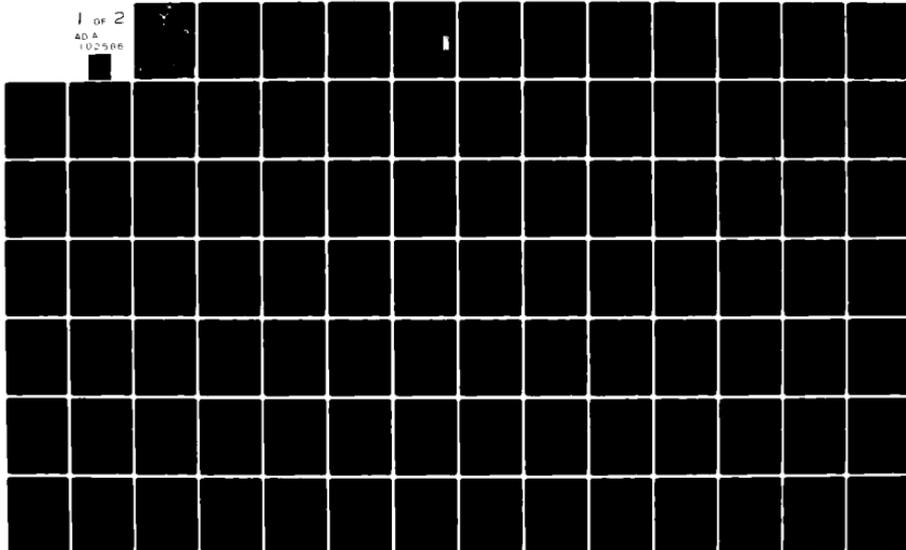


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EVALUATION OF THE AFIT TELETEACH  
EXPANDED DELIVERY SYSTEM (TEDS)  
METHOD OF INSTRUCTION FOR  
SYS 223 SYSTEM PROGRAM  
MANAGEMENT

John E. Vice, Captain, USAF  
LSSR 49-81

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EVALUATION OF THE AFIT TELETEACH EXPANDED  
DELIVERY SYSTEM (TEDS) METHOD OF  
INSTRUCTION FOR SYS 223 SYSTEM  
PROGRAM MANAGEMENT

A Thesis

Presented to the Faculty of the School of Systems and Logistics  
of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the Requirements for the  
Degree of Master of Science in Logistics Management

By

John E. Vice, BA  
Captain, USAF

March 1981

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This thesis, written by

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has been accepted by the undersigned on behalf of the  
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## CHAPTER I

### INTRODUCTION

#### Background

The goal of the Air Force Institute of Technology (AFIT) is to provide the education necessary to meet the technological and managerial requirements of the Air Force (1:1). The Institute accomplishes its goal through formal graduate schools and Professional Continuing Education (PCE) Programs. AFIT may be better known for its degree-granting Schools of Engineering and School of Systems and Logistics, but by far the greatest number of students are involved in professional continuing education.

Within the School of Systems and Logistics, the PCE Program seeks to provide the highest quality, most up-to-date education for Air Force and selected Department of Defense (DoD) logisticians. The Professional Continuing Education Program consists of 44 resident and many nonresident courses that last from one to six weeks (1:126). The resident programs attempt to maximize the learning of the students while they are at Wright-Patterson AFB (where the school is located) in order to minimize the time students are away from their jobs. Class times range from six to seven hours per day, five days a week. For these courses, AFIT uses guest lecturers who are experienced experts working throughout the base complex (2:1).

On-site, seminars, workshops, and correspondence courses provide nonresident PCE. For example, when there is an adequate group of people at one location, AFIT instructors travel to these students in order to hold a class "on-site" (2:1). This has the added advantage of keeping the instructors aware of current problems that field units are experiencing.

Because of the rapid growth of knowledge and constantly changing technology, neither the AFIT faculty or facilities have been able to keep pace with the expanding Air Force need for Professional Continuing Education (PCE) (1:1). For example, the School of Systems and Logistics has numerous PCE courses with two- or three-year backlogs. A need also exists for new courses (2:1). Facilities and monetary restraints limit the growth of current resident and nonresident programs. This growth is also constrained by the ceilings on the hiring of additional qualified instructors.

Of the 15,000 people who needed resident PCE training in the 1978-79 academic year, only 7,000 students were able to receive instruction at AFIT (2:1). During this same year, nonresident programs reached approximately 10,000 students. Still many more requests exist for nonresident education than AFIT can accommodate. One reason for this increased need is the decreasing experience level in the military and civil service. By the end of the year, the percentage of Air Force line officers who will be newly commissioned lieutenants will be forty percent (4:2).

For these reasons, AFIT needed an educational delivery method that could reach more students with existing courses and could expand to cover new courses without significantly increasing either the number of faculty, TDY costs, or resident facilities. In 1979, Colonel Lewis Israelitt, Dean of the School of Systems and Logistics, devised a solution to the problem. The solution centered on an expansion of the telephone educational delivery medium already being used by AFIT's School of Systems and Logistics and the School of Civil Engineering. Both schools use the telephone to provide short blocks of instruction (one or two hours long) to remote locations. The terms "tele-teach" and "tele-lecture" were selected to refer to educational delivery modes that use telephone lines to transmit verbal communication. Using this medium, AFIT instructors, without leaving the school, routinely lecture students at other bases. Commercial dial-up telephone services are used in this program (2:2).

The use of tele-communications is not a new concept. Since the early 1950s, numerous civilian educational institutions have operated some form of telephonic instructional networks. Today, there are over 37 telephone networks that convey instruction to college students attending classes away from the "home" campus. The University of Wisconsin, probably the most experienced user of telephonic networks, serves over 35,000 students annually via its educational telephone network. Furthermore, the results of many studies indicate no loss of learning when telephonic instruction is compared with

traditional resident classroom instruction (2:2).

Using the telephone instructional system as a nucleus, AFIT developed a system named the Teleteach Expanded Delivery System (TEDS). The instructors felt, because of the technical nature of the courses, some form of visual delivery mode would be essential if entire courses were to use a telephonic system. Several universities and colleges were contacted and published articles were reviewed to discover the most successful techniques in the field of telephonic delivery systems. The latest electronic instructional aids marketed by commercial companies were also investigated. Balancing cost and effective learning factors, Colonel Israelitt selected an electronic blackboard to supplement the audio system component.

The Teleteach Expanded Delivery Systems gained approval, and implementation of a test program began in October 1979. Two nationwide networks were installed to connect remote classrooms with a resident class at AFIT. Each network has two pairs of dedicated telephone lines. One line pair transmits two-way audio communication; the second pair transmits writing on the electronic blackboard. While no visual contact between the remote class and the instructor is provided, the electronic blackboard offers a significant capability for written communication. Words or equations placed on the special blackboards are digitized, transmitted over the telephone lines, and reproduced on television monitors located in each classroom. Moreover, microphones are provided for students, instructors, and monitors at each location.

Therefore, oral and blackboard interaction of all participants is possible (5:5-9).

The primary users of AFIT's PCE courses are the Air Force Systems Command (AFSC) and the Air Force Logistics Command (AFLC). Both commands have major centers geographically located throughout the continental United States including Wright-Patterson AFB. The telephonic networks connect selected bases of each command with AFIT. One network consists of five Air Logistics Centers of AFLC. The other links four AFSC locations. Since these are separate networks, AFIT may offer courses tailored for each command simultaneously (6:6). In this manner, one instructor using TEDS may conduct a course in an AFIT (WPAFB) classroom while simultaneously having additional students at different remote sites. AFSC and AFLC select students for the local class from Wright-Patterson personnel.

Several other features are incorporated into the system. Both audio and graphics are recorded on a stereo-tape recorder. The tapes can be replayed both at Wright-Patterson AFB (WPAFB) or any remote site. Video tape, 35 mm slides, vugraphs, and written materials, when necessary, are distributed to each site (4:6).

While telephonic instruction is a proven effective method of learning, several distinct features in TEDS preclude a direct correlation with other systems. First, most research of telephonic delivery systems has been based on one- or two-hour classes meeting one or twice a week. The

intensified AFIT program operates a four-hour daily schedule with ten-minute breaks between classes. No more than four hours were practical because time zone differences demanded the resident TEDS class at Wright-Patterson AFB be conducted from twelve o'clock to four o'clock in order that West Coast classes could be conducted during normal duty hours. Second, unlike most reported research, AFIT often uses guest lecturers who, though experts in their specialty, are not professional educators. Third, TEDS incorporates the electronic blackboard, which was not a part of other systems researched. Other factors such as mandatory attendance, different presentation formats, and inexperience with the medium distinguish TEDS from systems previously evaluated (2:2-3).

#### Justification of Research

Any innovative project of this size, cost, and student impact must be rigorously evaluated by independent researchers before being fully implemented. However, the already sizeable requirements for Air Force and DoD Professional Continuing Education courses dictated that AFIT move immediately to expand its enrollments. Hence, TEDS was developed and integrated into the PCE program without prior evaluation in order to satisfy increasing requirements while meeting budgetary and manpower restraints. Considerable research is now underway to evaluate the effectiveness of TEDS.

#### Summary of Current Research

Dr. G. Ronald Christopher, Chief of the Plans and

Evaluation Division at AFIT, is conducting the evaluation of the Teleteach Expanded Delivery System. It is important that the strengths and weaknesses of this delivery mode be revealed through controlled research (3).

Three studies have already been completed which evaluated some of the courses presented during the TEDS pilot program. Lieutenant Colonel Charles W. McNichols analyzed SYS 123 (Fundamentals of Acquisition Management); Major Alvin L. Milam and G. Ronald Christopher analyzed a second offering of SYS 123; and Captains David E. Fortna and Ronne G. Mercer recently completed their formal thesis evaluating LOG 220 (AFLC Materiel Management classes 79E and 80A).

The research findings from each separate study will provide the comprehensive data necessary for a complete evaluation of TEDS. Conclusions and recommendations arising from these independent studies will provide the guidance necessary to determine the future of TEDS. A summary of the results of the three studies will now be presented.

Lieutenant Colonel McNichols evaluated the first offering of SYS 123 (Fundamentals of Acquisition Management). This course was originally named SYS 326. The purpose of this AFIT technical report was to answer three of the original research questions of Dr. Christopher's evaluation of TEDS. These questions were:

1. Are student groups (control/experiment) comparable in terms of education level, grade/rank, age, and entry level knowledge?
2. What differences in academic achievement occurred

between resident student groups receiving instruction face-to-face with the presenter and student groups receiving instruction without face-to-face presentations when both groups used the TEDS?

3. To what extent was the TEDS acceptable to students, their supervisors, presenters, visitors, and site monitors? (Only student acceptability is addressed in this report.) [6:3-4].

The author concluded that:

1. The four student groups (WPAFB, SAMSO, Eglin, and Hanscom) attending the October 1979 course offering of SYS 123 were statistically equivalent in terms of demographic variables. (A later review revealed a significant difference with respect to the demographic variable rank/grade. Also the groups were found to differ in terms of entry-level knowledge with the remote group scoring higher.)

2. Statistically significant differences in mean post-test grades were found between resident and remote site students. The mean post-test grade was 63.2% at the resident site and 57.5% at the remote sites. The practical significance of a roughly 6% difference in mean test grade is, however, hard to judge. In comparing achievement as measured by the difference between pre-test and post-test grades for each student, a larger (and statistically more significant) difference was found between the resident and remote sites with a mean difference of 42.8% at the resident site and 28.5% at the remote sites. This result suggests that students with a low starting level of knowledge may increase their knowledge level by a greater amount in the face-to-face situation than they do in the teleteach remote situation. The impact of demographic differences on student learning as measured by either post-test grade or post-test/pretest grade difference was overshadowed by the impact attributable to location at which the course was taken.

3. Teleteach acceptability varied widely among students at various remote sites, ranging from quite positive at SAMSO to quite negative at Eglin. Significantly more positive opinions of course value, structure, and content were reported by students receiving the instruction in the face-to-face mode. The data suggest that classroom facilities, which apparently differed in quality among the remote sites, may have an important impact on student attitudes about the course and the acceptability of the teleteach delivery system [6:20-21].

Drs. Milam and Christopher prepared the second AFIT technical report which evaluated the second TEDS offering of SYS 123. The research objectives were the same as for the first report. Based on the January 1980 TEDS offering of SYS 123, the authors found:

1. The resident and remote site students were statistically different in terms of rank/grade ( $p = .0068$ ) and age ( $p = .0177$ ) with the remote site students being of higher rank/grade and older. The remote site students were slightly more educated and somewhat more experienced. In terms of entry level knowledge, the five sites were statistically equivalent.

2. All five sites were statistically equivalent in terms of achievement. In looking at the post-test grade for all five sites, the only predictor is the educational level of the student. In terms of achievement for all five sites, the only predictor is years of experience and this appears to have a negative influence, i.e., the more experience, the less achievement.

3. Teleteach acceptability varied significantly among the five sites with HQ (Andrews AFB) being the most positive and AD (Eglin AFB) being the most negative. Significant statistical differences were found among all sites. The most significant predictor of Teleteach acceptability was site location. As indicated earlier, this could possibly be attributed to a variety of feelings about the course, classroom, and method of delivery [7:15].

A third study evaluating TEDS was a formal thesis by Captains Fortna and Mercer. Their purposes were to determine whether TEDS was as effective educationally as resident instruction of the same course, whether TEDS was an acceptable mode of learning for both students and instructors, and whether TEDS was less costly on a per student basis than the previous delivery system. In their research, the authors evaluated the July 1979 nonTEDS and the October 1979 TEDS

offerings of LOG 220 (Materiel Management).

The authors concluded that for the LOG 220 course:

1. TEDS was as effective educationally as resident instruction.

2. TEDS was acceptable to participating students and instructors.

3. TEDS was more economical on a per student basis than resident instruction (4:95-100).

The thesis also contained a review of selected studies by professional educators who have examined various telephonic methods of instructional delivery in terms of their relative success. In general, these studies supported the contention that telephonic instruction is a viable means of communicating knowledge to a large body of people.

The main points summarized in the thesis were as follows:

First, as expressed by Edelman, the telephonic delivery system appears to be a viable solution to the conflict between high demand for education and low resource availability. Second, Edelman, Dotterweich, Arndt and Weinswig, Weinstock, and Reid all contend that attitude --both student and instructor attitude--will determine how effective this type of system is. Third, many evaluators, including Edelman and others cited throughout this study, have tested the learning effectiveness of this delivery system as a basis for determining overall effectiveness. Fourth, the other major measure of effectiveness used by authors such as Rao and Hicks focuses on the cost of this type of system as compared to the in-residence methodology. This comparison is exceptionally relevant to AFIT's TEDS in light of the Air Force's limited resources and its desire to realize maximum benefit from each dollar spent for education [4:22].

In addition to the research already published, two other technical reports on courses using TEDS were near completion at the time this thesis was written. Mr. Jeffrey C. Daneman was analyzing QMT 170 (Principles of Contract Pricing) and Major Alvin L. Milam and Dr. Christopher were analyzing a second TEDS offering of LOG 220 (AFLC Materiel Management).

### Statement of the Problem

A requirement exists for an independent research effort to evaluate the TEDS method of delivery compared to the traditional one instructor-one class nonTEDS method of instruction for each course in the experiment.

Specifically, this thesis evaluates the use of TEDS in the 1980 offerings of the System Program Management course (SYS 223). The general areas addressed are: 1) the learning effectiveness of TEDS versus nonTEDS instruction and 2) the degree of system acceptance by students and instructors of this method of instruction.

