

6-1993

Cost effective, high technology classroom delivery systems

Lawrence J. Genalo

Iowa State University, genalo@iastate.edu

Follow this and additional works at: http://lib.dr.iastate.edu/mse_conf

 Part of the [Engineering Education Commons](#), [Other Engineering Commons](#), and the [Other Materials Science and Engineering Commons](#)

Recommended Citation

Genalo, Lawrence J., "Cost effective, high technology classroom delivery systems" (1993). *Materials Science and Engineering Conference Papers, Posters and Presentations*. 33.

http://lib.dr.iastate.edu/mse_conf/33

This Conference Proceeding is brought to you for free and open access by the Materials Science and Engineering at Iowa State University Digital Repository. It has been accepted for inclusion in Materials Science and Engineering Conference Papers, Posters and Presentations by an authorized administrator of Iowa State University Digital Repository. For more information, please contact digirep@iastate.edu.

Cost effective, high technology classroom delivery systems

Abstract

Iowa State University is a member of the Synthesis Coalition, funded by the National Science Foundation in the inaugural year for coalitions. The other coalition partners are Cal Poly at San Luis Obispo, Cornell, Hampton, Southern, Stanford, Tuskegee, and UC Berkeley. The Synthesis Coalition is creating a National Engineering Education Delivery System (NEEDS). This will include a multimedia data base of engineering courseware modules which can be transported at network speeds for classroom delivery. In order for these lesson modules to be effectively delivered, appropriate classroom delivery systems are being designed, prototyped, and tested.

Disciplines

Engineering Education | Other Engineering | Other Materials Science and Engineering

Comments

This is a conference proceeding from *Proceedings of the ASEE Annual Conference 1* (1993): 620. Posted with permission.

Cost Effective, High-Technology Classroom Delivery Systems

Lawrence J. Genalo

Iowa State University

Introduction

Iowa State University is a member of the Synthesis Coalition, funded by the National Science Foundation in the inaugural year for coalitions. The other coalition partners are Cal Poly at San Luis Obispo, Cornell, Hampton, Southern, Stanford, Tuskegee, and UC Berkeley. The Synthesis Coalition is creating a National Engineering Education Delivery System (NEEDS). This will include a multimedia data base of engineering courseware modules which can be transported at network speeds for classroom delivery. In order for these lesson modules to be effectively delivered, appropriate classroom delivery systems are being designed, prototyped, and tested.

The Synthesis Coalition has prepared a preliminary document describing standard features for three categories of high-technology classroom delivery systems based on cost (1). The high-cost delivery rooms feature high quality projection systems, a full range of media, and the ability to interact with remote learning sites. The medium cost rooms are primarily for large lectures and feature permanently installed projection systems capable of displaying whatever computer and video images are desired. The low cost delivery systems are capable of displaying selected media in a "standard" classroom. These low cost delivery systems are the primary focus of this paper.

Iowa State University has created two state-of-the-art high-technology classrooms for engineering education (2). These high cost delivery system rooms allow for computer images (including engineering workstations), laser disk video, videotape, 35 mm slides, and live camera output to be projected on a large screen. These rooms will also be used to originate and receive remote lectures. The room environment is controlled by a computer which will automatically change lighting to appropriate pre-set conditions for each media selected for presentation. Other schools: Cornell, Stanford, and UC Berkeley within the coalition as well as others outside the coalition, have created similar high-technology classrooms. Almost all universities have a version

of a medium cost, high-technology classroom - usually an auditorium outfitted with a projection system and computer.

Low cost, high-technology delivery - hardware

The low cost, high-technology classroom delivery system brings a cost-effective, multimedia presentation into a "standard" classroom. With this delivery system the instructor has an overhead projector and LCD panel for displaying the desired images. The media to select from will include a computer and, if desired, one or more other media. The other media which can be added include a laser disk player, a videotape player, a 35 mm projector, or a live camera. The selected media for the day's lecture will be placed on a mobile cart and wheeled into a classroom for delivery. With the advent of Digital Video Interactive (DVI) or Quicktime movies, it is possible to digitize full-motion video so that the video player is not necessary for the classroom presentation.

In order to make use of the NEEDS database, the instructor would need to download modules in advance and store them with the classroom computer for the lecture delivery. If the classroom to be used has a network connection, "live" downloading may be performed during the lecture. Since this allows for many more complications and possible stumbling blocks, one would only choose this practice for lectures needing to demonstrate this capability.

The cost for such a delivery system will vary considerably, primarily due to the system capabilities of the computer. Some variation will occur due to the video media included and the LCD panel selected for use. As of this writing, the LCD panel technology is at least as rapidly advancing as the computer technology. Table 1 shows the system configuration and approximate costs for a prototype low cost, high-technology delivery system in use at Iowa State University. The table does not include the cost of a cart as these vary a great deal and at many universities are already available.



