A Community for Developing High-Quality Technology-based Courseware

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Workshop Goals

- A better insight into how technology can improve teaching/learning for engineers
- Understand how a community of developers can improve the courseware creation process
- Develop framework and guidelines for a peer review system that will ensure quality and broad deployment
Scope Restrictions

- Can’t do much in 1.5 hours
- Not covering institutional change or institutional purchase/licensing/adoPTION of tools
- Not going into depth on Learning Styles and techniques to address those styles
- Not going to talk about specific development tools
"...for the computer to bring about a revolution in higher education, its introduction must be accompanied by improvements in our understanding of learning and teaching."

--Nobel Laureate Herbert Simon
Overview

- Focus is on good teaching practice
- Recognize that technology is a tool to support good teaching practices
"I used a $3,000 computer, a $1200 laser printer and a $300 word-processing program—and I still got a D on my term paper!"
Instructional Design Model

(Smith & Ragan, 1993)
What is Educational Technology?

- Melding of computing & communication technology to enhance the education environment
- Multimedia, the World-wide web, simulation, animation, sound, video, interactive problem solving, etc.
- Internet is a vast collection of resources--people, information, and multimedia (more than just data)
Questions That Need Be Asked

- Many of you are currently using technology tools e.g., Web, Matlab, Mathematica, etc.
- Your students are using technology tools
- How well is it working?
- Can you utilize the tools more effectively?
- Where should this technology be utilized and where is it better to shy away?
- This is NOT a session on implementation details
Scenarios for Student Learning

■ Goals
■ Outcomes
■ Assessment
■ Relationship to ABET (a) – (k) Criteria 2000
Understanding Student Learning

- What kinds of information and activities could enhance student learning in one of your classes?
Student Attention

% Retained

Time (min)

Passive

Active
Cone of Learning

- We tend to remember:
  - 10% of what we read
  - 20% of what we hear
  - 30% of what we see
  - 50% of what we hear and see
  - 70% of what we say
  - 90% of what we say and do
Questions

■ Who are the students?
■ How do they learn (preferences)?
■ How do we educate (teaching styles)?
■ What can we say about the learning process?
Learning Styles

Learning Style Dimensions

- Perception
  - Sensing
  - Intuitive

- Input Modality
  - Visual
  - Verbal

- Processing
  - Active
  - Reflective

- Understanding
  - Sequential
  - Global

- Organization
  - Specific Data
  - Inductive
  - Deductive

- Cognitive Principles
  - Conceptual
  - Logical

ASEE 2002
## Technology Impacts

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<th><strong>Styles</strong></th>
<th><strong>Teaching</strong></th>
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<td>Perception</td>
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Issues with Student Learning

- Students will always learn less than we hope.
- How much students learn is dependent upon their abilities, background, and match between their learning style and teaching style.
- We cannot change student’s abilities, background or strongly affect their learning style.
- Thus, faculty only can work with teaching style.
Technology Impact on Student Perception

- Student perception is sensory or intuitive
- Teaching Styles on content are concrete or abstract
- Provide facts/data for sensors; theories for intuitive learners
- Link these together so student can see both methods
Technology Impact on Student Input

- Learning style is visual and verbal
- Teaching style is visual and verbal
- Easiest to address via web is the visual
- Try to include audio summaries to include verbal learners
Technology Impact on Organization

- Inductive vs. Deductive Learning & Presentation
- Technology allows both to be integrated as user can select how to obtain information if navigation provided
- Linear and non-linear progression possible
- Intelligent tracking can even suggest navigation
Technology Impact on Processing

- Active and Reflective Learners
- Active learners can be supported with many interactive activities and links
- Reflective learners are allowed to move at their pace (may need to be encouraged to move forward)
Technology Impact on Understanding

- Sequential learners and global (big-picture) learners
- Using navigation, sequential learners are supported; both in deductive and inductive fashions
- With proper use of examples and cases, global learners can be helped
Technology Impacts for All Learners

