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THE UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

# THE EFFECTS OF A STUDENT RESPONSE SYSTEM ON STUDENT ACHIEVEMENT, SATISFACTION AND INTERACTION IN AN INTERACTIVE VIDEO TELETRAINING CLASS

A Dissertation

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

degree of

Doctor of Philosophy

By

HENRY E. PAYNE
Norman, Oklahoma
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THE EFFECTS OF A STUDENT RESPONSE SYSTEM ON STUDENT ACHIEVEMENT, SATISFACTION AND INTERACTION IN AN INTERACTIVE VIDEO TELETRAINING CLASS

A Dissertation APPROVED FOR THE DEPARTMENT OF EDUCATIONAL LEADERSHIP AND POLICY STUDIES

BY

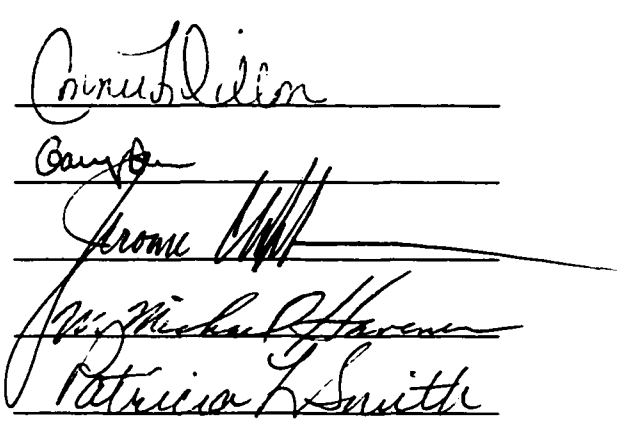


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## Abstract

The purpose of this study was to investigate the effects of using a student response system, and the capabilities it represents, as compared to using an audio conferencing system, and the capabilities it represents, on learner achievement, learner satisfaction, and the amount of interaction, both actual and perceived, in an interactive video teletraining class. The subjects were 70 primarily upper division undergraduate students enrolled in the Principles of Marketing course at Langston University. The study design was a quasi-experimental non-equivalent control group design. Students were equally split into two treatment groups. One treatment group had the use of a student response system, which provided students with both voice and data interaction capability, designed into its presentation. The other treatment group had the use of an audio conferencing system, which provided students with only an audio interaction capability, designed into its presentation. The study found no significant differences between treatment groups on learner satisfaction and the amount of learner perceived interaction. The study did find significant differences on learner achievement and the actual level of interaction. Students using the student response system had significantly higher posttest scores measuring learner achievement. Students using the audio conferencing system had a significantly higher level of verbal interaction, while students using the student response system had a

higher level of overall interaction, but not statistically significantly higher. All 35 students using the student response system interacted, using the voice and/or the data interaction capabilities of the student response system, while only 9 of the 35 students using the audio conferencing system used the voice interaction only capability of the audio conferencing system.

# CHAPTER ONE - INTRODUCTION

The demand for workplace education and training continues to grow at an alarming rate. Shortages in human resources are being created by demographic, economic, and technical forces that impact both new and experienced employees. Current workers now need a much broader set of skills along with a strong foundation of basic skills in order to facilitate learning on the job (Carnevale, 1991; Wexley & Latham, 1991). It has been estimated that office workers will require retraining between five and seven times during their careers (Wexley, 1984). It has been predicted that the amount of information produced will increase exponentially every year (McIsaac & Gunawardena, 1996) increasing the rate of obsolescence and the requirement to continually train and retrain workers, particularly professionals (Wexley & Latham, 1991). Also, the pool of qualified new workers is shrinking, increasing the number of new workers coming from segments of society historically lacking the basic entry level skills for many of today's jobs (Garvin-Kester & Chute, 1991; Wexley & Latham, 1991). The result is more and more businesses and government agencies are developing their existing workforces rather than trying to hire new employees who possess the newly needed skills. Between 1981 and 1991, American businesses alone spent in excess of $2 trillion to train its workforce (Wexley & Latham, 1991). In 1996, it has been estimated that in excess of $59B was spent for formalized training (Staff, 1996). Due to

this high cost of training, most businesses and government agencies are looking for lower-cost ways of providing necessary training to employees.

Many organizations are turning to a form of distance learning called *interactive video teletraining* as a lower-cost alternative to traditional classroom training (Garvin-Kester & Chute, 1991; Main & Riise, 1995; Oliver & McLoughlin, 1996). The International Conference for Distance Education estimated that over 500,000 people enroll in telecourses in the United States each year (Hyatt, 1992). To increase interactivity in the telecourse environment, a new technology called student response systems is being used (Portway & Ostendorf , 1997). In addition to increasing interactivity, student response systems are also claimed to increase student learning and satisfaction in interactive video teletraining courses (Portway & Ostendorf, 1997). However, these claims are neither adequately supported nor documented by research. As a result, corporate, academic, and government decision makers are being forced to make decisions about expensive training technology without the data to do so in an informed manner.

## Background and Magnitude of the Problem

Research has been conducted on the efficiency, effectiveness, and acceptance and appeal of teletraining systems. This research has shown that teletraining has produced significant cost-benefits (Chute, Hulick, &

Palmer, 1987; Hartigan & St. John, 1989; Parker, 1984). Teletraining has also been shown to be effective, that students learn, and that students accept teletraining (Chu & Schramm, 1967, 1975; Chute, Balthazar, & Poston, 1988; Mays, 1993; Michael & Knapp-Lee, 1985; Rudolph & Gardner, 1986; Russell, 1992; Simpson, Pugh, & Parchman, 1993; Whittington, 1987).

The level of interactivity in interactive video teletraining has been questioned (Graham & Wedman, 1989; Horn, 1994; Oliver & McLoughlin, 1996), and in particular, the appropriateness of the use of telephones to provide the level of interactivity required for learner acceptance and achievement (McCleary & Egan, 1989; Oliver & McLoughlin, 1996). Some businesses and government agencies, in order to ensure that interactive video teletraining courses are indeed interactive, are adding student response systems to their interactive video teletraining systems (Federal Aviation Administration, 1996; Garvin-Kester & Chute, 1991; Portway & Ostendorf, 1997). Student response systems allow instructors to query, question, and respond to student questions, while allowing students to ask questions, respond to questions and to communicate with other students at other remote classrooms (Portway & Ostendorf, 1997). While numerous studies have been conducted on questioning techniques that could be used with student response systems (Hamilton, 1985; Schloss, Sindelar, Cartwright, & Schloss, 1986; Wager & Mory, 1993; Winne, 1979), little

research has been conducted to determine if the use of student response systems can increase learning and retention or satisfaction for students in interactive video teletraining courses. Without the convincing results of such research, organizations may not be able to justify the additional cost of student response systems, and educators may not be able to justify their use based upon claims of improved learner achievement, learner satisfaction, and interaction.

The Federal Aviation Administration (FAA) is experiencing the same reengineering, downsizing, and cost cutting activities as other businesses and government organizations. At the same time, the FAA is also experiencing increasing training demands caused by attrition, hiring of additional employees, the fielding of new equipment, and the requirements for new job skills (Federal Aviation Administration, 1996, 1997; Payne, 1994). Like other organizations, the FAA is instituting interactive video teletraining in an effort to reduce overall training costs while increasing training opportunities. The FAA is planning to include the use of a student response system in order to ensure its interactive video teletraining courses are interactive (Federal Aviation Administration, 1996, 1997; Payne, 1994). The outcomes of this study could impact the decision the FAA makes on adopting a student response system.

## Consequences

The consequences of this problem are threefold. First, are the economic consequences of this problem. Decision makers are spending millions of dollars a year on student response technologies without knowing which systems may increase learner achievement and satisfaction. It may be that millions of dollars a year are being spent on student response system technologies, that may not benefit and might even inhibit learning. It was the intent of this study to provide decision makers with data to support their decision making around using student response systems.

Second, are the human consequences of this problem. If student response systems can increase learner achievement and satisfaction through increased levels of interaction, then learners using student response systems would have a distinct advantage over learners using audio conferencing systems and telephones in interactive video teletraining classes. It is possible that as learners experience increased achievement and satisfaction, that they may also be motivated to participate in additional interactive video teletraining classes. This study provided data on the relationship between interaction and learner achievement and learner satisfaction in an interactive video teletraining class.

Social consequences are also a part of this problem. For example, numerous government reports state that various FAA personnel are

under-trained or lack training for the positions they are asked to fill. This requires the FAA to work qualified personnel overtime to assist, oversee, and train those needing training, severely taxing those responsible with running the nation's airspace system safely. If student response systems can increase learner achievement and learner satisfaction, the number of FAA employees needing training can be significantly reduced, and safety can be increased. This study provides data on learner achievement and learner satisfaction using student response system in an interactive video teletraining environment.