### Research Objectives

To make this analysis, the following research questions from the original TEDS experiment were addressed (2:9):

1. Are student groups (classes) comparable in terms of the demographic variables of education level, grade/rank, age, and entry level knowledge? (Although not mentioned in the original objective, years of experience in a job related to the course is also analyzed.)

2. What effect upon academic achievement did the

TEDS course offerings have compared to the nonTEDS offering of the same course?

3. What difference in academic achievement were there between the two TEDS offerings of the same course?

4. To what extent was the TEDS acceptable to students and instructors?

5. To what extent did students consider the TEDS schedule acceptable?

### Scope

This evaluation includes three offerings of SYS 223. Two TEDS offerings were presented through the Air Force Systems Command (AFSC) network. A resident nonTEDS offering (80BR) constituted the nonTEDS group against which the two TEDS offerings (80CT and 80DT) were compared. The nonTEDS offering was conducted from 17 March through 18 April 1980. The 80CT TEDS offering of SYS 223 from 21 April through 6 June 1980 was the first TEDS course. The 80DT offering of SYS 223 from 23 June through 8 August 1980 was the second offering using the TEDS mode of delivery. Each TEDS class was further divided into the resident TEDS class and remote TEDS classes. In this thesis, "Resident" will refer to TEDS classes taught at WPAFB. Although accurate, it will not be used to refer to the nonTEDS class taught at WPAFB.

Since this analysis contrasts data from only three offerings of SYS 223, generalizations from these findings apply only to these three offerings and do not necessarily

apply to SYS 223 overall or the TEDS instructional mode in toto.

The methodology (to be discussed in Chapter II) is very similar to that used in previous studies of other courses so that further aggregate analysis could be possible in the overall evaluation. The methodology was derived directly from the research efforts listed earlier.

### Hypotheses

In order to test learning effectiveness and TEDS acceptability, the following hypotheses were constructed:

1. There is no significant difference in the age category among the student comparison groups.
2. There is no significant difference in the grade/rank category among the student comparison groups.
3. There is no significant difference in the education level category among the student comparison groups.
4. There is no significant difference in the experience category among the student comparison groups.
5. There is no significant difference between the mean acceptance scores of the various combinations of student groups.
6. There is no significant difference between student comparison group means on either post-test scores or achievement.
7. Instructors for SYS 223 consider TEDS an acceptable instructional delivery system.

## CHAPTER II

### METHODOLOGY

The methodology used in evaluating the hypotheses constructed in Chapter I is developed in this chapter. It begins with a discussion of the sampling plan and student and faculty populations. This is followed by an explanation of the experimental design and statistical procedures. Then decision criteria were established to determine whether the results of the data analysis supported the hypotheses. The set of assumptions necessary to permit use of the statistical procedures conclude the chapter.

#### Sampling Plan

The sampling plan consisted of a comparison among three separate offerings of SYS 223 (System Program Management). As described in Chapter I (under Scope), the TEDS 80CT and 80DT offerings were compared to the nonTEDS 80BR offering of SYS 223.

Each TEDS offering consisted of a resident class at WPAFB and interaction with four remote classes. These four remote sites were located at:

1. Electronic Systems Division (ESD), Hanscom AFB, Massachusetts
2. Armament Division (AD), Eglin AFB, Florida

3. Space Division (SD), Los Angeles, California
4. AFSC Headquarters (HQ), Andrews AFB, Maryland

#### Student and Faculty Populations

The sample data were drawn from student and instructor populations. The universe from which the student sample was taken consisted of all military and civilian personnel employed by AFSC who were also eligible to participate in PCE courses. The student population of interest included AFSC personnel who were eligible for enrollment in the 1980 offerings of SYS 223. Eligible students were either military officers between first lieutenant and lieutenant colonel, military enlisted grades E-4 to E-9, and civilians of grade 09 and above. Students were required to have program office experience and current or pending assignment to a program office or staff position involved in system program (acquisition) management.

The universe from which the instructor/lecturer sample was taken consisted of civilian and military AFIT faculty and guest lecturers who were qualified to present lessons in the SYS 223 courses. The faculty population of interest were those AFIT instructors and guest lecturers who were selected to make presentations in SYS 223.

A convenience sample of students was selected which included students enrolled in the SYS 223, Systems Program Management courses, between 17 March and 15 August 1980. Data collected from three course offerings during that time frame were used to compare nonTEDS, resident TEDS, and remote TEDS

classes. The group of 48 students taking SYS 223 in class 80ER in residence at Wright-Patterson AFB constituted the nonTEDS class.

The 80CT and the 80DT offerings of SYS 223 constituted the TEDS classes totaling 155 students. Class 80CT had 24 students in the resident TEDS Wright-Patterson AFB class, with 64 students at remote AFSC sites. Class 80DT had 22 students in its resident portion of the TEDS class, with 45 students at the same remote sites as 80CT.

There were no known biasing variables in the student selection process. The student selection process was the responsibility of AFSC and was assumed to have been random.

#### Data Collection

Demographic Data. During the first session of each class, students completed a demographic data collection instrument which recorded students' rank/grade, educational achievement level, age, and years of experience in a job-related to the course. These data were used to compare the homogeneity of the separate classes.

The demographic data were grouped into categories, and each category was assigned an ordinal ranking for purposes of comparison.

End-of-Course and Instructor Data. Students completed end-of-course questionnaires during the final class day. The questionnaires acquired student opinions concerning TEDS acceptability, course value, course structure, instructor

performance, etc. (Appendix B).

Instructors' attitudes toward acceptability of TEDS were collected via an AFIT-developed instructor critique questionnaire (Appendix C). Instructor opinions about TEDS were limited to those instructors and guest lecturers actually involved in either SYS 223 80CT or 80DT offering. Unfortunately, the researcher had no control over the gathering of this data. A six-month delay was incurred before some instructors were asked to fill out these questionnaires. Therefore, the data were incomplete and the results were less meaningful.

Pre-test Scores. A pre-test developed by the SYS 223 course director was administered during the first session of each class. This test covered a wide range of system acquisition and program management topics. This test served to identify student entry-level knowledge. Students were requested not to guess. Pre-test scores were used as a factor for determination of the homogeneity of classes and as a baseline data for comparison of student learning.

Post-test Scores. Content tests (or quizzes) were developed by the course director and administered periodically throughout the course. These test scores were combined and averaged for each student. The combined average was then identified as the post-test. Class 80BR had two tests, while classes 80CT and 80DT each had three tests which were included in this comparison. Class 80BR had only two tests since they met for six hours per day and covered the material at a

faster rate. The TEDS classes (80CT and 80DT) had five tests. Only the first three were in this analysis since they cover the same material as was tested in class 80BR.

Post-test Scores Minus Pre-test Scores. The difference between the mean post-test scores and the mean pre-test scores was used as the measure of achievement. These achievement measures (heretofore referred to as achievement score) were used as a basis for comparison among the nonTEDS, resident TEDS, and remote TEDS classes.

Data Base. Student responses and test scores were collected using student completed standard computer answer sheet A, Optical Scanning Form D 51120-A. These scan sheets were processed on the AFLC CREATE computer system using AFIT's OPSCAN equipment located in the School of Systems and Logistics. A numeric student identification code permitted consolidation of data items for each student.

After processing, output data in punch card form were loaded into files on the ASD CYBER computer system to prepare a consolidated data base. A program was run which consolidated test scores, demographic data, and end-of-course critique data by individual student. The result of this data consolidation process is shown in Appendix C. The format of each data record is as follows:

<u>Record Columns</u>	<u>Contents</u>
1	Student locations: 1-WPAFB; 7-SD; 8-AD; 9-ESD; 0-HQ
2-4	Student number

<u>Record Columns</u>	<u>Contents</u>
5-17	Demographic questions 1-13
25-54	End-of-course critique items 1-30
56-58	Pre-test score (percent) rounded to nearest .1
60-62	Post-test score (percent) rounded to nearest .1
64-66	Post-test score (percent) rounded to nearest .1
68-70	Post-test score (percent) rounded to nearest .1 (Class 80BT had only two post-tests)

In the data base, the alpha responses from the demographic instrument and end-of-course critique forms were transformed to a numeric representation. For example, "A" student responses were assigned a value of 0, "B" responses a 1, etc. A blank column was used to represent missing responses. The computer list containing these records is included as Appendix E.

### Experimental Design

The experimental design consisted of a comparison of demographic data, end-of-course critique data, and test score data in various combinations. Table 1 displays the combinations examined. Table 2 delineates the specific areas of evaluation used in this study.

### Statistical Procedures

Statistical methodologies selected from the Statistical Package for the Social Sciences (SPSS) were applied to this analysis. These procedures included crosstabulation and

TABLE 1  
EXPERIMENTAL DESIGN

Combinations for Comparison	Demographic Data/ Test Score Data/ End-of-Course Data	Acceptance of TEDS
1. nonTEDS BR to TEDS CT	X	
2. nonTEDS BR to TEDS DT	X	
3. nonTEDS BR to Resident TEDS CT	X	
4. nonTEDS BR to Resident TEDS DT	X	
5. Resident TEDS CT to Resident TEDS DT	X	X
6. TEDS CT to TEDS DT	X	X
7. Remotes of TEDS CT to Remotes of TEDS DT	X	X

Chi-square, one-way analysis-of-variance (ANOVA), and regression analysis.

Crosstabulation and Chi-square (contingency table)

Analysis. Crosstabulation, a common descriptive technique, was used to discover how two categorical variables were associated. With this approach, items were displayed in a two-way categorization to permit comparison of the percentage distribution of responses to one item across categories defined by a second item. This technique was particularly useful in comparing demographic and end-of-course items among the various treatments under evaluation (9:39).

Each of the frequency distributions arrayed in this

TABLE 2  
AREAS OF EVALUATION

	Demo- graphic Data	Test Score Data	End-of-Course Critique Data
Rank	X		
Education Level	X		
Age	X		
Experience	X		
Pre-test Scores		X	
Post-test Scores		X	
Academic Achievement		X	
TEDS Related			X
Remote TEDS Peculiar			X
TEDS Acceptance			X
Schedule Acceptance			X

comparison were tested by use of the Chi-square statistic. This statistic was calculated from the data array and was concerned with the question of statistical independence of the two modes of classification. The hypothesis was that the two modes of classification (item and site or course offering, in this application) were statistically independent. Rejection of the hypothesis would then suggest that the variables were not independent (thus dependent) and would imply statistically significant differences among the course offerings. This technique was used to compare demographic and end-of-course

items between nonTEDS classes and the TEDS classes. To facilitate comparison of end-of-course items, "strongly agree" and "agree" responses were combined to form a single "agree" variable. Similarly, the "strongly disagree" and "disagree" answers were combined to form a single "disagree" variable. For the remainder of this thesis, these statements will be referred to as "questions". "0" corresponded to "strongly agree" and "4" corresponded to "strongly disagree".

One-Way Analysis of Variance (ANOVA). The one-way analysis of variance (ANOVA) procedure was used to examine the question of whether or not two classes (sites) were different with respect to their mean value (9:424). The fixed effects model was used because inferences were made only from those categories included and because the research considered the given groups of a factor to be fixed over repeated experiments (9:399).

The ANOVA technique presented a mean score or single criterion variable for each group of respondents. Then a test of the hypothesis that all group means were equal was possible. Rejection of this hypothesis implied that at least two of the groups differed significantly in criterion mean score. For example, this method was used to examine the following variables.

1. Pre-test score
2. Post-test score
3. Achievement (post-test minus pre-test score)
4. Acceptance

Analyses were made between the WPAFB nonTEDS class and:

1. TEDS SYS 223 80CT
2. TEDS SYS 223 80DT
3. Resident TEDS SYS 223 CT only, and
4. Resident TEDS SYS 223 DT only

To complete the analyses, comparisons were made between:

1. Pooled remote classes of TEDS SYS 223 CT versus TEDS SYS 223 DT
2. Resident TEDS SYS 223 CT versus resident TEDS SYS 223 DT only
3. Remotes of TEDS SYS 223 CT versus remotes of TEDS SYS 223 DT

Stepwise Multiple Regression Analysis. Stepwise multiple regression was performed in an attempt to explain or identify any relationship between selected variables. This methodology assumes that the values of one variable, a dependent variable, can be predicted or explained by the values of the independent variables under consideration. The method is based upon the statistical technique of "ordinary least squares" (9:320-322).

This heuristic regression analysis sequentially selected specified independent variables to be used as predictors of the dependent variable. The sequence corresponds to the prediction ability of the independent variables. Appropriate demographic variables, attitudinal variables, test scores, locations, and mode of presentation were examined to determine any possible value as predictors of the learning

factors (post-test scores and academic achievement) and acceptance of TEDS. Only those predictor variables that were statistically significant at the five percent level were considered part of the linear regression equation.

Likert Scale. A Likert scale using numerical values ranging from zero to four was used to code responses of selected statements chosen from the end-of-course critiques. Statistical tests and class comparison were performed on the resulting variables.

#### Decision Criteria

In addition to the statistical tests applied to the research data, decision rules were used to determine whether the results of the data analysis satisfied the research objectives.

To determine whether the student groups were comparable in terms of the demographic variables, the following decision rule was established: If the contingency table analysis yields no statistical difference (at the .05 level) between the comparison groups, accept the null hypothesis that there is no relationship between the groups.

To determine whether the research objective of learning effectiveness was met with the implementation of TEDS in the SYS 223 course, the following decision rule was established: If there is no statistically significant difference in the post-test minus pre-test scores (achievement scores) of the nonTEDS class and the TEDS class, accept the null hypothesis that

learning by the TEDS method was as effective as learning by the nonTEDS method of instruction.

To determine whether the research objective of student acceptability of the TEDS method was met in the SYS 223 course, this decision rule was set: If the mean values of the questions selected to determine acceptability (questions 23 and 25 from the students' end-of-course critique) indicate that a majority of participants found TEDS acceptable, accept the null hypothesis that the TEDS approach used in SYS 223 was acceptable to participating students.

To determine whether the research objective of TEDS schedule acceptability was met, the following decision rule was set: If a group response was greater than 50 percent in agreement (disagreement) with question 17, conclude that the TEDS schedule was acceptable (unacceptable). Other end-of-course questions were evaluated in a similar manner.

To determine whether the research objective of instructor acceptability of the TEDS method was met in the SYS 223 courses, the following decision rule was set: If greater than 50 percent of instructor responses are in agreement (disagreement) with questions eight and nine on the instructor questionnaire, accept the null hypothesis that instructors consider TEDS an acceptable (unacceptable) delivery system.

#### Assumptions

In any statistical research, it is essential to clearly define the assumptions that had to be made about the probability

distributions of the data under observation. As described earlier, the populations included all AFSC personnel who were eligible for enrollment in the 1980 offerings of SYS 223. A second population included AFIT instructors and guest lecturers who qualify to lecture in SYS 223 courses. These assumptions include:

1. The samples were randomly selected and were independently drawn.
2. The means used in ANOVA analyses are normally distributed from populations with equal variances.

## CHAPTER III

### ANALYSIS AND INTERPRETATION

This chapter summarizes the analysis of data resulting from an application of the methodology described in Chapter II. This analysis addressed the following five areas:

1. Demographic Data
2. End-of-Course Questions Data
3. Student Acceptability of TEDS
4. Test Results
5. Instructor Acceptability of TEDS

The procedure followed in this chapter was to examine each area above in turn by addressing sequentially the seven combinations listed previously in Table 1. Except for end-of-course questions, analysis results were not discussed when no significant differences were found. Significance levels less than the five percent level were marked by an asterisk on those tables that also include insignificant values. First, significant demographic variables identified by Chi-square contingency table analysis were evaluated. Second, significant difference in end-of-course questions responses similarly identified were evaluated. Next, significant differences in student acceptance and test result scores, computed by ANOVA were discussed. Then an attempt was made to identify any statistically significant predictor

variables for student acceptance and test scores through regression analysis. Finally, instructor acceptance was examined.

