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ABSTRACT

Distance education is moving toward more interactive environments. Studies of student satisfaction with distance education suggest that the level of interaction in the class is related to perceptions of satisfaction regardless of the instructional medium. This paper reports findings from a study of four graduate research and evaluation courses at a midwestern public university that were taught using interactive television technology, specifically, a compressed video system. Two of the courses had three delivery sites each and two had two sites each. Data were collected using multiple sources. Data included information on student background and experience with distance education; videotapes of classes; surveys of distance education satisfaction; five-minute feedback forms; student journals; surveys of student perceptions of interactivity; and student achievement data. A particular focus in this study was on "interactivity" in distance education. The results reported focus on data from four sources: (1) surveys of student perceptions of interaction, (2) videotape data from the classes, (3) student journals, and (4) one-minute feedback forms. Contains 20 references and the interaction survey. (JMK)

Interaction in Interactive Television Instruction: Perception versus Reality

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Introduction

The literature reveals that technology is changing the practice of distance education. Distance education is moving toward more interactive environments. No longer is the isolated individual taking a correspondence course the essence of distance education. Groups of students, using new technologies, can now interact in "real time" and in "asynchronous" time not only with the instructor, but also with other students. This trend is expected to grow as demands for distance education increase, particularly among adult populations.

The resurgence of distance education is attributed to the development of new hardware and software applications that enhance the transmission and receipt of images and sounds at a distance. One of the more recent technologies is two-way interactive television. Technologies such as interactive television are widening the communications channels between student and instructor, channels that were limited in earlier forms of distance instruction. More interactivity is now possible between and among participants in the distance learning environment.

Studies of student satisfaction with distance education suggest that the level of interaction in the class is related to perceptions of satisfaction regardless of the instructional medium. This paper will report findings from a study of four graduate research and evaluation courses at a Midwestern public university that were taught using interactive television technology, specifically, a compressed video system. Two of the courses had three delivery sites each and two had two sites each. Data were collected using multiple sources. Data included information on student background and experience with distance education; videotapes of the classes; surveys of distance education satisfaction; five-minute feedback forms; student journals; surveys of student perceptions of interactivity; and student achievement data. A particular focus in this study was on "interactivity" in distance education. Therefore, the results reported here will focus on data from four sources: surveys of student perceptions of interaction, videotape data from the classes, and student journals and one-minute feedback forms.

Background

> *One of the most important instructional elements of contemporary distance education is interaction. It is widely held that a high level of interaction is desirable and positively affects the effectiveness of any distance education course.* (Kearsley, 1995, p. 366)

Distance education literature suggests that interaction is an important variable to consider in developing and delivering distance education. Two-way audio and video connections have increased interaction capabilities between instructor and remote students compared to earlier forms of distance education. However, while two-way interactive television provides more channels of communication

than other forms of distance education (i.e. correspondence study, videotape instruction, or one-way video instruction), the physical separation of learners and the instructor still creates barriers to communication and connectivity. Interaction between students and instructors is often regarded as essential by educators. Gunawardena and Zittle (1995) note that recommendations for successful distance education strategies often focus on providing maximum interaction between students and the instructor. A number of studies have focused on interaction in distance education classrooms.

Barker (1995) contends that distance learning forces instructors to find new ways to structure student-teacher interaction and requires "forced" interaction and more effort to involve remote students and make them feel part of the class. Barker recommends planning for interaction because of the tendency for distance students to be passive. Moore (1993) noted that distance education creates a physical separation that leads to a psychological and communications gap between instructors and learners and discusses three types of interaction (learner-content, learner-instructor, learner-learner). Hillman, Willis and Gunawardena (1994) added the dimension of learner-interface interaction, arguing that the effect of technology on interaction is often overlooked. They maintain that the interface acts as a "confounding intermediary" in other types of interaction.

In a study of interaction and satisfaction in an interactive television course for K-6 teachers, Fulford and Zhang (1993) found that a critical predictor of satisfaction with distance education is the students' perception of overall interaction in the class. They suggest that perception of interaction is a desired learning outcome. Their study also revealed that learner perceptions of interaction decrease over time, perhaps due to an increase in interaction expectations on the part of students as they become more confident and comfortable in the distance education environment. In a later article, Zhang and Fulford (1994) report that according to their research, how students feel about interaction in the classroom may not be directly related to the amount of time actually spent on interaction, but rather on the nature of the interaction as perceived by the students.

Miller, McKenna, and Ramsey (1993) concluded in their study of interaction in distance education that students' psychological perceptions may have more effect than the capability of the technology to simulate an environment that allows approximately the same level of interaction as a traditional classroom. Burnham (1995) found in observations of remote sites that students interacted with the instructor, but interacted more often and longer with other students at their local site.

Wilkes and Burnham (1991) found a relationship between satisfaction and student involvement and found that on-site students rated both areas significantly higher than distant students. These authors conclude that instructors have substantial influence on the amount of student involvement in the classroom. Ritchie and Newby (1989) found that classes where the instructor was not physically present had significantly lower ratings on involvement and overall satisfaction than either the traditional class or the television class with the instructor present in the room. It could be argued that students in television classes where the instructor is physically present (origination) are likely to have a learning experience more similar to that of a traditional classroom than to that of their remote counterparts.