## Purpose of the Study

The purpose of this study was to investigate the effects of using a student response system on learner achievement, learner satisfaction, and the amount of interaction, both actual and perceived. The study compared the effects of using a student response system, and the capabilities it represents, to the effects of using an audio conferencing system, and the capabilities it represents, on learner achievement, learner satisfaction, and the amount of both actual and perceived interaction in an interactive video teletraining class in a distance learning environment.

The objective of this study was to answer the following research questions.

1. Will the use of a student response system in an interactive video teletraining class increase learner achievement more than the use of an audio conferencing system?

2. Will learners completing an interactive video teletraining class using a student response system report higher levels of satisfaction than learners using an audio conferencing system?

3. Will learners using a student response system in an interactive video teletraining class perceive higher levels of interaction than learners using an audio conferencing system?

4. Will learners completing an interactive video teletraining class using a student response system display increased levels of verbal interaction over learners using an audio conferencing system?

5. Will learners completing an interactive video teletraining class using a student response system display increased levels of total interaction over learners using an audio conferencing system?

## Significance of the Study

This study reports the effects of using a student response system, and the capabilities it represents, as compared with an audio conferencing system, and the capabilities it represents, on learner achievement, learner satisfaction, the amount of perceived interaction, and the actual amounts of verbal and total interaction in an interactive video teletraining class. Additionally, the study provided data on the effects of increased

interaction on learner achievement and learner satisfaction in an interactive video teletraining environment. There were both theoretical and practical significances to this study.

Theoretical

This study attempted to contribute to the theoretical concept of interaction as a requirement for learning. It investigated whether increasing the amount of interaction, both real and perceived, would also increase learner achievement and learner satisfaction. By doing so, the importance of required interaction for learning may be further substantiated.

Practical

This was the first known study to compare the effects of using a student response system, and the capabilities it represents, to those of an audio conferencing system, and the capabilities it represents, in an interactive video teletraining environment, on learner achievement, learner satisfaction, and the amounts of perceived and actual interaction. By exploring how these variables were impacted through the use of a student response system, this study provided educators and decision makers with much needed data for use in making decisions about using student response systems in interactive video teletraining environments.

## Assumptions

It was assumed that the student response system used in this study is representative of student response systems in general. That is, the use of the *One Touch Viewer Response System*™ did not impact the outcomes of the study beyond that of other student response systems with similar capabilities.

It was assumed that the audio conferencing system used in this study is representative of audio conferencing systems in general. That is, the use of the *AT Products Audio Conferencing System*™ did not impact the outcomes of the study beyond that of other audio conferencing systems with similar capabilities.

It was assumed that the instructor was adequately prepared to teach each class using each system. That is, first, the instructor had a command of the subject matter. Second, the instructor received adequate training on the use of both the student response system and the audio conferencing system. Last, the instructor had adequate opportunity to rehearse and practice using both systems.

## Limitations

The application of the findings of this study are limited. The subjects of the study were upper division college students at Langston University, Langston, OK. Langston University is a historically Black university.

Over 90% of the subjects were African-American or African. Therefore, any generalizations of the findings of this study beyond the study population should be done cautiously.

The application of the findings of this study are also limited due to the design. That is, this study was conducted on a single class as opposed to an entire course. The results achieved by this study may be influenced by Clark's (1983) novelty effect of new technology, and should be applied beyond this study cautiously.

The findings of this study apply only to interactive video teletraining classes as defined below. They do not apply to video teleconference classes, employing two-way audio and video.

## Definition of Terms

The following definitions are provided in order to clarify the understanding of this study.

Distance Education - structured learning events in which the learners and the instructor are separated in time and/or space and in which communication between the instructor and learners is facilitated by some form or forms of print and/or electronic media.

Interactive Video Teletraining - a one-way video and two-way audio instructional delivery system in which the instructor's video and audio are delivered via compressed digital satellite signals. Learners are provided with a real-time, live interaction capability, either voice or both voice and

data, with which to interact with the instructor and with learners at other sites.

Student Response System - an electronic device that allows learners in interactive video teletraining classrooms to communicate with the instructor by both voice and data and with other learners at other interactive video teletraining classrooms by voice.

Audio Conferencing System - an electronic device that allows learners in interactive video teletraining classrooms to communicate with the instructor and with other learners at other interactive video teletraining classrooms by voice only.

Learner Achievement - how much students learn as a result of the treatment. Learner Achievement was measured by posttest scores.

Interaction - both voice and data communication between the instructor and learners or verbal communication between learners at different interactive video teletraining classrooms.

Learner satisfaction - the degree to which learners are satisfied, or like, the distance learning treatment to which they are exposed.

Types of verbal interaction - the ten different categories of verbal interaction as described by Flanders Categories for Interaction Analysis (Amidon & Flanders, 1967). A copy of Flanders Categories for Interaction Analysis is at Appendix A.

## Summary

This study provided much needed information to training and distance learning decision makers. It provided empirical data on the effects of using a student response system, and the capabilities it represented, as compared with using an audio conferencing system, and the capabilities it represented, in an interactive video teletraining class on learner achievement, learner satisfaction, and both actual and perceived levels of interaction. This was the first known study to attempt to show a relationship between the use of the capabilities of a student response system and learner achievement, learner satisfaction, and the amounts of perceived and actual interaction in an interactive video teletraining environment as compared to the use of the capabilities of a audio conferencing system.

# CHAPTER 2 - REVIEW OF THE LITERATURE

The purpose of this chapter was to review the literature related to the issues of conducting a media comparison study, the conceptual model behind the study, and the study's concepts. As this was a media comparison study, the issues around conducting media comparison research needed to be addressed, and therefore, media comparison research literature was reviewed. There were two major concepts upon which this study was based. The first concept was the role of interaction in learning. The second concept was the relationship between the amount of interaction, both real and perceived, and the level of learner achievement and learner satisfaction in a distance learning environment. This chapter concludes with a review of literature on the effects of educational television on learner achievement, learner satisfaction, interaction and the use of student response systems in distance learning environments.

## Media Comparison Research

Media comparison research is typically conducted to answer the question, Is one medium better than another? In order to answer the question, the comparison between the two media calls for a methodologically sound experiment. That is, one in which all variables except the media variable are held constant (Salomon & Clark, 1977). The content, method, mode of presentation, situation, and all other variables

must be the same between treatments. Only when the medium of the presentation is allowed to vary between treatments, with all other conditions of the study being equal, can any significant differences in achievement be attributed to the media alone (Mielke, 1968). However, media comparison studies with such a design rarely find any differences (Mielke, 1968; Salomon & Clark, 1977).

Occasionally, media comparison studies do report significant findings for one medium over another. When this happens, it has been suggested that some uncontrolled aspect of the content or instructional strategy caused the change and not the medium (Levie & Dickie, 1973; Mielke, 1968; Morrison, 1994; Schramm, 1977). Clark (1983) contends that when positive finding studies are investigated, their treatments are found to be confounded, and that evidence for this confounding is revealed in the newer meta-analyses of media comparison studies.

Two primary sources of confounding in media comparison research have been identified (Clark, 1983, 1985, 1994). The first source of confounding identified was the uncontrolled effects of instructional method or content differences between the compared treatments. The second source of confounding identified was the uncontrolled effects of a novelty effect for newer media.

When meta-analytic techniques are used to review media comparison studies, positive effects for media virtually disappear when the same

instructor develops and presents all treatments (Clark, 1985; Kulik, Kulik & Cohen, 1980). Usually, different content and instructional methods are given by different developers and different instructors to the treatments compared. When this happens, it is not known whether to attribute the positive effects for a medium to the differences in content and method or to the medium itself. Since this effect tends to disappear when the same instructor designs and presents both treatments, the lack of difference between media can be attributed to a better control of non-medium variables (Clark, 1983; Clark & Sugrue, 1991).

Meta-analyses give evidence that it is the method, not the media, that accounts for learning. Kulik, Kulik, and Cohen (1980) found that in studies where the same method of programmed instruction was delivered by text and computer, their effect sizes were similar. Both resulted in the same .2 standard deviation advantage over conventional instruction on the final exam. Clark (1983, 1994) strongly argues that separating media from method explains more significant amounts of learning variance and, therefore, it is the method, not the media, that influence learning.

