DOCUMENT RESUME

ED 347 972 IR 015 708

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TITLE The Effects of Two-Way Visual Contact on Student Verbal Interactions during Teleconferenced Instruction.

PUB DATE Feb 92

NOTE 14p.; In: Proceedings of Selected Research and Development Presentations at the Convention of the Association for Educational Communications and Technology and Sponsored by the Research and Theory Division; see IR 015 706.

PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.

DESCRIPTORS Analysis of Variance; *Conventional Instruction; Distance Education; Higher Education; Hypothesis Testing; Interaction; *Intermode Differences; Preservice Teacher Education; *Teacher Student Relationship; *Teleconferencing; Verbal Stimuli; Visual Stimuli

IDENTIFIERS Two Way Communication; *Video Teleconferencing

ABSTRACT

This study was designed to determine whether there was a difference in either the overall frequency or the frequency of specific types of student verbal interactions under three conditions: (1) teleconferenced instruction where students had two-way audio and video contact with the instructor; (2) teleconferenced instruction where students had only two-way audio contact with the instructor; and (3) traditional face-to-face instruction. Hypotheses tested by the study related to the numbers of verbal interactions in each of the three conditions, including restricted and expanded thinking questions and responses (Equivalent Talk Categories--ETC's). Subjects were 172 students enrolled in Classroom Educational Technology at the University of Northern Colorado, who were assigned to one of three treatment groups. Two-way audio and video teleconferencing facilities between two buildings on UNC's Greeley campus were utilized to deliver instruction for the two experimental groups; the third group received face-to-face instruction via lecture. Two lessons were presented: "Topics in Distance Education," which utilized handouts with true-false questions, open-ended questions, and case studies; and "Copyright Issues for Using Videotapes in the Classroom," which was videotaped and coded according to ETC's. One-way ANOVA's and t-tests were conducted for each of the ETC's. Results indicated that the experimental groups did not differ significantly in any of the ETC's or in the total number of interactions, and that the traditional (control) group generally interacted more than either of the teleconference groups both in terms of total number of interactions and in several of the ETC's. It is recommended that future studies focus on the role of nonverbal interactions in visual delivery modes. (10 references) (BBM)

Title:

The Effects of Two-Way Visual Contact on Student Verbal Interactions During Teleconferenced Instruction

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Rationale

Traditionally, audio teleconferencing has been a convenient method of bringing students together for distance learning (Wagner & Reddy, 1989). In addition audio teleconferencing, some colleges and universities have been experimenting with more sophisticated technologies that incorporate computer graphics (audiographic teleconferencing); full motion video distributed via satellite, cable, or microwave; and other less costly audio/video teleconferencing systems such as slow-scan or compressed video (Ritchie & Newby, 1989; Wagner & Reddy, 1989).

Developers of more sophisticated teleconferencing systems claim that these systems are superior to the traditional audio-conferencing systems because they offer the added benefit of visual contact among students and instructors which promotes interaction (dialogue) during instruction. The research upon which this claim is based is scarce, however, and the few studies that have addressed interaction have suffered from poor design.

Problem

Researchers investigated whether there was a difference in either the overall frequency or the frequency of specific types of student verbal interactions among the following three groups:
(a) teleconferenced instruction where students had two-way audio and video contact with the instructor,
(b) teleconferenced instruction where students had only two-way audio contact with the instructor, and
(c) traditional face-to-face instruction.

Hypotheses

This study was designed to test the following hypotheses:

1. The number of student verbal interactions that occur during teleconferenced instruction where students have two-way audio and video contact with the instructor will be greater than the number of student verbal interactions that occur during teleconferenced instruction where the students have only two-way audio contact with the instructor.
2. The number of student verbal interactions that occur traditional face-to-face instruction will be greater than the number of student verbal interactions that occur during teleconferenced instruction where the

students have only two-way audio contact with the instructor.

3. The number of student verbal interactions that occur during traditional face-to-face instruction will be greater than the number of student verbal interactions that occur during teleconferenced instruction where the students have two-way audio and video contact with the instructor.

4. The number of restricted thinking questions that students ask during teleconferenced instruction where students have two-way audio and video contact with the instructor will be greater than the number of restricted thinking questions that students ask during teleconferenced instruction where the students have only two-way audio contact with the instructor.

5. The number of restricted thinking questions that students ask during traditional face-to-face instruction will be greater than the number of restricted thinking questions that students ask during teleconferenced instruction where the students have only two-way audio contact with the instructor.

6. The number of restricted thinking questions that students ask during traditional face-to-face instruction will be greater than the number of restricted thinking questions that students ask during teleconferenced instruction where the students have two-way audio and video contact with the instructor.