Purpose of the Study

The purpose of this study was to better understand the interactions and dynamics that occur in on interactive television classroom, focusing on the manifestation of interactivity. With two-way interactive technologies, claims have been made that the level of interaction in a traditional classroom can be duplicated and that students' experiences in the distance environment are similar to experiences in a regular classroom (Simonson, 1994). Interactivity in the distance classroom was studied in three ways for this research project: 1) a survey was given asking students to rate their perceptions of the level of interaction, 2) classes were videotaped and randomly selected videotapes were analyzed for interaction patterns, and 3) student journals and feedback forms were reviewed for comments related to interactivity. In particular, this study compared student perceptions of interactivity as reflected in self-report surveys and in journals and feedback forms with data collected via videotapes of the classes.

The Subjects

This study took place at a public midwestern university of about 23,000 students. In the past few years, interactive television via compressed video has been increasingly used at the institution to deliver instruction to remote sites. However, 1997 marked the first year that courses from the department of curriculum and instruction were offered in this format. Four different sections of graduate level research and evaluation courses, taught by the same instructor, were the focus of this study. Two sections were taught in 1997 and two were taught in 1998.

Thirteen students were enrolled in one course which was delivered to three sites in Spring 1997: an on-campus section with five students, one remote site (A) with six students, and a second remote site (B) with two students. Five students were male and eight were female. Five were doctoral level students and eight were master's level students. This class met for a total of fourteen three-hour sessions. The instructor remained at the campus site for nine sessions. For three sessions, the instructor traveled to site A and for one session to site B. The final class was held at a central location and all but one student attended this face-to-face session.

Eighteen students were enrolled in the second course delivered to three sites in Summer 1997: an on-campus section with nine students, one remote site (A) with eight students, and a second remote site (B) with one student. Five students were male and thirteen were female. Eleven were doctoral level students and nine were master's level students. The class met for nine sessions, each three and a half hours long, over the interactive television system. This course also included an initial face-to-face Saturday class (six hours long) and a final face-to-face Saturday class. All students were present at the initial Saturday session, while two were absent at the final Saturday session.

Twenty students were enrolled in the third course delivered to three sites in Spring 1998: an on-campus section with four students, one remote site (A) with 15 students, and a second remote site (B) with one student. Two students were male and 18 were female. Seven were doctoral students and 13 were master's students. The class met for thirteen sessions over the interactive video system, with each session lasting for three hours. The instructor traveled to remote site A twice, with three students from the origination site traveling with the instructor for one of those visits.

Thirty-two students were enrolled in the fourth course delivered to two sites in Summer 1998: an on-campus section with 21 students and a remote site (C) with 11 students. Twenty of the students were female and twelve were male. Twenty-two were doctoral students and ten were master's students. The class met daily (Monday through Thursday) for four hours each day for four weeks. There were also two all-day Saturday sessions where the students met on campus face-to-face; one was the initial session and one session occurred midway through the course.

Instruments and Data Collection Tools

Interactivity was measured in three ways for the study. Students were asked to respond to self-report surveys asking about perceptions of interaction. Classes were videotaped and analyzed for interaction. Finally, students were asked as part of the class to reflect on their class experiences through feedback forms in 1997 and through journaling in 1998.

Interaction Surveys

Surveys designed to assess student perceptions of interaction were collected. This survey was based on the work of Fulford, Sherry, and Zhang (1997). Two versions of the survey were used. During the spring 1997 class, the survey assessed perceptions of the level of interaction for (a) student to instructor, (b) instructor to student, (c) student to student overall, (d) student to student at the same site, (e) student to student across sites, and (f) overall class interaction. Descriptive statistics were used for analysis (frequency distributions and means). Confirmatory factor analysis and reliability analysis indicated that four of the constructs (student to student at the same site, student to student across sites, student to student overall, and overall class interaction) were reliable while two were problematic. There seemed to be problems with the student to instructor and instructor to student constructs. The researchers, after reviewing the data, theorized that these two constructs were not differentiating between instructor and

student interactions when the students were at the same site as the instructor and when the students were at the remote site. T-tests indicated statistical differences in the responses of remote and origination site students to items in these two constructs.

The survey was revised for the summer 1997 course, maintaining the three of the stable constructs and using two new constructs. The constructs were named: (1) overall class interaction, (2) teacher-student interaction within site, (3) teacher-student interaction across site, (4) within site student interaction, and (5) across site student interaction. These five constructs were found to have adequate reliabilities (Cronbach alpha levels .77 to .98) following the summer 1997 administration. Subsequent administration and reliability analysis confirmed that these constructs were stable. During 1997 the interaction surveys were administered in a pretest-posttest design, with the pre-test given at the second session and post-tests at the concluding session. Surveys in 1998 were posttest only and given at the concluding session. Data were analyzed using SPSS.

Plus/Delta Feedback Forms and Personal Learning Logs

As a regular part of the class, students were asked to provide feedback to the instructor. During 1997, this feedback took the form of feedback forms (referred to as Plus/Delta sheets -- See figure below) which students were asked to complete in five minutes at the conclusion of each class.

Figure 1

What I thought about today's class....

Things I liked about this class and the most important thing I learned today.....

(May include points at which you felt most engaged with the class, actions taken by someone that were most helpful, events that were pleasantly surprising, topics that were most relevant, specific activities that were most useful, etc.)

PLUS + ☺

Recommendations I would have for improving today's class and/or one thing I think I need more information about or that was not covered that should have been....

(May include points at which you felt least engaged with the class, actions taken by someone that were distressful, events that were unpleasant or uncomfortable, topics that were puzzling or a suggestion you would have for improving the class)

DELTA Δ ☹

Transportation of material problems were observed in terms of getting the plus/delta sheets back to the instructor during 1997. In 1998, the instructor revised the process and asked each student to keep a journal (referred to as a Personal Learning Log) in which they should write about what they learned in each class and about their reactions to the class in general. These journals were submitted two times during the class at midpoint in the class and at the final class session.

