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ABSTRACT

Satellite Technology Demonstration (STD) was designed to provide data on the use of a satellite to deliver educational programs to 56 rural-isolated schools in eight Rocky Mountain States. Three series were broadcast: (1) a junior high school career development, (2) career development for public school administrators and teachers, and (3) topical programs for community members. The STD also used the Advanced Technology Satellite (ATS-3) as an interactive voice-link with 24 participating schools and recorded this data. Schools were defined as "interactive" and "noninteractive." Across all measures, the interactive students showed a greater number of learning gains and larger gains on those tests which reflected the cognitive aspects of the STD programing. The results of this research suggested that a satellite audio interaction system would enhance the quality of educational programing via satellite. Statistical tables show the results of measurements. (Author/DS)

SATELLITE TECHNOLOGY DEMONSTRATION

FEDERATION OF ROCKY MOUNTAIN STATES, INC.

technical report

TR0217

THE USE OF A SATELLITE HUMAN INTERACTION SYSTEM IN CONJUNCTION WITH A SATELLITE MEDIA DISTRIBUTION SYSTEM

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INTRODUCTION

The prototypic Satellite Technology Demonstration (STD) was designed to provide data on using a satellite communications system to deliver social or educational services to selected populations. Specifically, the STD's goals were: (1) to demonstrate the feasibility of distributing programs via satellite to rural-isolated communities; and (2) to test and evaluate user acceptance of the programs, as well as to determine the costs of employing different delivery modes.

The ATS-6 Broadcasts

In September, 1974, the STD began using Applications Technology Satellite-6 (ATS-6) to broadcast three series of educational television programs to 56 rural-isolated schools in eight Rocky Mountain States. These broadcasts included:

1. A 16-week, career-development series for junior high school students (grades 7 through 9), called "Time Out."
2. A 1-year, inservice series on career development for public school administrators and teachers, called "Careers and the Classroom."
3. An 8-month series of topical programs (broadcast evenings) for community members, called "Footprints."

The ATS-3 Interaction System

In conjunction with the above series, the STD used the ATS-3 as an interactive voice link with 24 participating schools. This link provided two-way audio communications not only between the STD and the schools, but also between each school participating in the Demonstration. The interactive portions of the student programs included:

1. A 6-minute, live interaction program that was broadcast immediately after each "Time Out" program--Monday through Thursday each week--and that was designed to give students an opportunity to ask STD career specialists about program-related topics; the program was called "Time In."

2. A 28-minute, 30-second, live interaction program--broadcast only on Fridays--that covered career-education concepts and strategies, as well as described Project activities (for example, programming and engineering); the program was called "Time for You."

The interactive portions of the inservice and evening programs were not titled as such, but occurred immediately following that portion of the program which presented the relevant information. These programs ran for 50 minutes, with varying time allocated for interaction. The inservice programs were broadcast once every two weeks; the evening programs, once every three weeks.

The Research Component

The STD's Research Component collected and analyzed data relative to using the ATS-3 interaction system for transmitting career-education programs to junior high school students. A summary of research activities is provided below.

METHODOLOGY

Before Research personnel could design and implement data-gathering procedures, they had to define not only the schools, but also the populations that would be involved in the Demonstration. "Interactive schools" were defined as 24 junior high schools which received all STD student programs and which interacted with the STD and each other via the ATS-3 audio system. "Noninteractive schools" were defined as 32 junior high schools which received all STD student programs, but did not interact with the STD or each other. The "population" was the junior high school students who participated in and/or viewed the interactive portions of the student programs--"Time In" and "Time for You."

Data Collection

Research personnel collected some data by recording the audio interaction which occurred during each interactive student program. Also, STD school personnel administered the following tests on a pre-post basis to the students and returned the tests (by mail) to tne STD.

1. The Time Out Test. A criterion-referenced test designed to measure behavioral objectives.

2. The Competence Test.* A standard test designed to measure learning outcomes in three areas--knowing about jobs, choosing jobs, and making career-related decisions.

3. The Attitude Scale.* A standard attitude test designed to measure feelings about choosing a career and entering the work force.

4. The Student Acceptance Questionnaire. A research instrument designed to assess student opinions about the interactive portions of the programs.

DATA ANALYSIS

Recorded Interaction Data

Using the following categories, researchers analyzed the recorded data via interaction and content analysis techniques.

A. Type of Interaction

1. Spontaneous School Responses: Interaction which was initiated solely by a school and was not, in any way, solicited by the STD.