ITEM	COST
IBM compatible 386-33 computer	\$ 2,500
Videotape player (standard)	\$ 300
Powered external speaker	\$ 100
Portable video camera (e.g. Elmo EV308)	\$ 2,450
Color monitor (used with camera)	\$ 309
LCD Panel (e.g. Sharp QA 1650)	\$ 5,300
High-intensity overhead projector (e.g. Apollo Eclipse - 3800 lumens)	\$ 400
	TOTAL \$ 11,359

Table 1: A prototype low cost delivery system

The computer included in Table 1 does not include DVI delivery capability. Such capability, and the required added storage, would add about \$2,000 to the cost of the computer. It would, however, allow for the digitization of video and its display without the use of external video sources. Similar configurations are in use in all of the coalition schools. Experience with these systems is being accumulated and will be presented in a "best practices" document to be produced during the next year and updated annually.

Low cost, high-technology delivery - software

Of course, the hardware is selected to deliver the educational material desired. Although some of this material is either live or recorded video, much of it is computer-based. The success of using computer-based lecture material is overwhelmingly dependent on the software to be used. The hardware selected above was chosen to operate and display the images produced by the software. The software used can be classified in two categories; applications and presentation. The choice for an application package will be made by the users, expert in the field in question. Presentation software packages are proliferating at a rapid rate. There are advanced techniques for showing digitized and compressed video such as DVI (for IBM) and Quicktime (for MacIntosh). There are other packages, such as PC-VCR, for interacting with a videotape machine. There are many packages which offer presentation graphics for creating "slides" containing text and graphic images. Another type of software package includes features from several, or all, of the above.

Hypercard (for the MacIntosh) programs, Toolbook (for IBM), and Authorware (for either), to name just a few, offer the ability to create and run multimedia-based lessons. Hypercard programs can be used to integrate Quicktime

movies with still images in a single lesson. Toolbook will soon have the capability to operate DVI images from within an integrated lesson. Authorware, although not capable of running full-motion digitized video yet, is capable of being translated easily between MacIntosh and IBM platforms (3).

With so many software packages available to create lessons and so many other lesson modules already available (in the NEEDS database and elsewhere), an individual professor is faced with the task of selecting not only the application software (presumably an area of expertise for the professor) which is best, but also the presentation software (for most, not an area of expertise). In the Synthesis coalition this extra burden is being eased by creating (courseware studios) where an instructor can find help in selecting presentation software, learning to use it in order to create lesson modules, and in accessing existing lesson modules for adaptation for the particular needs of the instructor.

Multimedia teaching practices

Several studies have been made which try to assess the efficacy of multimedia-based lectures (references 4, 5 and particularly 6). David Crismond (6) tells us of the importance of providing written material to augment multimedia and computer-based lectures. At Iowa State, Authorware has been extensively used for lecturing and for self-paced student work with great success (3). The MacIntosh version has been used in sophomore level computer engineering courses and the DOS/Windows version in the introductory engineering course, Engineering Problem Solving with FORTRAN Programming.

The freshman course includes Authorware-based lesson modules and self-paced tutorials for all topics in the course (for examples, see figures 1-4). The students may purchase hardcopies of the lecture material at a local copy center. The lectures of this course are all delivered in either the high cost, high-technology classrooms or in the cost effective, "standard" classroom. The student reactions to both the authorware lessons and the high-technology delivery systems has been very positive. Authorware lessons are being developed for the freshman Engineering Design / Graphics course. This course has been lectured in a cost effective, high-technology classroom with a good deal of emphasis on live video and computer demonstrations.

Conclusions

The pedagogical decisions must be made first. If multimedia or computer-based lessons are appropriate for the course in question (this will be the case for many engineering courses), the appropriate software should next be selected. Once the software has been selected, the hardware necessary to operate and display the lessons may be selected. The resulting delivery system - lesson modules, either self-generated or "off the shelf", software for applications and presen-



tations, and hardware capable of delivering the desired lessons - will provide an excellent learning and teaching environment. If properly used it can also provide greater productivity for the engineering instructor.