Student comments from the plus/delta sheets and personal learning logs were analyzed using qualitative techniques. Each entry was coded using the constant-comparative method. Coded entries were categorized and themes were developed from the categories.

Videotapes

The interactive television classrooms allow for easy videotaping of classes. Each classroom is equipped with a videotape system that will record the class as seen through the system camera. Class sessions were videotaped from both the origination site and one remote site (A). For this paper, three videotapes were randomly selected for analysis from one course in order to look at both interaction patterns in general and changes in interaction over the course. Analysis of the videotapes is continuing. Analysis was conducted using a modified video evaluation instrument based on the work of Fulford and Zhang (1994). The video evaluation instrument was designed to record each class event. Based on these events, the type of interaction is recorded. Two-way interactions were coded by hand in six categories: teacher to the class (T-C), teacher to a specific student (T - SS), origination site student to teacher (OS-T), remote site student to teacher (RS-T), student to student at the same site (S-SS), and student to the class or to student at the other site (S-C). Each event was noted by tape number, tape time notation, and type of event. Discourse was also analyzed for manifestations of specific interactive behaviors, for example, humor, nurturing, and self-disclosure. These were documented in the video analysis by noting the tape number and the time the event occurred on the videotape. Field notes documenting specific observations made by the researcher were also maintained.

Instructional Intent

Throughout these courses, the instructor intentionally sought ways to increase student interactions in the class. Introductory exercises during the first class session were designed for students to get to know one another. Students were designated as discussion leaders and required to lead a 30 minute portion of the class discussion related to critiquing a research article. Students were provided with opportunities to meet face-to-face at least once during the course. Group activities were used during class time, both within sites and across sites. Students were allowed, but not required, to work in teams for one assignment based on common interests in a research topic. E-mail and phone lists were provided to class members. The instructor's goal was to engage students in the distance setting in interactive behaviors.

Findings

Student Perceptions on Interaction Surveys

Since the instrument itself was being tested during the first two administrations, the results from the separate courses are reported separately here. The findings, however, show consistent trends across all administrations.

Spring 1997 Course

Students in the Spring 1997 course were given a pre-assessment and a post-assessment to gather information about their perceptions of the level of interaction that occurred in the distance education classroom. Students were asked to respond to items using a six-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = somewhat agree, 5 = agree, 6 = strongly agree). All thirteen students responded on the pre-assessment; eleven responded on the post-assessment. Table 1 indicates the mean score for each statement and for the constructs on the pre and post assessments.

Areas of potential improvement were identified by looking at items where at least 20% of the students (23% is equivalent to 3 of the 13 students) disagreed (marked a 1, 2 or 3). On both the pre-assessment and post-assessment there were a number of students who disagreed that the level of interaction between students was high. Ratings on "interaction in class is high," "students often state their opinions to the instructor," and "in class, students often state their opinions to each other" did not meet the 20% criterion on the pre- assessment, but did on the post-assessment. However, ratings for "the students often ask each other questions," "there is a high level of class interaction between students" and "students generally answer each others' questions" met the criterion on the pre-assessment, but not on the

post-assessment. All four items on the survey addressing interaction between students at different sites met the criterion on both the pre- and post-assessments.

Table 1: Mean ratings on pre- and post-assessment items for Spring 1997 course.

Item/Construct	Pretest Mean	Posttest Mean
OVERALL INTERACTION	**4.33**	**4.15**
The level of interaction between students is high	4.15	3.82
The instructor is effective in motivating students to interact in class	4.69	4.55
Interaction is high in class	4.15	4.09
Interaction between the instructor and the class is high	4.77	4.64
INSTRUCTOR TO STUDENT	**5.10**	**4.86**
The instructor frequently offers opinions to students	4.85	5.00
The instructor frequently asks the students questions	5.15	4.73
The instructor generally answers the students' questions	5.62	5.09
STUDENT TO INSTRUCTOR	**5.03**	**4.58**
Students often state their opinions to the instructor	4.92	4.36
Students generally answer the questions the instructor asks	5.15	4.55
The students often ask the instructor questions	5.00	4.82
STUDENT TO STUDENT OVERALL	**4.25**	**4.14**
The students often ask each other questions	4.31	4.18
There is a high level of class interaction between students	4.15	4.27
In class, students often state their opinions to each other	4.38	4.00
The students generally answer each others' questions	4.15	4.09
ACROSS SITE STUDENT INTERACTION	**3.48**	**3.45**
The students at different sites often ask each other questions	3.54	3.36
There is high interaction between students at different sites	3.31	3.18
Students at different sites often state their opinions to each other	3.62	3.55
Students at different sites generally answer each others' questions	3.46	3.73
SAME SITE STUDENT INTERACTION	**5.21**	**4.98**
Students at the same sites often ask each other questions	5.15	4.73
There is a high interaction between students at the same site	5.31	5.09
Students at the same site often state their opinions to each other	5.23	5.18
Students at the same sites generally answer each others' questions	5.15	4.91

The individual items were combined to form six constructs. Overall interaction scores declined from 4.33 to 4.15 from pre-to post-assessment. Declines in scores from pre- to post-assessment in the areas of instructor to student (5.10 to 4.86) and student to instructor (5.03 to 4.58) interactions may be a reflection of a wider gap in perceptions among individual students as evidenced by a larger post-assessment standard deviation. For both pre-and post-assessments, student to student interaction at the same site had the highest mean, followed by instructor to student interaction and student to instructor interaction. Perceptions of overall class interaction and student to student interaction overall may have been affected by the lowest score, student to student interaction at different sites.