Uncontrolled novelty effects with newer media are a second, but less frequent, source of confounding (Clark, 1983; Clark & Sugrue, 1991). Novelty effects result from the increased effort and attention research subjects appear to give media that are new to them. It is hypothesized that increased attention can lead to increased effort or persistence, which

leads to higher achievement. Novelty effect gains tend to diminish as students become more familiar with the new medium (Clark, 1983). Kulik, Bangert, and Williams (1983) found that average effect size for secondary students taking computer-assisted instruction dropped from .56 standard deviations for courses lasting 4 weeks or less to .2 standard deviations for courses lasting more than 8 weeks. Therefore, the uncontrolled novelty effects with newer media can also confound media comparison study results.

Research With and Research On Media

Most media comparison studies represent what Salomon and Clark (1977) call research *with* media. Research with media uses the media as modes of stimulus presentation but does not study anything inherently connected with the media. For example, in such a study a course is selected to be presented by computer-assisted instruction and by traditional instruction. More than likely, the course for computer delivery will be redesigned to take advantage of the computer's inherent attributes, but the traditional course will be left as it always has been, probably a lecture. The two versions of the course will then be taught and some achievement measure will be administered. Any differences in outcomes would be attributed to the media, when, according to Clark (1983), it should be attributed to the methods used. As Salomon and Clark (1977)

have pointed out, there would probably be no significant differences in outcomes, and if there were, they would be attributable to the uncontrolled effects of the differences in methods and content, and not the differences between the delivery media.

Research *on* media treats the media as the major focus of the study (Salomon & Clark, 1977). Research on media allows us to extract the various capabilities of media and study their effects on learning. This type of research allows the unique and unusual aspects of media to be studied for their influence on the way that information is processed. Research on media requires the identification of media attributes and the conduct of well designed studies to show what effects these attributes may have on learning.

Research on Media Attributes

Media attributes are often referred to as symbol systems or symbolic elements of instruction (Clark, 1983; Kozma, 1991; Salomon & Clark, 1977). These are the modes of appearance, or characteristics, that each media can employ. A medium can be described by and compared and contrasted with other media by its capabilities to use certain symbol systems (Clark, 1975; Kozma, 1991). Symbol systems can be shaped to represent the critical cognitive processes required for successful performance of a given task (Clark, 1983; Kozma, 1991). However, it is

here that researchers split on the effect of media attributes and related symbol systems on learning.

One group believes that it is the external modeling of the critical cognitive processes required for successful task performance that is necessary for learning and not the medium or the symbol system (Clark, 1983, 1994; Clark & Sugrue, 1991; Morrison, 1994; Ross, 1994). They claim that if a symbol system is shaped to represent, or model, the critical cognitive processes required for successful task performance, and all other things are equal, that learning will occur. Since they claim that different media can be replaced with other media with other attributes that can also model the critical cognitive processes required for the same task, it is the modeling, not the media attributes that cause learning (Clark, 1983, 1994; Clark & Sugrue, 1991; Ross, 1994). They contend that the learning is attributed to the external modeling of the critical features of the required cognitive processes and not the media attributes or the symbol system (Clark, 1983, 1994; Ross, 1994).

Other researchers believe that certain media attributes can and do influence learning (Jonassen, Campbell, & Davidson, 1994; Kozma, 1994; Petkovich & Tennyson, 1984; Reiser, 1994; Salomon, 1978). Learners can benefit from the use of a particular medium when the instructional method uses the capabilities of the medium to provide, or model, symbolic representations of critical cognitive processes required by the task and the

situation, and that the learners cannot or do not provide for themselves. They contend that a particular medium can model these critical cognitive processes more effectively than other media.

This group of researchers also contends that holding all things equal in a media comparison study does not accurately reflect the capabilities of any of the media involved (Ross, 1994; Ullmer, 1994). When a study uses a computer like a book, the results do not accurately reflect the capabilities of a computer. Mielke (1968) contends research that brings different mediated instruction down to a common denominator, where all other factors are equal, are a cause for concern. He believes that it is these other factors that are the very basis for deciding whether to use a particular medium, and not an experimental nuisance.

These researchers contend that media attributes can and do influence learning. To them, viewing learning with media is a continuous interaction between learner and situation, that is, the learner and the information presented by the medium. This learner-media interaction is an example of Snow's (1989; 1992) Aptitude-Treatment Interaction (ATI) theory.

Aptitude-Treatment Interaction (ATI) Theory

Individual learners have differing learning styles and aptitudes (Snow, 1989, 1992). It is, therefore, unlikely that a single instructional method or program is ideally suitable for all learners. Research using the ATI theory

seeks to determine if the effects of different instructional methods are influenced by individual learner cognitive or personality characteristics (Borg & Gall, 1989). ATI research assumes that the two factors of method and learner characteristics may interact in educationally significant ways. It does not assume that one instructional method is best or better than another. Additionally, it does not assume that learners with certain cognitive or personality characteristics are better learners than those without those characteristics.

There are usually two independent variables in an ATI theory study (Borg & Gall, 1989). One variable will be some instructional variable, such as a teaching method, curriculum materials, or learning environment. A student characteristic, such as an aptitude, personality dimension, level of academic achievement, or learning style is often the other independent variable. Hypotheses of ATI theory studies predict the selected instructional variable will have differing effects for learners varying in the selected student characteristic. ATI theory research allows for a more statistically sophisticated analysis of effects for tested instructional methods than is possible by just comparing treatment groups (Borg & Gall, 1989).

Summary of Media Comparison Research

There are clearly two positions on the question of media comparison research and its value. One side that believes that media do not influence

learning (Clark, 1983; Clark & Sugrue, 1991; Morrison, 1994; Ross, 1994) while the other side believes that media can and often do influence learning (Jonassen, Campbell, & Davidson, 1994; Kozma, 1994; Petkovich & Tennyson, 1984; Reiser, 1994; Salomon, 1978).

This study compared the effects of two different technologies with different capabilities and characteristics in a distance learning environment. The voice and data interactivity capabilities of a student response system were compared against the voice interactivity capability of an audio conferencing system on learner achievement, learner satisfaction, and amounts of perceived and actual interaction. It was the different characteristics of the two technologies that were compared.

As stated in the Skill Dynamics (1993) study, it would appear that this disagreement between these two positions is "more semantic than substantive" (p. 5-3). Research that claims to be about a given media is actually about the set of symbol systems, information processing capabilities and the instructional strategies made possible by that medium. Such was the case with this study. It would appear that such research is acceptable as long as the outcomes are attributed to their symbol systems, strategies, processes, and capabilities and not attributed to the medium per se (Skill Dynamics, 1993).

## Conceptual Model

The conceptual model for this study involved two major concepts. The first major concept was the relationship between interaction and learning. Interaction as a concept, while widely accepted in distance education by such authors as Duning, Van Kekerix, and Zaborowski (1993), Kruh and Murphy (1990), Lane (1997), McIsaac and Gunawardena (1996), Moore and Kearsley (1996), Murphy (1995), and Willis (1993), is not very well defined by any one (Bates, 1990). For example, McIssac and Gunawardena (1996) considered interaction as one of six important characteristics in the adoption and use of technologies for distance education. However, they defined interaction as "the degree to which the technology permits interaction (two-way communication) between the teacher and the student, and among students" (McIssac & Gunawardena, 1996, p. 427). Willis (1993) referred to interaction as providing either real time face-to-face or voice-to-voice interaction. Lane (1997) referred to interaction in distance learning environments as the capability to talk back to the user. Duning, Van Kekerix, and Zaborowski (1993) talked of interaction as providing "some form of two-way communication between sites," and they contended this communication can be verbal, electronic, or written (p. 128). Interaction was considered an essential element of the teaching-learning process by Kruh and Murphy (1990), but they do not define interaction. Murphy (1995) defined interaction as the nature and

frequency of verbal communication between instructors and students and among students. Moore and Kearsley (1996) talked about the need for interaction and different types of interaction, but never provide a definition. It is unfortunate that a clear definition, either conceptually or operationally, of the term *interaction* was not provided by the distance learning literature (Fast, 1995). For the purposes of this study, interaction was defined as *both verbal and data communication between the instructor and learners and verbal communication between learners at different interactive video teletraining classrooms.*

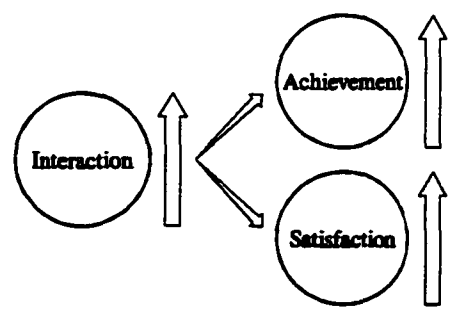
Interaction has been identified as a requirement in virtually every learning model and instructional theory (e.g., Bloom, 1976; Gagné, 1985; Kruh & Murphy, 1990; Merrill, 1979; Reigeluth, 1983; Wager & Mory, 1993). Interaction is required for such instructional events as gaining, stimulating, and maintaining attention, informing the learner of the instructional purpose, presenting information, asking and answering questions, and providing feedback on performance (Bates, 1990, Smith & Ragan, 1992). Virtually every adult learning model acknowledges some minimal level of interaction as a requirement for learning as well (e.g., Knowles, 1980; Knox, 1986; Long, 1983; Wlodkowski, 1985). Additionally, students interact with other students in sharing misery and mutual learning (Egan, Ferraris, Jones, & Sebastian, 1993; Thiagarajan, 1978). It

is clear that some form and level of interaction is required for learning to take place.

