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ABSTRACT

The Virtual Classroom(TM) is a teaching and learning environment constructed in software, which supports collaborative learning among students who participate at times and places of their choosing. While students may access only the record of their activities, the instructor can review the activities status of any student, require that activities be done in certain sequences, and designate activities as required or optional. Activity types include question/response and electronic gradebook. Seminar type presentations and discussions are an example of the collaborative learning activity that is often difficult in the traditional classroom, but that lends itself well to the Virtual Classroom. Computer mediated communication (CMC) can be utilized in many different modes to support education and training: as an adjunct to a regular face-to-face course in order to improve both teacher-student and student-student interaction; as a mechanism for providing communications in a remote course where students receive lectures via video; or as a total means of delivery, without any other communication mode. A New Jersey Institute of Technology (NJIT) project creating an entire degree program, the Bachelor of Arts in Information Systems, delivered via Virtual Classroom mixed with video, aims to attain five objectives: (1) faster progress towards the undergraduate degree, by facilitating self-paced learning and solving major educational logistics problems; (2) improved quality of learning through the increased collaborative learning and faculty-student interaction facilitated by computer conferencing; (3) increased access to educational opportunities for working adults or those trying to reenter the workforce; (4) formative and summative evaluation of the effectiveness of this media mix used in different ways for attaining the previous objectives; and (5) dissemination of the successful techniques and materials to other institutions. Using this instructional method to overcome logistical problems is discussed, and the evaluation measures are outlined. (Contains 15 references.) (MAS)

VIRTUAL CLASSROOM PLUS VIDEO: TECHNOLOGY FOR EDUCATIONAL EXCELLENCE:

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ABSTRACT: The Virtual Classroom™ is a teaching and learning environment constructed in software, which supports collaborative learning among students who participate at times and places of their choosing, through computer networks. This paper describes some of the authors' experiences utilizing Computer Mediated Communications structured to create a Virtual Classroom (VC). A project which is creating an entire degree program, the B.A. in Information Systems, via mixed mode delivery, (VC combined with video), is then described.

Computer-mediated communication systems (CMCS), especially when enhanced to create what we refer to as a Virtual Classroom,[TM] can make significant improvements in both access to and the quality of education. Currently over 80 programs worldwide are known to be offering courses partially or completely via CMC (See, for example, Harasim, 1990; Harasim, Hiltz, Teles & Turoff, 1994; Hiltz, 1986, 1994; Mason & Kaye, 1989; McCreary & VanDoren, 1987; Paulsen & Rekkedal, 1990; Rice & Case, 1983; Weedman, 1991; Welsch, 1982). The sophistication and flexibility of software structures for supporting distance education vary widely, from simple electronic mail systems to conferencing systems that have been specially enhanced to support classroom-like experiences, particularly group discussions and joint projects.

Generically, the Virtual Classroom is a teaching and learning environment located within a computer-mediated communication system. Rather than being built of steel and concrete, it consists of a set of group communication and work "spaces" and facilities that are constructed in software. Thus it is a "virtual" facility for interaction among the members of a class, rather than a physical space. Specifically, the Virtual Classroom™ is NJIT's trademarked name for a version of its Electronic Information Exchange System (EIES2) with special software structures designed to support collaborative learning. Participation is generally asynchronous; that is, the Virtual Classroom participants may dial in at any time around the clock, and from any location in the world accessible by a reliable telephone system. The fact that the educational process is asynchronous means each student may engage in more reflective thinking before having to answer or discuss issues. Some of the Virtual Classroom facilities and their traditional classroom analogies are summarized in Figure 1. For example, interaction in the form of "electures" (electronic lectures) and plenary discussions takes place in a main "class conference," which is like the classroom or lecture hall. For special activities such as a debate or small group work, other conferences can be established (like moving from a lecture hall to breakout rooms). Private conversations, the equivalent of hallway conversations or office hours, take place via "messages."

Note that messaging and conferencing serve very different objectives. Trying to hold group discussions and develop a shared database of the discussion is impossible in a message system, and cluttering up conferences with a lot of transitory material better sent in messages interferes with the flow of the discussion. Being able to utilize a key word index for finding material such as assignments in the conference and having a way of organizing the discussion threads are extremely critical to the use of the conference transcript as a database.