#### Comparison of Demographic Data

The percentage distributions of the demographic variables (rank, education level, age, and experience) were compared across the various combinations of the experimental design using crosstabulation. The contingency table results were then evaluated using the Chi-square statistic to determine if the student groups were homogeneous with respect to the variable. This hypothesis was accepted if the 95 percent confidence level was not exceeded. Therefore, only contingency tables that were less than five percent level of significance are depicted for demographic variables.

#### Comparison of End-of-Course Data

The percentage distributions of the responses to selected end-of-course questions are shown using the Chi-square contingency table analysis described in Chapter II. Contingency table values exceeding (less than) the five percent significance level provided evidence to reject the hypothesis that the variables were independent.

#### Comparison of Student Acceptance Data

The student acceptance of the TEDS classes was measured by combining end-of-course questionnaire items 23 and 25, then labeling this variable acceptance. For ease of

analysis, the combined responses were coded on a scale from 0 (high acceptance or agreement) to 8 (low acceptance or disagreement). Next, mean acceptance values were computed and compared by one-way ANOVA to discover any significant differences across applicable combinations (that is, those combinations which exclude nonTEDS) of student groups. Finally, this is followed by stepwise multiple regression to analyze demographic variables and location in terms of their predictor value for explaining significant differences discovered by the ANOVA tests on acceptance. The variables considered for predictors are:

1. Age (Demographic 6)
2. Experience (Demographic 7)
3. Grade (Demographic 2)
4. Education Level (Demographic 3 or 4)
5. Location
  - ESD
  - SD
  - HQ
  - AD
  - WPAFB (TEDS Resident)
  - WPNOTT (WPAFB nonTEDS)

#### Comparison of Test Score Data

This section presents the analysis used to discover significant differences between the learning of the student groups and to discover any predictor variables for these differences. Test scores were used to measure this learning variable. These test score variables are: pre-test scores, post-test scores, and achievement. The achievement variable was defined in Chapter II as the difference between post-tests

and pre-tests.

First, significant results of a one-way ANOVA of the mean test score variable are presented. This is followed by a stepwise multiple regression to analyze demographic variables, pre-test score, and location in terms of their potential predictor value for explaining significant differences discovered by ANOVA tests on post-test scores and achievement.

These variables are:

1. Age (Demographic 6)
2. Experience (Demographic 7)
3. Grade (Demographic 2)
4. Education Level (Demographics 3 or 4)
5. Acceptance (End-of-Course 23 and 25; used for combinations 5, 6 and 7 only)
6. Pre-test Scores
7. Location (an indicator variable)
  - ESD
  - SD
  - AD
  - HQ
  - WPAFB
  - WPNOTT (WPAFB nonTEDS)

#### Comparison of Instructor Acceptance Data

The table presenting the instructor questionnaire (Appendix C) responses was constructed similarly to the tables for end-of-course questionnaire responses. For question 11, "A great deal" responses are listed under agree, "Some" responses are listed under undecided, and "Not at all" responses are listed under disagree.

The percentage of responses to all questions except two are presented. Questions 13 and 14 were omitted because

they have no relevance to the study. However, only questions 1-4, 6, 8-11, and 15 are discussed since they are directly related to TEDS acceptance by instructors. Due to circumstances beyond the researcher's control, there was a six-month delay between the time the SYS 223 ended and when the questionnaires were sent out.

### Analysis Results

Demographic Analysis Results. When the distributions of rank/grade, education level, age, and experience were compared among the seven combinations, the only statistically significant difference revealed was between the nonTEDS group and the TEDS DT group. The grade/rank distributions of these two groups differed (Table 3). As the table reveals, the TEDS DT class had a large concentration of students in the lowest grade level, while the nonTEDS group had a large concentration of students in the middle grade level.

End-of-Course Questionnaire Analysis Results. The tables presenting the end-of-course questionnaire responses were constructed in the following manner. For all end-of-course questions, the percentage of "Strongly agree" and "Agree" responses were combined and tested under the single heading "Agree". Similarly, the percentage of "Strongly disagree" and "Disagree" responses were combined and listed under "Disagree".

All questions except 13, 14, 16, and 19 were evaluated. These questions were not germane to this research. In

TABLE 3  
CROSSTABULATION OF RANK DISTRIBUTION

Rank/Grade	nonTEDS %	TEDS DT %	Total
E4, 01, 02 GS5-GS10	19	40	31
E5, 03, GS11	26	17	21
E6, 04, GS12	43	21	30
E7, 05, GS13	6	14	11
E8, E9, 06, GS14	6	8	7
(Significance Level: .0367*) (Missing Observations: 2.6%)			
*Significance < .05			

evaluating the responses, greater than 50 percent agreement (disagreement) was interpreted as a positive (negative) student attitude. An "R" following a TEDS class represents a resident WPAFB class. In addition, "SL" is used to denote the significance level and the percent of missing observations is denoted by "MO". In addition to the 30 multiple choice questions, students were also asked for their written responses to the questions in Part II of their questionnaires (Appendix B). These written comments are included in the analysis where they offer support to the questions in Part I.

Special attention should be given to the percent of missing observations as the potential exists for the occasionally large numbers of missing data to skew the analysis results. For example, due to circumstances beyond the

researcher's control, the entire SYS 223 TEDS CT Armament Division's end-of-course questionnaire responses are missing from the data base (18 students).

Before examining the questions, it is necessary to point out any differences that may have had an effect on the comparisons. First, Systems Program Management had been reorganized with exercises introduced for the first time in the nonTEDS offering. Second, the TEDS CT offering was the first exposure to the TEDS delivery method by the course instructor and most guest speakers. Third, the nonTEDS schedule was six hours of class per day, while the TEDS classes were conducted for four hours per day. Finally, the difference in class day allowed the nonTEDS class to cover the material faster. As one result, they only had two longer tests, whereas the two TEDS offerings had three tests that constituted their post-test score (8).

Responses to Question 1, "The course objectives were made clear either orally or in the instructional aids," are displayed in Table 4. The only significant difference indicated in Table 4 was between the nonTEDS and TEDS CT classes. However, all groups appear to agree that the course objectives were clear.

Responses to Question 2, "The course appeared well structured," are displayed in Table 5. Analysis of Question 2 responses indicated significant differences with two of the combinations. The TEDS DT resident class appeared to have a much higher percentage of agreement than either the nonTEDS

TABLE 4  
 QUESTION 1: OBJECTIVES MADE CLEAR

Class	Agree %	Undecided %	Disagree %
TEDS CT	70.9	14.5	14.5
nonTEDS	90.9	4.5	4.5
	(SL = .0482* MO = 27%)		
TEDS DT	82.1	12.5	5.4
nonTEDS	90.9	4.5	4.5
	(SL = .3707 MO = 13%)		
TEDS CT(R)	85.0	5.0	10.0
nonTEDS	90.9	4.5	4.5
	(SL = .6996 MO = 11%)		
TEDS DT (R)	95.0	5.0	0
nonTEDS	90.9	4.5	4.5
	(SL = .6250 MO = 9%)		
TEDS CT (R)	85.0	5.0	10.0
TEDS DT (R)	95.0	5.0	0
	(SL = .3480 MO = 13%)		
TEDS CT	70.9	14.5	14.5
TEDS DT	82.1	12.5	5.4
	(SL = .2337 MO = 28%)		
Remotes CT	62.9	20.0	17.1
Remotes DT	75.0	16.7	8.3
	(SL = .4554 MO = 35%)		
* Significance < .05			

TABLE 5  
QUESTION 2: COURSE WEIL STRUCTURED

Class	Agree %	Undecided %	Disagree %
TEDS CT	50.9	18.2	30.9
nonTEDS	63.6	20.5	15.9
	(SL = .2193	MO = 38%)	
TEDS DT	71.4	12.5	16.1
nonTEDS	63.6	20.5	15.9
	(SL = .5502	MO = 13%)	
TEDS CT (R)	55.0	35.0	10.0
nonTEDS	63.6	20.5	15.9
	(SL = .4331	MO = 11%)	
TEDS DT (R)	95.0	0	5.0
nonTEDS	63.6	20.5	15.9
	(SL = .0268*	MO = 9%)	
TEDS CT (R)	55.0	35.0	10.0
TEDS DT (R)	95.0	0	5.0
	(SL = .0088*	MO = 13%)	
TEDS CT	50.9	18.2	30.9
TEDS DT	71.9	12.5	16.1
	(SL = .0781	MO = 28%)	
Remotes CT	48.6	8.6	42.9
Remotes DT	58.3	19.4	22.2
	(SL = .1263	MO = 35%)	
*Significance < .05			

class or the TEDS CT resident class. However, all classes except the combined remotes of TEDS CT showed greater than 50 percent agreeing that the course was well structured. Even the TEDS CT remotes had a slightly higher percent of agreement than disagreement.

Further examination of written comments of the students showed that many students, mainly in TEDS CT, and particularly in the resident portion of TEDS CT, felt the course was somewhat disorganized.

Responses to Question 3, "The course structure permitted questions to be asked and answered satisfactorily," are displayed in Table 6. Analysis of Question 3 responses indicated that all groups agreed that the course structure permitted questions. However, significant differences showed up in four of the seven combinations. The nonTEDS and the three breakdowns of TEDS DT (TEDS DT, TEDS DT resident and TEDS DT remotes) all had very strong agreement. Apparently, TEDS CT, especially the resident class of TEDS CT, was less satisfied than the other groups.

Responses to Question 4, "The room was conducive to learning," are displayed in Table 7. Analysis of Question 4 responses indicated that all classes except TEDS CT resident were convinced that the room was conducive to learning. This is interesting since the resident classes of TEDS CT and TEDS DT were both held in room 112 of the AFIT's School of Systems and Logistics. The large nonTEDS class was held in rooms 320 and 322 combined. Significant differences were

TABLE 6

## QUESTION 3: STRUCTURE PERMITTED QUESTIONS

Class	Agree %	Undecided %	Disagree %
TEDS CT	65.5	12.7	21.8
nonTEDS	90.9	6.8	2.3
	(SL = .0067* MO = 27%)		
TEDS DT	85.7	5.4	8.9
nonTEDS	90.9	6.8	2.3
	(SL = .3711 MO = 13%)		
TEDS CT (R)	55.0	10.0	35.0
nonTEDS	90.9	6.8	2.3
	(SL = .0008* MO = 11%)		
TEDS DT (R)	95.0	0	5.0
nonTEDS	90.9	6.8	2.3
	(SL = .4240 MO = 9%)		
TEDS CT (R)	55.0	10.0	35.0
TEDS DT (R)	95.0	0	5.0
	(SL = .0133* MO = 13%)		
TEDS CT	65.5	12.7	21.8
TEDS DT	85.7	5.4	8.9
	(SL = .0453* MO = 28%)		
Remotes CT	71.4	14.3	14.3
Remotes DT	80.6	8.3	11.1
	(SL = .6397 MO = 35%)		
* Significance < .05			

TABLE 7

## QUESTION 4: ROOM CONDUCIVE TO LEARNING

Class	Agree %	Undecided %	Disagree %
TEDS CT	58.2	16.4	25.5
nonTEDS	84.1	13.6	2.3
	(SL = .0038* MO = 27%)		
TEDS DT	67.9	16.1	16.1
nonTEDS	84.1	13.6	2.3
	(SL = .0592 MO = 13%)		
TEDS CT (R)	45.0	35.0	20.0
nonTEDS	84.1	13.6	2.3
	(SL = .0031* MO = 11%)		
TEDS DT (R)	80.0	15.0	5.0
nonTEDS	84.1	13.6	2.3
	(SL = .8298 MO = 9%)		
TEDS CT (R)	45.0	35.0	20.0
TEDS DT (R)	80.0	15.0	5.0
	(SL = .0686 MO = 13%)		
TEDS CT	58.2	16.4	25.5
TEDS DT	67.9	16.1	16.1
	(SL = .4510 MO = 28%)		
Remotes CT	65.7	5.7	28.6
Remotes DT	61.1	16.7	22.2
	(SL = .3278 MO = 35%)		
* Significance < .05			

found between TEDS CT and nonTEDS and between resident CT and nonTEDS.

Responses to Question 5, "I was in a position where I could hear and see well," are displayed in Table 8. Analysis of Question 5 responses indicated no significant difference among the classes. All classes agreed that they could hear and see well.

Responses to Question 6, "There should have been more handout materials," are displayed in Table 9. Analysis indicated that there were significant differences between TEDS DT and nonTEDS, between resident TEDS DT and nonTEDS, between TEDS CT and TEDS DT, and between the remotes of TEDS CT and TEDS DT. Overall, only resident TEDS CT and remotes TEDS DT felt that there should not be more handouts. The remaining classes had less than a 50 percent response to any answer. It should be noted that this was probably a distribution problem which was corrected for TEDS DT (8).

Responses to Question 7, "The course should have been longer," are displayed in Table 10. Analysis of Question 7 responses indicated no significant differences among the classes. All classes disagreed that the course should be longer.

Responses to Question 8, "My time could have been better utilized elsewhere," are displayed in Table 11. Analysis of Question 8 responses indicated that the only significant difference was between the resident classes of TEDS CT and TEDS DT. However, both of these classes disagreed

TABLE 8

## QUESTION 5: I COULD SEE AND HEAR WELL

Class	Agree %	Undecided %	Disagree %
TEDS CT	89.1	5.5	5.5
nonTEDS	88.6	6.8	4.5
	(SL = .9439	MO = 27%)	
TEDS DT	92.9	3.6	3.6
nonTEDS	88.6	6.8	4.5
	(SL = .7312	MO = 13%)	
TEDS CT (R)	100.0	0	0
nonTEDS	88.6	6.8	4.5
	(SL = .2915	MO = 11%)	
TEDS DT (R)	100.0	0	0
nonTEDS	88.6	6.8	4.5
	(SL = .2915	MO = 9%)	
TEDS CT (R)	100.0	0	0
TEDS DT (R)	100.0	0	0
	(SL = 1.0	MO = 13%)	
TEDS CT	89.1	5.5	5.5
TEDS DT	92.9	3.6	3.6
	(SL = .7866	MO = 28%)	
Remotes CT	82.9	8.6	8.6
Remotes DT	88.9	5.6	5.6
	(SL = .7658	MO = 35%)	

TABLE 9  
QUESTION 6: SHOULD BE MORE HANDOUTS

Class	Agree %	Undecided %	Disagree %
TEDS CT	29.1	29.1	41.8
nonTEDS	25.0	29.5	45.5
	(SL = .8931 MO = 27%)		
TEDS DT	5.4	48.2	46.4
nonTEDS	25.0	29.5	45.5
	(SL = .0114* MO = 13%)		
TEDS CT (R)	10.0	30.0	60.0
nonTEDS	25.0	29.5	45.5
	(SL = .3489 MO = 11%)		
TEDS DT (R)	5.0	60.0	35.0
nonTEDS	25.0	29.5	45.5
	(SL = .0377* MO = 9%)		
TEDS CT (R)	10.0	30.0	60.0
TEDS DT (R)	5.0	60.0	35.0
	(SL = .1613 MO = 13%)		
TEDS CT	29.1	29.1	41.8
TEDS DT	5.4	48.2	46.4
	(SL = .0026* MO = 28%)		
Remotes CT	40.0	28.6	31.4
Remotes DT	5.6	41.7	52.8
	(SL = .0023* MO = 35%)		
* Significance < .05			

