How Computer-Mediated Communication (CMC) Can Work to Enhance Distance Delivery of Courses

Cheryl L. Bielema

Abstract

An innovation, such as requiring connectivity and E-mail in a graduate course, can create barriers for the new users. The purpose of this study was to better understand one such innovation: the use of computer-mediated instructional techniques for a distance learning environment. The participants were instructors and extramural students in two audiographics courses. E-mail was archived, coded, and sorted to show differences in use among the students, while interviews were conducted with selected students to reveal any barriers and benefits they experienced. The findings suggest improvements are needed in facilitating electronic discussions; structuring learning projects, specifically, self-directed learning contracts; and better planning for different learning styles.

Introduction

Distance education involves using a variety of communication technologies to deliver the products of training information or formal courses to its students. Distance instruction is different from face-to-face classroom instruction. Not only is there physical separation of students and instructors, but the

Cheryl L. Bielema, ACE member for six years, was an Extension Communications Specialist in the Distance Learning Office, College of Agricultural, Consumer and Environmental Sciences, University of Illinois. She is currently Training Lead with the National Center for Supercomputing Applications, University of Illinois. The project which Cheryl leads is located at Aberdeen Proving Ground, Aberdeen, MD.

technologies used have their own unique constraints. For example, the audiographics technology requires networked computers and participants require training in the use of software features and file transfer. With audiographics systems, the interaction is limited to two sites at a time, during which the professor or student may illustrate or question by using the keyboard or stylus and sketchpad. Without a synchronous audio link, the messaging among participants is limited to words or symbols on a monitor.

Distance education differs contextually, in that the technology ". . . often limits the form, frequency, and immediacy of messages" (Garrison, 1989, p. 227). Moore and Kearsley (1996) call for special teaching behaviors to bridge the distance or separation imposed by space or time differences. Computer-mediated communication (CMC), along with other delivery technologies, can increase interactions at the levels of student-to-student, student-to-instructor, and student-to-learning materials.

Purpose

The purpose of this study was to enhance understanding of the practices, processes, and factors affecting the planning and use of computer-mediated instructional techniques in the distance learning environment. Specifically, the following research questions were addressed:

1. What personal barriers are encountered when implementing computer-mediated instructional techniques?
2. What institutional barriers are encountered?
3. What technical barriers are encountered?
4. What benefits accrue to the participants as a result of using an innovation (e.g., computer-mediated communication)?

Methodology

The participants were two instructors and 48 adult, extramural students enrolled in two audiographics graduate courses, fall semester, 1995. Small groups of two to eighteen students were located at seven sites—one campus classroom and six remote learning sites. The courses were from the College of Agricultural, Consumer and Environmental Sciences and the Graduate School of Library and Information

Sciences. One instructor required electronic connectivity and assigned a variety of electronic projects to be completed individually or in groups of two or three. The class with required connectivity will be termed Group A in the narrative. The second instructor made the electronic connection optional for his remotely-located students (referred to as Group B), but planned a campus computer laboratory to introduce the Internet and World Wide Web.

The study used quantitative and qualitative methods. Electronic mail and messages to the course newsgroup and listserv posted by the professor and students in Group A were archived, coded, and entered into a database management system for analysis. The instructors, selected students in both Groups A and B, and outreach program directors were interviewed. The transcriptions of the interviews were coded, using the same categories as the electronic messages.

Findings

What Students Did with E-Mail

All of the electronic mail going to and from the professor and postings made by Group A to the course newsgroup and listserv were archived, coded, and sorted (Table 1). The most frequent types of E-mail were those devoted to subject matter questions and assignments, accounting for almost 45% of the total. Technical barriers were second in frequency, 28%. Personal, family, or work barriers comprised over 12% of the total, while institutional barriers accounted for nearly 10%. Expressed benefits or successes was another category, totaling 4% of the total. New or emerging barriers accounted for .75% of total electronic activity.