The second major concept was the relationship between the amount of interaction and learner achievement and learner satisfaction in a distance learning environment. However, the concept of the amount of interaction affecting learner achievement and learner satisfaction has two possible relationships. The first relationship is between the actual amount of interaction and learner achievement and learner satisfaction. This conceptual relationship is depicted in Figure 1.

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Figure 1. Relationship Between Amount of Interaction and Learner Achievement and Learner Satisfaction.




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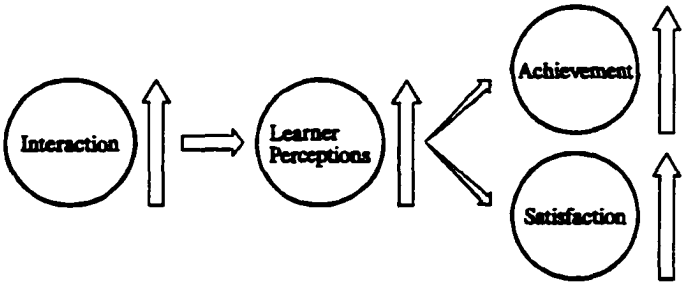
The first relationship hypothesized there was a direct relationship between the actual amount of interaction and the level of learner

achievement and the level of learner satisfaction. That is, if the amount of interaction was increased, learner achievement and learner satisfaction would also increase. This study provided increased opportunities for interaction by learners and controlled to determine if there were differences between learners using a student response system and learners using an audio conferencing system on learner achievement, learner satisfaction, and the amount of actual interaction. This study sought to determine if there was a relationship between the actual level of interaction and learner achievement and learner satisfaction.

The second relationship was between the amount of interaction perceived by learners and learner achievement and learner satisfaction. This relationship is depicted in Figure 2.

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Figure 2. Relationship Between Amount of Learner Perceived Interaction and Learner Achievement and Learner Satisfaction.




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The second relationship hypothesized there was a direct relationship between learner perceptions of the amount of interaction and the level of learner achievement and learner satisfaction. That is, if learners perceived that the amount of interaction was increased, learner achievement and learner satisfaction would also increase. This study provided increased opportunities for interaction and controlled to determine if there were differences between learners using a student response system and learners using an audio conferencing system on learner achievement, learner satisfaction and the amount of perceived interaction. This study sought to determine if there was an overall relationship between the level of perceived interaction and learner achievement and learner satisfaction.

## Literature Review

This section will review the literature related to the concepts of this study. It includes literature related to learner achievement, learner satisfaction, and interaction in an interactive video teletraining environment. It also includes literature related to the use of student response systems in both traditional and distance learning environments.

### Introduction

While interactive video teletraining has been demonstrated to be as efficient and effective as classroom training (Chute, Balthazar, & Poston, 1988; Moore, Thompson, Quigley, Clark, & Goff, 1990; Purdy, 1978;

Russell, 1992) and can produce a significant cost benefit over classroom training (Chute, Hulick, & Palmer, 1987; Hartigen & St. John, 1989; Parker, 1984), there continues to be resistance to its acceptance. Graham and Wedman (1988), Pirrong and Lathen (1990), and Horn (1994), among others, argue this resistance comes from a dissatisfaction on the part of course participants, both learners and instructors, directly related to opportunities for interaction. Learners have complained that reassurances and reinforcement from an instructor and misery-sharing and mutual learning with peers are two kinds of interaction typically missing from live educational television (Egan, Ferraris, Jones, & Sebastian, 1993; Thiagarajan, 1978). The technologies most frequently used for learner interaction in live educational television, either a telephone or an audio conferencing system, contribute to the loss of interaction between learners and between learners and the instructor. The production of adequate audio has been difficult and that has been the standard means of interaction. As classes become larger and larger for live educational television courses, insuring an interaction orientation becomes even more difficult (Garvin-Kester & Chute 1991; Graham & Wedman, 1988).

Many believe that student response systems can provide the interaction missing in other systems used in interactive video teletraining today (Garvin-Kester & Chute 1991; Horowitz, 1988). If student response systems can be shown to increase opportunities for interaction, adequacy

of interaction, and quality of interaction, then they may also increase student learning as well as student satisfaction with the learning experience (Graham & Wedman, 1988). If this can be demonstrated, decision makers will then have a better basis upon which to base their decisions for acquiring student response systems over existing telephone and audio conferencing systems.

The remainder of this chapter will review the literature of educational television related to this study. Educational television has a long history as a distance learning technology. As early as 1934, Iowa State University was broadcasting educational television programming and by 1939 had broadcast nearly 400 educational programs (Unwin & McAleese, 1988). By 1948, some eight universities and colleges were broadcasting educational programs on a regular basis (Zigerell, 1991). The first Instructional Television Fixed Service (ITFS) was licensed to the Plainedge School System on Long Island, New York, in 1961 (Curtis & Biedenbach, 1979). ITFS is a relatively low cost educational television distribution system that uses microwave technology to broadcast instructional programming up to 25 miles (Portway & Lane, 1997). Cable television networks were required to provide an educational channel by the FCC in 1972. The Appalachian Community Service Network, on the University of Kentucky campus, was one of the first educational cable channels, and was developed into today's Learning Channel (Moore &

Kearsley, 1996). One of the first attempts to use a special student keypad to make a video course interactive occurred in Columbus, Ohio in 1977 (Baldwin & McVoy, 1983). It is clear that educational television has a long history as a distance learning technology.

This literature review is divided into sections for learner achievement, learner satisfaction, interaction, and viewer response systems. It will begin with the literature related to learner achievement in educational television environments.

Learner Achievement

Learner achievement using instructional television as the delivery medium has been well documented for the last fifty years (e.g., Moore & Kearsley, 1996; Russell, 1992; Zigerell, 1991). This research encompasses elementary through graduate education, and includes military, government, and business and industry training. For the most part, these studies have concluded that there is *no significant difference in achievement* between learners being taught via instructional television, whether in a remote or classroom location, and learners being taught face-to-face with the instructor (e.g., Chu & Schramm, 1967, 1975; Chute, 1990, 1992; Johnstone, 1991; Moore, Thompson, Quigley, Clark, & Goff, 1990; Purdy, 1978; Russell, 1992; Schramm, 1977; Souder, 1993; Whittington, 1987; Zigerell, 1984). A selected review of this research is provided below.

A number of published literature reviews have been conducted that summarize the results from numerous studies on instructional television. For example, Russell (1992) identified data from more than 800 separate studies. These studies included elementary through graduate education and military efforts conducted between 1954 and 1992. Russell concluded from reviewing this data that the findings are clear, students learn equally well with instructional television technology in distance learning situations as their on-campus, face-to-face counterparts.

One of earliest comprehensive reviews of educational television research was conducted in the 1950's by Finn (1953). One part of Finn's review looked at effectiveness of educational television. Even though television was very young, he did find and summarize what he called "several carefully controlled studies" on the effectiveness of educational television (Finn, 1953, p. 119). Finn concluded from his review that instruction over television is effective, television instruction is remembered by those who receive it, and that learners receiving instructional television like it.

Chu and Schramm (1967) conducted one of the best known and most widely cited reviews summarizing results from existing studies on learning from television. They reviewed 421 comparisons made among one-way television systems and face-to-face classroom courses. The results showed no significant difference in 308 comparisons, with 63 comparisons

showing a difference in favor of one-way television systems and 50 comparisons showing a difference favoring traditional face-to-face instruction. Chu and Schramm (1975) reviewed additional studies between 1967 and 1974. They concluded in both reviews that there is no doubt that adults learn from televised instruction, and that the effectiveness of television in instruction had been demonstrated with a great variety of subject matter and methods.

Allen (1971) provided a review of research conducted on the effectiveness of instructional television from the mid-1950's to the mid-1960's. While he provided little detail on his review, his conclusions were firm. He concluded, "The predominant finding from the hundreds of evaluative studies in instructional television is its overall equal effectiveness when compared with face-to-face instruction. That students learn from televised teaching cannot be doubted...," (Allen, 1971, p. 10).