The special features added to a basic CMC to support collaborative assignments have been integrated into EIES 2, as "Activities," which are executable programs attached to an ordinary conference comment. Rather than automatically receiving everything that has been entered by any participant, as with comments, participants choose to do the activities only when they are ready, and explicitly give a command. A record is kept of *done* and ***undone*** activities for each conference member, and a review choice helps users to keep track of what they have accomplished.

Figure 1
Communication Structures in the Virtual and Traditional Classrooms

Computer Facility	Utilization	Physical Analogy
Private Conferences	Class Discussions & Lectures Student working groups Student Lounges	Classroom Study Groups
Public Conferences	Teacher Lounges Shared material (document data bases)	Coffee Houses
Messages	Student to student Teacher to student Transitory material	Office hours "Hallway" conversations
Notebooks and personal files	Composition facilities	Work book
Membership Status	Who has read and done what assignments (tracking)	Visual Presence
Binary File Attachments to Comments	Diagrams, Spread sheets, etc.	Sharing of PC software results
Anonymous Signatures	Encouraging Self-disclosure and experimentation Presenting mistakes Game and role playing	Impossible in face-to-face classroom
Membership Directory	Finding members by common interests	Clubs, interest group formulation
ACTIVITIES:		
Question/Response	Forces independent thinking and active participation	Face-to-face discussion questions
Selection	Manage distribution of unique assignments	Circulate sign up sheets
Document	Self selection of pieces and parts of long document	Printing press and copy machines
Exam	Time controlled question set	Written exam
Gradebook	Access to student grade record	Asking instructor
Voting	Voting for lists of alternatives	Voice votes or show of hands, ballots.

While students may access only their own records of done and undone activities, the instructor can review the Activities status of any of the students. The instructor can require activities to be done in certain sequences and declare whether they are required or optional. Activity types include:

* **QUESTION/RESPONSE**, which is the most frequently used. One or more questions for response by other conference members are contained in the main conference comment. Each person MUST ANSWER BEFORE SEEING THE RESPONSES OF OTHERS. This is very important for making sure that each person can independently think through and enter his or her own ideas, without being influenced by responses made by others. Alternatively the author may set it up so that participants cannot see other responses even after they answer, until the author "opens" the responses for viewing. This might be done for an essay-type quiz, for example.

* The electronic **GRADEBOOK** allows students to see not only their own grades and averages at any time, but also averages for the class as a whole. When grades are added, notifications are automatically sent to the members to alert them to the availability of new grades.

Collaborative Learning

Collaborative learning is defined as a learning process that emphasizes group or cooperative efforts among faculty and students. It stresses active participation and interaction on the part of both students and instructors. Knowledge is viewed as a social construct, and therefore the educational process is facilitated by social interaction in an environment that facilitates peer interaction, evaluation and cooperation (Bruffee, 1986; Johnson, 1981; Johnson & Johnson, 1975).

The Virtual Classroom is an environment that facilitates collaborative learning -- among students, between students and instructors, among teachers, and between a class and wider academic and nonacademic communities. It also supports independent learning and generative, active learning techniques that are self-paced by each participant. For distance education students, the increased ability to be in constant communication with other learners is obvious. But even for campus-based courses, the technology provides a means for a rich, collaborative learning environment that exceeds the traditional classroom in its ability to "connect" students and course materials on a round-the-clock basis.

An example of a collaborative learning strategy applied in the VC that is included in most courses is the "seminar" type of interchange in which the students become the teachers. Individuals or small groups of students are responsible for making a selection of a topic (usually from a list provided by the instructor as a Selection Activity); reading material not assigned to the rest of the class; preparing a written summary for the class of the most important ideas in the material; and leading a discussion on the topic or material for which they are responsible (usually via a Response Activity).

Seminar-style presentations and discussions are thus an example of a collaborative learning activity that is often difficult in the Traditional Classroom (TC), but which tends to work very well in the Virtual Classroom environment, even with fairly large classes of undergraduates. Other examples of collaborative learning strategy in the VC include debates, group projects, case study discussions, simulation and role-playing exercises, sharing of solutions to homework problems and/or answers to review questions for exams; and collaborative composition of essays, stories, or research plans.