What Students Experienced

The descriptions that follow were gleaned from interviews and observations of 18 selected students within both Groups A and B, two instructors, and three program directors of the Division of Outreach Programs. All were key players in the distance courses studied. The interview transcripts were coded by the same content categories used for the E-mail.

The students were asked to describe their experiences with electronic communications and to give details about two problems and two benefits they had encountered. They were not asked to respond to a checklist, comprised of the "uni-

Table 1

Group A (Required Connectivity) - Overall Electronic Messages by Content and Frequencies

Category	Number	Percent of
Subject Matter/Assignments	417	44.8
S1 (questions)	341	
S2 (questions)	76	
Technical Barriers	265	28.5
T1 (hdwr-sfwr)	46	
T2-3 (connect)	54	
T4 (usability)	155	
T5 (select)	10	
Personal Barriers	113	12.1
P1-3 (ind char)	38	
P4 (emotions)	21	
P5 (acknow)	54	
Institutional Barriers	91	9.8
U1&3 (crs info)	37	
U2 (computer lab)	16	
U4(facility)	6	
U5 (crs req)	32	
Benefits/Successes	38	4.1
New/Emerging Barriers	7	0.75
TOTAL	**931**	

Note. Hdwr-sfwr = hardware/software problems, connect = connectivity, usability = usability of tools, select = selection of tools, ind char = individual characteristics, emotions = expression of emotions, acknow = acknowledgment statements, crs info = course information, crs req = course requirements

Table 2

Frequencies of Barriers to Electronic Communications Expressed by Interviewed Students

Category	No.	Percent
Personal		
Personal attributes	7	39%
Individual learning styles	11	61%
Institutional		
Course information/materials	6	33%
Computer laboratory	6	33%
Enrollment	3	17%
Facilities/technical help	16	89%
Course requirements	6	33%
Technical		
Hardware/software operation	10	56%
Connectivity	6	33%
Electronic tools usability	9	50%
TOTAL STUDENTS	18	

Note. Number of student responses do not equal total number of students because multiple responses were given.

verse" of possible barriers and benefits. Instead, they were free to describe whatever situations occurred to them at the time of the interview. Common topics arose from this free-ranging inquiry (Table 2).

Personal barriers. Personal barriers were categorized in the following areas: personal and family characteristics (P1), level of computer experience (P2), individual learning style or preference (P3), expression of emotions (P4), acknowledgment statements (P5), and expression of personal benefits (P6).

Within this classification system, differences among individual learning styles (P3) were noted by 11 of the 18

interviewed students. Personal attributes, such as living in a rural area, family responsibilities, lack of computer experience, or busy lives, were mentioned as a problem in using CMC.

Institutional barriers. Institutional barriers were classified in five individual areas: course information and materials (U1), computer lab (U2), enrollment and fees (U3), facilities and technical help (U4), and course requirements (U5). The most problematic institutional barriers (i.e., facilities and technical help) were reported by 16 of the 18 interviewed students. Certain aspects of use of the computer labs at the remote learning sites and obtaining course materials were considered problematic by a majority of the reporting students.

Technical barriers. Technical barriers were categorized as hardware-software operation (T1), connectivity issues (T2), student accounts (T3), use of electronic tools (i.e., student-initiated use/misuse of computers, Internet, or WWW tools) (T4), and selection of hardware and software (T5). Ten respondents mentioned technical barriers related to hardware or software, and nine mentioned they had difficulty in using electronic tools. The problems varied from entering incorrect addresses or using incomplete strings of information for UNIX access, to being unsuccessful in transferring commands and function keys among the various computers they were using.

Benefits. On the other hand, these adult students listed six types of benefits of using CMC: increased access to resources, collaboration, and collegiality; convenience/expedience; personal growth; integration with work; and serendipitous discoveries (Table 3).