TABLE 10  
QUESTION 7: COURSE SHOULD BE LONGER

Class	Agree %	Undecided %	Disagree %
TEDS CT	5.5	7.3	87.3
nonTEDS	11.4	11.4	77.3
	(SL = .4063	MO = 27%)	
TEDS DT	12.5	16.1	71.4
nonTEDS	11.4	11.4	77.3
	(SL = .7671	MO = 13%)	
TEDS CT (R)	5.0	15.0	80.0
nonTEDS	11.4	11.4	77.3
	(SL = .6864	MO = 11%)	
TEDS DT (R)	20.0	15.0	65.0
nonTEDS	11.4	11.4	77.3
	(SL = .5608	MO = 9%)	
TEDS CT (R)	5.0	15.0	80.0
TEDS DT (R)	20.0	15.0	65.0
	(SL = .3481	MO = 13%)	
TEDS CT	5.5	7.3	87.3
TEDS DT	12.5	16.1	71.4
	(SL = .1199	MO = 28%)	
Remotes CT	5.7	2.9	91.4
Remotes DT	8.3	16.7	75.0
	(SL = .1236	MO = 35%)	

TABLE 11

## QUESTION 8: TIME BETTER UTILIZED ELSEWHERE

Class	Agree %	Undecided %	Disagree %
TEDS CT	29.1	29.1	41.8
nonTEDS	13.6	22.7	63.6
	(SL = .0720	MO = 27%)	
TEDS DT	14.5	25.5	60.0
nonTEDS	13.6	22.7	63.6
	(SL = .9316	MO = 14%)	
TEDS CT (R)	20.0	30.0	50.0
nonTEDS	13.6	22.7	63.6
	(SL = .5834	MO = 11%)	
TEDS DT (R)	0	15.0	85.0
nonTEDS	13.6	22.7	63.6
	(SL = .1337	MO = 9%)	
TEDS CT (R)	20.0	30.0	50.0
TEDS DT (R)	0	15.0	85.0
	(SL = .0331*	MO = 13%)	
TEDS CT	29.1	29.1	41.8
TEDS DT	14.5	25.5	60.0
	(SL = .1010	MO = 29%)	
Remotes CT	34.3	28.6	37.1
Remotes DT	22.9	31.4	45.7
	(SL = .5605	MO = 36%)	
* Significance < .05			

that their time could be better utilized elsewhere. The different groups of TEDS CT had 50 percent or less to disagree. Interestingly, TEDS DT remotes also had less than 50 percent to disagree. Therefore, both remote groups were divided among the three choices.

Responses to Question 9, "I will be able to do my job better as a result of this course," are displayed in Table 12. Analysis to Question 9 responses indicated no significant differences among the classes. All classes agreed that they would be able to do a better job as a result of the course.

Responses to Question 10, "The course met my expectations," are displayed in Table 13. Analysis of Question 10 responses indicated significant differences with five of the combinations as shown in the table. Differences were found in all combinations except nonTEDS to TEDS DT and the remotes of TEDS CT to the remotes of TEDS DT. NonTEDS, TEDS DT and TEDS DT resident agreed that the course met their expectations. The remaining classes (including the remotes of TEDS DT) did not have 50 percent responding to any choice.

Responses to Question 11, "The course was more informative than I had anticipated," are displayed in Table 14. Analysis of Question 11 responses indicated a significant difference only between TEDS CT and nonTEDS. In general, greater than 50 percent of the TEDS CT breakdowns were undecided across the combinations; whereas, the other groups were divided among the three choices.

TABLE 12

## QUESTION 9: WILL DO JOB BETTER

Class	Agree %	Undecided %	Disagree %
TEDS CT	69.1	23.6	7.3
nonTEDS	86.4	13.6	0
	(SL = .0664	MO = 35%)	
TEDS DT	80.4	16.1	3.6
nonTEDS	86.4	13.6	0
	(SL = .4115	MO = 13%)	
TEDS CT (R)	80.0	15.0	5.0
nonTEDS	86.4	13.6	0
	(SL = .3192	MO = 11%)	
TEDS DT (R)	100.0	0	0
nonTEDS	86.4	13.6	0
	(SL = .2033	MO = 9%)	
TEDS CT (R)	80.0	15.0	5.0
TEDS DT (R)	100.0	0	0
	(SL = .1084	MO = 13%)	
TEDS CT	69.1	23.6	7.3
TEDS DT	80.4	16.1	3.6
	(SL = .3724	MO = 28%)	
Remotes CT	62.9	28.6	8.6
Remotes DT	69.4	25.0	5.6
	(SL = .8065	MO = 35%)	

TABLE 13  
QUESTION 10: COURSE MET EXPECTATIONS

Class	Agree %	Undecided %	Disagree %
TEDS CT	23.6	40.0	36.4
nonTEDS	56.8	20.5	22.7
	(SL = .0032*	MO = 27%)	
TEDS DT	58.9	19.6	21.4
nonTEDS	56.8	20.5	22.7
	(SL = .9773	MO = 13%)	
TEDS CT (R)	25.0	50.0	25.0
nonTEDS	56.8	20.5	22.7
	(SL = .0296*	MO = 11%)	
TEDS DT (R)	100.0	0	0
nonTEDS	56.8	20.5	22.7
	(SL = .0022*	MO = 9%)	
TEDS CT (R)	25.0	50.0	25.0
TEDS DT (R)	100.0	0	0
	(SL = .0000*	MO = 13%)	
TEDS CT	23.6	40.0	36.4
TEDS DT	58.9	19.6	21.4
	(SL = .0008*	MO = 28%)	
Remotes CT	22.9	34.3	42.9
Remotes DT	36.1	30.6	33.3
	(SL = .4599	MO = 35%)	
* Significance < .05			

TABLE 14

## QUESTION 11: COURSE MORE INFORMATIVE THAN ANTICIPATED

Class	Agree %	Undecided %	Disagree %
TEDS CT	12.7	50.9	36.4
nonTEDS	34.1	38.6	27.3
	(SL = .0396* MO = 27%)		
TEDS DT	30.4	39.3	30.4
nonTEDS	34.1	38.6	27.3
	(SL = .9090 MO = 13%)		
TEDS CT (R)	15.0	50.0	35.0
nonTEDS	34.1	38.6	27.3
	(SL = .2895 MO = 11%)		
TEDS DT (R)	45.0	40.0	15.0
nonTEDS	34.1	38.6	27.3
	(SL = .5152 MO = 9%)		
TEDS CT (R)	15.0	50.0	35.0
TEDS DT (R)	45.0	40.0	15.0
	(SL = .0897 MO = 13%)		
TEDS CT	12.7	50.9	36.4
TEDS DT	30.4	39.3	30.4
	(SL = .0773 MO = 28%)		
Remotes CT	11.4	51.4	37.1
Remotes DT	22.2	38.9	38.9
	(SL = .3952 MO = 35%)		
* Significance < .05			

Responses to Question 12, "Overall, the course was extremely difficult," are displayed in Table 15. Analysis of Question 12 responses indicated no significant differences. Overall, all groups did not think the course extremely difficult. Only the TEDS CT resident class had less than 50 percent disagree with the question.

Responses to Question 15, "Discussion of the tests helped me learn," are displayed in Table 16. Analysis of Question 15 responses indicated significant differences with all combinations except nonTEDS to resident TEDS CT, resident TEDS CT to resident TEDS DT, and TEDS CT to TEDS DT. The TEDS classes generally disagreed with the question. The written comments suggested that the time lapse between the tests and the discussions of the tests was too long.

Responses to Question 17, "I liked the hours the course was offered," are displayed in Table 16. Analysis of Question 17 responses indicated significant differences with the first four combinations. TEDS CT, resident TEDS CT, and the remotes of TEDS DT groups clearly disliked the hours. TEDS DT and the remotes of TEDS CT had more students who disliked the hours than those who favored the hours. Obviously, the nonTEDS group, which was overwhelmingly pleased with the hours, accounted for the differences.

Time of day differed for the groups depending upon the time zones in which the class was located. TEDS classes were conducted from nine o'clock in the morning to one o'clock in the afternoon for the Pacific Time Zone students (SD only),

TABLE 15

## QUESTION 12: OVERALL COURSE EXTREMELY DIFFICULT

Class	Agree %	Undecided %	Disagree %
TEDS CT	9.1	27.3	63.6
nonTEDS	9.1	27.3	63.6
	(SL = 1.000 MO = 27%)		
TEDS DT	16.1	32.1	51.8
nonTEDS	9.1	27.3	63.6
	(SL = .4220 MO = 13%)		
TEDS CT (R)	5.0	25.0	70.0
nonTEDS	9.1	27.3	63.6
	(SL = .8162 MO = 11%)		
TEDS DT (R)	25.0	35.0	40.0
nonTEDS	9.1	27.3	63.6
	(SL = .1276 MO = 9%)		
TEDS CT (R)	5.0	25.0	70.0
TEDS DT (R)	25.0	35.0	40.0
	(SL = .0985 MO = 13%)		
TEDS CT	9.1	27.3	63.6
TEDS DT	16.1	32.1	51.8
	(SL = .3736 MO = 28%)		
Remotes CT	11.4	28.6	60.0
Remotes DT	11.1	30.6	58.3
	(SL = .9834 MO = 35%)		

TABLE 16

## QUESTION 15: TEST DISCUSSION HELPED ME LEARN

Class	Agree %	Undecided %	Disagree %
TEDS CT	36.4	10.9	52.7
nonTEDS	56.8	15.9	27.3
	(SL = .0380* MO = 27%)		
TEDS DT	30.4	28.6	41.1
nonTEDS	56.8	15.9	27.3
	(SL = .0278* MO = 13%)		
TEDS CT (R)	35.0	15.0	50.0
nonTEDS	56.8	15.9	27.3
	(SL = .1843 MO = 11%)		
TEDS DT (R)	30.0	10.0	60.0
nonTEDS	56.8	15.9	27.3
	(SL = .0426* MO = 9%)		
TEDS CT (R)	35.0	15.0	50.0
TEDS DT (R)	30.0	10.0	60.0
	(SL = .7950 MO = 13%)		
TEDS CT	36.4	10.9	52.7
TEDS DT	30.4	28.6	41.1
	(SL = .0648 MO = 28%)		
Remotes CT	37.1	8.6	54.3
Remotes DT	30.6	38.9	30.6
	(SL = .0091* MO = 35%)		
* Significance < .05			

TABLE 17

## QUESTION 17: LIKED HOURS COURSE OFFERED

Class	Agree %	Undecided %	Disagree %
TEDS CT	32.7	12.7	54.5
nonTEDS	95.5	0	4.5
	(SL = .0000* MO = 27%)		
TEDS DT	39.3	14.3	46.4
nonTEDS	95.5	0	4.5
	(SL = .0000* MO = 13%)		
TEDS CT (R)	30.0	5.0	65.0
nonTEDS	95.5	0	4.5
	(SL = .0000* MO = 11%)		
TEDS DT (R)	40.0	25.0	35.0
nonTEDS	95.5	0	4.5
	(SL = .0000* MO = 9%)		
TEDS CT (R)	30.0	5.0	65.0
TEDS DT (R)	40.0	25.0	35.0
	(SL = .0929 MO = 13%)		
TEDS CT	32.7	12.7	54.5
TEDS DT	39.3	14.3	46.4
	(SL = .6895 MO = 28%)		
Remotes CT	34.4	17.1	48.6
Remotes DT	38.9	8.3	52.8
	(SL = .5350 MO = 35%)		
* Significance < .05			

from eleven o'clock in the morning until three o'clock in the afternoon for Central Time Zone students (AD only), and from noon until four o'clock in the afternoon for all classes in the Eastern Time Zone (ESD, HQ, and WPAFB). The necessity to hold classes during the normal duty day dictated this schedule. The nonTEDS class was conducted at WPAFB from nine o'clock in the morning until three o'clock in the afternoon with a one-hour lunch break.

Responses to Question 18, "I learn more from a course when I am TDY (completely removed from my job location)," are displayed in Table 18. Analysis of Question 18 responses indicated that all classes felt that they learned more when they were TDY. The only significant difference appeared between the TEDS DT and the nonTEDS. Further examination of student written comments revealed that TEDS students were required to work on their normal jobs for half a day and attend class the other half. They seemed to feel that this took away from their ability to concentrate on the Program Management course.

Responses to Question 20, "The 'class day' should be: A. 1-2 hours; B. 2-3 hours; C. 3-4 hours; D. 4-5 hours; E. 5-6 hours," are displayed in Table 19. Analysis of Question 20 responses indicated that there were significant differences for each comparison which included the nonTEDS group (combination 1-4). The nonTEDS group favored a 5-6 hour class day (which they had). The overall TEDS CT sections seemed to favor a 3-4 hour day (which they had); whereas,

TABLE 18

QUESTION 18: I LEARN MORE WHEN TDY

Class	Agree %	Undecided %	Disagree %
TEDS CT	78.2	14.5	7.3
nonTEDS	75.0	22.7	2.3
	(SL = .3426 MO = 27%)		
TEDS DT	67.9	14.3	17.9
nonTEDS	75.0	22.7	2.3
	(SL = .0370* MO = 13%)		
TEDS CT (R)	70.0	20.0	10.0
nonTEDS	75.0	22.7	2.3
	(SL = .3975 MO = 11%)		
TEDS DT (R)	55.0	30.0	15.0
nonTEDS	75.0	22.7	2.3
	(SL = .0976 MO = 9%)		
TEDS CT (R)	70.0	20.0	10.0
TEDS DT (R)	55.0	30.0	15.0
	(SL = .6188 MO = 13%)		
TEDS CT	78.2	14.5	7.3
TEDS DT	67.9	14.3	17.9
	(SL = .2380 MO = 28%)		
Remotes CT	82.9	11.4	5.7
Remotes DT	75.0	5.6	19.4
	(SL = .1736 MO = 35%)		
* Significance < .05			

TABLE 19

## QUESTION 20: CLASS DAY SHOULD BE

Class	Hours				
	1-2	2-3	3-4	4-5	5-6
TEDS CT	5.5	10.9	45.5	3.6	34.5
nonTEDS	0	0	2.3	20.5	77.3
	(SL = .0000*		MO = 27%)		
TEDS DT	7.1	12.5	35.7	8.9	35.7
nonTEDS	0	0	2.3	20.5	77.3
	(SL = .0000*		MO = 13%)		
TEDS CT (R)			50.0	5.0	45.0
nonTEDS			2.3	20.5	77.3
	(SL = .0000*		MO = 11%)		
TEDS DT (R)			40.0	15.0	45.0
nonTEDS			2.3	20.5	77.3
	(SL = .0003*		MO = 9%)		
TEDS CT (R)			50.0	5.0	45.0
TEDS DT (R)			40.0	15.0	45.0
	(SL = .5427		MO = 13%)		
TEDS CT	5.5	10.9	45.5	3.6	34.5
TEDS DT	7.1	12.5	35.7	8.9	35.7
	(SL = .7214		MO = 28%)		
Remotes CT	8.6	17.1	42.9	2.9	28.6
Remotes DT	11.1	19.4	33.3	5.6	30.6
	(SL = .9217		MO = 35%)		

\* Significance &lt; .05

overall TEDS DT were mainly split between a 3-4 hour day and a 5-6 hour day.

Previous analysis of Question 17 responses indicated that most of the TEDS combinations found fault with the TEDS schedule, but student responses to Question 20 did not indicate that they were greatly displeased with the length of their class day. Furthermore, in written comments, students complained that their supervisors expected too much of them on their normal jobs in addition to attending class. This may have caused their dislike of the TEDS schedule. The fact that the nonTEDS class, which consisted of students TDY at WPAFB away from their jobs, liked their schedule and class hours supported this theory.