7. The number of expanded thinking questions that students ask during teleconferenced instruction where students have two-way audio and video contact with the instructor will be greater than the number of expanded thinking questions that students ask during teleconferenced instruction where the students have only two-way audio contact with the instructor.

8. The number of expanded thinking questions that students ask during traditional face-to-face instruction will be greater than the number of expanded thinking questions that students ask during teleconferenced instruction where the students have only two-way audio contact with the instructor.

9. The number of expanded thinking questions that students ask during traditional face-to-face instruction will be greater than the number of expanded thinking questions that students ask during teleconferenced instruction where the students have two-way audio and video contact with the instructor.

10. The number of restricted thinking responses that students give during teleconferenced instruction where students have two-way audio and video contact with the instructor will be greater than the number of

restricted thinking responses that students give during teleconferenced instruction where the students have only two-way audio contact with the instructor.

11. The number of restricted thinking responses that students give during traditional face-to-face instruction will be greater than the number of restricted thinking responses that students give during teleconferenced instruction where the students have only two-way audio contact with the instructor.

12. The number of restricted thinking responses that students give during traditional face-to-face instruction will be greater than the number of restricted thinking responses that students give during teleconferenced instruction where the students have two-way audio and video contact with the instructor.

13. The number of expanded thinking responses that students give during teleconferenced instruction where students have two-way audio and video contact with the instructor will be greater than the number of expanded thinking responses that students give during teleconferenced instruction where the students have only two-way audio contact with the instructor.

14. The number of expanded thinking responses that students give during traditional face-to-face instruction will be greater than the number of expanded thinking responses that students give during teleconferenced instruction where the students have only two-way audio contact with the instructor.

15. The number of expanded thinking responses that students give during traditional face-to-face instruction will be greater than the number of expanded thinking responses that students give during teleconferenced instruction where the students have two-way audi. and video contact with the instructor.

Significance of the Problem

Most of the research in distance education consists of comparisons between traditional on-campus courses and their distance counterparts (Ritchie & Newby, 1989). Verbal interaction is rarely reported in these intermedia studies; in fact, student/teacher verbal interaction is often not permitted during instruction in order to avoid introducing an uncontrollable variable (Salomon & Clark, 1977).

Evidence suggests that students' perceived achievement and affect towards the subject and instructor are related to student/teacher interaction. When high levels of verbal interaction are present, students report that they learn more and enjoy the

experience more than situations that involve low levels of student/teacher interaction (Richmond, Gorham, & McCroskey, 1987; Gorham, 1988).

During audio teleconferences, nonverbal interaction is not transmitted between remote sites; however, during video teleconferences this nonverbal information is transmitted. Research by Wiener and Mehrabian (1968) and Mehrabian (1971, 1972) suggests that some of this nonverbal information has the potential of inducing verbal interaction. Since verbal interaction is considered to be desirable during instruction, one could make a case for developing and utilizing distance delivery systems that provide optimum potential for two-way student/teacher interaction. In order to do so, such systems would require two-way video capabilities in order to transmit nonverbal information among remote sites. These systems are expensive and require significant human resources to manage and maintain. Institutions must be convinced that the benefits are worth the costs before investing these resources. By measuring the benefits in terms of the potential for student/teacher interaction rather than exam scores and course grades, the benefits may, indeed, justify the costs.

Methods and Procedures

One-hundred seventy-two subjects enrolled in four separate sections of Classroom Educational Technology (ET 401), during the Fall semester, 1991 at the University of Northern Colorado took part in the study. All of the students enrolled in ET 401 were Professional Teacher Education (PTE) students, meaning that they were pursuing teacher certification in Colorado.

There were four separate sections of ET 401, each containing about forty-three students. Within each section, students were randomly assigned to one of three treatment groups. In other words, within each of the four sections of ET 401 there were three treatment groups, each containing about fourteen students. After the treatments were conducted, the results of the four separate sections of ET 401 were collapsed for data analysis, resulting in three larger treatment groups of approximately fifty-seven students each.

The selected site for this study was the University of Northern Colorado (UNC) College of Education and College of Continuing Education. Two-way audio and video teleconferencing facilities exist between the Western Institute of Distance Education

(WIDE) conference room and Frasier Hall, both located on UNC's Greeley campus. The instructor taught from the Frasier Hall site and the students were located in the WIDE conference room except for the traditional face-to-face treatment where the instructor was physically present in the WIDE conference room with the students. Each location was equipped with 26" monitors, conference tables and seating to accommodate about twenty students, plus all of the necessary hardware and software in order to operate either a two-way audio-only teleconference, or a two-way audio and video teleconference.

