Teaching Multimedia for Management Through Distance Learning
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Abstract: A paradigm for distance learning is introduced, and the present state of distance learning technology is reviewed. The development and delivery of a new course, "Multimedia and Visualization for Decision Makers," is presented as a case study. The course emphasizes competence in using visualization for presentation and problem solving, in understanding how multimedia is used in business and industry, and in gaining technical facility with multimedia software.

Distance Learning
Economic forces and technological advances are converging to make distance learning an increasingly popular venue for offering a variety of courses. The emphasis on demonstrable value in exchange for rising tuition has brought competition from "corporate universities" -- that is, for-profit corporations that offer academic courses for credit -- into the fray. In order to compete and remain financially viable, educational institutions have begun using distance learning to attract students for whom traditional on-campus courses are impractical.

Distance learning has long depended on satellite and videotape recording technology, but now Internet access and small monitor-top cameras (such as Connectix's Quick Cam) provide interactive alternatives to the old-fashioned "talking heads." Both of these newer technologies are inexpensive and rapidly becoming ubiquitous among personal computer users. Students who take a distance learning course through a local institution may have access to higher-end technology such as video conferencing (participants can see and hear each other through a live satellite linkup), computer conferencing (participants can see each other's work in a computer application), two-way compressed audio and video, and distributed and cooperative virtual workspaces.

The trend toward specialization and outsourcing offers another way for universities to get more mileage out of their resources. University departments are stronger in some areas and weaker in others. Rather than offering a full spectrum of courses, perhaps including some that are not of the best possible quality, since no department can specialize in every area, departments from different universities can join to become a "virtual department." For example, if one university's management science department has a large statistics faculty but is weak on operations research, and another university's management science department is in the opposite situation, both institutions would benefit from a joint effort to offer the best of both of their departments to as many students as possible, via distance learning." Tuition banks," in which the credits granted by each university to students of other institutions is tracked, could be established with selected universities to promote intra-university cooperation.

In this paper, we introduce a paradigm for distance learning, one that allows for optimal distribution of educational resources. The production of a single course, from the initial conception through final grades, takes place over four stages: course design, materials development, course delivery, and student certification. The course designer is an information designer, defining the educational goals and developing a detailed outline of the content to be covered. The outline should include a bibliography and relevant Web sites and
suggestions on materials development. The materials developer, a presentation designer, works from the designer's outline and bibliography to create presentation materials for the instructor, integrating computer demonstrations, videotapes, and other media as appropriate. The instructor is responsible for course delivery, using the materials created in the previous step. Student certification is the last step in the process, and can be administered by the student's local institution. The goal of certification is to verify that the student has achieved the goals set by the course designer. Certification may become increasingly competency-based, in a style not unlike video games: one can't move on to Level 2 until one can successfully leap all the hurdles of Level 1.

Developing informative evaluation measures for each step of course production is essential. Is the type and amount of content consonant with the course's goals? Is the content arranged in a logical fashion? Do the course designer's materials provide enough information for the materials developer? Are the course materials informative, well-organized, visually appealing? How well does the instructor present the material? And, ultimately, do the students learn? These evaluations could be done in a number of ways, running the gamut from the traditional form filled out by students to having faculty travel to students' sites for evaluation meetings.

Distance Learning Technology

Teleconferencing options (Barron and Orwig 1995) that can be used in distance learning include audio teleconferencing, audiographic teleconferencing, and video teleconferencing. Audio teleconferencing is the oldest technology. It is simple and inexpensive, but as its name implies, its users are limited to voice communications. Audiographic teleconferencing adds two-way still image transmission to audio teleconferencing. Prepared slides and spontaneously-drawn sketches can be sent back and forth, as well as still images of people. Most audiographic systems connect only two sites; connecting additional sites is considerably more complicated. Image transmission can take up to fifteen seconds and the images themselves will have limited visual resolution. Full motion video teleconferencing is the option closest to actually having a group in one location. Options for distributing a video image include cable television, microwave transmissions, satellite technology, or digital video teleconferencing. Video teleconferencing offers the highest level of information exchange, but it also requires significant financial and personnel resources, which need to be justified. Special physical facilities usually need to be built for video teleconferencing, and instructors usually need some training in order to teach in front of cameras. Computer teleconferencing allows users in different locations to work cooperatively, sketching on a shared whiteboard, working as a group on an shared analysis or design software, and commenting on one anothers' work.