Responses to Question 23, "The Teleteach delivery system is an acceptable learning medium," are displayed in Table 20. Analysis of Question 23 responses indicated that the comparison between the resident classes of TEDS CT and TEDS DT was the only one to differ significantly. In that combination, resident TEDS DT agreed that Teleteach was acceptable, while resident TEDS CT did not agree. Overall, the delivery system was apparently more acceptable to the TEDS DT group. However, this difference was primarily caused by the resident class responses. To repeat, both sets of remote classes agreed that TEDS was acceptable by approximately 56 percent (see discussion at the end of this section for further comments).

TABLE 20  
QUESTION 23: TELETEACH IS ACCEPTABLE  
LEARNING MEDIUM

Class	Agree %	Undecided %	Disagree %
TEDS CT (R)	25.0	20.0	55.0
TEDS DT (R)	65.0	35.0	0
	(SL = .0005* MO = 9%)		
TEDS CT	45.5	16.4	38.2
TEDS DT	58.9	23.2	17.9
	(SL = .0571 MO = 28%)		
Remotes CT	57.1	14.3	28.6
Remotes DT	55.6	16.7	27.8
	(SL = .9623 MO = 35%)		
* Significance < .05			

Responses to Question 24, "The teleconferencing equipment (mikes and blackboard) was easy to operate," are displayed in Table 21. Analysis of Question 24 responses indicated a significant difference between the TEDS resident classes. Overall, all groups with the exception of the TEDS CT resident class agreed that the teleconferencing equipment was easy to operate (see discussion at end of this section for further comments).

Responses to Question 25, "I would take another course which used this delivery system," are displayed in Table 22. Analysis of Question 25 responses indicated significant differences between both TEDS CT and TEDS DT, and

TABLE 21  
 QUESTION 24: TELECONFERENCING EQUIPMENT  
 EASY TO OPERATE

Class	Agree %	Undecided %	Disagree %
TEDS CT (R)	35.0	25.0	40.0
TEDS DT (R)	60.0	35.0	5.0
	(SL = .0288* MO = 13%)		
TEDS CT	56.4	16.4	27.3
TEDS DT	71.4	16.1	12.5
	(SL = .1326 MO = 28%)		
Remotes CT	68.6	11.4	20.0
Remotes DT	77.8	5.6	16.7
	(SL = .5953 MO = 35%)		
* Significance < .05			

TABLE 22  
 QUESTION 25: I'D TAKE ANOTHER COURSE  
 USING TELETEACH

Class	Agree %	Undecided	Disagree %
TEDS CT (R)	30.0	25.0	45.0
TEDS DT (R)	80.0	15.0	5.0
	(SL = .0033* MO = 13%)		
TEDS CT	41.8	18.2	40.0
TEDS DT	58.9	23.2	17.9
	(SL = .0356* MO = 28%)		
Remotes CT	48.6	14.3	37.1
Remotes DT	47.2	27.8	25.0
	(SL = .3042 MO = 35%)		
* Significance < .05			

between the resident classes of each. Apparently, since the remotes were not significantly different, most of the difference was caused by the strong agreement by resident TEDS DT versus the more negative attitude by the resident TEDS CT class (see later discussion).

Responses to Question 26, "There should be more interaction among the sites," are displayed in Table 23. Analysis of Question 26 responses indicated that the resident class of TEDS CT differed significantly from the resident class of TEDS DT. Resident TEDS CT favored more site interaction, but resident TEDS DT was undecided. Generally, very few disagreed, but many were undecided.

TABLE 23  
QUESTION 26: THERE SHOULD BE MORE  
SITE INTERACTION

Class	Agree %	Undecided %	Disagree %
TEDS CT (R)	50.0	30.0	20.0
TEDS DT (R)	35.0	65.0	0
	(SL = .0286* MO = .13%)		
TEDS CT	40.0	45.5	14.5
TEDS DT	35.7	55.4	8.9
	(SL = .4913 MO = 28%)		
Remotes CT	34.3	54.3	11.4
Remotes DT	36.1	50.0	13.9
	(SL = .9212 MO = 35%)		
* Significance < .05			

Responses to Question 27, "The absence of eye contact with the instructor created a learning barrier/problem," are displayed in Table 24.

TABLE 24  
QUESTION 27: ABSENCE OF EYE CONTACT  
LEARNING PROBLEM

Class	Agree %	Undecided %	Disagree %
Remotes CT	74.3	11.4	14.3
Remotes DT	72.2	5.6	22.2
	(SL = .5104 MO = 35%)		

Analysis of Question 27 responses which were relevant only to the combined remote groups of each TEDS class revealed no significant difference. As might be expected, both groups considered that the absence of eye contact with the instructor created a learning problem. This feeling is not substantiated by post-test scores since no difference was found between the various combinations when mean post-test scores or achievement were examined (see Test Score Analysis Results).

Further examination of student written comments indicated that many students felt that communication was hampered because the information normally transmitted between students and instructor by body language was missing. For example, instructors could not determine when remote students had "puzzled looks" on their faces. Additionally, persistent audio problems mentioned in students written comments probably contributed to this attitude.

Responses to Questions 28, "The person locally aiding the course director (site monitor) appeared knowledgeable of equipment operation": 29, "The local person aiding the course director (site monitor) had the room and materials prepared for class"; and 30, "A subject matter expert should be available at each site to assist students". are displayed in Tables 25, 26, and 27.

Analysis of Questions 28, 29, and 30 responses indicated no significant difference between the remotes of TEDS CT and DT. Remote students thought the site monitor was knowledgeable and the monitor had the room prepared. They also thought that a subject matter expert should be available at each site.

Examination of the written responses on the back of the end-of-course answer sheets indicated that several students in the nonTEDS offering perceived that the reorganization of SYS 223 resulted in some confusion in the course structure. But more profoundly, the students in the TEDS CT offering, even the resident TEDS CT group, were uncomfortable with the organization and the new delivery medium. They also perceived that the guest speakers were uncomfortable with the new delivery mode. Although there were some negative comments, the TEDS DT class had a more positive opinion.

Several other important aspects surfaced from the TEDS CT and DT student comments which were supported by the course director. First, many technical problems occurred during both the TEDS CT and DT offerings. Mainly, these were

TABLE 25  
 QUESTION 28: SITE MONITOR KNOWLEDGEABLE  
 OF EQUIPMENT

Class	Agree %	Undecided %	Disagree %
Remotes CT	77.1	5.7	17.1
Remotes DT	66.7	16.7	16.7
	(SL = .3371 MO = 35%)		

TABLE 26  
 QUESTION 29: SITE MONITOR HAD  
 ROOM PREPARED

Class	Agree %	Undecided %	Disagree %
Remotes CT	54.3	8.6	37.1
Remotes DT	55.6	8.3	36.1
	(SL = .9942 MO = 35%)		

TABLE 27  
 QUESTION 30: A SUBJECT MATTER EXPERT  
 SHOULD BE AVAILABLE

Class	Agree %	Undecided %	Disagree %
Remotes CT	58.8	26.5	14.7
Remotes DT	58.3	25.0	16.7
	(SL = .9713 MO = 35%)		

garbled audio transmissions and mechanical malfunctions. In addition, there were numerous comments that the electronic blackboard was used very little for actual instruction in the course. Second, the course director stated that he spent additional time explaining to the TEDS DT class what was expected of them and some of the idiosyncracies of the TEDS equipment (8). This may have accounted for the 100 percent of the expectations of TEDS DT being met.

Student Acceptance Analysis Results. The mean acceptance scores for combined Questions 23 and 25 are in Table 28. Scores below four indicate acceptance, while scores above four indicate nonacceptance. A score of four indicates undecided. When reviewing the results presented in this chapter, the reader should remember that the higher the numerical acceptance scores, the less satisfied students were with TEDS. Therefore, increasing acceptance scores mean decreasing satisfaction with TEDS.

Analysis of the TEDS class combinations indicated a significant difference with two of the combinations. First, the TEDS CT class had a mean significantly different from TEDS DT class. TEDS CT appeared to have a slightly negative attitude toward TEDS (4.2), while TEDS DT had a positive attitude (3.1). The previous discussion concerning the differences between TEDS CT and TEDS DT may account for some of the improvement in TEDS DT's attitude towards Teleteach. Second, there was a significant difference in means when some remote sites were compared against each other. The ESD remote

TABLE 28  
MEAN TELETEACH ACCEPTABILITY SCORES

Class	Mean (Scale: 0 to 8)
TEDS CT (R)	5.0
TEDS DT (R)	2.5
(SL = .3654    MO = 13%)	
TEDS CT	4.2
TEDS DT	3.1
(SL = .0068*    MO = 28.4%)	
Remotes CT	3.8
Remotes DT	3.5
(SL = .6009    MO = 34.9%)	
Remotes by Location CT/DT:	
SD	2.9
AD	--
ESD	4.8
HQ	3.0
SD	2.8
AD	3.5
ESD	2.9
HQ	6.8
(SL = .0044*    MO = 34.9%)	
Population Mean 3.7	
* Significance < .05	

class of TEDS CT and the HQ class of TEDS DT had negative opinions, while the remaining locations had positive opinions. Available data were insufficient to explain these results.

The most dramatic reversal of acceptance was that of the small HQ's classes (six students for the TEDS CT and five students for TEDS DT). Their switch to a very negative attitude for the TEDS DT class is contrary to the overall trend and unexplainable with available data. Their written comments (DT) were also negative toward Teleteach equipment and the instructors. The resident TEDS CT class opinion seems to be the determinant which caused the negative opinion of the total TEDS CT class. Apparently, even though the resident TEDS CT group had visual, in-person contact with the instructor, they felt that the remote students were at a disadvantage (8). At any rate, it is important to recognize that the majority of the TEDS CT students who were the remote students found TEDS acceptable.

The multiple regression results for the three TEDS combinations (5, 6, and 7 which exclude nonTEDS) to which the acceptance variable applies are displayed in Table 29. Analysis of Table 29 indicated that no non-location variables were statistically significant as independent variables in a linear relationship when acceptance was the dependent variable, i.e., no non-location variable was a significant predictor (at the five percent level) of acceptance. The only significant independent variable was the location SD, an indicator variable. This was identified when regression was performed on the

TABLE 29

## REGRESSION ANALYSIS: ACCEPTANCE

Combination	Significant Predictor	C	B	SL	R <sup>2</sup>
7	SD	3.88	-1.31	.045	.07
<p>NOTE: The following symbols are used in Tables 29, 39 and 40.</p> <p>C = The constant term in the regression equation</p> <p>B = The partial regression coefficient (slope) in the regression equation</p> <p>SL = Significance level</p> <p>R<sup>2</sup> = Multiple Coefficient of Determination (ratio of explained variation to the total variation of the dependent variable)</p>					

remotes of TEDS CT and DT (combination 7).

Test Score Analysis Results. The mean scores for the three test score variables (pre-test, post-test, and achievement) are in Tables 30 through 38. Analysis of these tables indicated that the only significant differences at the five percent level occurred in the pre-test and achievement variables when nonTEDS was compared to the TEDS CT by location. Although the ANOVA statistic does not exactly show where the difference lies, observation of Table 30 and Table 31 (nonTEDS to TEDS CT) showed SD had the lowest pre-test score and the highest achievement score. SD's post-test score was close to the population mean, but their low pre-test score made it possible for them to obtain the highest achievement (post-test minus pre-test) score. It is noteworthy that the combined mean achievement scores for the remote sites of

TABLE 30  
 MEAN TEST AND ACHIEVEMENT SCORES FOR  
 COMBINATION 1

Location	Pre-test	Post-test	Achievement
Population	37.4	73.4	36.3
nonTEDS	38.4	73.5	35.1
TEDS CT	36.9	73.3	37.2
WPAFB	36.2	72.7	36.5
SD	26.5	72.4	49.6
AD	36.4	71.8	36.0
ESD	43.4	76.6	30.8
HQ	44.6	69.2	34.2
	(MO = 2.2%	MO = 12.5%	MO = 14%)

TABLE 31  
 SIGNIFICANCE LEVELS FOR TESTS OF  
 DIFFERENCES FOR COMBINATION 1

Combination	Pre-test	Post-test	Achievement
nonTEDS to TEDS CT	.6012	.9296	.4690
By Location (nonTEDS + 5 TEDS CT sites)	.0446*	.5324	.0371*
* Significance < .05			

TABLE 32  
 MEAN TEST AND ACHIEVEMENT SCORES  
 FOR COMBINATION 2

Location	Pre-test	Post-test	Achievement
Population	36.2	72.6	36.7
nonTEDS	38.4	73.5	35.1
TEDS DT	34.5	71.8	38.2
WPAFB	31.0	73.1	42.4
SD	31.0	74.0	43.0
AD	38.1	77.6	41.1
ESD	36.5	66.4	30.8
HQ	35.0	67.5	32.6
	(MO = 3.5%	MO = 11.3%	MO = 13.9%

TABLE 33  
 SIGNIFICANCE LEVELS FOR TESTS OF  
 DIFFERENCES FOR COMBINATION 2

Combination	Pre-test	Post-test	Achievement
nonTEDS to TEDS DT	.2071	.3810	.3346
By Location (nonTEDS + 5 TEDS DT sites)	.5865	.0538	.2615

TABLE 34  
MEAN TEST AND ACHIEVEMENT SCORES FOR  
COMBINATION 3

Combination	Pre-test	Post-test	Achievement
Population	37.7	73.2	35.5
nonTEDS	38.4	73.5	35.1
TEDS CT(R)	36.2	72.7	36.5
	(SL = .5438	SL = .7227	SL = .6989)
	(MO = 1.4%	MO = 0%	MO = 1.4%)

TABLE 35  
MEAN TEST AND ACHIEVEMENT SCORES FOR  
COMBINATION 4

Combination	Pre-test	Post-test	Achievement
Population	36.2	73.4	37.1
nonTEDS	38.4	73.5	35.1
TEDS DT (R)	31.0	73.1	42.4
	(SL = .0685	SL = .8796	SL = .0743)
	(MO = 4.3%	MO = 4.3%	MO = 7.1%)

TEDS CT (37.5) and TEDS DT (36.0) were very close to nonTEDS (35.1) and to the resident TEDS CT (36.5). The resident class of TEDS DT had a somewhat higher mean achievement score (42.4). The fact that there were no statistically significant differences between the post-test scores for TEDS CT and any of the comparisons was an interesting finding since several of the student end-of-course responses revealed negative (or less

TABLE 36  
MEAN TEST AND ACHIEVEMENT SCORES FOR  
COMBINATION 5

Combination	Pre-test	Post-test	Achievement
Population	33.8	72.9	39.0
TEDS CT (R)	36.2	72.7	36.5
TEDS DT (R)	31.0	73.1	42.4
	(SL = .1854	SL = .8816	SL = .2050)
	(MO = 4.3%	MO = 6.5%	MO = 8.7%)

positive) opinions of TEDS by the TEDS CT group in the areas of course structure, handouts, time better utilized elsewhere, course met expectations, class hours, TEDS acceptance, and TEDS equipment. Also, because there were no significant differences in overall achievement scores among nonTEDS, TEDS CT, and TEDS DT, one might assume that the negative or less positive attitudes by the TEDS CT class were not reflected in greater achievement results.

To summarize the test score analysis, the seven combinations listed in Table 1 were tested by one-way ANOVA. No significant differences were found in pre-test scores, post-test scores, and achievement scores for these combinations. However, further analysis of the seven combinations by location did reveal differences among the locations involved in the comparison of combination 1 (nonTEDS to TEDS CT).