2. Spontaneous Conversational Responses: Unsolicited responses which were made spontaneously by school persons participating in interactive conversations.

3. Solicited School Responses: Responses made during interactive sessions by schools that had been called on by name.

4. Solicited Conversational Responses: Responses made by school persons in answer to followup questions asked by STD personnel.

B. General Content of Interaction

1. No Response, Failure to Reply: The failure of a school to reply when called on by name.

2. No Response, Reply Inaudible: Solicited or spontaneous school response that could not be understood by STD personnel.

3. Content-Related Reponses: Solicited or spontaneous responses that were understandable and, in some way, related to the program or the program topic.

*The Competence Test and the Attitude Scale were taken from the Career Maturity Inventory, a standard test battery published by McGraw-Hill, Inc., and developed by John Crites.

4. No Comment: A solicited response indicating "no comment" or "no questions.

5. Special Requests: A solicited or spontaneous request for public information materials or for questions to be repeated.

The researchers performed a more specific content analysis of all completed student interaction by placing each statement into career-related or production-related categories.

A. Specific Career-Related Categories

1. Education and training
2. Decision-making
3. Definitions of content words
4. Self-assessment, including student--
   (a) Values
   (b) Aptitudes
   (c) Interests
   (d) Temperaments
   (e) Personal/social skills
5. Self-assessment, related to specific jobs and including workers'--
   (a) Aptitudes
   (b) Temperaments
   (c) Values
6. Man/women differences relative to jobs
7. Working hours
8. Salary scales
9. DOT* questions
10. Depressions and unions
11. Job requirements and duties
12. Job outlook and future job markets
13. Specific job information
14. Sources of information
15. Consumer questions
16. Self-employment vs. salaried employment
17. Social change

*The Dictionary of Occupational Titles (DOT) is a U.S. Department of Labor publication, which divides all occupations into nine categories and describes the work performed in each job; The DOT was used as the STD's major source of career information.

18. Life styles

19. Job interviews and applications

20. Other (including all categ ies which received a frequency count of 11)

B. General Program/STD/Production-Related Categories

1. Program compliments

2. Program changes and suggestions

3. Program and production questions

4. Special questions and requests, related to the STD

5. Special questions and problems, related to the hardware

For each of the categories described in this section, the researchers calculated the percent of interaction occurring in any one category by dividing the frequency count within that category by the total amount of interaction attempted, including both spontaneous and solicited interaction.

Knowledge and Attitude Data

The researchers analyzed the knowledge and attitude data by computing means, standard deviations, and independent t-tests for pre-post differences in means.

Student Opinion Data

In examining the student opinion data, th researchers used two methods. The first method was simple descriptive statistics; for example, percents and means. The second was independent t-tests for the equality of student means at interactive and noninteractive schools.

INTERACTION AND CONTENT ANALYSIS RESULTS

Type of Interaction and General Content

Using frequency counts, the researchers computed the percent of interaction occurring in each general category. Table 1 presents the student data relative to the interaction and general content categories.

ANALYSIS CATEGORIES	INTERACTIVE STUDENT PROGRAMS "Time In"	"Time for You"
Interaction	(N = 629)	(N = 511)
Spontaneous School Response	05%	04%
Spontaneous Conversational Response	04%	02%
Solicited School Response	65%	71%
Solicited Conversational Response	27%	23%
General Content		
Reply Failure	09%	14%
Reply Inaudible	18%	11%
Content-Related Response	65%	67%
No Comment	04%	06%
Special Requests	04%	02%

Table I. The Percent of Student Interaction Occurring in Each Interaction and General Content Category.

Table 1 shows that most of the attempted interaction was deliberately initiated by the STD staff. This "controlled" participation was necessary to prevent the ATS-3 system from becoming inoperative during simultaneous attempts at interaction.

Approximately two-thirds of the interaction was content- or program-related. The remaining third largely consisted of failures to reply and reply inaudibles. The "inaudibles" were largely due to sound quality fluctuations, caused by power reductions during ATS-3 transmissions and the simultaneous operations of other experimenters.

Specific Content of Completed Student Interaction

The researchers performed a more specific content analysis on the completed student interaction data. Table II shows the percent of interaction occurring in each of the specific content categories. The table includes only those categories with 2.00% or higher interaction.