Internet technologies include email, the World Wide Web, File Transfer Protocol (FTP), and Telnet. In distance learning, email may be used for instructors to send out lecture notes, for students to submit assignments, and for students to communicate with one another and with the instructor. The World Wide Web allows quick and easy display of and access to text and graphics. FTP is used to send data files from one location to another, and Telnet allows the user to remotely operate another computer.

A Multimedia Course for Distance Learning

Rensselaer Polytechnic Institute's Department of Decision Sciences and Engineering Systems soon will be offering, for the first time, a course entitled "Multimedia and Visualization for Decision Makers." Multimedia authoring software is a visualization tool that is widely available to managers and decision makers. Managers use visualization technology for both communications and problem solving. Communications includes disseminating information and persuading others to adopt the
presenter's point of view. In the context of problem solving and decision making, visualization can stimulate creative thinking and streamline collaborative effort.

**Rensselaer Satellite Video Program**

The time and effort required to convert a traditional on-campus course to distance learning format should not be underestimated. An important factor in the success of a university's distance learning venture is the degree to which the university is willing to invest in supporting its faculty. Because distance learning formats often require specialized support, many institutions have a centralized distance learning department that assists in course development and production for all academic departments. Rensselaer Polytechnic Institute's Rensselaer Satellite Video Program (RSVP) is a model distance learning department, offering graduate degree programs to engineers, scientists, and other professionals who use and manage technology. The program has established relationships with a long list of "corporate partners," including General Motors, General Electric, Dupont, Pitney Bowes, Lockheed Martin, Xerox, and IBM. Participating sites are located all over the United States, and soon will be expanded to include Mexico and Luxembourg. Faculty support services offered by RSVP include development of course materials, including WWW pages; teleconferencing for classes and office hours; videotaped lectures; extensive computing support; and interactive compressed two-way audio-video.

**Course Format and Design**

An important element in the design of a course for distance learning is creating a sense of class community despite separation in space and, often, in time as well. In addition to viewing the videotaped lectures (live for some sites) that include computer demonstrations and extensive graphics as part of the material on visualization, students will be encouraged to communicate with one another and with the instructor via email and through the class newsgroup. A WWW page will include shareware software to download (to use in conjunction with the authoring software), course information such as syllabus and lecture notes, and links to students' home pages. Where possible, two-way video will allow students at different remote sites to see each other; for less technologically advanced sites, RSVP will digitize photographs of students and display them as appropriate (for example, when a student asks a question or is presenting a project). Students at sites showing live lectures will be able to telephone the instructor during class. Students will submit their work either electronically or on a diskette. Students at sites with two-way video will be able to present their projects to the class, while projects from students at other sites will be run by the instructor with the student offering comments through a telephone bridge with speakerphone.

This course breaks new ground at Rensselaer in two ways: 1) content: it is the first course that addresses using visualization in the decision sciences, and 2) process: it is the first multimedia course to be taught in a distance learning format. The course will be developed in three phases. During Phase I, development of content, the course will be offered on-campus only. During Phase II, development of the distance learning format, the course will be offered through RSVP. During Phase III, the course will be offered using an interactive distance learning tool that will permit two-way visual and audio contact between the instructor and remote sites, as well as computer conferencing. Ideally, the course would incorporate live computer laboratory sessions at this phase of its development. Two-way audio and video will permit the instructor to offer to students at remote sites that "over the shoulder" supervision that enhances and personalizes the learning process.