TABLE 37  
 MEAN TEST AND ACHIEVEMENT SCORES  
 FOR COMBINATION 6

Combination	Pre-test	Post-test	Achievement
Population	35.9	72.7	37.6
TED CT	36.9	73.3	37.2
TEDS DT	34.5	71.8	38.2
	(SL = .3998	SL = .3675	SL = .7344)
	(MO = 3.2%	MO = 19.4%	MO = 21.3%)
-----			
By Location, Ten Sites			
TEDS CT:			
WPAFB	36.2	72.7	36.5
SD	26.5	72.4	49.6
AD	36.4	71.8	36.0
ESD	43.4	76.7	30.8
HQ	44.6	69.2	34.2
TEDS DT:			
WPAFB	31.0	73.1	42.4
SD	31.0	74.0	43.0
AD	38.0	77.6	41.1
ESD	36.5	66.4	30.8
HQ	35.0	67.5	32.6
	(SL = .1378	SL = .0914	SL = .0758)
	(MO = 3.2%	MO = 19.4%	MO = 21.3%)

TABLE 38  
MEAN TEST AND ACHIEVEMENT SCORES  
FOR COMBINATION 7

Combination	Pre-test	Post-test	Achievement
Population	36.7	72.6	36.8
TEDS CT (Remotes)	37.1	73.6	37.5
TEDS DT (Remotes)	36.1	71.1	36.0
	(SL = .7763	SL = .2273	SL = .6939)
	(MO = 2.8%	MO = 24.8%	MO = 26.6%)

The stepwise multiple regression results are displayed in Tables 39 and 40. (The key beneath Table 29 explains the symbols used for these tables.) Table 39 shows the results when regression was performed using post-test scores as the dependent variable. Table 40 shows the results when regression was performed using achievement as the dependent variable.

The regression analysis of the post-test variable yielded several predictors at the five percent significance level. First, regression for the combined nonTEDS and TEDS CT classes (Table 39, combination 1) indicated that age was the only significant independent variable in a linear relationship with post-tests as the dependent variable, i.e., a significant predictor of post-tests. A close examination of Table 39 (combination 1) reveals that as the age category (or factor) increased, post-test scores decreased, The "R"

TABLE 39  
REGRESSION ANALYSIS: POST-TEST SCORES

Combination	Significant Predictor	C	B	SL	R <sup>2</sup>
1	Age	76.1	-4.9	.002	.21
2	Experience	71.8	+2.6	.009	.13
	ESD		-7.7	.012	.12
5	Age	76.0	-5.3	.006	.10
	Grade/Rank		+3.4	.038	.10
6	Experience	75.2	+2.2	.001	.07
	Age		-3.2	.002	.10
7	Experience	74.3	+3.2	.001	.16
	Age		-3.4	.007	.11

NOTE: See Table 29 (page 65) for definition of symbols.

square score indicated that the age factor could explain about 21 percent of the variation from the mean score. For combination 2 (nonTEDS and TEDS DT), regression revealed experience as the only significant predictor of post-test performance. The indicator (or location) variable ESD was also significant. As the experience category increased, post-test scores increased. Combined, these predictors explain about 25 percent of the variance about the mean.

For combinations 3 and 4, there were no significant predictors for post-test performance. Regression for combination 5 (resident TEDS CT and resident TEDS DT) yielded age and grade/rank as significant predictors for post-test performance. As the age category increased, post-test scores decreased. As the grade/rank category increased, post-test

TABLE 40  
REGRESSION ANALYSIS: ACHIEVEMENT SCORES

Combination	Significant Predictor	C	B	SL	R <sup>2</sup>
1	Experience	41.4	-4.6	.004	.20
2	Age	46.0	-5.4	.020	.11
3	Age	52.3	-9.0	.049	.20
5	Age	49.9	-7.1	.007	.19
6	Experience	54.6	-3.0	.011	.20
	Age	54.6	-4.2	.016	.03
7	Experience	52.7	-4.3	.002	.17
	Acceptance	52.7	-2.1	.035	.07

NOTE: See Table 29 (page 65) for definition of symbols.

scores increased. Age and grade/rank explain only 20 percent of the post-test variance.

For both the last two combinations, combined TEDS CT and TEDS DT and the combined remotes of both TEDS classes, regression yielded experience and age as statistically significant predictors. As the experience category increased, post-test scores increased. As the age category increased, post-test scores decreased.

Earlier demographic analysis revealed no significant differences with any combinations for age or experience. Apparently, the strongest trend was for the younger students to score higher on the post-tests. Also, experience appeared in three of the regressions as a significant predictor. As might be expected, the more experienced students tended to

have the higher post-test scores.

Regression analysis for the achievement variable (Table 40) revealed three significant predictors at the five percent significance level. Age appeared as a significant predictor in combinations 2, 3, 5, and 6. In each case, as the age category increased, the achievement score decreased. This parallels the post-test results previously discussed. The younger students tended to score higher on the post-test and achievement scores.

On the other hand, experience, which was a significant predictor for combinations 1, 6, and 7, had the opposite effect on achievement scores as it had on post-test scores. As the experience category increased, achievement scores decreased.

The third significant predictor, acceptance, was identified when the remotes of the two TEDS classes were combined. Earlier analysis of acceptance scores showed that the majority of both classes slightly favored TEDS. As stated earlier, the higher the acceptance score (on the scale of 0 to 8), the less satisfaction with TEDS. As acceptance scores increased (less satisfaction with TEDS), achievement scores decreased. This finding indicated that those TEDS students less satisfied with TEDS had lower achievement scores than those satisfied with TEDS.

Earlier analysis revealed no significant difference within the appropriate combinations for age, experience, or acceptance. Of course, the acceptance variable was only

applicable to combinations which excluded nonTEDS (combinations 5, 6, and 7).

To summarize the regression analysis results for achievement scores, the following variables were found to be important predictors in one or more of the seven combinations: age, experience, and acceptance. In general, the younger, less experienced students were predicted to score somewhat higher on the achievement score. This appears logical since the measure of achievement used was the difference between pre-tests and post-tests.

Instructor Acceptance Analysis Results. Table 41 displays the responses to the instructor questionnaire. The questions are listed in Appendix C. The total number of instructors responding to a question was 31 unless stated otherwise in the table. When helpful, comments that instructors wrote on the back of the answer sheet are summarized to support the analysis. As described in Chapter II, greater than 50 percent response is used to determine if instructors had a definite opinion.

Analysis of Table 41 indicated that instructors had a definite opinion on Questions 1, 4, 6, and 11. Instructors felt that equipment problems, mainly audio transmissions, and lack of face-to-face contact were a problem during course presentations when using TEDS. Their written comments indicated that TEDS required different presentation techniques because of that lack of face-to-face contact, that their usual "free flowing" presentation was inadequate, and that

TABLE 41  
INSTRUCTOR CRITIQUE RESPONSES

Questions (N*)	Agree %	Undecided %	Disagree %
1	32.2	22.5	45
2	61.2	3.2	35.4
3	41.9	9.6	48.3
4	19.3	19.3	61.2
5	35.4	32.3	32.2
6	54.8	16.1	29
7	51.6	12.9	35.4
8	29	25.8	45
9 (30)	23.3	33.3	43.3
10 (30)	43.3	20	36.6
11 (30)	23.3	60	16.6
12** (27)	7.4	59.2	33.3
15 (26)	23	50	26.9
16 (25)	48	20	32
17 (25)	24	52	24

\* N is the number of instructors responding to a question;  
N = 31 unless another number is given in ( ).

\*\*Questions 13 and 14 were omitted.

lack of face-to-face contact made student rapport difficult to establish. Also, a few stated that TEDS degrades the quality of instruction at AFIT because:

1. Lesson objectives must be greatly reduced.
2. Student boredom is high due to the slow pace.

3. Absenteeism is high at remote sites

4. Instructor enthusiasm/motivation is reduced.

Instructors disagreed (Question 4) that student participation from remote sites met or exceeded their expectations. Even though some written comments suggested otherwise, 60 percent responded neutral to Question 11 concerning whether TEDS caused a change in instructor presentation technique. The fact that many instructors added that it had been too much time since they gave a presentation for them to remember their feelings probably contributed to neutral response here and elsewhere. No definite opinion, according to the 50 percent rule, was expressed on the remaining questions.

Even though it must be emphasized that written comments were expressed by a minority, they seem to offer additional insight into the analysis. Two other comments were relevant. First, the suggestion was made several times that implementation of closed-circuit TV would alleviate the problems caused by lack of face-to-face contact. Second, some instructors stated that TEDS could be very effective when instructors become more familiar/comfortable with the system.

The acceptance of TEDS by instructors was directly determined by Question 8. Even though more instructors felt that TEDS was unacceptable (as judged by their not wanting to teach again using TEDS), no clear opinion was expressed in the three responses.

## CHAPTER IV

### CONCLUSIONS AND RECOMMENDATIONS

In this chapter the results of Chapter III are evaluated in light of the research objectives, hypotheses, and decision criteria previously described in Chapter II. Conclusions drawn from the research data are presented first. Then recommendations aimed at course improvements and future research are presented. Because this research effort analyzed only three 1980 offerings of SYS 223, these findings do not necessarily apply across the SYS 223 program or to other course offerings using the Teleteach Expanded Delivery System.

#### Conclusions

Demographic Results. The decision rule used to determine whether the student groups were comparable in terms of the demographic variables was: If the contingency table analysis yields no statistical differences among the comparison groups, accept the null hypothesis that the groups were homogeneous.

The contingency table analysis revealed one statistically significant difference with demographic variables, which was the grade/rank distribution between the nonTEDS and TEDS CT groups. Therefore, the null hypothesis for grade/rank was rejected. However, considering the results of acceptance

and test score analysis, this difference was not considered to be of significance in the overall evaluation, i.e. grade/rank was not found to be a predictor for acceptance or any test score variables within the nonTEDS to TEDS CT comparison. Since no significant differences were found on other demographic variables, the decision was made to accept the remaining null hypotheses for demographic variables.

Student Acceptance of TEDS. The decision rule used to determine whether TEDS was acceptable to the TEDS students was: If the mean value of the responses to the end-of-course questions selected to determine acceptability indicate that a majority of students found TEDS acceptable, accept the null hypotheses that the TEDS, as used in SYS 223, was acceptable to the students.

The results of the mean acceptability score permit rejection of the null hypotheses for TEDS CT and resident TEDS CT groups. In short, these two groups did not accept TEDS. However, for the remotes of TEDS CT and all the TEDS DT comparisons (resident and remote), the null hypotheses are accepted, i.e., TEDS is acceptable.

Overall, the majority of the students in both TEDS CT and TEDS DT considered the delivery medium acceptable. This is not to say, however, that there was no dissatisfaction with the system or the course. Considerable dissatisfaction was expressed in responses to some of the end-of-course questions and through written comments.

Based upon the responses to the end-of-course

questions, the different combinations of TEDS CT found fault with the course structure, their ability to ask questions, the quantity of handouts, the wise use of their time, the course hours, and equipment operation. On the other hand, the data analysis of TEDS DT leads the researcher to conclude that many of these shortcomings were overcome for the TEDS DT offering. This conclusion was based upon the more positive responses by TEDS DT students on the structured portion and the open-ended portion (student comments) of the end-of-course questionnaire. Further support for this position was forthcoming during an interview with the course director.

More than 70 percent in both TEDS remote classes felt that the absence of eye contact with instructors created a learning barrier. This feeling was not supported by the test results. The mean post-test scores and mean achievement scores were very close between all groups who had eye contact with the instructor (nonTEDS, resident TEDS CT, and resident TEDS DT) and those groups who had no eye contact (remote TEDS CT and DT).

Student Acceptance of the TEDS Schedule. The decision rule used to determine whether the TEDS schedule was acceptable to students was: If group responses were greater than 50 percent in agreement (disagreement) with Question 17, conclude that the TEDS schedule was acceptable (unacceptable). As evidenced by the responses to Question 17, resident TEDS CT, TEDS CT, and the remotes of TEDS DT did not like the schedule. The remaining TEDS groups did not express a clear



opinion, but they had slightly less than 50 percent that disliked the hours. The nonTEDS class was clearly pleased with their hours. Despite the time zone differences, none of the TEDS classes found the TEDS schedule acceptable. Analysis of written comments suggested that TEDS classes disliked the hours because their supervisors expected too much of them on their normal jobs in addition to attending class. In light of the above, the researcher felt that it was probably not the hours the course was offered, but the fact that the students were required to work at their jobs when not in class which probably caused the negative opinions expressed by TEDS students concerning the schedule.

Learning Effectiveness of TEDS. The decision rule used to determine whether the research objective of learning effectiveness was met was: If there were no statistically significant differences with the mean achievement scores of the nonTEDS class and the TEDS classes, accept the null hypothesis that learning effectiveness by the TEDS method is no different from learning effectiveness of the nonTEDS method of instruction. Except when compared by location, the analysis of the test results in Chapter III revealed no statistically significant differences in the learning effectiveness as measured by post-test scores or achievement scores. In addition, no significant differences were found with any of the seven combinations (as groups). Therefore, evidence supported the hypothesis that the TEDS method of instruction was as effective as the nonTEDS method of instruction. This

finding is quite interesting when one considers the equipment malfunctions and the negative attitudes which were identified earlier.

The only significant differences occurred in the pre-test and achievement scores when the nonTEDS and TEDS CT comparisons were further analyzed by location. However, these differences were not large enough to cause significant differences in the nonTEDS to TEDS CT comparison. Thus, no evidence was found that suggests the learning effectiveness of TEDS was different among the nonTEDS, TEDS CT, and TEDS DT classes.

Regression analysis indicated that age, experience, and acceptance were significant predictors of achievement. Each comparison group had approximately the same percentage of students in each category and did not differ significantly on any of these factors. Even if the achievement "measure" were to include one or more of these predictors, there would probably be no significant difference in average achievement because the comparison groups did not differ significantly on any of these three factors.

In conclusion, post-test and achievement results support the contention that students learn as well when instructed by TEDS or nonTEDS.

Additionally, there were no significant differences in aggregate test performance results between the resident TEDS students who had the advantage of face-to-face contact with the instructor and the remote TEDS students whose contact with the instructor was limited to audio and blackboard video.

Among the remote locations, the differences in achievement were attributable primarily to differences in pre-test scores. Although greater than 50 percent of the students and instructors perceived the lack of eye contact to be a learning barrier, measured learning was not impaired.

Instructor Acceptance of TEDS. The decision rule used to determine whether TEDS, as used in SYS 223, was acceptable to instructors was: If greater than 50 percent of instructor responses are in agreement (disagreement) with Question 8 on the instructor questionnaire, accept the null hypothesis that instructors consider TEDS an acceptable (unacceptable) delivery system. The analysis of instructor end-of-course Question 8 responses indicated that 45 percent of the participating instructors found TEDS not to their liking. According to the decision rule used, instructors expressed no clear opinion on TEDS acceptance. Only 29 percent of the instructors indicated that they would like to use TEDS again. From their responses to the questionnaire and from written comments on the back of the answer sheet, it was clear that many instructors felt that TEDS impaired learning. However, as previously discussed, test results do not support this opinion.

While not all questions concerning the use of TEDS have been answered, the central research objectives have been met. Based on this analysis, TEDS did not adversely effect learning; the majority of TEDS students considered it acceptable; the instructors presented no clear consensus on TEDS acceptance.

### Recommendations

Even though the conclusions reached were limited to three specific offerings of SYS 223, the researcher can make some recommendations which might be helpful to the overall TEDS program and to future TEDS research.

This study revealed several areas where the current TEDS system could be improved. First, students should be given an initial briefing on the positive and negative aspects of TEDS. This "up front" approach to explaining TEDS, as was done in TEDS DT, will hopefully dispel false assumptions (such as loss of eye contact impeding learning) and allow the students to concentrate on the message of the course rather than its medium. During such a briefing, each student's responsibilities should be thoroughly explained.

