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ABSTRACT

This paper examines two different delivery methods, video and computer-based instruction (CBI) for instructing preservice teachers in the use of an electronic mail system, FIRNMAIL. Three questions were asked about students who were taught FIRNMAIL through a video presentation and those taught through an interactive, computer-based simulation (CBI): (1) Is there a difference in the mean achievement gains on a writing post-test? (2) Is there a difference in students' perception of instruction? (3) Is there a difference in the mean near-transfer performance? Twenty-four students were randomly assigned to either the video or the CBI. Pre- and post-tests indicated that both treatments are instructionally effective. In analysis of perception of instruction it was found that students in the computer-based tutorial/simulation group were more likely to: enjoy the instruction; prefer their mode of instruction over a lecture; want another lesson like this; and prefer their mode of instruction over reading the material in a book. Analysis of near-transfer performance revealed that students in the CBI group performed significantly better on the electronic mail assignment than the students in the video group. Data is presented in three tables and four figures. (Contains 34 references.) (Author/MAS)

Teaching Telecommunications: A Comparison Between Video and Computer-Based Instruction

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Abstract

This paper examines two different delivery methods (video and CBI) for instructing preservice teachers in the use of an electronic mail system. Questions regarding student achievement, perception of instruction, and near-transfer performance are investigated. Results indicate that a significant difference exists between the two delivery methods on students' perception of instruction and on students' near-transfer performance.

Introduction

Telecommunications can benefit education in numerous ways. For example, telecommunications is an excellent means to teach multicultural awareness: "Indeed, never before could teams of students, thousands of miles apart, engage in dialogue through which they jointly construct a model of their respective economics, cultural surrounding, or ecologies, and then collaboratively test its implications" (Salomon, 1991, p. 43).

Communications skills can also be enhanced through telecommunications. Students from different schools, nations, or countries can send their compositions for others to read, critique, and review. Several studies have reported a significant increase in the quality of students' writing with distant audiences (Cohen & Riel, 1989; Wright, 1991).

Telecommunications also inspires students and teachers and makes learning exciting and relevant. Studies have found it to be very motivating for students to correspond through telecommunications with experts who would be inaccessible through other means (Perry, 1984).

The use of telecommunications is flourishing in today's society; hence, telephone companies, online commercial services, and state departments of education have taken steps to ensure that the use of telecommunications is an integral part of today's education. For example:

- "Tele-Communications, Inc. (TCI) and Bell Atlantic Corporation have joined forces to provide 26,000 K-12 schools, or roughly one-quarter of all U.S. schools, with connections to the information highway" (Salvador, 1994, p.6).

- Pacific Bell has promised to connect every public school and library in the state of California to the Internet (Graumann, 1994).

- Online commercial services such as Prodigy and America Online are offering discounts and special programs to educators (Kinnaman, 1994; Salvador, 1994).

- Florida, Texas, and other states offer networked education systems that enable their educators to communicate through e-mail, access the Internet, and obtain electronic information and resources at no cost.

Although there is an abundance of educational resources related to the use of telecommunications, few instructional benefits will be realized if educators are not instructed and motivated to use the infamous "Information Highway." As we have learned by the infusion of computers into the classroom of the 1980s, access to technology will have little affect if teachers are not instructed on how to use and integrated it within the curriculum (Fulton, 1989; Glenn & Carrier, 1986; Munday, Windham, & Stamper, 1991).

Telecommunications, like computers, is now becoming a standard tool for many teachers. In fact, in 1991, the Florida Department of Education implemented an electronic mail system (FIRNMAIL) and provided it free of charge to all educators in Florida. In addition to a technical manual, two alternative training programs (a videotape and a computer-based tutorial/simulation) were developed to provide instruction on using the system. This paper examines the two training methods and their effects on student achievement, perception of instruction, and near-transfer performance.

Research Questions

The study presented in this paper was designed to answer the following questions:

1. Is there a significant difference on the mean achievement gains on a written posttest between students who are taught FIRNMAIL through a video presentation and students who are taught FIRNMAIL through an interactive, computer-based tutorial/simulation?

2. Is there a significant difference on students' perception of instruction between students who are taught FIRNMAIL through a video presentation and students who are taught FIRNMAIL through an interactive, computer-based tutorial/simulation?

3. Is there a significant difference on the mean near-transfer performance between students who are taught FIRNMAIL through a video presentation and students who are taught FIRNMAIL through an interactive, computer-based tutorial/simulation?