Schramm (1977) summarized the findings from three large literature reviews of studies that mostly compared television instruction with traditional classroom instruction. The three reviews Schramm looked at included over 900 studies. Schramm concluded that, while under certain conditions for some subject matter some students learn more from one medium than the other, but in general there was "no significant difference" between television instruction and face-to-face classroom instruction (1973, p. 28).

Purdy (1978) reviewed an unspecified number of studies conducted between the late 1940s and the mid 1970s. These studies, conducted at the elementary, secondary and college levels and with a wide range of subject matter, all compared televised instruction to on-campus, face-to-face instruction. Purdy concluded from his review that televised instruction works. That is, there is either no significant difference in achievement in comparative studies or when there is a difference, students in televised courses generally have higher achievement rates than on-campus students in the same or similar courses.

Chute, Balthazar, and Poston (1988) provided a summary of five years of learning from teletraining conducted at AT&T's National Teletraining Center. These studies were conducted with adult learners over specific job-related content and included studies conducted with interactive video teletraining technology. These authors concluded from their review that AT&T students learned from the teletraining mode as well as if not better than they did in the face-to-face mode. They also found that AT&T students perceived teletraining and face-to-face courses to be equally effective.

A review of research reporting on the use of communication technologies in the 1980's was conducted by Moore, Thompson, Quigley, Clark, and Goff (1990). This review included higher and continuing education, and K-12 education using a variety of content. The authors

concluded that teaching and studying at a distance, particularly that which uses interactive electronic telecommunications media such as interactive video teletraining, is effective when effectiveness is measured by learner achievement. They went on to conclude that the best of distance education instruction is superior to average classroom teaching.

Whittington (1987) reported on a research project that reviewed more than 100 published and unpublished studies on the educational merit of instructional television. The studies reviewed were on college level and adult level learners and included a variety of subject matter. Whittington found that, in most cases, comparative studies showed that learners completing courses by instructional television achieve, or learn, as well as learners completing traditional courses. She also found that these equivalent learner achievement findings hold even when rigorous methodological research standards were applied.

An article by Johnstone (1991) reported research findings on telecommunicated learning, including instructional television. She reported that at least five review articles were published in the 1960's that examined hundreds of studies comparing televised and traditional classroom instruction. The conclusions reached by these studies agreed that, at worst, there were no significant differences in learner achievement between televised and traditional classroom instruction. She went on to

say that in several of the studies, learner achievement was higher for learners receiving televised instruction.

The last literature review to be included in this section was by Zigerell (1984), who conducted a review of selected literature in the broad field of distance education. This review included a section on the use of television to deliver telecourses. He concluded that the results of adults enrolled in telecourses has been studied thoroughly and that the most reliable studies confirm that performance between learners in telecourses and learners in face-to-face courses does not differ significantly.

In addition to the numerous literature reviews, there are hundreds of individual studies that look at the effectiveness of learning over television. While many of these studies have the same no significant difference findings (e.g., Haynes & Dillon, 1992; Simpson, Pugh, & Parchman, 1992; 1993), there are those studies that do find significant achievement results in favor of the television instruction (e.g., Bruning, Landis, Hoffman, & Grosskopf, 1993; Martin & Rainey, 1993; Ritchie & Newby, 1989).

Souder (1993) reported the results of effectiveness of traditional versus satellite delivered instructional television in three master's degree programs using a management of technology course. Fifty-seven master's degree students, in three separate degree programs, participated in the course taught by the same instructor. Twenty-four students took the course by satellite, 13 students took it face-to-face with the instructor

simultaneously with the satellite group, and 20 students took it face-to-face with the instructor at a different time and location. Achievement was measured by exams, term papers and homework assignments. The findings showed that students taking the course by satellite delivered instructional television performed as well as or better than students taking the course face-to-face, as measured by results on exams, term papers and homework. The study concluded that learners at a distance should not be viewed as disadvantaged in their learning experiences.

Haynes and Dillon (1992), in a study to examine the impact of telecommunications media on learning outcomes designed on level of learning and instructional strategy, found the same impact on student learning. The study of consisted of 28 graduate level learners, split into 17 in the on-campus group and 11 in the remote site group, taking a 14 week library science course. Interactivity was provided by two-way audio and two-way video between the sites. The study concluded that there were no significant differences in learning between groups at any level or with any instructional strategy.

A study to determine differences in instructional effectiveness among three learning environments in terms of academic performance and learner attitudes was conducted by Chung (1991). The three environments were traditional classroom, with 24 students, studio classroom with the instructor, with 13 students, and telecourse classroom,

with 33 students. Chung found no significant differences in academic performance and only a few differences in learner attitudes. Studio students felt they were less active in class, while remote students were less satisfied with the instructor's evaluation of their work and they felt the course was more difficult even though they had the highest overall grades.

Simpson, Pugh, and Parchman (1993) conducted a study to compare training effectiveness and learner acceptance between live instruction and six instructional television technologies. The six instructional television technologies were multi-channel two-way video and two-way audio, single channel two-way video and two-way audio, one-way video and two-way audio, one-way video and one-way audio, one-way video and intermittent two-way audio, and audiographics. Subjects were 743 Navy active duty and reservist supervisors and officers. The study found a small but statistically significant difference in favor of live instruction over all instructional television treatments, but found no statistically significant difference between live instruction and one-way video and two-way audio instruction.

A study to compare learner achievement of Air National Guard students in an experimental course with active duty and part-time Air National Guard students in a resident course was conducted by Hunter, Renckly, Smith, and Tussey (1995). The subjects were 270 noncommissioned officers taking the Noncommissioned Officer Academy

curriculum. The experimental course, with 97 volunteers, consisted of 114 hours of live satellite delivered instruction supported by an on-site facilitator and two weeks of in residence instruction. The two control groups, one with 100 students and the other one with 79 students, received the traditional 6-week resident course. Achievement was measured with three multiple choice exams. No statistically significant difference was found between the experimental and control groups' exam scores.

Lennon and Payne (1997) reported on a study comparing traditional resident-based classroom instruction to interactive video teletraining instruction in a Federal Aviation Administration Quality Assurance course. Learners were 49 air traffic employees split into two control groups with a total of 31 learners and one treatment group, for interactive video teletraining, with 18 learners. There were no statistically significant differences in learning outcomes as measured by posttest scores.

More recently, a number of studies have been reported that do find significant achievement findings in favor of the television instruction (Bruning, Landis, Hoffman, & Grosskopf, 1993; Martin & Rainey, 1993; Ritchey & Newby, 1989). While these studies are not nearly as numerous as those that did not find significant differences, they should not be ignored. A representative sample of these studies is provided below.

Bruning, Landis, Hoffman, and Grosskopf, (1993) reported on an interactive television based course in introductory high school Japanese. This study evaluated three successive years and included 911 students in 1990, 1157 students in 1991 and 1330 students in 1992. Students were divided into control (traditional) and treatment (interactive television) groups that were spread across twenty states. Interaction consisted of verbal interaction between the students and the instructor and between students. Listening and writing component test scores were compared between the two groups for each of the three years. The results showed that the students in the interactive television groups had significantly higher scores on both measures than did the traditional resident-based groups. The study concluded that introductory Japanese can be successfully taught using interactive television-based instruction.

A study investigating the effects of satellite delivered instruction on student achievement and attitudes in a high school anatomy and physiology course was conducted by Martin and Rainey (1993). Course segments were broadcast live via satellite and students were able to talk with the instructor using a telephone. Ninety-eight students participated in the study, divided among seven high schools, that were split into experimental (satellite delivered) and control groups (face-to-face). Participants were administered a pretest and a posttest to measure learner achievement and a pretest and a posttest to measure learner

attitudes. There were no significant differences in learner attitudes. However, learners taking anatomy and physiology by satellite delivered instruction scored significantly higher on the posttest.

Ritchie and Newby (1989) conducted a study to compare the effects of the environment in which instruction was delivered on several factors, including performance, or achievement. The study consisted of 26 undergraduate college students, each randomly assigned to one of three treatment groups, distance with television, live studio, and traditional classroom, with the content covering nominative absolute clauses. Interactivity was provided by an audio conferencing system. Achievement was measured by a written exam. The findings showed that students in the distance with television environment scored significantly higher on the written exam than did students in the studio classroom environment and equivalent to students in the traditional classroom environment.

Nixon (1992) reported a study examining the effectiveness of simulteaching by comparing learning outcomes of three groups of post secondary students receiving instruction from the same instructor at the same time. For each of the 17 liberal arts community college courses in the study, the students were assigned to one of three treatment groups, remote with one-way video and two-way audio, remote with two-way video and two-way audio, and origination site with the instructor. A total of 582 students participated in the study. Findings showed that students in the

one-way video and two-way audio groups had significantly higher learning outcomes, based on exams and class assignments, than the other two groups, while there was no difference in learning outcomes between the origination site and the remote with two-way video and two-way audio.