The instructors should be better prepared to teach the course using TEDS. It is essential for the course organization and structure to be well synchronized when using TEDS. Particularly when guest instructors are used, they should understand the positive aspect and the peculiarities associated with TEDS. For example, they should understand that TEDS' ability to reach more students and to save money and time (4:105) should outweigh the disadvantages of having to proceed at a slower pace and modify their presentation styles. A training program could be established for this purpose. Perhaps such a program would improve instructor acceptance.

Third, because the number of students at each remote site is relatively small, it is important for course

directors to insure that the data collection process is complete, timely, and accurate in order for statistical analysis to be effective.

Fourth, it is also critical that course directors and site monitors be aware of the importance of distribution of instructional aids such as vugraphs and course materials. If materials are not available when the classes are held, the students may have difficulty following the instruction.

Fifth, supervisors should be advised to treat the students as if they were TDY during class hours. The students should not be expected to perform their normal duties.

Sixth, classes at each site should have as many students enrolled as each classroom can accommodate properly.

Seventh, the regression results of this thesis (see Chapter III) indicates that some demographic factors were significant predictors of post-test scores. An alternative definition of achievement could contain consideration of these significant factors. In this way, TEDS achievement comparisons might better isolate the effect of TEDS alone on academic achievement.

Eighth, future studies of TEDS might address student performance on less objectively measured activities, including team and individual reports, exercises, simulations, and case studies.

Finally, data collection instruments might be developed which address specific concerns in order to determine definitive cause-effect relationships in areas such as

schedule/supervisor expectations, classroom environment/  
performance and acceptance, and course completion effect upon  
specific job performance.

APPENDIX A  
DEMOGRAPHIC INFORMATION

DEMOGRAPHIC INFORMATION

GENERAL INSTRUCTIONS FOR COMPLETING THE SURVEY

Use the attached answer sheet to mark your responses. Use only a No. 2 pencil when filling out the answer sheet. DO NOT USE INK. Enter your 4-digit student number in the last four positions in the STUDENT NUMBER area. Please do NOT write your name or social security number anywhere on the answer sheet. Select only one answer to each question. Mark the answer sheet carefully to negate computer error. Fill in the box with a heavy mark, do not go outside the lines of the box. If you made a mistake, erase the mark completely before entering a new one.

1. My present STATUS is:

- A. Officer
- B. Enlisted
- C. Civilian
- D. Contractor
- E. Other (foreign, etc.)

2. My present RANK or GRADE is: (If you answered D or E above, please leave blank.)

	<u>Officer</u>	<u>Enlisted</u>	<u>Civilian</u>
A.	01 or 02	E4	GS 5-10
B.	03	E5	GS 11
C.	04	E6	GS 12
D.	05	E7	GS 13
E.	06	E8-9	GS 14

3. My EDUCATIONAL background: (Mark highest completed)  
(Answer only question 3 or 4, not both)

- A. Did not complete high school
- B. High school graduate or equivalent
- C. College--some credits
- D. College - Associate degree (A.A. or A.Sc.)
- E. College - Baccalaureate degree (B.A. or B.S.)

4. Continued from above

- A. College - Graduate credit, no graduate degree
- B. College - Master's Degree
- C. College - Work beyond Master's
- D. College - Doctorate
- E. None of the above

ANSWER EITHER 3 or 4  
NOT BOTH

5. My SEX is:

- A. Female
- B. Male

6. My present AGE is:

- A. 20-25
- B. 26-35
- C. 36-45
- D. 46-55
- E. 56 or over

7. Years of EXPERIENCE in a job related to the course:

- A. 0-1
- B. 2-3
- C. 4-5
- D. 6-7
- E. 8 or more

Answer only THREE of the next six questions, 8 or 9, 10 or 11, 12 or 13.

The FIRST digit of your DAFSC or Civilian Job Series Number:

Select	8. A. 0	B. 1	C. 2	D. 3	E. 4
<u>One</u>	9. A. 5	B. 6	C. 7	D. 8	E. 9

The SECOND digit of your DAFSC or Civilian Job Series Number:

Select	10. A. 0	B. 1	C. 2	D. 3	E. 4
<u>One</u>	11. A. 5	B. 6	C. 7	D. 8	E. 9

The THIRD digit of your DAFSC or Civilian Job Series Number:

Select	12. A. 0	B. 1	C. 2	D. 3	E. 4
<u>One</u>	13. A. 5	B. 6	C. 7	D. 8	E. 9

APPENDIX B  
STUDENT END-OF-COURSE CRITIQUE

### STUDENT END-OF-COURSE CRITIQUE

This critique is designed to obtain feedback concerning whether the course achieved its objectives. Your daily critiques have addressed most of the specific aspects of the course. Your contribution to the improvement of this course is greatly appreciated and will benefit future students.

Please answer each question to the best of your ability. Your answer sheet will be machine processed except for the questions in Part II. Additional written comments are welcomed.

#### GENERAL INSTRUCTIONS FOR COMPLETING THE SURVEY

Use the attached answer sheet to mark your responses. Use only a No. 2 pencil when filling out the answer sheet. DO NOT USE INK. Enter your four-digit student number in the last four positions of the STUDENT NUMBER area. Please do NOT write your name or social security number anywhere on the answer sheet. Select only one answer to each question. Mark the answer sheet carefully to negate computer error. Fill in the box with a heavy mark; do not go outside the lines of the box. If you make a mistake, erase the mark completely before entering a new one. The Part II questions require a written response. Put your answers on the back of the answer sheet.

#### PART I

Respond by using the options A thru E indicating the degree to which you agree with the statements below.

- A. Strongly agree
- B. Agree
- C. Neither agree nor disagree
- D. Disagree
- E. Strongly disagree

(These options will be repeated at the top of each page for your convenience.)

1. The course objectives were made clear either orally or in the instructional aids.
2. The course appeared well structured.
3. The course structure permitted questions to be asked and answered satisfactorily.
4. The room was conducive to learning.
5. I was in a position where I could hear and see well.

- A. Strongly agree
  - B. Agree
  - C. Neither agree nor disagree
  - D. Disagree
  - E. Strongly disagree
6. There should have been more handout materials.
7. The course should have been longer.
8. My time could have been better utilized elsewhere.
9. I will be able to do my job better as a result of this course.
10. The course met my expectations.
11. The course was more informative than I had anticipated.
12. Overall, the course was extremely difficult.
13. Throughout the course, there was adequate transition between the various days of instruction in terms of tying in and relating materials.
14. The simulation exercise aided in the total learning experience.  
(Darken "c" if not applicable.)
15. Discussion of the tests helped me learn.  
(Darken "c" if not applicable.)
16. The tests were given at proper intervals.
17. I liked the hours the course was offered.
18. I learn more from a course when I am TDY (completely removed from my job location).
19. When required to critique presentations, I learn less of the content presented.
20. The "class day" should be:
- A. 1-2 hours
  - B. 2-3 hours
  - C. 3-4 hours
  - D. 4-5 hours
  - E. 5-6 hours
21. How many presentations were you unable to attend?
- A. 1-3   B. 4-6   C. 7-10   D. 11 or more   E. Had perfect attendance.

22. How many presentations did you "make up" through playback of the audio-tapes?

- A. 1-3 B. 4-6 C. 7-10 D. 11 or more E. None

Use these responses:

- A. Strongly agree  
B. Agree  
C. Neither agree nor disagree  
D. Disagree  
E. Strongly disagree

23. The Teleteach delivery system is an acceptable learning medium.

24. The teleconferencing equipment (mikes and blackboard) was easy to operate.

25. I would take another course which used this delivery system.

26. There should be more interaction among the sites.

NOTE: WPAFB personnel do not answer questions 27-30, go to Part II.

27. The absence of eye contact with the instructor created a learning barrier/problem.

28. The person locally aiding the course director (site monitor) appeared knowledgeable of equipment operation.

29. The local person aiding the course director (site monitor) had the room and materials prepared for class.

30. A subject matter expert should be available at each site to assist students.

## PART II

Please answer the questions on the back of your answer sheet.

(NOTE: Students were asked to respond to open-ended questions in Part II. Student responses constitute the written comments referred to throughout the research. Due to the nature of the responses, they were not included in the formal data analysis.

The nonTEDS version included questions 1-20.)

APPENDIX C  
INSTRUCTOR CRITIQUE OF TELETEACH  
DELIVERY SYSTEM

### INSTRUCTOR CRITIQUE OF TELETEACH EXPANDED DELIVERY SYSTEM

Use the attached answer sheet to mark your responses. Please do NOT write your name or social security number anywhere on the answer sheet. Select only one answer to each question. Use only a No. 2 pencil when filling out the answer sheet. DO NOT USE INK. Mark the answer sheet carefully to negate computer error. Fill in the box with a heavy mark; do not go outside the lines of the box. If you make a mistake, erase the mark completely before entering a new one. The last statement on the critique requires a written response. Put your answer on the back of the answer sheet. Additional comments are welcome.

Respond by using the options A thru E indicating the degree to which you agree with the statements below (1-10).

- A. Strongly agree
- B. Agree
- C. Neither agree nor disagree
- D. Disagree
- E. Strongly disagree

1. Before using the teleteach system, I would have liked more explanation of its particular demands upon me as an instructor.
2. There were equipment and/or transmission problems during my presentation.
3. I feel students at WPAFB tend to be slighted when the Teleteach system is used.
4. Student participation from remote sites met or exceeded my expectations.
5. I tried special techniques to increase remote student involvement.
6. My inability to discuss the subject face to face with remote students was very disturbing.
7. My inability to see students at the remote sites was very disturbing.
8. I would like to teach again using the Teleteach system.
9. After using the Teleteach system I feel more favorable towards its use.
10. Advantages of the system outweigh the disadvantages.
11. The Teleteach system caused me to change my presentation.

- A. A great deal
- B. Some
- C. Not at all

NOTE: Please explain on reverse side of answer sheet.

12. If I were to teach again using the Teleteach system, I would change my presentation.

- A. A great deal
- B. Some
- C. Not at all

NOTE: Please explain on reverse side of answer sheet.

13. I have given my presentation in this course WITHOUT teleteach.

- A. Never before
- B. Once before
- C. Twice before
- D. Three times before
- E. More than 3 times before

14. I have given my presentation in this course USING the Teleteach system.

- A. Never before
- B. Once before
- C. Twice before
- D. Three times before
- E. More than 3 times before

15. WPAFB students discussed aspects of my teleteach presentation with me (before and after class).

- A. Frequently
- B. Seldom
- C. Never

16. The Electronic Blackboard is an essential component of the delivery system.

- A. Strongly Agree
- B. Agree
- C. Not sure
- D. Disagree
- E. Strongly disagree

17. I used the Electronic Blackboard...

- A. Frequently
- B. Some
- C. Never

Please complete the reverse side of the answer sheet.

APPENDIX D  
COMPUTER PROGRAM

```

PRINT BACK CONTROL
VARIABLE LIST LOCATION, DEM01 TO DEM07, ENOC1 TO ENOC10,
TEST1 TO TEST6
INPUT FORMAT FIXED(A1, T5, I7F1, 0, 3X, 30F1, 0, 6F9, 1)
N OF CASES UNKNOWN
MISSING VALUES LOCATION TO ENOC10 (BLANK, 9999)
RECODE TEST1 TO TEST6 (0)
LOCATION (1=1) (2=2) (3=3) (4=4) (5=5) (6=6)
(7=7) (8=8) (9=9) (8=11)
IF (LOCATION EQ 1) POSTTGRD=(TEST2+TEST3)/2
IF (LOCATION NE 1) POSTTGRD=(TEST2+TEST3+TEST4)/3
COMPUTE PRETGRD=TEST1
COMPUTE ACH=POSTTGRD-PRETGRD
ASSIGN MISSING POSTTGRD, PRETGRD, ACH (9999)
COMPUTE ACCEPT=ENOC23+ENOC25
ASSIGN MISSING ACCEPT (9999)
RECODE DEM03, DEM04 (BLANK=0) (0=1) (1=2) (2=3) (3=4) (4=5) (ELSE=0)
COMPUTE EDLEVEL=DEM03
IF (DEM03 EQ 0 AND DEM04 GT 0) EDLEVEL=DEM04+5
ASSIGN MISSING EDLEVEL (9999)
IF (LOCATION EQ 1) WPAF9=1
IF (LOCATION EQ 2) SPACE=1
IF (LOCATION EQ 3) EGLIN=1
IF (LOCATION EQ 4) HANSCOR=1
IF (LOCATION EQ 5) HQAFSC=1
IF (LOCATION EQ 6) WPAFB=1
IF (LOCATION EQ 7) SPACE=1
IF (LOCATION EQ 8) EGLIN=1
IF (LOCATION EQ 9) HANSCOR=1
IF (LOCATION EQ 10) HQAFSC=1
IF (LOCATION EQ 11) WPNOTT=1
IF (LOCATION NE 1) TT=1
IF (LOCATION EQ 11) TX=1
IF (LOCATION GE 6) QR=1
VAR LABELS DEM06, AGE/DEM07, YRS. EXP./DEM02, GRADE/
DEM04, HAVE YOU DISCUSSED THIS COURSE OR TEDS ?/
DEM05, IF YES, WHAT WAS THEIR OPINION OF COURSE?/
DEM06, IF YES, WHAT WAS THEIR OPINION OF TEDS ?/
DEM07, AS YOU BEGIN CRSE, WHAT IS YOUR ATT. TOWARD TEDS ?/
ENOC1, OBJECTIVES MADE CLEAR/ENOC2, COURSE WELL STRUCTURED/
ENOC3, STRUCTURE PERMITTED QUESTIONS/
ENOC4, ROOM CONDUCTIVE LEARNING/
ENOC5, I COULD SEE & HEAR WELL/ENOC6, SHOULD BE MORE HANDOUTS/
ENOC7, COURSE SHOULD BE LONGER/ENOC8, TIME BETTER UTIL. ELSEWHERE/
ENOC9, WILL DO JOB BETTER/ENOC10, COURSE MET EXPECTATIONS/
ENOC11, COURSE MORE INFORM. THAN ANTICIPATED/

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ENOC12.OVERALL COURSE EXTREMELY DIFFICULT/
ENOC13.ADEQUATE TRANSITION BETWEEN DAYS/
ENOC14.SIMULATION AIDED LEARNING/
ENOC15.TEST DISCUSSION HELPED ME LEARN/
ENOC16.TESTS GIVEN AT PROPER INTERVALS/
ENOC17.I LIKED HOURS COURSE OFFERED/ENOC18.I LEARN MORE WHEN TDY/
ENOC19.LEARN LESS WHEN I CRITIQUE/ENOC20.CLASS DAY SHOULD BE /
ENOC21.CLASSES UNABLE TO ATTEND/ENOC22.CLASSES MADE UP WITH TAPE/
ENOC23.TELETEACH IS ACCEPTABLE LEARNING MEDIUM/
ENOC24.TELECONF EQUIP EASY TO OPERATE/
ENOC25.I'D TAKE ANOTHER COURSE USING TELETEACH/
ENOC26.THERE SHOULD BE MORE SITE INTERACTION/
ENOC27.ABSENCE EYE CONTACT LEARNING PROBLEM/
ENOC28.SITE MONITOR KNOWLEDGEABLE OF EQUIP./
ENOC29.SITE MONITOR HAD ROOM PREPARED/
ENOC30.A SUBJECT MATTER EXPERT SHOULD BE AVAIL. AT EACH SITE/
VALUE LABELS DEMO2(0)01-2;E+;GS9-10(1)03;E9;GS1(2)00;E6;GS12
(3)09;E7;GS13(4)06;E9;9;GS14/
EDLEVEL(1)NO H.S.(2)H.S.(3)SOME COLLEGE(4)B.A.-A.S.(5)B.A.-M.S.
(6)SOME GRAD(7)MASTERS(8)> MASTERS(9)DOCTORATE(10)NONE OF ABOVE/
DEMO6 (0)20-25(1)26-35(2)36-45(3)46-55(4)56&OVER/
DEMO7(0)0-1(1)2-3(2)4-5(3)6-7(4)8&OVER/
LOCATION(1)MPAFB(2)SPACE(3)EGLIN(4)MANSCOM(5)MO AFSC
(6)WPAFB(7)SPACE(8)EGLIN(9)MANSCOM(10)MO AFSC(11)WPNOTT/
TX,TELETEACH OR NOT/
VAR LABELS TT.PRESENTATION MODE/
VAR LABELS RR, TT C OR TT D/
VALUE LABELS TX (0)TEDS(1)NONTEDS/
VALUE LABELS TT (0)TEDS C(1)TEDS D/
VALUE LABELS RR (0)TEDS C(1)TEDS D/
VALUE LABELS ENOC1 TO ENOC19,ENOC23 TO ENOC30(1)AGREE-ST AGREE
(6)UNDECIDED(7)DISAGRE-ST DISAG/
ENOC20(0)1-2 HRS.(1)2-3 HRS.(2)3-4 HRS.(3)4-5 HRS.
(4)5-6 HRS./
ENOC21,ENOC22(0)1-3(1)4-6(2)7-10(3)11-15(4)15/
DEMO14(0)YES(2)NO/
DEMO19,DEMO16(0)VERY GOOD(1)GOOD(2)AVERAGE(3)POOR
(4)VERY POOR/
DEMO17(0)VERY POS.(1)POSITIVE(2)NEUTRAL(3)NEGATIVE
(4)VERY NEG/
TASK NAME #PNOT B AGAINST RES TT C
*SELECT IF (LOCATION EQ 1 OR 11)
*RECODE ENOC1 TO ENOC19,ENOC23 TO ENOC30 (BLANK=9999)(0,1=9)(2=6)(3,4=7)
CROSSTABS VARIABLES=DEMO2(0,4),EDLEVEL(1,10),DEMO6(0,4),DEMO7(0,4)
ENOC1 TO ENOC19,ENOC23 TO ENOC30(0,7),ENOC20 TO ENOC22(0,7)
LOCATION(0,11),TX(0,1)/
TABLES=DEMO2 TO ENOC19,ENOC20 TO ENOC22,ENOC23 TO ENOC30 BY TX/
DEMO2 TO ENOC19,ENOC20 TO ENOC22,ENOC23 TO ENOC30 BY LOCATION/
STATISTICS 1
OPTIONS 3,5,8