Review of the Literature

Research suggests that video and computer-based technologies can provide effective instruction for adult learners (Dillion & Kincade, 1990; Lewis, 1976; Moore, 1987; Sivin-Kachala & Bialo, 1993). Hannafin (1985) notes, however, that "little evidence supporting the *differential* effectiveness of instructional technologies exists" (p. 235). For example, in their analysis of 63 interactive video-related studies, McNeil and Nelson (1991) report that there was no significant gains in achievement between students using only videodiscs and students using interactive videotape-based units. In other comparison studies, researchers report that video can be just as effective or better than other forms of instruction (Atherton & Buriak, 1988).

Research on simulations is also controversial. Thomas and Hooper (1991) reviewed and categorized 29 simulation studies, most of which indicated no difference in knowledge gained when compared to other methods of instruction. They did find, however, that simulation groups presented a higher degree of transfer, citing Mayer (1981) that "the value of ... simulations appears to be greatest where the material to be learned is foreign to the learner and the goal of the instruction is transfer" (p. 500).

Other studies are contradictory. Kinzer, Sherwood, and Loofbourrow (1989) conducted a study where one group of fifth graders acquired knowledge about a food chain by reading an expository text, while another group of fifth graders used simulation software. The non-computer group outperformed the computer group on all measures. Woodward, Carnine, and Gersten (1988), however, reported significant differences ($p<.01$) on basic facts and concepts that were reinforced by a simulation treatment versus structured teaching alone. Much of the controversy and mixed results of simulation studies can be attributed to fundamental weaknesses in research design, the multiple definitions and subcategories of simulations, and the unknown quality of the simulations used (Thomas & Hooper, 1991; Woodward, Carnine, & Gersten; 1988).

Although there appears to be a significant amount of research on the effectiveness of computer-based instruction (CBI) and video, little research has examined students' perception of instruction. Winn (1993) notes that "[p]erception can be thought of as a set of physiological and psychological processes by means of which we make sense of our environment" (p. 57). Perception of instruction can influence student motivation toward instruction, as well as the students' ability to process information (Milheim & Martin, 1991; Newby, 1989; Winn, 1993).

Researchers have been examining teachers' perception toward computers for over a decade (Bracey, 1990; Dupagne & Krendl, 1992; Handler, 1993; Knupfer, 1989; Knupfer, 1989-90; Mackowiak, 1991). In a review of the literature on teachers' attitudes toward computers, Dupagne and Krendl (1992) found that "[t]he literature stresses the importance of training to stimulate teachers' computer use and to foster favorable attitudes toward computers" (p.423). They also state "[t]he less anxious teachers are about computers, the more likely they are to implement computers in the curriculum" (p.423). Teachers' perception of the delivery method of instruction, therefore, can play a significant role in teachers' attitudes and use of technology.

Methods and Data Source

This study was conducted at the University of South Florida, Tampa, Florida, during the Fall semester of 1993. The population consisted of undergraduate, preservice teachers enrolled in EME 4402, Microcomputers in Education, in the College of Education. The sample was constructed using 24 volunteer students. The students were randomly assigned to one of two conditions: video or CBI. None of the students had any prior experience with FIRNMAIL or telecommunications.

The video was designed by the Florida Information Resource Network, and it demonstrated the procedures for logging into FIRNMAIL, reading a new message, creating and sending a message, and logging out of FIRNMAIL. The same material was presented through an interactive, computer-based tutorial/simulation. Students viewed the video in groups of three and four, were encouraged to ask questions, and were allowed to review any information on the videotape. Students assigned to the computer-based tutorial/simulation worked individually. Students in each group took approximately 40 minutes to complete the instruction.

Both the tutorial/simulation and video were critiqued and validated by experienced FIRNMAIL users and FIRNMAIL support personnel (FIRNTECs), following the guidelines set by Ruben and Lederman (1982). Ruben and Lederman note,"The criterion of construct validity is satisfied when the rules, roles, interactions, goals, and the criteria of the game or simulation have one-to-one counterparts in the skills, concepts, and paradigm, or theoretical framework, that the activity is intended to impart" (p. 238).

All of the students followed the same sequence of instruction. Each group received a pretest, followed by instruction (video or computer-based), a posttest, a FIRNMAIL assignment, and a perception questionnaire on the instruction.

Both the pretest and posttest were in multiple-choice formats, administered via paper and pencil, and consisted of 25 knowledge-level questions relative to the instruction. The posttest paralleled the questions on the pretest, and neither test had a time limit. Cronbach's alpha coefficient of internal consistency reliability was reported at .91 for the pretest and .88 for the posttest.

The FIRNMAIL assignment required students to read a new message, create and send a message, and log out. Students were labelled "successful" if they were able to read a new message, create and send a message, and log off the system.