Summer 1997 Course

As noted earlier, when factor analysis and reliability analysis using Cronbach alpha were conducted on the constructs for the Spring 1997 instrument, two of the constructs (student to instructor and instructor to student) did not perform as expected. The survey was reconceptualized and the constructs revised prior to the conclusion of the summer class in which the new form was administered.

Students in the Summer 1997 course were given the interaction survey during the last week of the class. Again, students were asked to respond using the six-point Likert scale. Three constructs from the Spring survey were deleted and two new constructs were added. Fourteen of the eighteen students in the class responded. Table 2 indicates the mean score for each statement and for the constructs.

Table 2: Mean ratings on interaction items for Summer 1997 course.

Item/Construct	Mean
OVERALL INTERACTION	**4.82**
The level of interaction between students is high	4.71
The instructor is effective in motivating students to interact in class	4.93
Generally, interaction is high in class	4.43
Interaction between the instructor and the students is high	5.21
SAME SITE INSTRUCTOR-STUDENT INTERACTION	**4.94**
Instructor asks questions of students at same site	4.25
The instructor answers questions of students at same site	5.00
Students at same site ask instructor questions	5.29
Students at same site respond to instructor questions	5.21
REMOTE SITE INSTRUCTOR-STUDENT INTERACTION	**4.38**
Instructor asks questions of students at remote sites	4.00
Instructor answers questions of students at remote sites	5.00
Students at remote site ask instructor questions	4.07
Students at remote sites respond to instructor questions	4.43
ACROSS SITE STUDENT-STUDENT INTERACTION	**3.24**
The students at different sites often ask each other questions	3.00
There is high interaction between students at different sites	3.21
Students at different sites often state their opinions to each other	3.42
Students at different sites generally answer each others' questions	3.33
SAME SITE STUDENT-STUDENT INTERACTION	**4.78**
Students at the same sites often ask each other questions	4.71
There is a high interaction between students at the same site	5.07
Students at the same site often state their opinions to each other	4.71
Students at the same sites generally answer each others' questions	4.64

The only items with a mean rating below 4.00 were items related to across site student interactions. Again, areas where at least 20% of the students (3 of 14 students is approximately 21%) disagreed were considered to be areas of concern. Four students disagreed that the overall level of interaction between students was high and that the instructor frequently asked questions of the students at the instructor's site. Three students disagreed that the instructor frequently asked questions of remote students, students at the remote sites asked the instructor questions, and students at the same site asked each other questions. Six or more students disagreed with each of the statements related to across site student interaction.

Additional analysis of these items revealed no statistical differences in responses by gender, degree status (master's or doctoral), or location at origination or remote site. Perceptions of the level of interaction in the class were consistent among groups. Factor analysis and Cronbach alpha reliability assessment indicated that the constructs performed as predicted (alpha levels .77 to .98). This survey was used again in 1998.

Spring and Summer 1998

Interaction surveys were again distributed and collected at the conclusion of Spring and Summer classes in 1998. These surveys were combined for analysis. Fifteen of the 20 students in Spring completed the survey as did 22 of the 32 students in the summer course. Table 3 indicates the mean ratings on the survey items and the percent of agreement and disagreement. The same six-point agree to disagree Likert scale was used as in the previously described instruments.

Table 3: Mean ratings on interaction items for Spring and Summer 1998 courses.

Item/Construct	% Agree (4,5,6)	% Disagree (1,2,3)	Mean
OVERALL INTERACTION			**4.93**
The level of interaction between students is high	95.8	4.2	5.08
The instructor is effective in motivating students to interact in class	95.8	4.2	4.79
Generally, interaction is high in class	91.7	8.3	4.75
Interaction between the instructor and the students is high	95.7	4.3	5.13
SAME SITE INSTRUCTOR-STUDENT INTERACTION			**5.18**
Instructor asks questions of students at same site	88.2	11.8	4.76
The instructor answers questions of students at same site	100.0	0.0	5.28
Students at same site ask instructor questions	100.0	0.0	5.47
Students at same site respond to instructor questions	94.7	5.3	5.10
REMOTE SITE INSTRUCTOR-STUDENT INTERACTION			**4.69**
Instructor asks questions of students at remote sites	90.9	9.1	4.82
Instructor answers questions of students at remote sites	95.5	4.5	5.04
Students at remote site ask instructor questions	81.8	18.2	4.50
Students at remote sites respond to instructor questions	86.4	13.6	4.40
ACROSS SITE STUDENT-STUDENT INTERACTION			**2.87**
The students at different sites often ask each other questions	20.0	80.0	2.80
There is high interaction between students at different sites	33.3	66.6	2.89
Students at different sites often state their opinions to each other	22.2	87.8	2.78
Students at different sites generally answer each others' questions	22.2	87.8	2.67
SAME SITE STUDENT-STUDENT INTERACTION			**5.12**
Students at the same sites often ask each other questions	91.0	9.0	5.00
There is a high interaction between students at the same site	100.0	0.0	5.35
Students at the same site often state their opinions to each other	95.5	4.5	5.18
Students at the same sites generally answer each others' questions	95.2	4.8	4.81

As noted earlier, the instructor in the class made a concerted effort to provide opportunities for interaction in the class. Based on the findings above, it appears that students perceived the level of interaction between the instructor and the students as fairly high. However, there was a definite perception that the interaction between the instructor and students at the same site (5.18) was higher compared to interaction between the instructor and students at the remote site (4.69). The individual items in the instructor-student remote site construct indicate that the lower means were on items related to the students' behavior (students at the remote site ask the instructor questions = 4.50 and students at the remote sites respond to instructor questions = 4.40). The behavior of the instructor (instructor asks questions of remote site students= 4.82 and instructor answers questions of remote site students = 5.08) seems to be rated higher. In fact, instructor asks questions of remote students mean rating was actually higher (4.82) than the mean for instructor asks questions of students at the same site (4.76).

