Selecting and Adapting Learning Technologies to Improve Engineering Education

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Background

• **Information technologies provide the opportunity to “re-think” how we teach our classes**
  – Computers, Web and other learning technologies

• **Builds upon the work of:**
  – The Engineering Education Coalitions
  – NEEDS, a digital library for engineering education
  – *Premier Award for Excellence in Engineering Education Courseware*
  – National Institute for Science Education
Background, continued

- **This presentation...**
  - Provides a number of models and processes for selecting and adapting learning technologies
  - Forms the basis for a workshop at 2001 IEEE/ASEE Frontiers in Education Conference
Approach we will be discussing...

- **Provides processes and frameworks**
  - To help you understand what tools you might want to use
  - To evaluate the quality of learning technologies
  - Leading to selecting and adapting learning technologies for your courses

- **Uses learning technologies as tools to improve teaching and learning**
  - Learning technologies provide a number of benefits ... but ... don’t use technology just because you can.
Selecting Learning Technologies...

Begins with understanding the environment in which it will be used

- Establish Course Goals
- Identify Student Learning Outcomes
- Design Learning Environment
- Design Learning Process (e.g., individual or collaborative)
- Design Learning Activities (e.g., computer or other non-computer)
- Assess Student Learning
Designing Learning Environments

• Jon Jungck, et. al, suggests a model for selecting activities to achieve your learning objectives

• Three axes (on next slide)
  – Learning Centeredness: emphasizes teaching and learning that transforms the student as “receiver” to “constructor” of knowledge
  – Nature of Learning Task: emphasizes transformation of the task itself from simple to more complex activities
  – Collaboration: emphasizes transformation from individual to group activities
7 Principles of Good Teaching

- Encourages contact between students and faculty
- Develops reciprocity and cooperation among students
- Encourages active learning
- Gives prompt feedback
- Emphasizes time on task
- Communicates high expectations
- Respects divers talents and ways of learning

Evaluating Learning Technologies

• Identifying high-quality learning materials based upon criteria developed for *Premier Award for Excellence in Engineering Education Courseware*
  – Developed with the help of a number of experts in the field
  – Evolved over the last four years of competition
  – Brings diverse viewpoints together -- content area experts, instructional designers, students and publishers
Premier Award Selection Criteria

• Instructional Design
  – Will students learn from the courseware?
  – Interactivity: Is the learner actively involved and does the interaction enhance learning?
  – Cognition/Conceptual Change: Is learning significant and long lasting, allowing the construction of useful cognitive models?
  – Content: Is the content well chosen and structured?
  – Multimedia Use: Is multimedia used effectively to promote learning objectives and goals?
  – Instructional Use/Adaptability: Can the software be used in a variety of settings?
Premier Award Selection Criteria, cont.

• Software Design
  – Is the software well designed and useable?
  – Engagement: Does the software hold the interest of a diversity of learners?
  – Learner interface and navigation: Is the software easy to use?
  – Technical reliability: Is the software free from technical problems?
Premier Award Selection Criteria, cont.

• Engineering Content
  – Is the content appropriate and error-free?
  – Accuracy of content: Is the content error-free?
  – Organization of content: Is the content presented consistent with typical engineering instruction.
  – Consistency with learning objectives: Does the content match the stated learning objectives?
Premier Courseware of 1997 & 1998

- Virtual Disk Drive Design Studio
- Drill Dissection and Bicycle Dissection
- Mars Navigator

- Della Steam Plant
- MDSolids
- Structural Engineering Visual Encyclopedia - UNH

For more info or to receive copies go to http://www.needs.org/engineering/premier/
Premier Courseware of 1999 & 2000

- Engineering Graphics
- Cracking Dams

- Project Links
- West Point Bridge Designer

For more info or to receive copies go to http://www.needs.org/engineering/premier/
Guidelines for Selecting Learning Technologies

- Support Good Practices in Higher Education (Seven Principles)
- Support teaching goals and learning outcomes
- Use quality resources
- Consider (technical) support environment
The SMETE Open Federation

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Brief Background

- To build a successful National SMETE Digital Library for deployment in Fall 2002...
  - To focus on science, mathematics, engineering and technology at all levels
  - And more important, it focuses on education
- ...we needed to develop a team...
  - To overcome the challenges we face in developing a National SMETE Digital Library
  - To cover target audiences and disciplines
  - To share in the development efforts
Portal at www.smete.org

Welcome to the SMETE Digital Library.
The most comprehensive collection of science, math, engineering and technology education content and services.

News
The Mathematical Association of America, a SMETE CIG Alliance Partner, recently launched the premier issue of the Journal of Online Mathematics and its Applications (JoMA). JoMA takes advantage of the Web to make modern tools, curricula, and active learning environments more accessible to students and teachers everywhere. Visit JoMA and find out more about the MathDL project, too.

Community
The National SMETE Digital Library Community Center formed to gather and share information from all concerning the present and future of SMETE digital libraries, tools and services, lessons learned, standards used, user studies and publications. Come share your ideas in our forum.
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The SMETE Open Federation is committed to providing a service
- to support learning
- across disciplines in science, mathematics, engineering and technology
- providing access to high-quality resources
- in support of education reform and cross-disciplinary learning
- from K-12 to higher education to professional development
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