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AUTHOR Hodge-Hardin, Sherri
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ABSTRACT

The purpose of this study was to determine if there were differences in math achievement of students taught in an interactive television (ITV) class setting with the instructor present (host site), students receiving instruction via television at an off-campus location (remote site), and students taught in a traditional classroom setting. The study also examined student attitudes toward enrolling in future ITV courses. The sample was made up of all developmental students enrolled in an introductory algebra or an intermediate algebra course at East Tennessee State University (ETSU) taught via ITV during seven consecutive semesters, and developmental algebra students at ETSU enrolled in the instructor's traditional classrooms during these same semesters. Students were given math instruction by the same instructor at one of three sites: the host site, the remote site, and the traditional classroom. Students' numerical final grades were used as a dependent variable in determining the effectiveness of these ITV courses. A two-way analysis of variance with one covariate (ANCOVA) was used to determine if differences in student achievement existed among the three instructional sites. Results give empirical evidence that ITV should be considered as an adequate method of providing developmental algebra instruction beyond the campus. Questions for futures studies are listed. (DLS)

Interactive Television vs. a Traditional Classroom Setting: A Comparison of Student Math Achievement

Sherri Hodge-Hardin, Ph.D.

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Abstract

While a dramatic expansion of distance learning through the use of interactive television (ITV) is allowing colleges and universities to offer students potentially unlimited access to educational opportunities, the question may be raised --- Is ITV an effective medium of instruction? The purpose of this study was to determine if there were differences in math achievement of students taught in an ITV class setting with the instructor present (host site), students receiving instruction via television at an off-campus location (remote site), and students taught in a traditional classroom setting. This study also examined student attitudes toward enrolling in future ITV courses.

The Problem

Recent technological advances, as well as changes in demographics among student populations, have made television an increasingly viable medium for the delivery of university curriculum (Jacobson, 1994). As more university courses become available via interactive television systems in the future, research focusing on instructional practices in televised classrooms will have greater utility. This study was designed to investigate the effects of using interactive television (ITV) asa means of teaching developmental algebra at East Tennessee StateUniversity (ETSU).

Purpose

This study focused on the achievement of three groups of developmental algebra students. The purpose of the study was to determine if there were differences in math achievement of students taught in an ITV class setting with the instructor present (host site), students receiving instruction via television at an off-campus location (remote site), and studentstaught in a traditional class setting. This study also compared traditional students and nontraditional students to see if there were differences in achievement based on age. Finally, this study tried to determine if students who enrolled in a developmental algebra course taught via interactive television would consider taking another ITV course in the future, and if they would consider taking another ITV math course in the future.

Significance

Any new method of instructional delivery requires assessment to determine the strengths and weaknesses of the system. Technology applied to education produces a greater need to evaluate outcomes to provide evidence that students in ITV classrooms will achieve as well as those students taught in traditional classrooms. If the system fails to achieve these goals, the method of delivery needs to be reconsidered. The use of interactive television to offer courses at remote locations holds promise for being an exciting method of reaching more students than would generally be able to attend if classes were restricted to lecture halls and classrooms on campus (Fulmer,Hazzard, Jones, & Keene, 1992). If it can be shown that the students at the distance learning sites are learning as well as those students in the traditional classrooms, then there would be empirical evidence that ITV should be considered as an adequate method of providing instruction beyond the campus.

Methods

For the purposes of this study, the sample was made up of all developmental students at ETSU enrolled in an Introductory Algebra or an Intermediate Algebra course taught via ITV during the following seven consecutive semesters: Spring 1993, Summer 1993, Fall 1993, Spring 1994, Summer 1994, Fall 1994, and Spring1995. The researcher was the instructor for all of these classes. The sample also included developmental students at ETSU enrolled in an Introductory Algebra course or an IntermediateAlgebra course taught in this instructor's traditional classrooms during these same semesters. Over the period of these seven semesters, 189 students were enrolled in the Introductory Algebra course under investigation, and 112 students were enrolled in the Intermediate Algebra course under investigation. Of the 189 Introductory Algebra students, 89 were traditional age (22 and younger) and 100 were nontraditional age (23 and older). Of the 112 Intermediate Algebra students, 42 were traditional age and 70 were nontraditional age. Tables 1 and 2 give the enrollments by student age and method of instructional delivery for the Introductory and Intermediate Algebra courses.