The perception questionnaire was constructed in a binary (agree/disagree) format and consisted of nine questions and two fill-in-the blank options for student comments. The questionnaire specified the video or tutorial as the instructional component. The students were asked to respond to the following agree/disagree questions:

- I felt I could work at my own pace.
- I enjoyed using the video/tutorial*.
- I would have rather had a lecture in a classroom.

- There was too much information to remember.
- I would like to take another lesson like this.
- The lesson gave clear explanations of the material.
- The video/tutorial was boring*.
- I would rather read the material in a book.
- I like to learn new things through video/computers*.

*The question was worded to correspond the students' mode of instruction.

The analyses incorporated analysis of covariance for pre- and posttest scores, t-tests to measure any significant differences between group transfer performance, and chi-square analyses to examine the students' perception toward instruction. Cramer's V was used as the chi-square measure of association. The level of significance for the analyses was set at .05.

Data Analysis

Achievement

Results of the pretest and posttest indicated that both treatments were instructionally effective. Achievement for both groups increased significantly between the pretest and the posttest (see Table 1).

TABLE 1
T-TEST FOR PRETEST AND POSTTEST SCORES

Group	Test	Mean	SD	DF	T	Sig. p
Video (n=12)	pretest	9.00	1.86	11	8.24	<.01
	posttest	17.25	2.14			
CBI (n=12)	pretest	9.75	3.02	11	29.68	<.01
	posttest	17.83	2.03			

In order to ascertain that the treatment groups were equal at the beginning of the experiment, a t-test was performed on the pretest means. The results of the t-test on the pretest means indicated that the two groups differed significantly at the beginning of the experiment; therefore, an analysis of covariance was used (using the pretest as the covariate) to examine the results of the posttest. These results are presented in Table 2. No significant findings were found between the achievement gains of the two groups.

TABLE 2
RESULTS OF ANALYSIS OF COVARIANCE ON POSTTEST

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig. F
Covariate Pre	10.26	1	10.26	2.48	.13
Main Effects Group	.89	1	.89	.22	.68
Explained	11.16	2	5.58	1.35	.28
Residual	86.80	21	4.13		
Total	97.96	23	4.30		

Perception of Instruction

Significant differences were found between the groups toward their perception of instruction. Chi-square analyses indicated that students in the computer-based tutorial/simulation group were more likely to:

- enjoy the instruction
- prefer their mode of instruction over a lecture
- want another lesson like this
- prefer their mode of instruction over reading the material in a book.

These results are presented in Figures 1, 2, 3, and 4.

	CBI	Video	Row Total
Agree			
Count	12.0	6.0	18.0
Exp. Value	9.0	9.0	75.0%
Residual	3.0	-3.0	
Disgree			
Count	0.0	6.0	6.0
Exp. Value	3.0	3.0	25.0%
Residual	-3.0	3.0	
Column Total	12.0 50.0%	12.0 50.0%	24.0 100.0%

Pearson chi-square statistic = 8.00
Cramer's V = .58
p<.01

Figure 1. Chi-square analysis for "I enjoyed using the video/tutorial."

	CBI	Video	Row Total
Agree			
Count	0.0	6.0	6.0
Exp. Value	3.0	3.0	25.0%
Residual	-3.0	3.0	
Disgree			
Count	12.0	6.0	18.0
Exp. Value	9.0	9.0	75.0%
Residual	3.0	-3.0	
Column Total	12.0 50.0%	12.0 50.0%	24.0 100.0%

Pearson chi-square statistic = 8.00
Cramer's V = .58
p<.01

Figure 2. Chi-square analysis for "I would have rather had a lecture in a classroom."

	CBI	Video	Row Total
Agree			
Count	12.0	7.0	19.0
Exp. Value	9.5	9.5	79.2%
Residual	2.5	-2.5	
Disgree			
Count	0.0	5.0	5.0
Exp. Value	2.5	2.5	20.8%
Residual	-2.5	2.5	
Column Total	12.0 50.0%	12.0 50.0%	24.0 100.0%

Pearson chi-square statistic = 6.31
Cramer's V = .51
p<.02

Figure 3. Chi-square analysis for "I would like to take another lesson like this.'

	CBI	Video	Row Total
Agree			
Count	0.0	5.0	5.0
Exp. Value	2.5	2.5	20.8%
Residual	-2.5	2.5	
Disgree			
Count	12.0	7.0	19.0
Exp. Value	9.5	9.5	79.2%
Residual	2.5	-2.5	
Column Total	12.0 50.0%	12.0 50.0%	24.0 100.0%

Pearson chi-square statistic = 6.31
Cramer's V = .51
p<.02

Figure 4. Chi-square analysis for "I would rather read the material in a book."

