for Excellence in Engineering Education Courseware*

• User Services and Features
Systems Development

• Expand www.needs.org/www.smete.org
  – Continue participation in the development of IEEE/IMS Learning Object Metadata Standards
  – Adopt emerging IEEE standards
  – Implement discussion systems
  – Expand user comments
  – Implement customized user profiles

• Expand Collections
  – Chemistry, Physics, Math

<table>
<thead>
<tr>
<th>Total Collection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering</td>
</tr>
<tr>
<td>Chemistry</td>
</tr>
<tr>
<td>Physics</td>
</tr>
<tr>
<td>Math</td>
</tr>
<tr>
<td>Other</td>
</tr>
</tbody>
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The Premier Award for Excellence in Engineering Education Courseware

- A national competition to identify and reward the authors of high-quality, non-commercial courseware designed to enhance engineering education.
  - The *Premier Award* is about the entire experience of using the courseware by learners, not just the courseware itself
- A dissemination system to distribute the Premier Courseware (via CD’s and promotional materials at engineering education conferences).
Prototype at www.smete.org
What is www.smete.org?

- Learning and teaching resources for science, math and engineering
- “Re-use” of learning materials:
  - Evaluate quality
  - Locate resources
- User comments
- Online discussion

ABOUT THIS SITE

Prototype of a National Science, Mathematics, Engineering, and Technology Education Digital Library

This site contains:

- Working prototype of a National SMETE Digital Library, Search for learning resources.
- Prototype federated search for the Math Community and the American Mathematics Metadata Task Force (AMMTF).
- Survey about visions, features, and lessons learned for a NSDL.

PARTNER FOCUS

The Math Forum

Their goal is to build an online community of teachers, students, researchers, parents, educators, and citizens at all levels who have
Demonstration: www.smete.org
www.smete.org Goals

• Develop a NSDL Core Integration System
  – Provide seamless access to services and resources
  – Create a dynamic learning community that promotes and supports SMET education in the 21st century

• Demonstrate effectiveness of collaboration to provide
  – Expanded services
  – Resources
  – Community
Multidisciplinary Partnerships

• We appreciate the value of multi-disciplinary partnerships
  – Common with engineering educators
  – Use of multi-disciplinary/cross-disciplinary teams

• www.smete.org has over 20 partners
  – Industry
  – Academic
  – Professional societies
Collaborating with Partners

• Working with Eisenhower National Clearinghouse and Math Forum
  – Identify common metadata
  – Exchange records for common searching
  – Working together as part of the American Mathematics Metadata Task Force

www.mathforum.com  www.enc.org
Collaborating with Partners

• Working with University of California Office of the President - (10 campuses)
  – Identifying courseware under development systemwide
  – Developing TLT@UC Website to showcase teaching and learning with technology at the University of California
How does NEEDS help users find and “re-use” learning materials?

• Provides mechanisms to help user locate materials
  – Uses standardized descriptions (metadata) to describe resources

• Provides mechanisms to help users evaluate the “quality of materials”

• Developed upon an extendable platform to:
  – Support multiple uses
  – Integrate new services and features
  – Integrate research
Standards and Protocols for Resource Description and Interoperability

• Standards for resource description
  – US-MARC and Library cataloging standards (early-1990’s)
  – IEEE Learning Object Metadata standard and IMS Metadata specifications (today)

• Protocols for interoperability
  – From the Digital Library community: SDLIP, Dienst
  – From the Library community: Z39.50
Challenges toward the future...

• Improving ability to encapsulate the instructional intent and use of materials
  – Metadata standards and cataloging practice
• Developing subject thesauri to describe science, math and engineering education
• Implementing specifications and protocols for interoperability for education
Community Development

- Development of a community of use is as important as developing the technical infrastructure
  - Focus groups with science, math, and engineering educators
- Challenge: Form a community of users in SMETE
  - PKAL workshops and seminars
  - Work with disciplinary partners
  - Support both pedagogy and content
  - Research on adapters
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http://www.needs.org/engineering/info/presentations/