When designing a distance learning course, it is important to specify what kinds of hardware and software students will need. The requirements for this course are a 486 personal computer (or equivalent Macintosh), 8-16 megabytes of RAM, CD-ROM, an Internet email address, and World Wide Web access.
Courses designed for managers are especially appropriate for a distance learning audience, since most managers have to schedule their courses around their work day. Distance learning via corporate partners enlists the company's support in the employee's education and provides the necessary flexibility in scheduling, since employees have the option of watching tape-delayed broadcasts at their convenience. The primary goal of the course is for students to learn to use a multimedia authoring tool effectively for communications and problem solving in a decision making context. The effective use of multimedia requires competence in three areas: conceptual, practical, and technical.

**Course Content**

Conceptual competence means understanding how visualization is used for presentation and problem solving. Conveying principles of effective visual communication is essential. Students are exposed to ideas on visualization and perception, including humans as information processors and the functioning of the cognitive system. In the segment on visualization for presentation, the course covers color theory and use and principles of design (Martinez and Block 1995). The section on visualization and problem solving addresses visualization and the modeling process, principles of graphing (Cleveland 1994), color and quantitative information (White 1990), and scientific visualization (Rosenblum et al. 1994).

Practical competence means understanding the context of multimedia use in business and industry. Multimedia is widely used in the production of sales presentations and marketing promotions, resumes and business cards, employee training products, and product simulations and prototypes. This part of the course also will incorporate material on interactive design (Kristof and Satran 1995), including information design, storyboarding, and multimedia components and technology.

Technical competence means being fluent in the basics of using a multimedia authoring tool and using that tool in to create required projects. Macromedia Director is the authoring tool that was chosen for this course. This choice was based on a number of factors, including the availability of an inexpensive ($99) educational version, excellent documentation, the package's popularity in the corporate world, and its portability between IBM-clone personal computers and Macintosches. Director is based on a "stage metaphor." Users create a "movie" frame by frame; for each frame, cast members are dragged onto the stage and arranged appropriately. Cast members may be text, still graphics, animation loops, video clips, or audio files. Hypertext navigation and other types of interactivity are easy to implement. Director provides tools for creating a wide variety of special effects, including transition effects, animation, palette changes, growing and shrinking objects, and the synchronization of graphics and sound. A powerful paint window allows the user to import and edit files in different graphics formats.

Students will demonstrate their mastery of these three areas through a series of projects, including a resume or business card, a marketing project, a project using quantitative data, and a final project on using multimedia and visualization for problem solving.

**Conclusion**

The goal of the multimedia course is to provide an educational experience in which the student can gain the conceptual, practical and technical competence needed to make effective use of multimedia for communication and for supporting problem solving and decision making. The course design reflects these three areas of competence by (1) exploring how and why visualization works; (2) identifying the uses of the technology in business and industry; and (3) teaching the basics of a multimedia authoring tool by having students create interactive productions using Macromedia Director. The course materials include textbooks, articles, static pictures and displays, animation,
and video. Course delivery will at first be in a traditional computer laboratory setting, then will take place via video supported by email, and, for subsequent offerings, will incorporate interactive distance technology with two-way visual and audio contact. The student certification will be accomplished by having the instructor evaluate student projects. Evaluation metrics will be developed for each of these components by defining a baseline competency in each of the three areas -- conceptual, practical, and technical.

The success of distance learning depends on how it is implemented. Implementation takes place on three levels: organizational, financial, and technological. Organization implementation will include the administration of virtual departments and tuition banks, as well as the development of metrics of evaluation for the four-step course production process. A tuition bank will be established with MIT for this course, allowing MIT students to take the course, and Rensselaer students to take courses at MIT. Financial implementation will depend on a cost analysis that compares the costs of traditional lectures with the costs of distance learning. Any disparity that is found could be built into the tuition structure, or it could be covered by overhead. Technological implementation hinges on upcoming technological developments, and the effects those developments will have on such issues as ease of Internet access, cost of Internet access, and methods of data delivery (cable network, telephone network, satellite dishes, and so on).

The multimedia course offered at Rensselaer demonstrates how a variety of distance learning formats -- one- and two-way video with two-way audio conferencing, email, and WWW -- can be integrated to provide a comprehensive learning environment.

References