Across site interaction among students was particularly low (construct mean=2.87). More than 80% of the students disagreed that students at different sites asked each other questions, stated their opinions to each other or answered each others questions. Two-thirds disagreed that there was high interaction between students at the different sites.

Additional t-test analysis again indicated no statistical differences between responses of males and females, master's and doctoral students, or remote and origination site students. Stepwise regression analysis indicated that the best predictor of student ratings of overall class interaction was the rating for the interaction between the instructor and the remote site students, which accounted for approximately 68% of the variance. None of the other constructs (instructor-same site students, student-student same site, student-student across site) entered the regression equation. Cronbach alpha analysis again indicated the constructs were reliable (alpha levels ranged from .67 to .92 and followed the same pattern as the summer 1997 data).

Student Perceptions from Plus/Delta Feedback Forms and Personal Learning Logs

Differences in interaction in the videoconference classes were described by students in their open-ended comments. Students noted that they were more inhibited in the distance setting . Their perceptions of student-to-student interactions, teacher and student interactions, and the impact of the technology are noted below.

Student to Student Interaction

Students noted less interaction with classmates at different sites, although the interaction among students at the same site was seen as "more intimate" than in a traditional class with a greater sense of "belonging to the group." Group and introductory activities were seen as promoting more interaction. Providing opportunities for students to meet face-to-face was suggested as a way to improve student-to-student interactions across sites. Some felt that students needed to take more responsibility for initiating interactions in the distance setting.

Introductory Activities

The instructor's focus on introductory activities designed to introduce students to one another on the first class session were perceived as an important component in building a sense of community.

Getting to know each other activities were most helpful. Helped me feel like part of the class. (remote student)

I really appreciated your encouragement to get to know classmates and opportunities to do so. (remote student)

Group Activities

The instructor intentionally built in opportunities for students to work together on activities during class time. Sometimes those activities involved groups at each site, and occasionally groups across sites. These group activities were perceived as valuable to the students.

I enjoy the opportunity to work in our little group when doing the activities. (remote student)

I liked the cooperative activity today. It provided time for discussion which helps me assimilate information. (origination student)

Group work was productive and enjoyable. Everyone contributed and interacted well. Enjoyed distance ed. (remote student)

Within-Site Community

Student comments indicated that a strong sense of community emerged among the students at the individual sites. This was particularly evident among the students at the remote sites. However, the sense of community at the sites may have emerged at the expense of a broader sense of community across sites.

The group in [Site A] has really gelled. I feel a lot of support from cohorts! (remote student)

I like the way the [Site A] group has 'jelled.' There's a strong feeling of collegiality. (remote student)

The discussion the [Site A] group has amongst ourselves is more stimulating to me than the group discussion at large. (remote student)

Seeing more interactivity across and within sites. It seems that (on-campus) students are more interactive among themselves. (origination student)

Interaction is obviously more intimate among students in each setting as a whole - - simply one gets to converse with other people at the site. Therefore, there is a sense of belonging to the group. (remote student)

It was difficult to get used to the set up. It has been difficult to get to know the other students at the other site as well as the students at my site. (remote student)

Opportunities for Face-to-Face Interactions

Students continued to suggest that student should have the opportunity to meet face-to-face early in the semester to help build the sense of a larger community.

Meeting students from other sites early on in the semester may be helpful. May bring about more interaction between students at different sites. (remote student)

It might help to meet all students in person early on in the semester. (origination student)

I also think it would help to meet as an entire class in one spot before meeting in separate classes for distance ed. (origination student)

Group class meeting prior to separating to different sites might encourage interaction at different sites. (remote student)

A possible suggestion for enhancing the experience is to meet as a group at least twice at one location for a more personal effect and interaction of students and teacher. (remote student)

Student Responsibility

Some students saw the need for students to become more active in initiating interactions.

I think students need to take the responsibility to interact with each other in class. (origination student)

Since this is new to many students, may I suggest that we make a conscious effort to include [a remote site student], specifically asking for his ideas, etc. (origination student)

Teacher to Student Interaction

The students at both remote and origination sites expressed a preference for having the instructor on-site, and noted that interaction patterns shifted depending on the location of the instructor. Students were seen as more involved in discussions at the site where the instructor was present.

Preference for Having the Teacher On-Site

Students preferred to have the instructor at their location. They perceived less interaction with the instructor in this setting compared to a traditional setting. While the teacher was normally at the origination site, at least two trips per semester were made to the remote site.

Having the instructor on-site was positive. It provides a more personalized effect. (remote student)

Distance learning is an interesting innovation, but it does not replace the impact of the instructor. (origination student)

I much prefer to be at the site with the instructor. It is very difficult to feel part of the class. (origination student)

Loved having the teacher in the class in person. The ideal in distance ed would be to have the teacher rotate each session. Not best for the teacher, but great for the students. (remote student)

It was great to have the "real live" teacher. (remote student)

I much prefer to be at the site with the instructor. It is very difficult to feel part of the class, especially since we couldn't always see the teacher. (origination student)

I much prefer being in the actual classroom with the instructor. You tend to lose something as a result of the equipment. (remote student)

There is definitely less interaction between students and teacher. (remote student)

I'm not as comfortable asking questions of the instructor since she isn't at our site often. (remote student)

Changing Classroom Dynamics

Comments from the students indicated that the presence of the instructor at the remote site changed the classroom dynamics. Students at the same site as the instructor (whether on-campus or at the remote site) seemed to feel more involved in the class. Students noted that instructor location made a difference in the level of participation and interaction. Remote students who had previously been less involved in class discussions became more active when the instructor visited their site. The on-campus students, who were more accustomed to having the instructor in person, found it more difficult to pay attention when the instructor was at the remote sites. The origination site students were disconcerted at having to experience being remote students.