Discussion

The following recommendations encompass both instructional design improvements for which educators might take responsibility and leadership, and infrastructure improvements that will require broader institutional decision-making and partnerships to accomplish. With more communication and information management professionals getting involved in distance education, it seemed advisable to look for the most important instructional design strategies that made a difference with adult students, who were themselves professionals in agriculture and library sciences.

Table 3

Frequencies of Benefits of Electronic Communications Expressed by Interviewed Students (N=18)

Category	No.	Percent
Access to Resources	11	61%
Collaboration/Collegiality	9	50%
Convenience/Expedience	4	22%
Growth	4	22%
Integration in Work	6	33%
Serendipitous Discoveries	3	17%
TOTAL STUDENTS	**18**	

Note. Number of student responses do not equal total number of students because multiple responses were given.

Important ideas from the qualitative study of student and faculty experiences include these instructional caveats:

1. CMC can increase interaction on several levels.
2. The moderator is essential to revitalize electronic discussions over time.
3. Students need reasons (in well-defined and frequent assignments) to practice the skills.
4. A wide variety of learning preferences can be accommodated by use of multiple media.
5. Self-directed learning is possible via CMC.
6. CMC projects are best integrated in the real-life work and needs of individual students as opposed to hypothetical situations.

I. CMC Increased Interaction

Interactions were substantially greater between students and the professor who used E-mail than those who did not. Students in Group A contacted their professor on average 20 times, compared to three times reported by students in Group B, using telephone or office visits. The professor requiring E-mail also submitted evidence of the higher quality interactions he had achieved with his students. He maintained that he could develop a broader relationship with more students "that in a regular classroom situation you would [have to] work hard to [develop with only a few]."

Interactions among students were mentioned as success stories in using electronic mail. Collaboration was a common theme. The students reported finding commonalities of experience or learning interests and submitting high quality assignments together. They praised the strengths of individual partners who contributed valuable pieces, such as topics and legitimization with cooperating agencies. The following example was given by a student, who related his partner's relationship with an organization which agreed to turn over proprietary materials for the students' project. His partner's contribution was a legitimizing of their work, while the reporting student's role was described as doing the technical work of converting materials to Hyper Text Mark-up Language (HTML) code.

> Everyone brings strengths and weaknesses and my research partner brings certain strengths in terms of his topical selection and his connections. . . .We're working with an organization that's turning over original material that we're then turning into a Web page. So, part of it is a collaborative model in getting all the various departments to work with us (ID1007).

II. The Moderator in CMC

The missing instructional role in the current study was facilitator or moderator, to continue or revitalize use of the class listserv and newsgroup, over time. There were only five postings per student to either the class newsgroup or mailing list, or a total of 164 postings for the semester (average of 10 per week). In addition, E-mail activity dropped off as the semester progressed (i.e., 46% of the total occurred in the first one third of the semester, 38% mid-semester, 16% in final third of the semester). The professor working with Group A had three stated objectives for CMC: (a) students work together on

electronic assignments; (b) students learn the course material; and (c) all students gain something, no matter what their level of computer experience. He used the class newsgroup and the mailing list primarily for students to post their individual assignments. He asked students mid-semester to post their project ideas in order for potential collaborators to find one another. He did not encourage interaction among the students, a means of facilitating learning at higher cognitive levels according to practitioners who have used CMC as the primary learning tool (Davie & Wells, 1991; Rohfeld & Hiemstra, 1995). These practitioners advocate more electronic interaction as a way to exercise the higher order intellectual skills.

To accomplish greater interaction via electronic media, the professor must model and encourage electronic participation, much the same way s/he encourages discussion in a face-to-face class. This role has been termed the moderator's role (Olgren, 1992; Paulsen, 1995). Paulsen listed moderation roles in three general areas: organizational, social, and intellectual. The organizational approach emphasizes required participation, simple assignments, and regular prompts to remain involved and focused. Socially-oriented tasks include reinforcement of desirable discussant behaviors, such as praising student contributions in personal E-mail or using cues or quotes from students to summarize or continue discussions. Overseeing the intellectual aspects of electronic discussions means linking the various contributions, summarizing, staying practical and relevant, and presenting conflicting views.

