The Development of a National Science, Mathematics, Engineering and Technology Education Digital Library and Learning Community

Lessons Learned from NEEDS

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Outline

How we are building upon NEEDS as we help to develop the National SMETE Digital Library and Learning Community

- 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
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, 2000-2005?
  – Four focus areas
    • Core Integration System
    • Collections
    • Services
    • Targeted Research
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 bridge engineering with science, mathematics and technology education
  – 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
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
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
Demonstration: www.smete.org
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
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
Locating Resources

To help users locate resources there must be 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
  – Through metadata standards and cataloging practice

• Developing subject thesauri
  – To describe science, math and engineering education

• Implementing specifications and protocols for interoperability
  – Must focus on teaching and learning
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
  – Work with NSF Coalitions and engineering education conferences
  – Work with disciplinary partners
  – PKAL workshops and seminars
  – Support both pedagogy and content
  – Research on adapters
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