A study to evaluate the effectiveness of a satellite training program for achieving a variety of learning requirements, from recognition and recall to specific job performance procedures, was conducted by Whetzel, Felker, and Williams (1996). The study also reported the results for two courses comparing satellite and classroom training. The learners were 1,177 supervisors and managers of the US Postal Service. Results were reported on pretest-posttest comparisons for eight satellite delivered courses. Significant differences (increases in posttest scores over pretest scores) were reported for seven of the eight satellite courses. Two additional satellite courses were compared to their traditional classroom counterparts. Both satellite courses had significantly higher scores on the posttest than did the traditional courses. Additionally, students in one of the two satellite courses had significantly higher scores on the performance test that did their traditional counterparts, while the other course showed no statistically significant difference between the satellite and traditional students on the performance exam.

A pilot study was conducted for this study with 60 undergraduate students taking a marketing principles course (Payne & Payne, 1997;

Appendix E). The students were equally split into two treatment groups, one using a student response system and one using an audio conferencing system. Both treatment groups had strategies designed into their class that maximized the capabilities of the technology with which the class was presented. Students using the student response system scored significantly higher on the posttest that did students using the audio conferencing system.

The research findings on student achievement using instructional television are clear. The weight of the evidence shows that students in instructional television courses learn as much or in some cases more than their counterparts in traditional, face-to-face courses. Therefore, students participating in this study were expected to achieve as much as they would have done in a traditionally delivered class and were not considered to be at a disadvantage because their courses were delivered by instructional television. Moore and Kearsley (1996) provided a simple summation of the findings on the effectiveness of distance learning by television when they said, "there is ample evidence that instructional television can be effective" (p. 85).

This study compared the effects of using a student response system, and the capabilities it represents, and an audio conferencing system, and the capabilities it represents, in a video teletraining environment. Learner achievement was one of the dependent variables used to compare

the capabilities of these two technologies. Since these two technologies, and the capabilities they represent, had never been compared before in an interactive video teletraining environment, it was possible that differences in learner achievement could have resulted from their use.

Learner Satisfaction

Distance learner satisfaction has been identified as an important criterion by which to judge the effectiveness of instructional television courses (Biner, 1993; Biner, Dean, & Mellinger, 1994). In fact, Biner, Dean, and Mellinger (1994) contend distance learner satisfaction is, arguably, as important as distance learner performance, or achievement. Biner (1993) developed a seven dimension evaluation survey for distance learner satisfaction, and contended that high levels of satisfaction would lower attrition rates, increase referrals for enrolled students, increase levels of student motivation, increase commitment to a program, and increase learning. However, none of these contentions were supported with empirical evidence by the authors. It should be noted that a modified version of Biner's (1993) Telecourse Evaluation Questionnaire was used in this study to measure learner satisfaction.

Hult (1980) studied the relative effectiveness of three instructional modes on graduate student achievement and attitudes. The three modes were television without instructor contact, television with instructor contact, and traditional classroom. The instructor contact in the television

with instructor contact mode consisted of four site visits by the instructor during the semester. The subjects were 96 graduate students enrolled in a basic human development course that were split equally among the three instructional modes. While mid-term and final test scores for learners in the television with instructor contact group were higher than the other two groups, there were no significant differences in achievement between the three groups. Learners in the television without instructor contact group had significantly more negative attitudes toward the course and the instructor than did the other two groups. Hult surmised that there is some optimal level of personal interaction between the instructor and the learners that may vary based on a number of factors, but did not identify what that optimal level of interaction may be.

A study to investigate the perceptions of students and faculty involved in educational television and interactive television courses was conducted by Barron (1987). One hundred students who had completed educational television and interactive television courses between 1982 and 1986 were surveyed, with 87 responses included in the review. Four out of every five learners taking a course by either educational television or interactive television rated their involvement in their course as better than or the same as traditional courses. Eighty-two percent of the learners taking a course by either educational television or interactive television indicated

they enjoyed their course better than or as well as they did traditional courses.

Ritchie and Newby (1989) conducted a study involving 26 undergraduate students assigned to one of three treatments, distance classroom, studio classroom or traditional classroom, with instruction over nominative absolute clauses. The study found that students in the traditional and studio classrooms rated their instruction more enjoyable than did students in the distance classroom. However, the distance students performed as well as the traditional students and better than the studio students on a written exam. In this study, distance student attitudes toward the course did not affect their learning, nor did their performance appear to affect their attitudes toward the course.

Simonson, Johnson, and Neuberger (1989) conducted a series of studies to examine the efficacy of using satellite technology to deliver high school courses. Responses were collected from 290 learners who responded to 40 Likert-type statements designed to measure attitudes about satellite instruction. Learners, on the whole, had positive attitudes towards satellite instruction. However, while students supported the use of satellite instruction, they indicated a preference for traditional courses over satellite courses.

Wilson (1990) surveyed 75 high school students taking satellite delivered courses to assess their perceptions towards distance learning.

Student interaction was provided by telephone calls placed by learners to the instructor. The study found that 84% of the learners indicated that the high school should continue to offer satellite delivered courses and 85% indicated they would recommend satellite courses to other learners. The majority of learners indicated that learning via satellite courses helped them develop a greater sense of personal responsibility (65%) and develop more confidence in themselves (59%).

A study to test if student attitudes and performance would vary among students located in a traditional classroom, an on-campus interactive television classroom and an off-campus interactive television classroom was conduct by Pirrong and Lathen (1990). The study consisted of 71 college students enrolled in an undergraduate level introductory financial accounting course, with 16 students located at three off-campus interactive television classrooms, 34 students located at the on-campus interactive television classroom from which the course was broadcast, and 21 students located in a traditional classroom. Students at the off-campus interactive television classrooms were able to interact verbally with the instructor and students at other sites by use of microphones in the classroom. There were no significant differences in students' mean performance scores, as measured by 5 quizzes, 4 exams, a term project, and homework. Three questions on the two attitude questionnaires did show significant differences between off-campus and on-campus students. The ability to

communicate with the instructor, the ability to read the instructor's writing, and the readability of the instructor's visuals were rated significantly lower by the off-campus group than by both on-campus groups. However, there were no differences between groups on their evaluation of the instructor, and the majority of the remote students reported they liked the overall experience well enough to take another interactive television course.

A study to determine differences in instructional effectiveness among three learning environments in terms of academic performance and learner attitudes was conducted by Chung (1991). The three environments were traditional classroom, with 24 students, studio classroom with the instructor, with 13 students, and telecourse classroom, with 33 students. Chung found no significant differences in academic performance and only a few differences in learner attitudes. Studio students felt they were less active in class, while remote students were less satisfied with instructor evaluation of their work and they felt the course was more difficult even though they had the highest overall grades.

Haynes and Dillon (1992), in a study to examine the impact of telecommunications media on learning outcomes designed on level of learning and instructional strategy, found this same lack of impact of student attitudes on student learning. That is, while distance students expressed negative attitudes towards the delivery system, their attitudes

did not appear to inhibit their learning, nor did their level of learning appear to affect their attitudes toward the course.

Johnstone (1991) reported research findings on telecommunicated learning, including instructional television. She reported that at least five review articles were published in the 1960's that examined hundreds of studies comparing televised and traditional classroom instruction. Johnstone detailed one study in which a survey of high school students taking satellite delivered television courses indicated 70% would choose traditionally taught courses over satellite courses. She went on to conclude that there is evidence to suggest that, if given the option, students prefer a face-to-face environment, which would appear to suggest low satisfaction with televised instruction. Johnstone contended that adults also seem to prefer face-to-face instruction, when given a choice. It may be that learners of all ages prefer the social integration afforded in traditional classrooms.

A study investigating the effect of satellite delivered instruction on student achievement and attitudes in a high school anatomy and physiology course was conducted by Martin and Rainey (1993). Course segments were broadcast live via satellite and students were able to interact verbally with the instructor using a telephone. Ninety-eight students participated in the study, divided among seven high schools, and were split into experimental and control groups. Participants were

administered a pretest and a posttest to measure learner achievement and a pretest and a posttest to measure learner attitudes. Learners taking anatomy and physiology by satellite delivered instruction scored significantly higher on the posttest measuring learner achievement. However, there were no significant differences in learner attitudes.

In a study looking at learner satisfaction with distance learning technologies, including video with audio talk-back, Zuniga and Johnstone (1994) surveyed learners from 35 classes at 7 different institutions. A total of 550 surveys were returned. The results showed that less than 5% of the off-campus students "disliked" any of the distance learning technology, including video with audio talk-back.