Table 1
Introductory Algebra Enrollment by Student Age and Method of Instructional Delivery

	ITV Host Site	ITV Remote Site	Traditional Classroom
Traditional Age	32	15	42
Nontraditional Age	43	26	31
Totals	**75**	**41**	**73**

Table 2
Intermediate Algebra Enrollment by Student Age and Method of Instructional Delivery

	ITV Host Site	ITV Remote Site	Traditional Classroom
Traditional Age	15	11	16
Nontraditional Age	19	19	32
Totals	**34**	**30**	**48**

The students in this sample were given math instruction by the same instructor at one of three sites:

Group 1 - ITV Host Site - This was an interactive television studio (housed in room 123 Sam Wilson Hall) located on the main campus of ETSU. Students in this setting were given instruction in a room equipped with cameras and microphones at each desk. The instructor was physically present with these students. Math instruction was given on camera, with the students seeing the

problems worked by the instructor on two overhead television screens. Instruction originated in this on-campus studio and was transmitted to another group of students at the ETSU/UT Kingsport Center in Kingsport, Tennessee.

Group 2 - Remote Site - The students in Kingsport were the second group in the study. They were part of this live, interactive instruction. They could talk to the instructor via cordless telephone at any time during the class. The students in Kingsport saw (via television) and heard everything that was going on in the on-campus studio. However, the students and the instructor at the on-campus site could only hear the students in Kingsport (two-way audio but only one-way video). A faculty assistant was always present with the students at the ITV remote site. This person monitored the television equipment, kept class attendance records, and proctored exams.

Group 3 - Traditional Classroom - Students in this setting were taught algebra in a regular classroom. The teacher was present with the students and instruction was given utilizing the chalkboard.

Students were placed in either the Introductory Algebra or Intermediate Algebra course based on their score on the Academic Assessment and Placement Program (AAPP) exam (TBR AAPP Student Information Bulletin, 1994). As a second check in making sure students were placed properly, a 10-problem proficiency test was given on the first day of each class. This test covered the objectives that would be taught throughout the semester. Student scores on this proficiency test could range from 0 to 100. If students scored 70% or higher on the exam, they were "bumped up" to the next level math course. This proficiency exam helped to ensure that students were equitable mathematically from the beginning of the course. The proficiency exam scores were used as a covariate in the study to control for any preexisting differences among groups prior to the research. Students in all classes were given four exams and a comprehensive final, each of which comprised 20% of the student's grade. Exams for each class were graded by the instructor. Final grades were calculated for each student in all classes based on a 100-point scale. This numerical final grade was used as a dependent variable in determining the effectiveness of these ITV courses.

Student attitude toward taking another ITV course was another dependent variable in the study. During the final exam, students enrolled in the ITV classes were asked to check 'yes' or 'no' to two questions: (1) Would you take another math class taught via interactive television? and (2) Would you take any other class taught via interactive television?

A two-way analysis of variance with one covariate (ANCOVA)was used to determine if differences in student achievement existed among the three instructional sites. The ANCOVA procedure was also used to determine if differences in student achievement existed among the three instructional sites when comparing traditional age students with nontraditional age students. Student achievement was measured by the final course grade and was ratio level data. The parametric ANCOVA procedure is appropriate when attempting to find significant differences among three or more groups using ratio level data (Hinkle, Wiersma, & Jurs, 1988). A covariate was used to control for any preexisting differences among groups prior to the research. The covariate was each student's proficiency test score.

Results for Introductory Algebra

Table 3 presents the results of the ANCOVA for Introductory Algebra.

Table 3
Analysis of Covariance on Final Course Grade by Group and Age for Introductory Algebra

Source	SS	df	MS	F	p
PROFTEST	31066.82	1	31066.82	14848,47	<.0005
GROUP	7.32	2	3.66	1.75	.177
AGE	.23	1	.23	.11	.739
GROUP by AGE	.72	2	.36	.17	.843
error	380.79	182	2.09	---	---

There were no significant differences in student achievement in Introductory Algebra using three different methods of delivering instruction. There were also no significant differences in student achievement among the three groups when comparing traditional age students with nontraditional age students. Tables 4 and 5 give the Observed and Adjusted group means for Introductory Algebra as calculated by the ANCOVA procedure.

Table 4
Observed Group Means on Final Course Grade for Introductory Algebra

	ITV Host Site	ITV Remote Site	Traditional Classroom
Traditional Age	87.231	87.800	82.286
Nontraditional Age	83.714	83.577	85.548

Table 5
Adjusted Group Means on Final Course Grade for Introductory Algebra

	ITV Host Site	ITV Remote Site	Traditional Classroom
Traditional Age	87.248	87.652	82.328
Nontraditional Age	83.705	83.662	85.491

As can be seen from Table 4, the traditional age students at the ITV remote site in Kingsport had the highest group mean (m = 87.652) for Introductory Algebra. The traditional age students in the traditional classroom setting had the lowest group mean (m = 82.328) for Introductory Algebra.

