Steps Toward A National Digital Library for Science, Mathematics, Engineering and Technology Education

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Outline

- NSF Program Solicitation
- Vision
- Background on NEEDS
- Prototype NSDL: www.smete.org

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NSF Program Solicitation

- National Science Foundation Program Solicitation (NSF 00-44):

  NATIONAL SCIENCE, MATHEMATICS, ENGINEERING, AND TECHNOLOGY EDUCATION DIGITAL LIBRARY (NSDL)

- Over the last four to five years, NSF has investigated the development of a NSDL
- Numerous NSF and NRC reports recommend the development of a system

Vision of NSDL ...

"… 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."

www.needs.org

www.enc.org

www.mathforum.org

www.mathmetadata.org

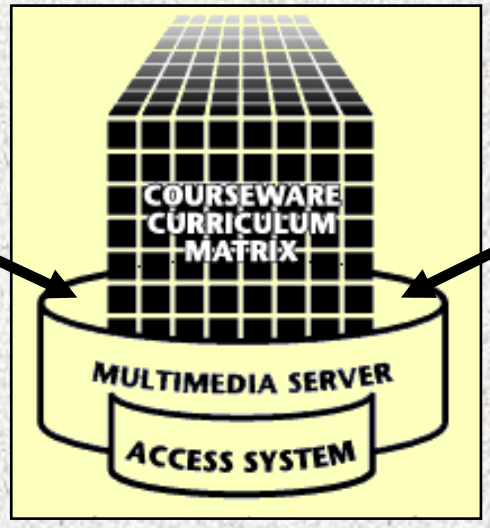
NEEDS
NATIONAL ENGINEERING EDUCATION DELIVERY SYSTEM

www.needs.org

Delivery

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

Three Components Connected Through the Internet



Development

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

We are building upon our experience with NEEDS as the foundation for the SMETE Information Portal, coupled with on-going research.

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 presentation at engineering education conferences)**

WILEY Premier Award

INFORMATION PORTAL
A Digital Library for Science, Mathematics, Engineering and Technology Education

Prototype Project Goals

- **Expand partnerships**
  - Math Forum at Swarthmore College
  - University of California Nexus K–12 project
- **Collaborate with partners to develop a prototype SMETE Digital Library**
  - test interoperability of federated searches and shared services with partners
  - expand requirements analysis to include K–12
  - develop criteria and standards to assess the impact of learning objects across disciplines
  - implement community feedback systems and evaluate services

Building a SMETE Information Portal

- **Searching for learning resources**
- **Cataloging (adding) learning resources**
  - Standards, IEEE and IMS
- **Evaluating the quality of learning resources**
  - “User” reviews
  - “Expert” reviews
- **Forming a community of users in SMETE**

INFORMATION PORTAL

A Digital Library for Science, Mathematics, Engineering and Technology Education

www.smete.org

- **SMETE Digital Library Prototype Under Development based on NEEDS Infrastructure**
  - User Comments (user-based reviews)
  - Adopted IEEE/IMS Metadata
- **Expanded Collections**
  - Expanding into Chemistry, Physics, and Mathematics
- **Working with Partners**
  - Eisenhower National Clearinghouse
  - Math Forum at Swarthmore College
  - Math Metadata Task Force

Total Collection	
Engineering	58%
Chemistry	21%
Physics	14%
Math	5%
Other	2%

INFORMATION PORTAL

A Digital Library for Science, Mathematics, Engineering and Technology Education

Example Record: www.smete.org

INFORMATION PORTAL

A Digital Library for Science, Mathematics, Engineering and Technology Education

Search for Learning Resources

Go

Help Add Advanced

Info Portal | Search Results | MDSolids: Educational... HELP WITH INFO

Info | Download | Pedagogy | Comments & Reviews | Add Comment | Details

MDSolids: Educational Software for Mechanics of Materials

Premier Courseware of 1998

Download | Pedagogy | Comments & Reviews

Title: MDSolids: Educational Software for Mechanics of Materials

Authors: Timothy A Philpot

Publisher: University of Missouri - Rolla (08/1999)

Courseware Series:

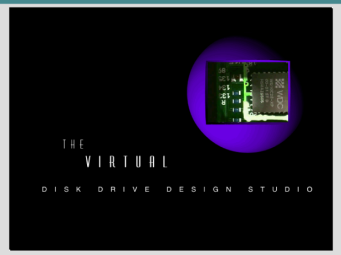
Version: 1.7

Summary: In the mechanics of materials course, students are challenged to develop problem-solving skills necessary for the design of machines and structures. MDSolids is multi-faceted software that offers students numerical, descriptive, and visual results and details that illustrate and explain many types of problems involving stress and strain, axial members, beams, columns, torsion members,