Near-Transfer Performance

A t-test analysis revealed that students in the CBI group performed significantly better on the FIRNMAIL assignment than the students in the video group. These results are presented in Table 3.

TABLE 3
T-TEST COMPARING GROUP NEAR-TRANSFER PERFORMANCE

Group	Mean Score of Success	SD	DF	T	Sig. p
Video (n=11*)	.46	.52	20	3.45	<.01
CBI (n=10**)	.80	.42			

* One student was unable to participate because FIRNMAIL was down.
** Two students were not able to participate because FIRNMAIL was down.

Discussion

Achievement

The results of this study did not find a significant difference on the mean achievement gains on a written posttest between students who were taught FIRNMAIL through a video presentation and students who were taught FIRNMAIL through an interactive, computer-based tutorial/simulation. These results support previous research stating that video and computer-based instruction can provide effective instruction for adult learners. T-tests revealed that both groups made significant achievement gains ($p.<05$) in their knowledge of FIRNMAIL.

Perception of Instruction

There was a significant difference on students' perception of instruction between students who were taught FIRNMAIL through a video presentation and students who were taught FIRNMAIL through an interactive, computer-based tutorial/simulation. Results indicate that students prefer to learn about the use of telecommunications through an interactive, computer-based tutorial/simulation rather than a video. Students made the following comments about what they liked and disliked about their mode of instruction:

<u>Students using CBI: (Liked)</u>

- I liked the interactive nature -- it really involved me.
- The instructions were very detailed on how to use FIRNMAIL. It allowed one to go back and review.
- I enjoyed being able to go at my own pace. I also liked that you could go back to a particular area at any given time. I also liked practice at the end of each section.
- All instructions were very clear and instruction was easy to follow.
- I liked getting feedback and if I chose the incorrect answer I had to find the correct one on the next try.
- It had step-by-step directions.

<u>Students using CBI: (Disliked)</u>

- I disliked nothing.
- A little more practice may have helped.
- A few screens could have been combined.

<u>Students watching video: (Liked)</u>

- It was very detailed; the explanations were thorough.
- It was informative with clear details.
- The examples were done while the speaker was explaining the concept or instruction.
- The people who did the video were knowledgeable, polite, and tried to be very helpful.

- The video gave a step-by-step procedure for working through the program.

- The fact that after the video we discussed any questions that were bothering us.

Students watching video: (Disliked)

- I didn't have a chance to practice it on the computer while it was being explained.

- It was hard to see the screens and menus in the video.

- The information was given too fast.

Overall, seven of the 12 students (58%) in the CBI group found nothing they disliked about their instruction. On the other hand, all of the students in the video group reported disliking their instruction in some manner or form. For example, three of the 12 students commented on wanting hands-on practice, while six of the students commented that the computer screens and menus were difficult to read via video.

Preference for CBI has implications for the teaching of telecommunications to future educators. Student comments suggest that they prefer hands-on instruction; the opportunity to review; concise step-by-step instructions; immediate feedback; practice exercises; and, to work at their own pace. Based on the comments made by the students in the video group, fidelity of instruction is a key factor, especially when it comes to seeing the computer screen and practicing the procedures. In addition, student comments and perception of instruction support the idea that computer-based instruction can allow users to interact and simulate the use of a telecommunications system, whereas video remains a passive instructional tool.

Near-Transfer Performance

There was a significant difference on the mean near-transfer performance between students who were taught FIRNMAIL through a video presentation and students who were taught FIRNMAIL through an interactive, computer-based tutorial/simulation.

The students' ability to successfully complete the FIRNMAIL task differed significantly between groups. Eighty percent of the students in the CBI group were successful in reading a new message, creating and sending a message, and logging off of FIRNMAIL, whereas only 45 percent were successful in the video group.

Results of this study support research by Alessi (1988) who noted that computer-based simulations were superior to other media (print, film, video, or lectures) for teaching transfer; and, Reigeluth and Schwartz (1989) and Gorrell (1992) who stated that simulations enhance transfer.

Conclusion

This study emphasizes the importance of the method of instruction and its affect on students. One factor is clear: If we are to engage educators in the use of telecommunications, it is important that we first engage them in the instruction about telecommunications. Based on the results of this study, it appears that hands-on instruction via CBI is a key factor in transfer and student perception of instruction. In addition, paper and pencil achievement tests do not necessarily measure a student's true ability in procedural knowledge.

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