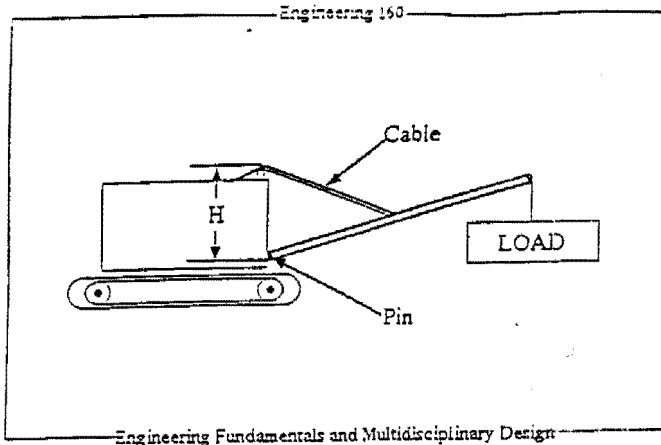


FIGURE 1

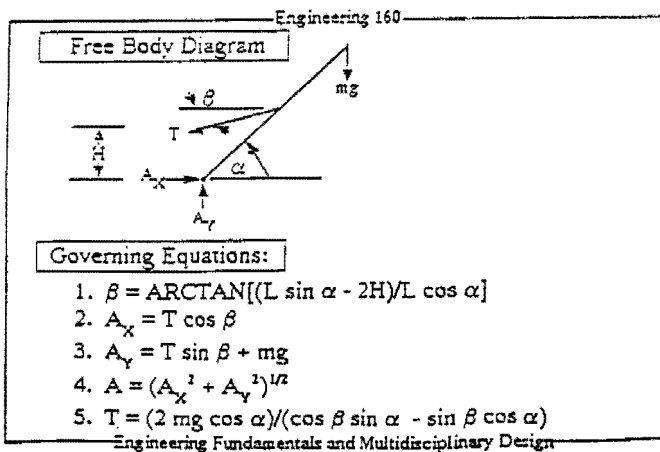


FIGURE 2

Engineering 160

5.11 The density of water at 50° F is about 1.94 slug/ft³. Determine the volume of a 50.0-ft-diameter cylindrical tank with a height of 35.0 ft. Then calculate the mass of water contained if the tank is full. Express volume in cubic meters and mass in kilograms.

$\text{Vol} = \pi R^2 H$

$$= \pi \left| \frac{(25 \text{ ft})^2}{\text{ft}^2} \right| \left| \frac{35 \text{ ft}}{\text{ft}} \right| \left| \frac{(0.3048 \text{ m})^3}{\text{ft}^3} \right|$$

$$= 1946 = \underline{1.95 \times 10^3 \text{ m}^3}$$

Mass = (Vol) (Density)

$$= \pi \left| \frac{(25 \text{ ft})^2}{\text{ft}^2} \right| \left| \frac{35 \text{ ft}}{\text{ft}} \right| \left| \frac{1.94 \text{ slug}}{\text{ft}^3} \right| \left| \frac{14.594 \text{ kg}}{\text{slug}} \right|$$

$$= \underline{1.95 \times 10^4 \text{ kg}}$$

Engineering Fundamentals and Multidisciplinary Design

FIGURE 3

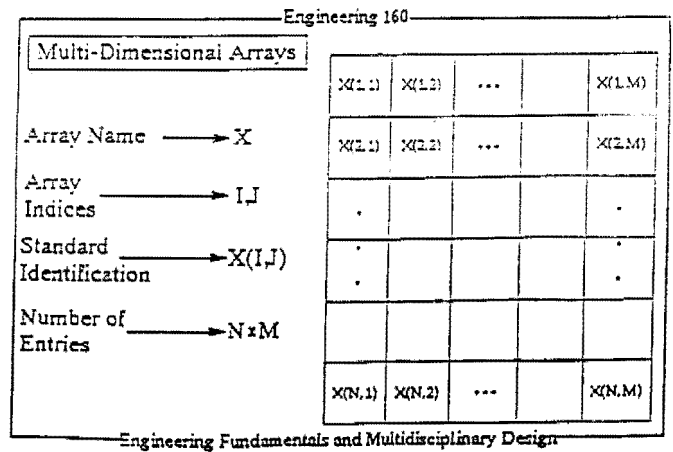


FIGURE 4

References

- (1) Synthesis Coalition, Standards Advisory Committee, Electronic Classroom Subcommittee, April 30, 1992.
- (2) Genalo, Lawrence J., "New Technologies in Engineering Classrooms", Proceedings of the Frontiers in Education Conference, p668, November, 1992.
- (3) Smay, Terry A. and Genalo, Lawrence J., "Creating Courseware for Engineering Education", Proceedings of the ASEE Annual Conference, Vol. 1, p1752, June, 1992.
- (4) Clark, Richard E., "Reconsidering Research on Learning from Media", Review of Educational Research, 53, no. 4, Winter, pp445-459, 1983.
- (5) Crismond, David P., "Evaluating EDICS: assessment and suggestions for improving an interactive multimedia system in engineering design education", MIT Masters' Thesis, 1992.
- (6) Crismond, David P., and Wilson, David G., "Designing an Evaluation of an Interactive Multimedia Program: Assess MIT's EDICS Program", Proceedings of the Frontiers in Education Conference, p656, November, 1992.



LAWRENCE J. GENALO

Lawrence J. Genalo obtained the B.A. degree from Hofstra University in 1971, and the M.S. and Ph.D. degrees from Iowa State University in 1974 and 1977, respectively. His Ph.D. is in Applied Mathematics with an emphasis in Systems Engineering. He has been at Iowa State University since 1971, and has been an Associate Professor since 1981. He has served ASEE as Program and Division Chair for Freshman Programs and DELOS. His current research interest is in bringing high-technology classroom delivery systems into greater use in engineering education through his work with the NSF-funded Synthesis Coalition.