A study to compare learner satisfaction of Air National Guard students in an experimental course with active duty and part-time Air National Guard students in a resident course was conducted by Hunter, Renckly, Smith, and Tussey (1995). The subjects were 270 noncommissioned officers taking the Noncommissioned Officer Academy curriculum. The experimental course, with 97 volunteers, consisted of 114 hours of live satellite delivered instruction supported by an on-site facilitator and two weeks of in residence instruction. The two control groups, one with 100 and the other with 79 subjects, received the traditional 6-week resident course. Satisfaction was measured by an end-of-course survey, which gathered student perceptions on overall effectiveness, mission

accomplishment, test and evaluation relationship to objectives, course content appropriateness, ability of instructors and length of the course. The experimental group rated their experience with the experimental course significantly higher the traditional groups rated their experiences with the traditional course.

Simpson, Pugh, and Parchman (1993) conducted a study to compare training effectiveness and learner acceptance between live instruction and six instructional television technologies. The six instructional television technologies were multi-channel two-way video and two-way audio, single channel two-way video and two-way audio, one-way video and two-way audio, one-way video and one-way audio, one-way video and intermittent two-way audio, and audiographics. Subjects were 743 Navy active duty and reservist supervisors and officers. Student attitudes were measured with a posttest questionnaire rating the instructor, audiovisual aids, tests and homework, overall assessment of instructor and course, course content and form of instruction. The study found no statistically significant differences in learner attitudes between any of the groups.

Pugliese (1994) conducted a study involving 306 community college students to investigate loneliness, communication apprehension, communication competence, and locus of control as predictors of withdrawal and withdrawal failures in telecourses. He found that while factors of social integration may be important in traditional education,

they do not account for withdrawal and withdrawal/failure problems of telecourses. Pugliese concluded that telecourses may be a social equalizer, minimizing both assets and liabilities of social skills, as well as the potential for teacher bias toward the more socially skilled.

Lennon and Payne (1997) reported on a study comparing traditional resident-based classroom instruction to interactive video teletraining instruction in a Federal Aviation Administration (FAA) Quality Assurance course. Learners were 49 air traffic employees split into two control groups with at total of 31 learners and one treatment group, for interactive video teletraining, with 18 learners. There were no statistically significant differences in learner satisfaction as measured by a standard FAA Academy end-of-course evaluation.

A pilot study was conducted for this study with 60 undergraduate students taking a marketing principles course (Payne & Payne, 1997; Appendix E). The students were equally split into two treatment groups, one using a student response system and one using an audio conferencing system. Both treatment groups had strategies designed into their class that maximized the capabilities of the technology with which the class was presented. After deleting factors from the end-of-class learner satisfaction survey that did not apply to the study, there were no statistically significant differences in learner satisfaction between the two groups.

The literature on learner satisfaction with instructional television courses appears to indicate the following generalized findings. First, learner attitudes do not appear to impact learner achievement. Learners can have negative attitudes toward instructional television courses and still achieve as much or more than their counterparts in traditional on-campus courses. Second, learner achievement does not appear to impact learner attitudes. Learners can do well academically in instructional television courses and still have negative attitudes toward courses delivered by instructional television. Lastly, learner attitudes do appear to impact their desire to take additional courses and whether they will recommend instructional television courses to other learners.

This study compared the effects of using a student response system, and the capabilities it represents, and an audio conferencing system, and the capabilities it represents, in a video teletraining environment. Learner satisfaction was another one of the dependent variables used to compare the capabilities of these two technologies. As these two technologies, and their representative capabilities, had not previously been compared, it was possible that there could have been a statistically significant difference in learner satisfaction.

Interaction

Interaction as a concept, while widely accepted in distance education by such authors as Duning, Van Kekerix, and Zaborowski (1993), Kruh and

Murphy (1990), Lane (1992), McIsaac and Gunawardena (1996), Moore and Kearsley (1996), Murphy (1995), and Willis (1993), is not very well defined by any one (Bates, 1990). For example, McIssac and Gunawardena (1996) considered interaction as one of six important characteristics in the adoption and use of technologies for distance education. However, they defined interaction as "the degree to which the technology permits interaction (two-way communication) between the teacher and the student, and among students" (McIssac & Gunawardena, 1996, p. 427). Willis (1993) referred to interaction as providing either real time face-to-face or voice-to-voice interaction. Lane (1997) referred to interaction in distance learning environments as the capability to talk back to the user. Duning, Van Kekerix, and Zaborowski (1993) talked of interaction as providing "some form of two-way communication between sites," and they contended this communication can be verbal, electronic, or written (p. 128). Interaction was considered an essential element of the teaching-learning process by Kruh and Murphy (1990), but they did not define interaction. Murphy (1995) defined interaction as the nature and frequency of verbal communication between instructors and students and among students. Moore and Kearsley (1996) talk about the need for interaction and different types of interaction, but they never provided a definition. It is unfortunate that a clear definition, either conceptually or

operationally, of the term *interaction* was not provided by the distance learning literature (Fast, 1995). For the purposes of this study, interaction was defined as *both verbal and data communication between the instructor and learners and verbal communication between learners at different interactive video teletraining classrooms.*

Interaction has been identified as a requirement in virtually every learning model and instructional theory (e.g., Bloom, 1976; Gagné, 1985; Kruh & Murphy, 1990; Merrill, 1983; Reigeluth, 1983; Wager & Mory, 1993). Interaction is required for such instructional events as gaining, stimulating, and maintaining attention, informing the learner of the instructional purpose, presenting information, asking and answering questions, and providing feedback on performance (Bates, 1990; Smith & Ragan, 1992). Virtually every adult learning model acknowledges some minimal level of interaction as a requirement for learning as well (e.g., Knowles, 1980; Knox, 1986; Long, 1983; Wlodkowski, 1985). Additionally, students interact with other students in sharing misery and mutual learning (Egan, Ferraris, Jones, & Sebastian, 1993; Thiagarajan, 1978). As stated earlier, it is clear that some form and level of interaction is required for learning to take place.

Interaction between the learners and the instructor is also required to reduce what Moore (1990) calls *transactional distance.* Transactional

distance is determined by the amount of *dialogue*, or interaction, between learners and the instructor and by the amount of *structure* designed into the course (Moore, 1990; Moore & Kearsley, 1996; Saba & Shearer, 1994). It is not limited to distance education programs. Transactional distance is determined by the relationship between dialogue and structure.

Dialogue is defined as the ability of the learner and the instructor to respond to each other (Moore, 1990; Moore & Kearsley, 1996; Saba, 1990). Three environmental factors affect or influence the amount of dialogue. First, is the existence and size of the learning group (Moore & Kearsley, 1996). The smaller the group, the more likely the instructor and individuals are to interact. The second factor is language (Moore & Kearsley, 1996). Students learning in a foreign language are less likely to interact with the instructor than are those who share the same native language as the instructor. The last environmental factor that influences the amount of dialogue in distance education programs is the medium of communication (Moore & Kearsley, 1996). Technologies that allow for more communication between learners and the instructor will have more dialogue.

Structure is defined as the program's responsiveness to the individual needs of the learners (Moore, 1990; Moore & Kearsley, 1996; Saba, 1990). Rigid, inflexible programs have high structure, while flexible, learner

responsive programs have low structure. Structure is determined by the elements of the program's design, such as the program's educational objectives, teaching strategies, and evaluation methods, and describes the extent to which these components can be responsive to individual learner needs (Moore & Kearsley, 1996).

Transactional distance is reduced when educational programs have more dialogue and less structure. Distance is determined by the relationship between dialogue and structure and not by geography (Moore & Kearsley, 1996; McIsaac & Gunawardena, 1996; Saba & Shearer, 1994). Thus, transactional distance can be reduced by increasing dialogue, or the amount of interaction between learners and the instructor, and by decreasing structure, or increasing learner control (Saba & Shearer, 1994). If interaction between learners and the instructor can be increased in instructional television courses, then the amount of transactional distance can be reduced. McIssac & Gunawardena (1996) state that interaction is fundamental to determining the effectiveness of distance education programs. According to Moore and Kearsley (1996), one of the most frequent sources of dissatisfaction and frustration for distance learners is the lack of sufficient relevant feedback.

Threlkeld (1990) surveyed 415 California school superintendents on the relative importance of learning attributes in high school level satellite delivered education. The ability of the learners and the instructor to

communicate during the live broadcast was the second most important learning attribute identified, listed on 58% of the returns. Threlkeld concluded that interaction between learners and instructor is of vital importance for satellite delivered high school classes.

