

Developing Engineering Courseware: A Personal Perspective and Lessons Learned from the Synthesis Coalition, NEEDS and the *Premier Award*

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Issues in Courseware Development

- **Personal Perspectives**
- **Experiences of the Synthesis Coalition**
- **Observations from NEEDS and the *Premier Award***

Synthesis

- **NSF-funded Engineering Education Coalition**
- **8 Diverse Institutions**
 - Research, Undergraduate Teaching and Historically Black Colleges and Universities
 - Geographically Distributed
- **Developed a number of courseware modules to support reform efforts**

Vibrating Beam: Background

- **Developed CD-ROM (and later Web) based courseware to support a senior mechanical engineering lab class in 1993-1995**
 - Based upon experiment designed in 1980
 - Still in use in 2002
 - See <http://bits.me.berkeley.edu/~beam>
 - Experiment design and redesign coupled with advanced data acquisition and courseware support higher-level conceptual analysis

Vibrating Beam: Lessons Learned

- **Consider process**
 - Knew that courseware would need to work in multiple settings
 - In a separate multimedia lab, in the physical lab, at home by students, and over the web
 - Developed all materials in a modular manner to separate content from display
 - Separate files for all text, graphics and video
 - “Database” to track materials

Vibrating Beam: Lessons Learned (cont.)

- **Rigorous process of separating content from display allows easy evolution**
 - Courseware easily transferred to the Web in 1995
 - Video can be re-digitized and re-compressed to support advances in bandwidth and technology
 - (Well, that's the theory...we haven't actually done it because there hasn't been demand)
- **Consider templates and shell to facilitate further development**
 - (The template and shell exists but further work hasn't been done because of lack of funding.)

Synthesis: Collaboration

- **Most projects required investigators at more than one coalition member**
 - Board of Directors Goal
 - To use diversity as a strength
 - To transfer courses and courseware between institutions
 - Outcomes
 - Collaboration is difficult, “local” pressures compete with needs to collaborate
 - Something “special” required—high motivation, great need, etc.

Synthesis: Infrastructure

- **Early 1990' s campus infrastructures were much different**
 - Infrastructure Needs
 - Lack of Internet access
 - Lack of computers for development and/or delivery
 - Need for specialized hardware and software
 - Need for “experts” and training
 - Outcomes
 - Invested in infrastructure
 - Invested in courseware development studios and staff

Synthesis: Lessons Learned

- **Environment in which materials are developed is important**
- **“Local” support necessary**
 - Hardware and software, but not at the level of building a super-advanced facility that others can't use
 - Most importantly expertise
- **Collaboration is difficult**
 - Need to find common ground
 - Need to develop common vision and understand the big picture
 - Need to work toward that vision

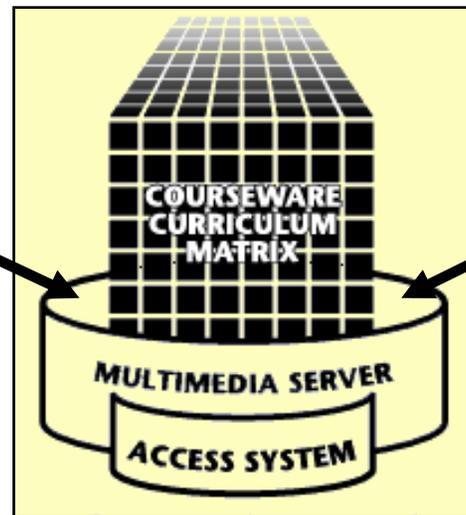


**NEEDS—A Digital Library for
Engineering Education
www.needs.org**

Delivery

- Classrooms
- Instructional Labs
- Small Study Groups
- Residences
- Libraries
- Anywhere

Database



Development

- Courseware Studios
- Instructional Labs
- Faculty Offices & Residences
- Libraries
- Anywhere

NEEDS is the foundation for the National SMETE Digital Library and Learning Community at www.smete.org.

Why Develop the Digital Library in NEEDS?



- **Need to share and distribute courseware beyond original developer**
- **Saw potential to go beyond an index of resources and/or a repository of resources**
 - (I' ll talk a bit more about this later in Educational Digital Libraries talk)
- **Need to determine metrics for quality**
- **Need to provide mechanisms to recognize time and effort to develop courseware**

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 publicize and distribute the Premier Courseware**



NEEDS: Lessons Learned

- **With respect to courseware development and re-usability...**
 - Many authors don't design with distribution in mind
 - Lack of the support materials demonstrate lack of understanding of pedagogy and use
 - Materials aren't well cataloged or even well described by author (on his/her website)
 - Instructors (and students) are finding many new uses for materials
 - Use through NEEDS show additional support structures needed

Premier Award: Lessons Learned

- **Supporting materials are critical in evaluating quality (and how to adopt/adapt) courseware**
 - Instructor's guides, etc.
- **Winning courseware develops higher level cognitive skills**
- **Environment of use is important**
- **Courseware should be adaptable to different learning environments**
 - For example, classrooms, labs, self-study
- **Courseware should address different learning styles**