The “Virtual Classroom”: Using Computer-Mediated Communication for University Teaching

by Starr Roxanne Hiltz

A report of a long-term project developing computer conferencing for specific courses and to supplement traditional teaching shows advantages to some students in terms of access and interactive opportunities between teacher and student.

Is it possible to build a “virtual classroom,” an interactive communication and learning space located within a computer system? Can a computer-mediated communication system be used to create an electronic analogue of the communication forms that usually occur in a classroom, including discussion as well as lectures and tests? Can it provide new modes of teaching and learning that may be more effective than the traditional classroom? Our initial findings in a long-term investigation of computer education at the postsecondary level suggest that the medium can be effective for some types of students, course materials, and teachers. In addition, the nature of interaction is different.

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Murray Turoff has been responsible for the specifications of software to support a “classroom” structure on the Electronic Information Exchange System and has collaborated in the various experiences reported here. The editorial “we” is used for conclusions jointly reached. Agnes Richie assisted with data entry and statistical analysis of some of the survey data. Elaine Kerr contributed to the design of the surveys of participants.
in the "virtual classroom" than in the physical classroom. Perhaps most important, when it works well interactive computer use can lead to greater communication among the members of a learning group or "class," not just between teacher and student.

The use of the computer and other forms of teleconferencing for educational purposes should be seen within the context of a wide variety of technological innovations that are being applied in order to improve access to educational opportunities or the quality of education (see, for instance, 1, 2, 5, 8). Computerized conferencing is an attempt to overcome the problems of gathering adults together at the same time or place while preserving the advantages of interaction and fostering active learning.

But the "active learning" teleconference is merely a potential; some educational teleconferences have fit the model of a dull lecture, and others might best be described as empty classrooms. How can we utilize computer-mediated communication systems to support effective, active learning? Can we provide facilities for the types of activities that usually occur outside the classroom, such as office hours, libraries, and even extra-curricular activities? Further, can the new technology-based modes of communication serve as more than an emulation of the process of face-to-face communication in the traditional classroom? Can they support a different, more active and involved style of learning on the part of the student?

A great deal of controversy exists about the essential nature of human communication via computer. There is general acceptance of the possibility for a greater flow of information from the latter, given the ability to upload and download from personal computers and to search or browse through items at a relatively rapid rate. There is also agreement that the lack of nonverbal cues can diminish or distort "social presence" (9). On the other hand, a sense of depersonalization often occurs when individuals are restricted to technology-mediated written communication through a computer, sometimes resulting in "flaming" and highly emotional or personal exchanges; the communication content is not necessarily "impersonal." Indeed, there are "cold" and "warm" schools of thought about computer-mediated communication (7). Our hope is that by systematically trying innovations and evaluating their impacts, we can learn to capitalize on the strengths of computerized conferences for educational purposes and to minimize or overcome the weaknesses.

EIES, the Electronic Information Exchange System at the New Jersey Institute of Technology (NJIT), was created as a "laboratory without walls" to develop and assess various structures for computer-mediated communication (4, 11). During the last few years, we have been exploring the use of computer-mediated communication in both the "adjunct" function of supplementing traditional classes and as the primary mode of course delivery for postsecondary education (10). Our
goal has been to understand what types of software structures and teaching techniques may be most effective for the "virtual classroom."

A number of courses have been conducted on EIES, with surveys of students at the end of each. The first three, offered during the fall of 1982 with FIPSE (Fund for the Improvement of Post-Secondary Education) support, lasted a little over three months each, to match a normal academic semester. The topics were computers and society, the use of microcomputers in teaching, and personnel management techniques. Participants included college professors on ten small liberal arts campuses and anyone else with an account on EIES who wanted to join. There was no fee for taking part and no grading or credit.

In all three courses, the first week was spent with "get acquainted" exercises, in which the instructors asked the participants to introduce themselves to the rest of the class and provided course plans and ground rules for participation. At various points, combinations of software and structured social processes were used to try to increase participation. For example, when a feature called "+QUESTION" was used, a member of a conference had to answer the question before being allowed to view the responses of others. This enabled each member to formulate an independent answer, while retaining the ability to see and react to the responses of others. It is thus not quite like anything that takes place in the traditional classroom where, whenever one person answers a question orally, all hear it. Further, in a traditional classroom, a few "talkers" commonly answer most of the questions, while other members of the
class are passive. Also, with a written "essay exam," each person provides independent input but, typically, there is no subsequent sharing and discussion of these individual answers.