```

```

*SELECT IF (LOCATION GT 5)
REGRESSION METHOD=STEPWISE/
VARIABLES=POSTTGRD,ACH,PRETGRD,ACCEPT,DEMO6,DEMO7,ECLEVEL,DEMO2,
TT,PAFB TO WPNOTT/
REGRESSION=POSTTGRD(.3,0,.3,0) WITH PRETGRD TO WPNOTT/
REGRESSION=ACH(.3,0,.3,0) WITH ACCEPT TO WPNOTT/
REGRESSION=ACCEPT(.3,0,.3,0) WITH DEMO6 TO WPNOTT/
STATISTICS 1-2

```

```

TASK NAME TWO OFFERINGS, WPNOTT B AGAINST TT D
*SELECT IF (LOCATION GT 5)
BREAKDOWN TABLES=PRETGRD,POSTTGRD,ACH,ACCEPT BY LOCATION/
PRETGRD,POSTTGRD,ACH,ACCEPT BY TX/
STATISTICS 1

```

APPENDIX E  
DATA BASE

CURRENT DATA BASE

1024224	124	30	1		500	862	650	725
1023004	1002	22			425	850	882	825
1022224	1201	01		31311421143331312232441323	112	800	912	475
1021024	1102	22		211313321223232130224421322222	187	825	782	882
102023	2110	30	1		337	900	737	700
101922	0012	7	10	11221333213411111222342131	462	925	812	750
101802	11102	32		141213312332314114334444432331	375	900	887	350
1017224	120	30	1	1211131312233324034444332	575	937	850	812
101622	1110	30	1	31341144023233314024044440	237	850	762	812
1015214	130	7	10	10000233100110011132041212	350	850	787	200
1014224	1341	1	0	12111222133211213024444232	512	925	725	200
1013212	091	0	10	12111232211221113234443321	225	737	575	537
101200	11002				337	912	612	712
101103	21202	20		02320143113431113012441310	487	882	812	182
101001	2114	1	13	02321241122331411112044210	362	912	887	875
100902	1122231			1111134212232131222344240	475	882	725	782
100803	11232	2	2	01121333122312113134443323	425	912	875	825
1007014	1102	22		11311343121311324032442120	125	737	700	575
1006222	114140			11310242132330424024343120	375	750	525	500
1005004	110	1	22	11111332122321214034003132	437	812	882	712
100403	1121	1	011	033203301223144140042444440	487	725	725	700
100300	01102	22		11111333112334313134041211	257	837	887	937
100222	01100	30		12121223123331110222341112	237	900	862	550
1001211	1303	7	1	1224044422323113022042111	350	925	837	825
2015004	000	1	24		52	737	687	759
201421	0121	311		111113312212323231103011123111	182	900	887	859
2013004	1102	22		111111032223421110220011100111	87	862	787	759
2012014	1142	24		111013430112212101220410122011	987	825	850	880
2011004	1102	22		111113032323314322314011122010	225	825	725	772
2010004	0002	32		44211242343241323132041144103	225	782	825	558
2009004	1002	22		123132431222101140333041320010	212	750	0	582
200822	0011	0	10	11111233112131113040011112112	57	775	725	721
200724	21201	3	1	111101421123114120313411121001	112	800	687	708
200601	1110	1	12	131133321332313230314421311111	412	0	0	0
200500	11102	22		111112331223313130321411221112	157	950	750	886
200402	11202	04		23111441144313130340041411113	412	737	750	832
200303	21222	21		331111432333113111113400003003	325	900	200	645
200201	00102	21		31111233122311313232441122112	292	925	187	848
200100	01102	34			125	850	0	0
2010				131112331133433121324411111001	782	0	0	0
3016201	0312	0	0	1	412	812	0	0
301521	01213	4	1		375	882	837	797
301400	01112	22			500	725	662	607
301300	11102	22			350	782	850	883
3012224	1242	3	4		400	762	750	746
301122	01232	2	2		450	825	850	721
3010224	1241	1	0		425	812	825	0
3009224	124	33	0		75	882	900	493
300822	0114	3	0	0	625	837	812	810
3007204	010	01	0		12	900	375	0
300523	0134	3	0	0	212	500	687	746
300400	01002	22			482	882	800	810
3004234	132	3	0	0	275	725	712	670
300301	01101	0	0		282	912	737	922
3002004					300	700	487	520
300101	11112	22			325	882	787	837
3018					687	0	0	0
3017					400	782	375	344
401900	0111	01	3	112311321223411300320012421130	150	950	800	822
401822	131341				312	912	0	0
401700	01102	22		212124331112111100224421210222	450	775	687	670

4016004 1202 22	111113331323211110224411111141	225 662 537 569
4019222 0143 0 1	332313*113312031311***33320030	300 803 790 797
401422 0111 3 0 0	24111131122333220144432320121	500 750 712 708
4012234 124 3 0 0	3432231242312112220441321442	612 962 0 0
401122 01132 32	13131240444213132424431421130	575 825 775 848
401021 01112 32	242110401222332230043442420320	387 775 700 748
400923 2124 3 0 0		637 787 850 784
400827 01323 3 4		937 529 775 607
400700 11112 22	111210231223311001324412121140	462 853 862 835
4006004 0002 22	221420312423334233304433201131	362 775 729 759
400522 0123341		475 650 662 696
4004014 1103 0 3	111102321221103112340411131242	187 812 729 721
400300 11112 32		500 862 687 670
400201 11142 21	1114404233324114024034420141	600 329 812 772
400122 21113 4 1	111410412322113130313414411443	662 912 875 973
4022		337 0 0 0
4021		400 0 0 0
4020	233210321323321340433301340	382 882 787 810
4013	11231332123210210422441412414	112 750 0 0
4025		0 800 700 0
4024	120310321123311111320423130330	0 775 875 734
5006004 000 204 1 1	343311313444331130324411321002	390 429 0 0
500424 0110 01 0	141101321132233131240421220002	375 875 637 810
5003222 1402 0 1	13113322211311110340400211111	30 650 900 507
500203 10242 3 1	111133430133331111212411133413	625 912 675 658
500103 11242 21		400 0 0 0
5005	233112312433234121100421121112	675 612 0 0
6024204 011 30 1	11121233011210110222002132	290 712 687 662
602320 2120110	0000023400010000244440002	362 487 450 462
6022004 1012 22	11010233011110313124042112	290 800 800 782
602100 01102 22	01000434012311312124001112	387 775 687 712
601901 11102 33		237 0 0 912
601722 1110 30 1	010002321133212122220012211222	387 725 787 0
6016004 1002 22	11111234063310313034442112	137 650 875 762
6015234 123 3 11	01010234100111111232441212	375 712 700 662
601401 0110 1 12	01110223011221312223041111	475 800 900 787
6013222 130 332	23100203111231123034441111	350 650 787 550
601200 0110222	11111323112310203234442122	237 762 862 300
601104 11310 0		0 0 0 0
601002 11102 22	11111213112422321423441112	612 375 690 625
6009004 1002 2 2	010113431121310143324401123111	187 650 637 512
6008004 0002 2 2	0130011401121442013204211	112 812 737 662
600700 21012 22	11121342112222323034342211	350 800 862 787
600603 2120 20 1	11100213011220311132041311	112 712 729 550
600503 11302 31	01100343012312311023442122	300 700 850 912
600401 11102 22	11131332112311313132001112	0 750 700 587
600321 1122 3 0 1	10120333003122311234441111	325 750 675 725
600201 11122 3 4	00310233112321111124342122	482 812 837 787
6001222 1142 1 3	01110223111221312132442212	300 800 675 750
7009004 100 1 03	010104321112302030211010023010	200 837 800 737
700800 01002 22		162 625 737 737
700700 01102 22	113212312123322140301131321111	925 700 737 675
7006004 100 1 24	111112221112212111220412122001	387 612 837 675
700522 01211 1 0	11111333111311331213111132112	237 875 812 790
700300 00102 22	111103332223113132121011223113	350 812 787 775
901920 0110 01 0	111323331332313131324423230331	87 837 812 750
801420 10112 0 0	011203412233112130341431210341	375 0 950 625
901323 0124 1 04	111212431233313131220421221231	9751000 887 890
901221 0011 01 0	111302422333321110310420200110	62 862 712 675
901124 0141 30 1	111412421332211131210412221111	300 675 950 612
8010004 1002 2 2	1111134 3224112140201411120110	437 0 0 550
8009213 0133 0 1		625 0 0 0
8008202 0233 4 1		962 0 737 0

8007004	1002	22	103414421334214340240411101243	312	775	812	762
800823	01242	3 0	221213322333223110140433333441	675	787	912	723
900500	01112	22		225	3	0	0
900401	11112	333	111113431223211111224421220111	325	737	712	612
8003004	1002	22	231001401223322040143410410142	225	737	662	0
8002211	033331		091112130103112211224400123141	275	750	962	900
8001			110313331111301010124411123243	450	737	712	750
9018			3213333122333130310413330131	7	925	862	725
901701	11102	32	241313402432413231344431420110	525	750	700	200
901623	1142		131112121323321131244431130111	337	737	725	675
9015004	1102	32	232112231333213110444411120112	512	712	675	662
9014224	1223	0 1	121103439123311123424011010013	675	862	900	325
901322	0130	32 0	111003330021111004223400023003	337	587	562	512
901222	3020		22922331323202211201011111112	325	812	575	537
901101	11202	32		225	825	725	0
901002	01203	0 1		925	0	0	0
9009224	1203	4 1	011112331112211132244421201000	100	437	412	500
9008223	1203	4 1	001002231221111121144010120112	300	750	582	512
900722	0114	3 0 0		462	675	725	0
900623	2134	300	12112121123122113134013121321	812	812	862	862
9005333	130	10 1	111142232214122130114441310222	362	3	0	0
9004203	0203	4 1	131122331132333113320400023113	137	590	937	487
9003144	120301		111112220032132110340011111012	57	750	837	787
900222	01142	320	113213321433221113320031221211	787	675	890	712
900100	00103	0 2	132112331114212003234412111221	100	725	700	675
800824	10123	0 1		325	787	687	775
8005204	0003	0 1	131311301333313130211431410141	312	712	787	675
8004004	0001	1 2		52	325	450	562
8003221	1203	4 1	343113402420324330244441420442	400	737	587	625
800223	01341	41	32211330242222130224443400332	375	700	750	512
800104	11302	21	221113221222122123300023213131	425	737	700	750
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804402	112223	0	11111343133311331334	487	711	814	0
804322	1112	00 1	11111232112312111134	425	644	814	0
804201	01102	32	11130342143311310044	125	745	813	0
804120	00301	1 0	01000334100200130234	350	711	833	0
8040142	1204	3 1	12111333112211211234	487	745	799	0
8039004	0003	0 3	11111241211231131223	225	745	851	0
8038224	1301	1		425	723	740	0
803602	1		04013402232333300203	600	913	796	0
8035014	1103	0 3		287	981	759	0
803322	1110	3 0 0	12111133122311211234	437	530	851	0
803201	11202	22	00003444000300310033	200	457	848	0
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802822	1110	3 11	11111234011312111223	412	510	722	0
8027031	132		1111214011211111143	187	813	891	0
802620	20113	0 1	11321141233430030024	600	813	796	0
8025213	013	001	33111142144334111024	325	711	796	0
8024221	0243	0 1		425	610	833	0
8023132	020	40	11000323122210330024	275	491	518	0
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8021022	121	1 1 1	14211322113141111014	297	308	703	0
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801923	11203	4 1	00020344002211210334	712	847	868	0
801800	01002	21	11010232012310110013	450	728	703	0

8017223	1212	21	22111142133332313133	200	610	833	0
8018224	110	1 00	13220312133343110034	337	782	888	0
801901	11102	3 4	33110141033424330144	137	779	870	0
801400	01112	22		450	527	629	0
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801221	112	30 1	01111331233331331124	387	919	870	0
801001	21102	21	11111333111313321134	562	728	722	0
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800602	1114	1 12	11100334011111110014	237	677	629	0
800501	21202	22	11110203112231211134	262	779	759	0
800422	1114	0 10	11011223111321211224	350	796	870	0
800301	01112	32	11120343111311111024	550	830	888	0
800202	1114	1 01	01110134111331310024	397	728	814	0
8001004	1112	32	11001243113331011134	375	542	629	0
8007			12022340121311211134	0	627	814	0

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Captain John E. Vice is a native of Demopolis, Alabama. In 1970, he earned a Bachelor of Arts degree in Mathematics from Livingston University in Alabama. After teaching high school mathematics for two years, he joined the Air Force and received his officer commission via Officer Training School. He subsequently attended Undergraduate Pilot Training at Craig AFB, Alabama. Prior to attending AFIT to attain a Master of Science in Logistics Management degree, Captain Vice was stationed at Mather AFB, California, where he served as an aircraft commander in the 904th Air Refueling Squadron. After graduation, he will work in aircraft maintenance for the 552nd Airborne Warning and Control Wing, Tinker AFB, Oklahoma.

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