Student Attitudes Toward ITV in Introductory Algebra

Students at both the ITV host site on campus and the ITV remote site in Kingsport overwhelmingly checked yes to taking future ITV classes and future ITV math classes. Tables 6 and 7 give the results of Introductory Algebra student responses toward future ITV participation.

Table 6
Introductory Algebra Student Responses Toward Taking Another ITV Class

	ITV Host Site	ITV Remote Site
Students Responding YES	75	40
Students Responding NO	0	1
Percentage Responding YES	100	97.6
Percentage Responding NO	0	2.4

Table 7
Introductory Algebra Student Responses Toward Taking Another ITV Math Class

	ITV Host Site	ITV Remote Site
Students Responding YES	75	39
Students Responding NO	0	2
Percentage Responding YES	100	95.1
Percentage Responding NO	0	4.9

Results for Intermediate Algebra
Table 8 presents the results of the ANCOVA for Intermediate Algebra.

Table 8
Analysis of Covariance on Final Course Grade by Group and Age for Intermediate Algebra

Source	SS	df	MS	F	p
PROFTEST	13969.38	1	13969.38	6071.19	<.0005
GROUP	2.71	2	1.36	.59	.556
AGE	.05	1	.05	.02	.888
GROUP by AGE	7.33	2	3.67	1.59	.208
error	241.60	105	2.30	---	---

There were no significant differences in student achievement in Intermediate Algebra using three different methods of delivering instruction. There were also no significant differences in student achievement among the three groups when comparing traditional age students with nontraditional age students. Tables 9 and 10 give the Observed and Adjusted group means for Intermediate Algebra as calculated by the ANCOVA procedure.

Table 9
Observed Group Means on Final Course Grade for Intermediate Algebra

	ITV Host Site	ITV Remote Site	Traditional Classroom
Traditional Age	89.533	84.909	82.438
Nontraditional Age	87.474	92.105	83.562

Table 10
Adjusted Group Means on Final Course Grade for Intermediate Algebra

	ITV Host Site	ITV Remote Site	Traditional Classroom
Traditional Age	89.107	85.071	82.725
Nontraditional Age	87.809	92.011	83.419

As can be seen from Table 10, the nontraditional age students at the ITV remote site in Kingsport had the highest group mean (m = 92.011) for Intermediate Algebra. The traditional age students in the traditional classroom setting had the lowest group mean (m = 82.725) for Intermediate Algebra.

Student Attitudes Toward ITV in Intermediate Algebra

Students at both the ITV host site on campus and the ITV remote site in Kingsport overwhelmingly checked yes to taking future ITV classes and future ITV math classes. Tables 11 and 12 give the results of Intermediate Algebra student responses toward future ITV participation.

Table 11
Intermediate Algebra Student Responses Toward Taking Another ITV Class

	ITV Host Site	ITV Remote Site
Students Responding YES	33	29
Students Responding NO	1	1
Percentage Responding YES	97.1	96.7
Percentage Responding NO	2.9	3.3

Table 12
Intermediate Algebra Student Responses Toward Taking Another ITV Math Class

	ITV Host Site	ITV Remote Site
Students Responding YES	33	29
Students Responding NO	1	1
Percentage Responding YES	97.1	96.7
Percentage Responding NO	2.9	3.3

Conclusions

1. Students at the distant learning site in Kingsport performed as well as the students in the traditional classroom in both Introductory and Intermediate Algebra courses.

2. In Introductory Algebra, traditional age students at thedistant learning site in Kingsport had a higher group mean on the final course grade than did students in the traditional classroom setting.

3. In Intermediate Algebra, nontraditional age students at the distant learning site in Kingsport had a higher group mean on the final course grade than did students in the traditional classroom setting.

4. Students in both Introductory Algebra and Intermediate Algebra had positive attitudes toward future participation in interactive television courses.

5. The results of this study give empirical evidence that ITV should be considered as an adequate method of providing developmental algebra instruction beyond the campus.

Recommendations

To determine the applicability and validity of distance learning through ITV, additional research is required. Questions that could be posed in future studies include:

1. To what extent to corresponding studies of other ITV systems find similar or disparate results?
2. How does the role of interaction between distant students and the instructor relate to student achievement?
3. What are the cost benefits of the various distance education media as these relate to institutional budgeting?
4. What are the skills required for effective distant teaching?
5. Are distant teaching skills different from the skills required by the traditional on-campus instructor?
6. What institutional policies support or hinder distance teaching?

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