Modes of Use of the Virtual Classroom

CMC technology can be utilized in many different modes to support education and training:

* As an adjunct to a regular face-to-face course in order to improve the communications between the students and the instructor, as well as to improve the communications among the students.
* As a mechanism for providing communications in a remote course where the students receive the lectures via video (by direct broadcast or by recorded tapes).
* As a total means of delivery, without any other communication mode.

In general, the more the course is oriented to teaching basic skills (such as deriving mathematical proofs), the more the lecture is needed in some form as an efficient means of delivering illustrations of skills. However, the more the course involves pragmatics, such as interpretations of case studies, the more valuable is the CMC mode of delivery. CMC is the ideal technology for extending the ability of students to discuss material and to work in collaborative groups as an integral part of the learning process. It is also the ideal technology for extending education or training to those segments of the population that have difficulty in taking the time to attend face to face sessions. Our initial studies (Hiltz, 1993) showed that mastery of course material in a variety of online courses was equal to or better than that in traditional courses, and subjective satisfaction was higher. However, for totally online courses, it is recommended that students be at the sophomore level or higher, or be screened to exclude freshmen with poor study skills.

Some of the courses incorporating video for "lectures" use standard public television courses, such as "Discovering Psychology," produced by PBS. Most video segments are filmed by NJIT in its "candid classroom" and then distributed to remote students on videotape, or via broadcast on a cable channel or satellite. In all video variations, the Virtual Classroom is used for all assignments and additional discussions.

Initial experiments with the mix of Video for "lecture" type material and VC for discussion and collaborative assignments worked so well that we proposed to deliver an entire degree program this way, and were fortunate enough to receive funding from the Alfred Sloan Foundation that has enabled us to do this.

Virtual Classroom + Video: The Degree Program

This project will develop, offer, and assess the effectiveness of an undergraduate major in Information Systems delivered via Virtual Classroom plus video, to attain five objectives:

* Faster progress towards the undergraduate degree, by facilitating self-paced learning and solving major educational logistics problems;
* Improved quality of learning through the increased collaborative learning and faculty-student interaction facilitated by computer conferencing;
* Increased access to educational opportunities for working adults or those trying to re-enter the work force, particularly women;
* Formative and summative evaluation of the effectiveness of this media mix used in different ways, for attaining the above objectives;
* Dissemination of the successful techniques and materials to other institutions.

Access: Overcoming Logistical Problems

The majority of NJIT's students are "first generation" college students, who must work while attending school and who commute rather than live on campus. They are faced with overcrowded classes with sections that fill up early and then become closed (due to budget cuts that laid off staff and raised class sizes). They are also faced with degree programs that because of their technological nature, have extensive sequences of courses that build on one another and must be taken in order. If a student is closed out of a course one semester or must withdraw, he or she might lose a whole semester waiting for another opportunity to take this course which is a pre-requisite for subsequent courses.

In addition, many of the courses are offered more slowly than would be possible for the better prepared or more motivated students to proceed. The "mass lectures" that have emerged as a result of budget cuts tend to slow down to the pace of the "lowest common denominator" and frustrate the better students. Both video and VC allow "fast forward" and "replay" self-pacing.

By using a combination of video (tape and/or broadcast) plus Virtual Classroom to deliver courses, students may more easily fit them into busy lives as employees and family members as well as students. Since the vast majority of NJIT students work 20 hours a week or more, and many work 40 hours a week or more (in order to pay their own educational expenses and/or to help support their families) it is very difficult for them to fit courses they need to graduate into their schedules. By offering distance education sections, scheduling difficulties can be alleviated. Students can graduate in fewer calendar years because they can more easily fit in all the courses they want.

In addition to the asynchronous nature of the VC helping to overcome course enrollment and completion difficulties, we are trying several innovations that may better facilitate self-pacing and improved rates of progress towards the degree, while maintaining or enhancing quality. These innovations include double courses offered during the same semester, independent study opportunities during the summer, and "late start" courses.

Many of the courses in the CIS majors form a series of prerequisites and must be taken in order. For example, the calculus perquisites must be taken before the first introductory course(113), which must be taken before 114; which serves as a pre-requisite to more advanced courses. Students can lose many semesters trying to get through this rigid sequence of courses, one at a time, meanwhile being closed out of some of the courses in the sequence some semesters.