Another innovative procedure used in the FIPSE courses was simulation–role play games. A complex, realistic situation was described, and the participants were assigned roles to play in this situation. Each person was given additional background and information relevant to his or her position. Using pen names if they preferred, the course participants then carried out a role-playing game in which the issues were brought out through the interaction. Such a role-playing game is usually difficult for large classes, and many participants feel too shy or prefer more time to be able to put on an effective real-time performance.

One of these first courses was co-taught, with two instructors. Joint teaching and the use of "guest lecturers" marked several of the subsequent courses offered online. Based on this initial experience, the software was improved, and NJIT offered three courses online as part of its continuing education program during the fall of 1983. Each course cost $700 tuition, including the cost of EIES accounts. Continuing education credit was granted but, as with other NJIT continuing education courses, there were no grades.

The FIPSE and continuing education courses present problems of generalizability, since the students were all self-selected. Further, the lack of grading and traditional college credit may have affected student participation. During the fall of 1984, a regular undergraduate and graduate section of two NJIT courses were put online in "adjunct" mode—that is, with regular class meetings as well as required conferences and activities online. One of the required online activities for students was to enter a complete review and critique of an article from a journal, which was then shared and discussed with the other members of the class.

A survey of course members provides information on how students felt about online activities and whether they found them to offer a "better learning experience."

Table 1 shows some of the results obtained, separated for the undergraduate and graduate classes. The majority of students did not feel more inhibited in taking part in discussions in this medium. Although typing takes longer than speaking, they could take as much time as needed to formulate a reply and did not have to respond immediately. They also felt that the system provided good access to their instructors. Their motivation to do a thorough job on assignments was increased because other members of the class would read them.

A few questions addressed whether students felt they "learned more" due to using the computerized conferencing system and whether
they thought it was a "better learning experience." The majority agreed with these summary statements, but a sizable minority, especially among the graduate students, did not. Generally, the graduate students were more negative than the undergraduates. It may be because the undergraduates were on campus a lot and thus had frequent opportunities to use terminals to access the conferences. The graduate students all worked full time, and many did not have convenient terminal access either at home or at work. Of course, the undergraduate section may simply have been a better course in other ways or attracted students with different characteristics.

A separate survey of the FIPSE and continuing education classes received a poor response rate and therefore is not included in Table 1. However, a few highlights of student responses in those courses may be noted. The majority of the FIPSE and continuing education students reported that when they were busy, they were much more likely to neglect to sign online than they would have been to "cut" a traditional class. Further, a majority did not feel that they communicated more with other students than they would have in a face-to-face class, though this had been one of the objectives. In the "adjunct" mode, by contrast, a majority felt that interaction with other students was enhanced.

Some open-ended comments from the surveys help to illustrate student attitudes.

*I think EIES can be very beneficial by allowing students to take classes without having to meet a rigid schedule of classroom activities.*

*A face-to-face course would have been out of the question for me and I greatly appreciate the opportunity to have the chance to participate.*
I would like to have the reading material given to me. I'm a busy person and don't really have the time to hunt through a local library to get copies of the articles for the suggested readings.

Easy to use sample lessons should be used in the beginning so the student can acquire confidence on the system. . . . People must be online long enough before the course begins to become familiar with the operation of EIES.

Since many of my own best moments in life were spent in face-to-face learning situations, such as small graduate school seminars, I have a strong bias that that's the best way to go about education. . . . The problem for me is that there's something alienating about being separated both in time and space from my fellow participants, and I don't have any idea how to overcome it. Perhaps it's simply a matter of acclimating to a new way of doing things—by computer.

Teleconferencing loses the personal contact of face to face. I am often as much interested in how someone says something as what he or she says. Thus, I don't feel that I have much of a mental image of the other participants.