ANALYSIS CATEGORIES	PERCENT OF INTERACTION
Career-Related	(N = 433)
1. Education and Training Requirements for Specific Jobs	24.77%
2. Decision-Making	10.47%
3. Self-Assessment (Student Values, etc.)	6.41%
4. Self-Assessment (Workers' Aptitudes, etc.)	3.21%
5. Man/Woman Differences Relative to Jobs	2.99%
6. Salary Scales	2.99%
7. DOT Questions	2.35%
8. Depressions and Unions	2.99%
9. Specific Job Information	2.99%

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Program- or STD-Related	
1. Program Compliments	7.27%
2. Program Changes and Suggestions	3.63%
3. Program and Production Questions	7.27%
4. Special Questions and Requests, Related to the STD	3.42%
5. Special Questions and Problems, Related to the Hardware	2.35%

Table II. The Percent of Student Interaction Occurring in Each Content Analysis Category for Completed Student Interaction Data.

Table II shows that the category with the highest percent of interaction is Education and Training Requirements for Specific Jobs. The second highest is Decision-Making. The two categories dealing with self-assessment are third, with a total of 9.62%. Across all categories, the specific content of the student interaction demonstrates a high correlation with the content structure used in the development of student programming.

STUDENT OPINION DATA RESULTS

Frequency of Viewing Interactive Programs

During the first semester of programming to junior high students, the researchers noted that the schools varied in the degree to which they viewed the interactive programs. This variation was primarily due to the previously described fluctuations in sound quality. The Student Acceptance Questionnaire was used to determine how often students viewed the interactive programs.

Table III shows the percent of students who viewed "Time In" and "Time for You" at interactive schools versus the percent of students who viewed those programs at noninteractive schools.

FREQUENCY OF VIEWING	PERCENTAGES FOR EACH TYPE OF SCHOOL Interactive	Noninteractive	TOTAL PERCENTAGES
"Time In"			
Never	2.1%	8.1%	5.1%
One Day a Month	3.4%	6.1%	4.8%
One Day a Week	4.7%	10.6%	7.7%
Every Day	89.9%	75.1%	82.5%
"Time for You"			
Never	1.8%	12.1%	7.0%
One Day a Month	6.3%	12.6%	9.5%
Every Week	91.8%	75.3%	83.5%

Table III. How Often Students Viewed "Time In" and "Time for You"

Table III shows that 82.5% of the students viewed each daily broadcast of "Time In," and 83.5% of the students viewed each weekly broadcast of "Time for You." Respectively, 5.1% and 7.0% of the students never viewed either interactive program.

For both programs, the students at the interactive schools had a higher viewing rate than the students at the noninteractive schools.

Opinions of All Students Regarding Taped and Live Interactive Programs

In assessing student opinions regarding each program, the researchers used three 4-point scales. The participating students rated each program series in terms of:

1. How interesting the program was.
2. How much they learned from viewing each program.
3. How helpful the information gained from each program would be both now and in the future.

The researchers computed the mean of the ratings drawn from each of the scales. Table IV presents the data analysis results for each program series.

RATING SCALES/PROGRAMS	N	MEAN
Interest		
"Time Out"--Pretaped	986	3.047
"Time In"--Live Interaction	918	2.590
"Time for You"--Live Interaction	904	2.313
Learning		
"Time Out"--Pretaped	990	3.126
"Time In"--Live Interaction	935	2.643
"Time for You"--Live Interaction	920	2.503
Helpfulness		
"Time Out"--Pretaped	989	3.052
"Time In"--Live Interaction	922	2.594
"Time for You"--Live Interaction	909	2.370

Table IV. The Average Ratings of Students on Each Assessment Scale for Each Program

As shown in Table IV, the pretaped "Time Out" program received higher ratings on all the scales than either of the two live interaction programs. The interaction program that

received the highest rating was "Time In," the six-minute program which always followed the pretaped "Time Out" series.

Across all programs, the students gave the highest rating to how much they learned from viewing the programs. The "how helpful" category received the second highest rating; "how interesting," the lowest rating.

Differences Between Student Opinions at Interactive and Noninteractive Schools (STD Programming)

In examing what students thought about STD programming at interactive and noninteractive schools, the researchers applied an independent t-test to the means of both groups. Table V shows the results of this test.