One example of a continuing topic within the newsgroup was "netiquette," that which constitutes acceptable electronic behavior. When students in Group A were questioned about why they did or did not post anything related to netiquette, two commented that they either weren't interested in the topic or did not have anything more to contribute.

The professor possibly could have encouraged more postings by introducing a greater number of topical discussions. For example, the potential of CMC for exploring common research interests, discussing and evaluating some of the current literature, or reflecting on work experience was not fully developed in this case. These have all been given as examples of what can be done with the electronic medium which works to involve students more completely in their own learning. Professors will be more effective moderators if they

structure their courses to require interaction, reinforce active discussions, and stimulate intellectual growth. Suggestions for structuring a computer-mediated learning experience to encourage the necessary practice and to help students learn new skills are elaborated in the next section.

III. Practice the Skills

Well-defined and structured assignments are recommended by various distance educators (Eastmond & Ziegahn, 1995; Smith & Taylor, 1995) to help distance students learn the course content and to "bridge the distance" between professor and students and among students. The structure of the course as described by Moore and Kearsley (1996) includes "learning objectives, content themes, information presentations, case studies, pictorial illustrations, exercises, projects, tests" (pp. 202-203). Smith and Taylor (1995) recommend the use of specific goals to be accomplished daily and to be verified by the instructor. Eastmond and Ziegahn (1995) make the following comparison of distance and face-to-face settings: "the structure of a [computer-mediated learning experience] inhibits, directs, or encourages participation in much the same way that chair and desk arrangement affects involvement in the conventional classroom" (p. 79).

Methods for structuring the computer-mediated environment might include requiring a set number of contributions per student; having two-week topical discussions, followed by summaries prepared by students; revising and reflecting on the improvements in writing assignments; and, assignments requiring use of various electronic databases, resource people, and Internet tools.

IV. Accommodation of Learning Preferences

The students in both Groups A and B indicated whether they preferred learning by using selected instructional techniques and technologies. One student was adamant that she preferred learning face-to-face, but said she could "bend" her preference in order to have courses available and close to home. Others alluded to being visual learners or hands-on learners. "I'm not good at reading directions and envisioning what I should do. I like to watch somebody do it . . . that really works . . . watching somebody [do the task]" (ID5002). The course sessions were characterized as mostly auditory; two students thought that those who were dexterous or visual

might be extremely frustrated.

The professor using electronic mail in Group A used a variety of teaching methods such as hands-on exercises, lecture, and trial-and-error experimenting, to accommodate the variety of personal learning styles.

Trailblazers in CMC techniques recommend that print, text supplemented with illustrations, can be combined with video and audio, and that a wide variety of electronic activities can be developed (Mercer, 1994; Moore & Kearsley, 1996; Olgren, 1992). Mercer listed class discussions, class tutorials, group analysis and report writing, guest lectures, role playing, and polling as among the possible electronic activities. Once acquainted with CMC, the students may find additional ways to build on the collegiality and interactions that were not conceived in the original course design.

V. Self-Directed Learning via CMC

This group of adult students endorsed self-directed learning—determining learning needs, developing specific learning objectives, and pushing themselves in new areas. One student expressed his propensity to perform better when there were "really rigorous requirements" (ID2007).

Berge and Collins (1993) assert that "CMC promotes self discipline and requires students to take more responsibility for their learning" (p. 3). Instructional strategies to activate self-directed learning require both the formulation of well-structured guidelines and the development of a formal learning contract, according to Knowles (1975).

The discrete parts of the learning contract postulated by Knowles include: (a) learning objectives stated in words that are personally meaningful, (b) learning resources stated for each objective, (c) evidence of accomplishments, and (d) criteria and means of evaluating one's performance. Use of CMC for developing the learning contract has been described by several educators (Bates, 1995; Rohfeld & Hiemstra, 1995). In one scenario, through group process learners posted their contract drafts, received feedback, clarified their needs and potential resources, and gained help from fellow students. The instructor also used CMC to negotiate acceptable criteria, measurements, and evaluation methods for verifying that learning objectives had been accomplished.