The open-ended comments suggest that students perceive the advantages of computer conferencing to center on greater convenience of access; the disadvantages center on the awkwardness or difficulty felt by many in communicating without the accustomed nonverbal cues that serve to regulate interaction in the face-to-face mode. This is related to the time required to feel comfortable using the system. Social interaction online does not seem "natural" at first. Note, too, that the logistics of substituting for the traditional availability of a "reserve shelf" for assigned readings pose a problem for those not located near good libraries. The electronic university must emulate not only the classrooms, but also the other types of spaces and services provided on the traditional college campus.

The effectiveness of the "virtual classroom" approach rests in whether students do take a more active part in the learning process and take advantage of the potential for more interaction with the professor and the other students, despite the absence of nonverbal cues to facilitate this interaction.

Two types of data can inform us about the effectiveness of the "virtual classroom" approach in supporting a more active role for the student than the traditional classroom environment. One is activity counts of actual contributions in the class conferences. (Ideally, one would also
have counts of private message traffic between student and professor, and among students, but we felt that this would be an invasion of privacy.) The second is correlations, available for the courses offered online in "adjunct" mode, between variables measuring active participation and interaction, and assessments of the overall value of the online experience.

We took one class conference from each of the three major groups of courses and used an analysis routine to profile participation. In addition to private messages, these activity counts also exclude student assignments, which were deposited in separate class conferences or notebooks. Two units of analysis were used: the comment, or discrete item entry in a conference (similar to a "turn" in the face-to-face situation); and the number of lines entered, which is analogous to share of speaking time. The data are displayed in Table 2. The first line shows the total number of participants in the online course; the second shows the number who played an active role. The latter category was determined by an arbitrary cutoff of those who contributed five or more items to the discussion. The key data are the proportions of lines contributed by the students as compared to the professors; these vary from 66 percent to 83 percent in the three courses for which a content analysis was done. Comparable data for face-to-face courses are not available, but we suspect that for most courses of comparable size, the instructors would speak for a much higher percentage of the class time. In an earlier study of the use of electronic mail in an adjunct mode, Welsch (12) also reports that the medium leads to more interaction among the members of a class.

In Table 3, Pearson’s correlation coefficients are shown for items measuring active participation and interaction with others online. Table 3 also presents the summary judgments by the students about whether they learned more and had a better “learning experience.” These data are available only for the courses offered in the online “adjunct” mode. The correlations support our hypotheses. There are very strong correlations between measures of perceived greater interaction with other students, feeling more involved, and the perception of having learned

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Table 2: Participation by instructors and students in FIPSE, continuing education, and adjunct online courses

<table>
<thead>
<tr>
<th></th>
<th>Continuing education</th>
<th>Adjunct</th>
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<tbody>
<tr>
<td>Total participants</td>
<td>65</td>
<td>20</td>
</tr>
<tr>
<td>Active participants (5 or more comments)</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>% of lines by instructors</td>
<td>31</td>
<td>34</td>
</tr>
<tr>
<td>% of lines by students</td>
<td>69</td>
<td>66</td>
</tr>
<tr>
<td>% of items by instructors</td>
<td>33</td>
<td>51</td>
</tr>
<tr>
<td>% of items by students</td>
<td>67</td>
<td>49</td>
</tr>
<tr>
<td>Total number of items</td>
<td>360</td>
<td>215</td>
</tr>
</tbody>
</table>
Table 3: Pearson's correlation coefficients for student participation and interaction with others in adjunct online courses (n = 46)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Learned more</th>
<th>Had better learning experience</th>
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<tbody>
<tr>
<td>More student interaction</td>
<td>.59**</td>
<td>.61**</td>
</tr>
<tr>
<td>Felt more involved</td>
<td>.51**</td>
<td>.36*</td>
</tr>
<tr>
<td>Course more interesting</td>
<td>.53**</td>
<td>.78**</td>
</tr>
<tr>
<td>Increased motivation</td>
<td>.40**</td>
<td>.40**</td>
</tr>
<tr>
<td>Reviews by others useful</td>
<td>.35*</td>
<td>.40**</td>
</tr>
<tr>
<td>Comments by others useful</td>
<td>.30*</td>
<td>.31**</td>
</tr>
<tr>
<td>Better access to professor</td>
<td>.19</td>
<td>.42**</td>
</tr>
</tbody>
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* p < .05
** p < .01

more. In fact, these are the only items that do correlate strongly. Such variables as typing skill, grade in the course, previous experience with interactive computer systems, and time online show little or no relationship with the perceived effectiveness of the conferencing experience.