RATING SCALES/ PROGRAMS	INTERACTIVE Mean	SD*	NONINTERACTIVE Mean	SD	DF**	t
Interest						
"Time Out"	3.174	0.797	2.965	0.874	984	3.780***
"Time In"	2.814	0.905	2.434	1.025	916	5.785***
"Time for You"	2.695	1.047	2.036	0.975	902	9.704***
Learning						
"Time Out"	3.189	0.722	3.086	0.772	988	2.099***
"Time In"	2.864	0.778	2.491	0.904	933	6.540***
"Time for You"	2.812	0.869	2.284	0.924	918	8.729***
Helpfulness						
"Time Out"	3.174	0.810	2.973	0.921	987	3.487***
"Time In"	2.859	0.952	2.411	1.001	920	6.815***
"Time for You"	2.697	1.012	2.136	0.948	907	8.539***

*Standard Deviation
**Degrees of Freedom
***P < .05

Table V. The Means, Standard Deviations, and t-Values for STD Program Ratings by Students, Using Interest, Learning, and Helpfulness Scales

As shown in Table V, across all scales and programs, the differences between the ratings of the interactive and the noninteractive students were significant at the .05 level. A comparison of the means for each group reveals that the students at the interactive schools rated each program higher on all scales than the noninteractive students. Also, the size of the differences between the two groups increased concomitantly with the amount of interaction which occurred.

Overall Student Evaluation (the Interactive System)

The researchers asked the students at both interactive and noninteractive schools to indicate how much the interaction system contributed to their understanding of the information presented in the pretaped "Time Out" series. Responding to this question, 50.2% of the students indicated that the system contributed "a great deal" or "much." On a 4-point scale, the contribution of the interactive system received a 2.4226 rating.

Differences Between Student Opinions at Interactive and Noninteractive Schools (ATS-3 Interactive System)

On a 4-point scale, the students at the interactive schools gave the ATS-3 system an average contribution rating of 2.876, while students at noninteractive schools gave it an average rating of 2.085. Using an independent t-test, the researchers found that the difference between the two was statistically significant at the .05 level.

Differences in Learning Gains Among Students at Interactive and Noninteractive Schools

The first-semester broadcast of the STD student programs was a formative effort, without built-in comparison techniques or control groups. The learning gains reported in this section are, therefore, limited by the possible impact of student maturation or outside experiences on programming.

The researchers examined learning differences by computing the average pre-post change scores and by applying an independent t-test for the quality of the pre-post means. Table VI shows the average change scores, standard deviations, and t-values for students at interactive and noninteractive schools.

TYPE OF SCHOOL	THE "TIME OUT" TEST	CAREER ATTITUDES	CMI	CMI PART I	CMI PART II	CMI PART III
Interactive						
Average Change	8.040	4.124	2.553	2.048	2.074	3.308
SD	16.046	13.459	10.066	10.605	14.953	14.002
N	156	215	212	212	210	208
t	6.257*	6.012*	3.507*	1.994*	1.973*	3.407*
Noninteractive						
Average Change	6.306	5.622	2.056	0.313	1.271	4.930
SD	15.450	9.898	12.161	16.792	16.949	16.420
N	284	393	391	390	389	387
t	6.877*	11.266*	3.343*	0.368	1.480	5.904*

* $P < .05$

Table VI. The Average Change-scores, Standard Deviations, and t-values for the Pre-Post Knowledge and Attitude Scores of Students at Interactive and Noninteractive Schools

As shown in Table VI, the students who were capable of interacting with STD career specialists in Denver had significant pre-post gains on every knowledge and attitude measure. The students who could listen only to the interaction, or interact via mail, had four significant gains out of a possible six.

An examination of significant average change-scores for both interactive and noninteractive students revealed that, on two measures, the noninteractive students achieved larger gains than did the interactive students. On the other four measures, the interactive students demonstrated larger gains than did noninteractive students.

Across all measures, the interactive students showed: (1) a greater number of learning gains; and (2) larger gains on those tests which reflected the cognitive aspects of the STD programming.

CONCLUSIONS

The research presented above indicates that those students who participated in the Demonstration (65.3% of the interactive students) used the ATS-3 system to ask STD career specialists questions about the programming and the Project. Further, the research indicates that, compared to students without the interactive capability, students at the interactive schools:

1. Viewed more programs--both pretaped and live.
2. Perceived all programs to be more informative, interesting, and helpful.
3. Considered the contribution of the ATS-3 system to be greater.
4. Demonstrated more learning gains, particularly on those measures reflecting the cognitive aspects of the STD programming.

These comparisons suggest that a satellite audio interaction system enhances the quality of educational programming via satellite. Future studies, in controlled settings, are needed to determine the validity of this hypothesis.

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