Treatment Group A received instruction delivered via two-way audio teleconference (audio group). Treatment Group B received instruction delivered via two-way audio-video teleconference (audio/video group). Treatment Group C received instruction delivered in a traditional face-to-face manner with the instructor present in the WIDE conference room with the students (traditional group).

Each group of fourteen students met twice in the WIDE conference room during regular class hours. The first meeting was designed to desensitize the students to the newness of the instructional situation. No data were collected during this first session. The first lesson was entitled "Topics in Distance Education." The second lesson was entitled "Copyright Issues for Using Videotapes in the Classroom."

The formats of the two lessons were very similar. The instructor gave the students handouts with a series of true/false questions designed to stimulate thinking on the subject. Students completed these questions and the instructor went over the answers. The instructor then presented the new information. Students were told to interrupt if they had questions or comments. A series of open-ended questions and short case studies were then presented. The instructor read the question or case and then called for comments. A standard wait time of five seconds was used during all instruction. If students did not respond, the instructor would issue one more call for responses and wait an additional five seconds before moving on to the next question or case. For both lessons, students were given handouts with outlines, discussion questions, and cases.

The second lesson on copyright issues was videotaped, and the videotapes were reviewed and coded by two independent consultants according to the following Equivalent Talk Categories (ETC's): (a) restricted thinking questions, (b) expanded thinking questions, (c) restricted thinking responses,

and (d) expanded thinking responses (Ober, Bentley, & Miller, 1971).

Results

A series of one-way ANOVA's and Dunn's t-tests were conducted for each of the equivalent talk categories to determine whether there were differences among the three treatment groups (see Tables 1-10). The following summarizes the results for each of the equivalent talk categories.

Total Number of Student Responses

An F value of 9.09 indicated that there were significant differences among the three groups in total number of student responses. The difference between the means of the audio and audio/video groups was .0946 (see Table 2). This difference was not large enough to yield significance at the .05 level. Tne difference between the audio and traditional groups, however, was 2.62, indicating significance. The traditional group interacted more than the audio group in this category.

Dunn's t-test also yielded significance between the audio/video group and the traditional group (difference between means = 2.72). The traditional group interacted more than the audio/video group in terms of the total number of interactions given during the lesson (see Tables 1 and 2).

Table 1
ANOVA Summary Table for Total Number of Student Responses by Group.

Source	df	SS	MS	F
Between Groups	2	270	135	9.09**
Within Groups	169	2510	15	
Total	171	2781		

*p < .05
**p < .01

Table 2
Dunn's Test for Total Number of Responses by Group

Group Comparison	Difference Between Means
A & B	0.0946
A & C	2.6216*
B & C	2.7163*

*Significant at .05

Restricted Thinking Questions

An F value of 4.02 indicated that there were significant differences among the three groups in this category. Dunn's t-test revealed that there was no difference between the audio group and the audio/video group. Also there was no difference between the audio group and the traditional group. Students in the traditional group, however, initiated more restricted thinking questions than students in the audio/video group. The difference between the group means was .35, indicating significance at the .05 level (see Tables 3 and 4).

Table 3
ANOVA Summary Table for Restricted Thinking Questions by Group

Source	df	SS	MS	F
Between Groups	2	3.41	1.71	4.02*
Within Groups	169	71.81	0.42	
Total	171	75.23		

*p < .05
**p < .01

Table 4
Dunn's Test for Restricted Thinking Questions by Group

Group Comparison	Difference Between Means
A & B	0.0111
A & C	0.2945
B & C	0.3056*

*Significant at .05

Expanded Thinking Questions

In the expanded thinking response category, students in the traditional group interacted significantly more than students in the video teleconference group (F = 3.37) (see Table 6). The audio and the audio/video groups did not differ significantly, with differences in group means of .13. The difference between the audio and traditional group of .14 was not large enough to indicate significance in this category (see Tables 5 and 6).

Table 5
ANOVA Summary Table for Expanded Thinking Questions by Group

Source	df	SS	MS	F
Between Groups	2	5.71	2.86	3.37*
Within Groups	169	143.28	0.85	
Total	171	149.00		

*p < .05
**p < .01

Table 6
Dunn's Test for Expanded Thinking Questions by Group

Group Comparison	Difference Between Means
A & B	0.1354
A & C	0.1386
B & C	0.4325*

*Significant at .05

Restricted Thinking Responses

A large F value of 10.35 showed that there were significant differences among the three groups in this category. The audio group gave significantly fewer restricted thinking responses than the traditional group (difference between means = 1.19). The audio/video group also gave significantly fewer responses than the traditional group (difference between means = 1.29). No significance was indicated between the audio group and the audio/video group in this category (see Tables 7 and 8).