**Among the access barriers to the “virtual classroom” is the simple problem of learning to use a computerized conferencing system.**

Typically, there is no “start-up” time in a class at the college level. Professors and students know how to behave in order to make the communication process flow with reasonable effectiveness: for students, raise your hand when you wish to speak, take notes in order to retain material, etc.; for teachers, face the class, speak loudly and clearly, use the board and visual aids to supplement lectures, ask questions to stimulate discussion, etc. Computerized conferencing is a quite different environment, however, and both “teachers” and “students” must learn some new communication skills before they can get down to the business of teaching and learning.

In our field trials with EIES, most users have not received any face-to-face training sessions (though these would probably shorten training time significantly, they are not necessary). All users receive a short written manual, including directions for access to the online documentation and learning aides and to the online consultants to help them learn the system. Direct observations show that if they manage to figure out how to make their equipment work and actually get connected to the computer network, they are able to send and receive messages within the first fifteen minutes or so. The time taken to master the other features varies tremendously among individuals but seems to be within reasonable boundaries. A study of EIES users (3) divided learning into three levels: “the basics,” “feeling comfortable,” and “learning advanced features.” Most users reported less than five hours to learn the
basic mechanics, though one in five reported taking longer. The median was 2.4 hours. For "feeling comfortable," however, the median was 5.1 hours.

Taking these learning requirements into account, we have formulated a number of guidelines. New users should be given a week or two just to get acquainted with the system and with each other before being given complex material and assignments. Some personal attention from the instructor, by telephone or by message, will be needed by many students during their period of adjusting to the medium. Some people will never feel comfortable with this medium and will become "drop outs." Even among self-selected students, one can expect a drop-out rate of 20 percent or more. Thus, at best, the medium should be seen as an appropriate option for delivering education to some adults, but other options must also be retained.

Learning advanced features is more problematic. In order to participate in an online course, students need to know only a few basic procedures and feel comfortable; however, instructors must be familiar with many advanced features in order to be able to control the delivery of long text items, construct tests or voting exercises, and moderate their conferences. About half of EIES users with less than 50 hours of time online never learned these features at all, and one-third of the high users with 50 to 99 hours online did not. Of course, they never may have felt the need to know how to use anything other than simple message and conference capabilities. The more time a person spends online, the longer the time reported to learn advanced features. For instance, among those with more than 100 hours online, over one-third reported 30 hours or more to learn the advanced features.

It may be concluded that only those experienced with the medium of computerized conferencing should undertake to offer a course using this medium. Further, 30 to 50 hours online will be necessary to gain this experience. Teachers with no knowledge of advanced features will need an experienced user to act as a technical facilitator.

Some fundamental software enhancements are also needed for a more effective "virtual classroom." One is graphics, including the ability to display mathematical notations, flowcharts, and diagrams (analogous to the blackboard). Another is a software architecture that would segregate and order the sequence of units or lessons and activities in an online course. This is necessary in order to overcome the problems created by the asynchronous nature of the medium. Some students may be weeks behind others and not ready for the most recently raised topics and assignments. We are currently developing prototypes of such enhanced "virtual classroom" environments.

A recent report by the Office of Technology Assessment concludes:

*Information technology holds significant promise as a mechanism for responding to the education and training needs of society, and it*
will likely become a major vehicle for doing so in the next few decades.

Much remains to be learned about the educational and psychological effects of technological approaches to instruction. Not enough experience has been gained with the new information technology to determine completely how that technology can most benefit learners or to predict possible negative effects of its use (6, p. 8).

Based upon our experiences and research with computer conferencing, we believe that one important requirement for realizing the promise of new educational technologies is to use them to create learning and teaching environments that are more effective and exciting for at least some kinds of materials, rather than merely trying to replicate the traditional classroom electronically.

REFERENCES