It was evident that our class [Site A] was more interactive in your presence. More visits are recommended. (remote student)

It was nice to have you in class today! We were all much more involved in the class today. We were asking questions, seemingly much more comfortable, etc. The immediate feedback was great! (remote student)

Obvious that there is more discussion at whatever site the instructor is. Individuals at [Site A] contributed more than usual and those at [Campus site] much less. (origination student)

I realized that I ask a lot fewer question of the teacher when I must do it via television. I think it's just harder to get you to hear (no real eye contact). (origination student)

I didn't like being the remote site today, but I thought it was interesting to see how the class dynamics changed. [Site A] more involved and [on-campus site] much less involved. (origination student)

It was interesting to experience what it feels like to be at the remote site. It seems that the site you are at contributes more to the discussion than the remote site. It's easier to be passive at the remote site. (origination student)

I don't like being at the remote site. I'm spoiled! It seemed more difficult to pay attention. Could be just because this was my first experience though. (origination student)

Having the instructor at [the remote] site made all the difference. I could see we participated more. (remote student)

Visibility of the Instructor

Students seemed to feel that the instructor-student interaction was OK, although there were suggestions that keeping the camera focused on the instructor might improve the sense of interacting more directly.

Maybe you could have the camera on yourself more when you are going over the packets that we have in front of us. It would help keep us involved at [the remote site]. (remote student)

I would recommend that during the powerpoint presentations, the camera stays on you. I feel more connected when I can see you talking on the screen. (remote student)

I am becoming more comfortable in class. I feel that when you talk to the class you are addressing everyone and I appreciate it. (origination student)

Interaction with the Technology

Students did indicate that the technology affected interaction, although some indicated that it was "a neat way to take a course." Some even indicated that it focused class attention on the instructor and resulted in fewer "diversions."

Reduced Interaction

Lack of physical presence combined with the technology appeared to inhibit interaction in the class.

I know it is possible to have interaction, but it is decidedly difficult. (remote student)

I was seated in the "Extra seats" in the room. Due to the fact that this is a distance learning environment and communication is already hindered by lack of physical presence, I felt removed from the discussion by being away from the table. (origination student)

The distance education classroom just seems to limit participation in discussions. (remote student)

Didn't take long to get used to is, but it does keep me quieter than usual. (remote student)

This experience is not a natural setting. It sometimes feels a little "stiff". (origination student)

This is very different. I am used to a lot of interaction between students and I think distance ed hinders that. I also makes it difficult to "connect" or "network". (remote student)

I am intimidated by the technology and don't yet feel comfortable with this type of class format. (origination student)

It is difficult to participate in class discussions. (remote student)

It is quite different with the TV monitor and not seeing everybody at the same time. (remote student)

I think I am just not a distance learner, even at the site of origin. I would really like all of my classmates to be present and a more viable part of the discussion. (origination student)

Maintaining Focus

Students also indicated some difficulty in maintaining focus. This was particularly evident for the origination students when the instructor was at the remote site. Students indicated that it was more difficult to pay attention and to participate in class discussions generally in the distance education environment. The normal visual cues students used to determine when to speak up were often absent. It was also disconcerting for some to be able to hear a voice, but not be able to see the student speaking. Some students, however, found that the technology helped keep the students focused on the instructor.

I was having difficulty staying on task today. I am still not totally comfortable with the distance education concept. (origination student)

Still very difficult to stay motivated to listen to the other site. Difficult to hear individual students there. (remote student)

Class discussions are difficult to participate in. I always feel I am cutting someone off. (remote student)

Difficult to participate in class discussions. (remote student)

I am beginning to be bothered by several [students] talking at the same time or not knowing who is talking. I need to work on identifying myself before I speak. (remote student)

The distance learning set up make me more of an introvert! (origination student)

Distance [ed] does keep me quieter than usual. (remote student)

I don't like being at the remote site. I'm spoiled! It seemed more difficult to pay attention! (origination student)

It was interesting being on the other side of the camera. It's harder to pay attention. (origination student)

Still very difficult to stay motivated to listen to the other site and it is difficult to hear individual students there. (remote student)

There is a lot more class focus on the person doing the talking. The TV draws the entire class's attention. In a normal (non-distance) class, there are other diversions and the total class is less focused on the speaker. (origination student)

However, even with the difficulties and some discomfort with the environment, most students were satisfied with interactions in the videoconference setting.

Discussions seem to flow well. We seem relatively comfortable already with the televisions and cameras. (origination student)

I still feel a little stiff in this setting. The format is not as natural as a regular classroom, but I still enjoy it. (origination site)

The telecommunications piece is no longer an obstacle. Almost becoming invisible as we interact among sites. (remote site)

Distance ed worked much better than I expected. I still feel like we're yelling, but we've gotten to know each other well enough to have real interaction. (remote site)

Observation Data from Videotapes

Approximately nine hours of video tape were reviewed and analyzed from three randomly selected class sessions from the same course (each class session was approximately three hours in length). The sessions selected included the second class session, the fourth class session, and the seventh class session. Each event was coded by tallying a hash mark in a category. Events were coded as T-C (an interaction initiated by the teacher and directed at the class), T-SS (an interaction initiated by the teacher and directed to a specific student), OS-T (interactions initiated by a student at the origination site and directed to the teacher),RS-T (interactions initiated by a student at a remote site and directed to the teacher), S-SS (interactions initiated by a student to another student at the same site), or S-C (interactions initiated by a student and directed to the class in general or to a student in another site). Table 4 shows the number of interactions recorded. The information, by class session and overall is discussed below.