VI. Integration of Course into Real-Life Work

The ability to integrate computer-mediated communications into their professions was mentioned as a benefit by several students in the study. A high-school media specialist reported that a class discussion had alerted her to the need for rules regarding acceptable use of the Internet.

> That kind of awakened me to a need, and I've done a lot of looking around; and I've accumulated a few [electronic documents]. . . . So, as we get to the point where we're going to have students using Internet, I realize that I'm going to have to put together some sort of acceptable use [statement] (ID3002).

Five students selected a term project to train colleagues at the workplace. The pressure to train others had been the impetus for their enrolling in the course. As one student explained, "We're kind of expected to automatically know how to use the [Internet] system and to be able to train others without being provided with instruction and training ourselves" (ID4002). Another student was enthusiastic about selling the potential of Internet access for her local library through the training she conducted with administrators: "This is not frosting on the cake, this is the bread and butter of today's librarianship," she said (ID2005).

Rogers (1959) advocates "direct experiential confrontation" as one of the most effective ways to learn. Development of case studies, critical incidents, or practice-based projects will prompt learners to apply the principles, methodologies, or skills when they plan around their real-life work or learning needs. This cohort of extramural students supported the importance of tying course deliverables to their individual, real-world needs.

Summary

The electronic medium can serve the needs of adults who avail themselves of education via distance technologies. By transcending space and time, computer-mediated communication allows conversational interaction and learning at higher cognitive levels through iterative improvements and collaboration with fellow learners. The research study produced the following set of guidelines and offered more specific examples that might improve the practice of computer-mediated communication in distance education:

1. CMC can increase interaction on several levels of interaction. Personalizing instruction via technology was accomplished by CMC in Group A. Contacts between students and the professor were increased, and collaborations between students occurred as they worked jointly on projects.

2. The moderator role is essential to revitalize electronic discussions over time. CMC was used primarily to solve certain technical glitches encountered by the students. In this study, the professor encouraged assignment postings and viewed electronic discussions as an optional activity. There were only five postings per student, on average, throughout the semester, and electronic activity dropped as the semester progressed.

3. Students need reasons (in well-defined and frequent assignments) to practice electronic skills. Technical barriers existed for this cohort of students where one-half identified themselves as beginners. The online assignments served as practice of specific electronic tools and techniques. The students mentioned the amount of personal, technical growth they experienced by completing the structured assignments.

4. A wide variety of learning preferences can be accommodated by use of multiple media in delivering educational content. Individuals varied in their statements about learning via technology—one student preferred face-to-face instruction. Others indicated they learned best by demonstration and hands-on practice under the watchful eye of an instructor. These preferences can be accommodated when text, synchronous audio and video, and interactive techniques, both asynchronous and synchronous, are used.

5. Self-directed learning and learning integrated in the real-life work and needs of students are possible via CMC. The course's electronic assignments were the catalyst for greater involvement in computer usage.

This group of students referred to electronic media being integrated in their daily lives as they hurried home from work to read E-mail, or their families adjusted evening schedules to allow online time. At the highest level of integration, they trained work colleagues in the use of electronic tools, as part of their self-determined course projects.

Additional research might help to clarify whether this group of adult students is typical in their experiences with computer-mediated communication (CMC). The combination of CMC with other audio graphics systems, with audio-only or video conferencing technologies, might expand the nature of inquiry. Developing quasi-experimental research designs to isolate specific instructional techniques, such as the moderator role, or student characteristics, such as learning styles, is another promising area of study. Barriers will exist until the innovation (e.g., use of CMC in distance education) becomes common practice.

Then, further refinement of the processes can create and sustain higher quality interactions and learning, no matter where or when students are engaged in distance education.

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