Table 7
ANOVA Summary Table for Restricted Thinking Responses by Group

Source	df	SS	MS	F
Between Groups	2	59.15	29.57	10.35**
Within Groups	169	482.97	2.86	
Total	171	542.12		

*p < .05
**p < .01

Table 8
Dunn's Test for Restricted Thinking Responses by Group

Group Comparison	Difference Between Means
A & B	0.1039
A & C	1.1917*
B & C	1.2956*

*Significant at .05

Expanded Thinking Responses

The final category tested was expanded thinking responses, and an F value of 3.55 indicated significance at the .05 level among the three groups. Dunn's t-test showed that there was a significance difference between the audio group and the traditional group--the traditional group gave more expanded thinking responses than the audio group (difference between means = .80). No differences were indicated between the audio and audio/video groups, nor between the video and traditional groups (see Tables 9 and 10).

Table 9
ANOVA Summary Table for Expanded Thinking Responses by Group

Source	df	SS	MS	F
Between Groups	2	20.88	10.44	3.55*
Within Groups	169	496.77	2.94	
Total	171	517.65		

*p < .05
**p < .01

Table 10
Dunn's Test for Expanded Thinking Responses by Group

Group Comparison	Difference Between Means
A & B	0.1180
A & C	0.8005*
B & C	0.6825

*Significant at .05

Implications and Recommendations for Further Study

The results of this study indicated that students were not likely to interact more during teleconferenced instruction where students had two-way audio and video contact with the instructor than they would during teleconferenced instruction where students had only two-way audio contact with the instructor. As a result Hypothesis 1 was rejected at the .05 level. The results indicated that students were likely to interact more during traditional face-to-face instruction than they would during either an audio only or an audio/video teleconference. These findings were consistent with Hypotheses 2 and 3.

In the specific Equivalent Talk Categories (ETC's), the control group asked significantly more questions--both in the restricted and expanded thinking categories--than the audio/video group. These findings were consistent with Hypotheses 6 and 9. The audio group and the traditional group, however, did not differ significantly in these ETC's. As a result, Hypotheses 4 and 7 were rejected at the .05 level. Also, there were no significant differences between the audio and the traditional group in either restricted or expanded thinking questions; consequently, Hypotheses 5 and 9 were also rejected at the .05 level. Further research needs to be conducted to determine exactly why the predictions given in Hypotheses 4, 5, 7, and 8 did not materialize.

Both the audio and the audio/video groups gave significantly fewer restricted thinking responses than the control group. This was consistent with Hypotheses 11 and 12. The audio and the audio/video groups, however, did not differ significantly in this ETC at the .05 level (reject Hypothesis 10). More research is needed to explain this finding.

In the final ETC, expanded thinking questions, there were no significant differences between the audio and the audio video group, or between the audio and the

traditional group. As a result, Hypotheses 13 and 15 were rejected at the .05 level. Further research is needed to explain these findings. There were significant differences between the traditional group and the audio/video group (Hypothesis 15).

In general, two patterns emerged from this study. First, the audio and audio/video groups did not differ significantly in any of the ETC's, nor did they differ in terms of the total number of interactions during the teleconferenced instruction. The question that needs to be answered is, "Can nonverbal cues that induce interaction be transmitted via television?" Perhaps the explanation lies in the way students are conditioned to watching a television screen. Viewing television is a passive activity and viewers' cognitive engagement appears to wane over time (Brown, 1988). The students in the audio/video group in this study may not have been mentally focused on the instructor when the open-ended questions were presented at the end of the lesson. As a result of this lack of attention, the audio/video teleconference experience was basically the same as the audio teleconference experience.

The second pattern that emerged was that the traditional group generally interacted more than the audio and the audio/video groups in terms of total number of interactions and in several of the ETC's. The implications of this finding on distance education are that occasional site visits on the part of the instructor may be beneficial. Further research could be conducted to determine whether site visits increase the amount of interaction that occurs during teleconferences that follow the site visits. Researchers in this study were only interested in the effects that student/instructor visual contact had on verbal interaction during teleconferences. The audio/video capabilities of the system used for the two-way audio/video teleconference would allow the user to take advantage of the attributes inherent in such a system by sharing graphics and other visual information. This may in turn stimulate verbal interaction. Further research needs to be conducted in order to determine whether effective uses of the video capabilities of teleconferencing systems influences the amount of interaction that takes place during instruction.

Finally, the assumption that the addition of visual contact is in and of itself capable of improving distance education is not substantiated in this study. In future studies, it might be beneficial to measure something other than the amount of verbal interaction

that takes place during teleconferences and focus on the role of nonverbal interactions in visual delivery modes.

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