Table 4: Interactions Observed on Videotapes for Sessions Two, Four, and Seven

	Session #2	Session #4	Session #7
Teacher to Class (T-C)	175	144	132
Teacher to Specific Student (T-SS)	69	116	85
Origination Student to Teacher (OS-T)	70	89	101
Remote Student to Teacher (RS-T)	55	101	105
Student to Student at Same Site (S-SS)	166	100	137
Student to Class (S-C)	27	87	78
TOTAL	**562**	**637**	**638**

Class Session Two

The two areas where the most incidents occurred were teacher initiated interactions to the entire class (175) and student interactions initiated to another student at the same site (166). Teacher initiated interactions primarily involved covering specific content material (119) and housekeeping comments and review of requirements (33). Student interactions with other students at the same site generally occurred during group activities (100) and during breaks (23).

Teacher initiated interaction directed to a specific student and student initiated interaction at the on-campus site directed to the teacher were noted almost an equal number of times (69 and 70 incidents, respectively). Student initiated interactions directed to the teacher from students at the remote sites occurred less frequently with 55 incidents noted. Only 27 incidents of interactions initiated by students and directed to the class or to a student at another site were documented.

Specific engaging behaviors noted included smiling, looking towards the other person, nodding, laughing, hand gestures, and shaking one's head. Distractions noted during the video review included audio feedback problems, rustling papers, and distracting noises caused by students moving around due to the open microphone set up of the ITV system.

Class Session Four

Teacher to class (T-C) interactions were again the highest (144) with most of the interactions related to course content (131). Teacher interacting with specific students (T-SS) was observed next most frequently (116) followed by remote site students interacting with the teacher (RS-T), observed 101 times, and students interacting with students at the same site (S-SS) 116 times. Origination site students initiating interactions with the instructor (OS-T) occurred 89 times. Eighty-seven interactions were initiated by students and directed toward the entire class or students at another site.

Specific engaging behaviors included smiling, laughing, displaying hand gestures, nodding, making jokes, and facing other students as a student talks. Distractions included rustling papers, background conversations (particularly at the remote site) and a thumping sound.

Class Session Seven

During session seven, the most frequent interactions were student initiated to students at the same site (137), followed closely by teacher to class interactions (132). Remote site student initiated interactions to the teacher (RS-T) occurred 105 times and origination site student initiated interaction with the teacher (OS-T) occurred 101 items. Teacher interactions with specific students (T-SS) was observed 85 times and student to class (S-C) interactions 78 times.

Engaging behaviors observed included smiling, facing the other students as a student talks, nodding, laughter, and leaning towards the TV monitor. Facing other students occurred more frequently in this video than in the others. Distractions included echo feedback, a humming noise, rustling papers, and various background noises.

General Patterns

The trends indicate a shift in the amount of teacher to class (T-C) initiated interactions and an increase in student initiated interactions (OS-T, RS-T, S-C) over time. In addition, at two points (session 4 and session 7) the number of interactions initiated by remote site students to the teacher exceeded those initiated by students at the origination sites. Remote site student-initiated interactions with the teacher tripled from session 2 to session 7. The lowest number of interactions in all cases was student to student across site interactions (S-C). In general, more interactions were observed in the later courses.

Other Observations

Other observations made by the researchers based on the videotape data were related to the influences of various instructional strategies on the interaction patterns. In several classes, the instructor used a discussant format which required students to lead the discussion for a limited amount of time. This instructional method appeared successful in increasing student-initiated interactions across sites. Group activities typically centered around within-site groupings. These activities were successful in building rapport within the site and increased student-to-student interactions at the same site.

Another interesting aspect observed in the videotapes occurred during teacher-dominated time (e.g. lectures with powerpoint presentations). Although the instructor typically kept these times to less than 30 minutes, remote site students appeared off-task. It was observed that students at the remote site placed their microphones on "mute" during these presentations and although the audio was thus not recorded, the video clearly shows interactions occurring between students at the remote site during the lecture. This occurred in spite of the fact that students knew that they were being recorded. It may be hypothesized that being in a setting with technology on a routine basis and the lack of additional equipment for recording resulted in students "forgetting" about the recorder. The observation data seemed to indicate that students at the origination site (where the instructor was generally present) behaved differently than the remote site students. Their behavior was more typical of a traditional class.

Perceptions of Interaction Versus Observed Interaction

Based on the survey data, in general, students perceived interaction between students and the instructor as moderate, interaction between students at the same site as high, and interactions with students at other sites as low. The lower ratings for across site interaction may have affected ratings of interaction in the class overall. Students suggested that having students meet face-to-face at least once during the semester, and preferably near the beginning of the semester, might increase the level of interaction across sites. Instructors might also want to consider using across-site groupings for activities and projects to increase the level of interaction among students at different sites.

Even though the pre- and post- comparisons on student perceptions of interaction were not statistically significant, post-assessment means were lower than pre-assessment means, indicating a decline in perceptions of interaction over the semester. This finding mirrors findings of Fulford and Zhang. This decline may be an artifact caused by increased expectations of interaction as students become more comfortable with the technology and the logistics of distance education.