- Need for good organization and navigation
- Quick down load times
- Current information
- Value added quality information
- Frequent responses
- Collaboration
Methods to assist different learning styles

- Inductive Learners need motivation
- Deductive Learners need applications
- Visual Learners need the graphics/pictures
- Active learners need both interaction with the pages and collaboration groups
- Inclusion of related Theory, Problems, Examples, and Real-world Cases
Potential Impact of Teaching & Learning Mismatches

- Students do not comprehend material
- Faculty are disappointed with poor student performance and unresponsiveness
- Society potentially loses future professionals
What Can Technology Do?

- Address a variety of Learning Styles

- Effective technology tools are difficult and time consuming to develop

- Does it replace/clone the good teacher? – Probably NOT
Development Strategy

- So what can you do???

- Can a community of developers improve the process and the product???
Barriers

- Faculty lack training in sound pedagogical practices

What are the effective methods?
Barriers

- Faculty lack training use of educational technology

Technology training needed
Barriers

- Short supply of time and resources

Support systems needed
Barriers

- Teaching not well rewarded
Developing Technology-Based Materials

Learning Objectives, Goals, Pedagogy

Content

Design

Implementation/Coding

Deployment
Courseware Development

Essential Elements for Developers

- Training in sound pedagogical techniques
- Training in the use of technology development tools
- Development software and facilities
- Time
- Support staff
- Incentives
- Deployment facilities
Heckuva Lot of Work!

Faculty Already Wear Too Many Hats and Too Many Time Commitments
Authors are trained in technology and pedagogy
A common template and user interface is applied
Each author contributes four or five modules
All share in using the modules for their classes
User Interface

- Usability ↔ Visibility ↔ Functionality
- Common set of user tools
- Assessment hooks built-in
- Operates across many

- A template is given to all developers – variants are allowed
Important Engineering Course Topics

Criteria for topic selection:
- Affect a broad segment of student population
- Topic lends itself to the use of technology
- Need for special assistance technology can provide
- Faculty interest
- Material longevity
Important Engineering Course Topics

80% of all engineering students take Statics
Question / Discussion

What core topics/courses should be addressed first?
Commonality

High degree of commonality:
- reduces development time
- minimizes user learning curve
- facilitates adoption/adaptation
Is Technology Effective?

- What are the measures?
- How do we measure effectiveness in a learning process?
- Somewhat early to determine true effectiveness!?
Measures

- Improved understanding of material
- Student engagement
- Access to the faculty member
- Ability to access the course despite location or time constraints
- Access to ancillary enrichment material - increase in breadth of understanding
- Difficult to isolate the cause of improvement or decline in measured characteristics
- Improved faculty efficiency
Measuring Effectiveness

- Need to facilitate collecting effectiveness data
  - collect user feedback
  - track user interaction
  - test information transfer success
  - determine author time/effort saving

- Develop peer review processes
  - Premier Award - best non-commercial courseware
  - NEEDS - National Engineering Education Delivery System
  - MERLOT
Courseware Quality Criteria

- **Instructional Design**
  - Will students learn from the courseware?

- **Software Design**
  - Is it well designed and usable?

- **Engineering Content**
  - Is the content correct (error free) and complete?
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, ASEE Prism ads, presentations at FIE and ASEE)
Use of *Premier Courseware*

- **Surveys**
  Users want...
  - information on how to use the courseware (e.g., user’s guides, comments, instructor’s manuals, peer/expert reviews, etc.)
  - to be able to “try” or “test” the courseware

- **Premier Award Author Interviews**
  Faculty report...
  - a positive impact on career
  - an increase in interest and use of their materials
Use of *Premier* Courseware (cont.)

- Focus groups about digital libraries

  Adapters and Adopters want...
  - adaptable materials
  - expert reviews
  - info on how to use the materials

  Community is the “glue” that allows for adaptation and adoption of courseware
The End

Questions?