Info | Download | Pedagogy | Comments & Reviews | Add Comment | Details

The Virtual Disk Drive

Premier Courseware of 1997



Download | Reviews | Comments

Title: The Virtual Disk Drive Design Studio

Authors: David Y. Yu
Alice M. Agogino

Publisher: University of California at Berkeley (03/1997)

Courseware Series: Multimedia Case Studies of Design in Industry

Version: 1.0b5

Summary: The Multimedia Virtual Disk Drive Design Studio is an engineering design case study using interactive multimedia courseware for undergraduate engineering and science students. The purpose of this multimedia case is to introduce students to the world of mechatronics in the form of a disk drive. Students play the role of a project engineer for the ACME disk drive company and will have to mine out the necessary information from a multimedia archive in order to build a new disk drive model. Students will have to keep track of the development and production costs. They will also be asked to launch their new disk drives in a certain time frame, simulating the idea of time-to-market. This interactive disk drive case study is ideally complemented by hands-on mechanical dissection of an actual disk drive.

This entire project is put together using Macromedia Director. This cross-platform software will allow us to distribute CD-ROMs to a wide spectrum of students around the country with 2x CD-ROM drives. The author is currently collaborating with Western Digital Corporation and IBM Almaden Research Center in San Jose. Western Digital Corp. provided the mathematical model for performance calculations while IBM has contributed in the form of technical literature and expert opinions.

Keywords:

Affiliations:

The Virtual Disk Drive

Comments

Alice Agogino @ Berkeley, CA, USA, December 5, 1999
Student Feedback
The VDDS CD-ROM was completed in 1997 and has been used in several classes including freshman/sophomore design seminars, multimedia case study classes, and pre-college programs. The student feedback from these courses has been very positive. Many students had no previous background in engineering or design. They showed signs of greater understanding of engineering and design trade-offs after using the courseware. The most positive comments related to the engagement of the game. Used along with a disk drive dissection in an Introduction to Engineering course during the summer of 1997, one student commented:

"This was also one of my favorites. In this class I learned about the components of a computer. About all the little itty bitty pieces of silicon and the drives in the computer. The activity was designing a disk drive in the computer simulation. That was my favorite. On my first try, my partner and I achieved the requirements right away!"

The enthusiasm for the game and the sensitivity of students to key design issues indicates the value in an educational tool like the VDDS. The comments about the CD-ROM version also indicated several areas that could be improved. These include making transcripts available for hearing-impaired students, making the time table more understandable, and having a "notebook" online to keep track of the work done and time used along the way. These issues will be addressed in the web version, as will the issues tying design in with mathematics and physics, an issue raised by some educators. The Matlab exercises and web version of the VDDS will be tested throughout the spring, summer, and fall of 1999.

See Also: Related paper presented at FIE'99.
"Virtual Disk Drive Design Game with Links to Math, Physics and Dissection Activities".

Alice Agogino @ Berkeley, CA, USA, June 17, 1999
Supplementary Information about the Virtual Disk Drive Design Studio
I've attached our Instructor's Guide to help everyone understand just some of the ways the Virtual Disk Drive Design Studio can be used.

See Also: Multidisciplinary, Multimedia Case Studies in Engineering Design: Instructor's Guide
This guide provides suggestions for using the courseware in several instructional settings, as well as problems with solution strategies that can be used in a number of existing courses in the engineering curriculum at the university or pre-college level.

Reviews

NEEDS Editor @ Berkeley, CA, USA, May 1, 1999
Premier Courseware of 1997

The Virtual Disk Drive Design studio provides an immersive, virtual design environment in which the learner designs ACME Engineering's newest disk drive. Designing the disk drive according to the specifications provided, the user first learns the key features and functionality of hard disk drives and then learns about the design trade-offs required to meet the specifications.

AMMTF American Math Metadata Task Force

www.mathmetadata.org

- Development of Best Practices of using metadata for the Mathematics community
- Development of subject thesaurus for range of mathematics resources

SMETE Information Portal Needs Assessment

Purpose:

To understand the math and science communities of educators and examine their needs in order to design services and structures to support users from multiple communities.

Research Questions:

- What services, features & programs are integral to success?
- What do users expect with regards to quality of the holdings?
- Who makes up the SMETE digital library community?

American Association of Physics Teachers, American Mathematical Society, American Association for the Advancement of Science, members of the NSF Chemistry Consortia and the NSF Engineering Education Coalitions

Translating Findings into Services & Features

Quality

- System to rapidly identify the quality of holding
- Place to comment about a learning object or regarding something of interest to the community
- Reviewers should include experts in pedagogy and content

Translating Findings into Services & Features

Community

- Embedded structures for developing and maintaining communication links
- Developing community should be on par with building content
- Build on discipline based communities to establish connection to a broader community

Content

- Useful content and community interaction will ensure user participation as authors, reviewers, adapters/ adopters, and consumers

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