We have redesigned three sets of courses in this series of pre-requisites as integrated "double courses" in the same semester. Students will be able to register, for instance, for 113 and 114 in the same semester. They cover 113 at twice the normal pace, devoting twice the normal number of hours to this task. By the middle of the semester, some of these "fast track" students may decide that they need a full semester after all; they will drop into a slower paced group online. Those who can learn at the accelerated pace will complete the first course in the first half of the semester, and then go on to take the follow on course (e.g.,

114) during the second half of the semester. The participating faculty members coordinate their efforts to provide a "seamless transition" between the two courses. We expect that many students will be able to learn at the increased pace because of the intensive interaction and the support available online. Every time students successfully complete a double course, they can conceivably cut an entire semester off of the number of semesters needed to finish their degree program.

Evaluation

We are using a "multi-method" approach, collecting both subjective and behavioral data, and employing both quantitative and qualitative analysis, including:

* Subjective assessments by faculty and students (based on questionnaires, interviews, and case reports by faculty). Both students and faculty must perceive benefits to this media mix in order for them to continue to select it and thus for the project to be a success in the long run.
* Quantitative/behavioral measures. These include:
    * System use: To be gathered by system monitor and automated statistical analysis routines
    * Time to Degree: We will establish baseline measures of the time currently needed to complete degree programs, by entering freshmen and by transfers full and part time, in the CIS degree programs. Four, five and six years after the project is implemented, we will examine and report data on semesters from first full time enrollment to graduation for freshmen, correlating this with number of Video plus Virtual Classroom sections of courses enrolled in.
    * Access for disadvantaged students: We will examine characteristics of students who opt to take various numbers of VC plus video courses, as compared to students registered in traditional sections, to determine if a higher proportion of women, disabled, and minority or otherwise disadvantaged students enroll in the experimental delivery-mode courses.
    * Quality measures: We will compare course grades for students in experimental sections with the distribution of grades for the same course offered by the same instructor via other media.
    * Repeat customers: We will examine the proportion of first-time enrollees in Video & VC courses, who are not graduating seniors and who choose to take a second or/or subsequent courses via this media mix, as a behavioral measure of satisfaction.

Looking to the Future

When most students have multi-media work stations, the awkward logistics of tape distribution or student recording of broadcasts will probably be supplanted with CD-ROM based digitized video modules. However, for the short term, the VC + video mix seems to work well for a wide variety of courses.

A development of great import is the tying together of the world's computerized information resources, and their accessibility to students and instructors through such networks as Internet, which links most colleges and universities. This means that students can access the equivalent of the world's libraries of information in computerized form, in doing research for papers or projects. In order to make the wealth of information navigable, it is being organized in many cases into a "Hypertext" format. An example of such a system is the "World Wide Web," which is now incorporated as part of the facilities of the Virtual Classroom on EIES 2. This provides access to the Internet GOPHER world wide information services, including the ability to search databases on many campuses connected to the Internet.

The future of this technology is tied to overcoming some of the difficulties related to the current situation of budget cutting and increased course loads for faculty in higher education. The first difficulty is the initial burden placed upon instructors to completely rethink the nature of their courses and adapt their teaching to a facilitative role. It is also necessary to provide some training for faculty on how to utilize collaborative learning approaches. There is also an initial workload in terms of creating materials in electronic form that is quite large the first time one teaches utilizing this medium. Faculty may be far slower to change and adopt this technology than students; therefore, one has to consider the incentives to do so in the particular educational institution.

In the comprehensive NJIT studies of undergraduate courses (Hiltz, 1994), one key generalization was that good students often do much better in the Virtual Classroom, while poor students may do worse. As a result, the average performance is usually the same as face-to-face classes. For graduate students, there is usually a much smaller proportion of students who do not have good study habits and the self-

discipline to do their studies without face-to-face supervision. In a distance education situation it is quite easy for students to put off their participation to a point where it becomes impossible to catch up with the class. The instructor must be provided, in the computer environment, with the tools to track the progress of the students and detect problems early on.

There is no comparison with other modes of delivery of distance education in terms of the ability of CMC technology to allow students to work together in groups and to become a student body with respect to the program of study as a whole. Those of us who hold that this peer group reinforcement is very necessary to creating an outstanding educational process see no other cost effective alternative to computer based conferencing. It is possible with this technology, not just to provide courses, but to establish a learning community and a "virtual university" with all the facilities necessary to make that a reality.

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