The qualitative data indicate that students perceived lower interactions across sites and that the technology limited interactions to some extent. Particularly evident from the qualitative data was the perception that interaction patterns changed as the instructor's location changed. The presence of the instructor at a site increased the level of interaction of the students at that site, particularly in terms of teacher-student interaction and across site interaction. Videotape analysis also showed this effect.

The videotape data showed verbal interactions, gestures, body language, and eye contact that indicated interaction is taking place, particularly between students at the same site and between teacher and students. However, there are fewer indications of interactions between students across sites, particularly early in the class. It appears that student initiated interactions increased later in the course and teacher initiated interactions declined. These data do not match the students' perceptions. Students perceived less interaction later in the course. This leads to a possibility that perception is influenced by the amount of teacher-initiated interaction. This interpretation is supported by the regression analysis conducted on the perception data that showed the best predictor of overall ratings of interaction was the perceived interaction between the instructor and the remote site students.

Based on the video data, group activities appear to have enhanced the within site interactions. Interaction between students and the instructor appears to depend on the location of the instructor. More interactions occur between students and instructor when the instructor is on-site. Having the instructor rotate sites may equalize interaction behaviors across sites. Instructors may also need to develop specific strategies to facilitate participation and interaction from the remote sites during class time.

Conclusion

The data gathered during this study can inform future planning and implementation of distance instruction. Since this was a convenience sample (the students in the instructor's classes) and used only graduate students, caution should be used in generalizing the findings to other populations. However, the patterns seem consistent across semesters and may warrant further investigation. The following conclusions may provide some guidance for those interested in improving interaction in videoconferencing settings.

While a sense of community appears to have developed at the individual sites, particularly the remote sites, ways of building a larger sense of community for the entire class should be examined. The presence of the instructor at different sites appeared to affect the class dynamics. Interaction and verbal expressiveness seemed to increase at the site where the instructor was present. Having the instructor rotate sites might equalize class participation across sites.

Classroom configurations also appeared to impact interaction. Students were inhibited in interacting with classmates due to visual and audio limitations. Perhaps providing monitors that can constantly display remote classrooms, or use of split screen options, could help students feel more in contact with their peers at other sites.

Maintaining attention in the distance classroom appears to be a more difficult task than perhaps in the traditional class. Varying activities and including hands-on exercises and small and large group discussions were instructional methods appreciated by the students.

Overall, students were satisfied with their distance learning experience, although there were a number of suggestions for improvement. Providing at least one opportunity for students to meet face-to-face seemed to be a consistent suggestion.

Future Directions

As part of efforts to investigate the potential of other technologies to increase interaction across sites in videoconference settings, the instructor has integrated web-based components into the research class as it is being taught currently (Spring 1999). Students are required to communicate with one another via an asynchronous communication tool interface (e.g., WebBoard) in response to a weekly question posted by the instructor. A chat room is also available at the web site. Investigations of the impact of web-based technologies on interaction patterns is underway. However, before we conclude this paper, we must point out a remark made by a student in one of the classes and echoed by other students.

> *We have more interaction within our group than we have in traditional classes. Why is it so important for us to interact across sites? We're still learning and we're still interacting. Why worry about it? (remote student)*

Perhaps it is a question we need to ask ourselves. What is our goal instructionally for improving across site interaction?

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INTERACTION SURVEY

Please rate the following items using the scale below:
1=strongly disagree 2=disagree 3=somewhat disagree 4=somewhat agree 5=agree 6=strongly agree
NA=not applicable/no basis for judgment

		SD	D	SWD	SWA	A	SA	NA
	OVERALL INTERACTION							
1.	Overall, interaction between the instructor and the students is high.	1	2	3	4	5	6	NA
2.	Overall, there is a high level of class interaction between students.	1	2	3	4	5	6	NA
3.	In general, the instructor is effective in motivating students to interact in class.	1	2	3	4	5	6	NA
4.	There is generally a high level of interaction in this class.	1	2	3	4	5	6	NA
	INSTRUCTOR-SAME SITE							
5.	The instructor frequently asks questions of the students at the instructor's site.	1	2	3	4	5	6	NA
6.	The instructor generally answers the questions of students at the instructor's site.	1	2	3	4	5	6	NA
7.	The students at the same site as the instructor often ask the instructor questions.	1	2	3	4	5	6	NA
8.	The students at the same site as the instructor generally respond to the instructor's questions.	1	2	3	4	5	6	NA
	INSTRUCTOR-DIFFERENT SITE							
9.	The instructor frequently asks questions of the students at the remote sites.	1	2	3	4	5	6	NA
10.	The instructor generally answers the questions of students at the remote sites.	1	2	3	4	5	6	NA
11.	The students at the remote sites often ask the instructor questions.	1	2	3	4	5	6	NA
12.	The students at the remote sites generally respond to the instructor's questions.	1	2	3	4	5	6	NA
	STUDENTS-SAME SITE							
13.	Students at the same site often ask each other questions.	1	2	3	4	5	6	NA
14.	There is a high level of class interaction between students at the same site.	1	2	3	4	5	6	NA
15.	Students at the same site generally answer each other's questions.	1	2	3	4	5	6	NA
16.	Students at the same site often state their opinions to each other.	1	2	3	4	5	6	NA
	STUDENTS-DIFFERENT SITE							
17.	The students at different sites often ask each other questions.	1	2	3	4	5	6	NA
18.	There is a high level of class interaction between students at different sites.	1	2	3	4	5	6	NA
19.	Students at different sites often state their opinions to each other.	1	2	3	4	5	6	NA
20.	Students at different sites generally answer each others questions.	1	2	3	4	5	6	NA

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