Learners in instructional television courses are only able to actively interact and participate in their courses if their instructional television system allows for synchronous interactivity. That is, they are able to interact with the instructor and with other learners live, during the actual course presentation. Interaction is an attribute of effective instruction, while interactivity is an attribute of contemporary instructional delivery systems, such as some instructional television systems (Wagner, 1994). Therefore, instructional delivery systems, such as educational television, must allow for interactivity before interaction can be increased.

Moore (1989) identified three types of interaction in distance education. The first type is learner-content interaction. This is the internal conversation learners have with themselves about the information and ideas contained in the instruction (Oliver & McLoughlin, 1996; Moore & Kearsley, 1996). This interaction of learners with the content is one of the "defining characteristics of education" (Moore & Kearsley, 1996, p. 128). The second type is learner-instructor interaction. This is the interaction between the instructor and the learner about the information and ideas presented in the instruction. This type of interaction is considered very

desirable by most instructors and essential by most learners (Bates, 1990; Moore & Kearsley, 1996; Oliver & McLoughlin, 1996; Ritchie, 1991). The third type is learner-learner interaction. This is the interaction between learners about the information and ideas presented in the instruction (Bates, 1990; Moore & Kearsley, 1996; Oliver & McLoughlin, 1996). A fourth type of interaction, called learner-interface interaction, was identified by Hillman, Willis, and Gunawardena (1994). This is the learner interacting with the technology in order to interact with the content, instructor and/or other learners. As this study looked at the effect of the capabilities of a viewer response system, as compared to the effects of the capabilities of an audio conferencing system, on learner-instructor and learner-learner types of interaction, this section reviewed selected research on the effects of learner-instructor and learner-learner types of interaction, during instructional television courses in distance learning environments.

Horn (1994) contends that one-way communication in distance education is becoming obsolete as telecommunications' technologies, like interactive instructional television, make advances in two-way communications. Horn reported that nearly one half of Rockland Community College telecourse students did not complete their telecourses in the Spring of 1992. Rockland's telecourses were one-way audio and one-way video, with any communication between students and faculty being

done asynchronously, or outside of normal class time. Surveys of telecourse dropouts indicated that the students missed the interaction between faculty and other students, which Horn contended also facilitates enthusiasm for learning.

A study to investigate perceptions of learners and faculty involved in educational television and interactive television courses was conducted by Barron (1987). Interaction in the educational television courses was provided by telephone calls placed by learners to the instructor. Interaction in the interactive television courses was provided via live microphones available to learners during the broadcast, providing immediate verbal contact with the instructor and with learners at other sites. One hundred students who had completed educational television and/or interactive television courses between 1982 and 1986 were surveyed, with 87 responses included in the review. Four out of every five learners taking a course by either educational television or interactive television rated their involvement in their course as better than or the same as traditional courses. Sixty-six percent of the learners taking a course by either educational television or interactive television rated the amount of their contact with the instructor and other learners as better than or the same as the amount of interaction in traditional courses. Seventy-six percent rated the quality of this contact as better than or the same as the quality of interaction in traditional courses.

A series of studies examining the efficacy of using satellite technology to deliver high school courses was conducted by Simonson, Johnson, and Neuberger (1989). Interactivity was provided by telephone connections from the remote sites to the instructors in the studio. Responses were collected from 290 learners who responded to 40 Likert-type statements designed to measure attitudes about satellite instruction. Learners, on the whole, had positive attitudes towards the level of interaction between the instructor and the learners. However, mixed responses indicated that many learners would have preferred increased opportunities for interaction.

Ritchie and Newby (1989) conducted a study involving 26 undergraduate students assigned to one of three treatments, distance classroom, studio classroom and traditional classroom, with instruction over nominative absolute clauses. Interactivity between the instructor and the distance classroom learners was provided by an audio conferencing system with live microphones for learners to use to talk to the instructor and learners at the studio classroom. The study found that distance classroom students perceived they had less involvement in the instruction, were less able to ask questions, and experienced less overall enjoyment than did learners in the other two groups. However, the distance classroom students performed as well as the traditional students and better than the studio students on a written exam over the content. As

was shown, student perceptions of their level of interaction, while affecting their level of satisfaction, did not appear to affect their learning, or achievement.

The effectiveness of six instructional formats which allowed differing levels of interaction was conducted by Beare (1989). The six formats were (1) lecture, (2) lecture with videotape back-up, (3) telelecture, (4) audio assisted independent study, (5) video assisted independent study, and (6) video on campus. The subjects were 175 non-traditional teacher education students. Results showed little if any effect on learner performance by instructional format and that the amount of interaction had no apparent effect on learner achievement.

A study to test if student attitudes and performance would vary among students located in a traditional classroom, an on-campus interactive television classroom and an off-campus interactive television classroom was reported by Pirrong and Lathen (1990). The study consisted of 71 college students enrolled in an undergraduate level introductory financial accounting course, with 16 students located at three off-campus interactive television classrooms, 34 students located at the on-campus interactive television classroom from which the course was broadcast, and 21 students located in a traditional classroom. Students at the off-campus interactive television classrooms were able to interact verbally with the instructor and students at other interactive television classrooms by the use of audio

conferencing system microphones in the classrooms. There were no significant differences in students' mean performance scores, as measured by 5 quizzes, 4 exams, a term project, and homework. Three questions on the two attitude questionnaires did show significant differences between off-campus and on-campus students. The ability to communicate with the instructor, the ability to read the instructor's writing, and the readability of the instructor's visuals were rated significantly lower by the off-campus groups than by both on-campus groups. However, there were no differences between groups on their evaluation of the instructor, and the majority of the remote students indicated they liked the overall experience well enough to take another ITV course. The authors speculated that the causes of the off-campus low ratings on the ability to communicate with the instructor may have been caused by two factors. One potential factor was student reluctance to use the microphone to talk to the instructor during class. Another was potential negative attitudes caused from students' inability to communicate with the instructor before or after class.

Miller, McKenna, and Ramsey (1993) conducted a study to examine the achievement and attitudes of graduate education students taught in both live and remote conditions. Fifty one students in two courses were divided into on-campus and off-campus groups, and all groups were taught in both the live and remote conditions. Interactivity in the remote condition was provided by two-way audio and two-way video instructional television.

The study found that students in the live condition perceived higher levels of interaction than when they were in the remote condition. However, this effect was attributed to the on-campus groups, as the off-campus groups had similar levels of perceived interaction in both the live and remote conditions. Perhaps on-campus students anticipated a live instructor condition and were not prepared to accept the remote condition, whereas the off-campus students, by the very nature of their location, were prepared for the remote condition.

May (1993) investigated the perceived contribution of interaction in women's studies courses delivered using distance education. Nine women from the courses were interviewed. One-way, content focused delivery provided mostly knowledge level information with very little interactivity. The women interviewed appeared not to miss interaction nor to recognize its potential benefits. The author concluded that "increased learner interaction is not an inherently or self-evidently positive educational goal or strategy" (May, 1993, p. 47). This would appear to be a questionable conclusion based upon interviews from only 9 participants and the results from other empirical studies.

Stone (1988) surveyed 8,431 graduate students from 8 institutions to determine if student performance varied based on age, gender, graduate major and instructional modality. The three instructional modalities were traditional on-campus instruction, videotape delivery without interaction,

and interactive television using real-time audio feedback to the instructor. Student performance was significantly higher for the videotape delivery without interaction group than the other two modalities. There was no significant difference between the traditional classroom and the interactive television groups using real-time audio feedback to the instructor. Stone concluded that as long as student to instructor interaction was sufficient to support quality instruction, even if not carried out real-time, that non-interactive delivery formats could be effective. Unfortunately, Stone neither described, identified, nor tested the level of interaction sufficient for quality instruction.

A study focusing on the specific interaction behaviors of asking and answering questions, as opposed to looking at overall levels of interaction was conducted by Sholdt, Zhang, and Fulford (1995). Learners were split into traditional and television with audio conferencing capability classes. Learners in the television classrooms felt it was easier to ask and answer questions from a television classroom, while traditional learners felt there was no difference. Remote site learners felt it was significantly easier to ask and answer questions at the same site than across sites. Learners at remote sites felt it was easier to send answers across sites than it was to ask questions across sites. However, the student location or type of communication (asking or answering questions) did not have a significant

effect on learner perceptions of how easy it was to communication with the instructor.

Chute, Balthazar, and Poston (1988) provided a summary of five years of learning from teletraining, defined as two-way audio and two-way video instructional television, conducted at AT&T's National Teletraining Center. These studies were conducted with adult learners and with specific job-related content. These authors concluded from their review that learner satisfaction with teletraining was related to a number of factors, including the need for courses to be highly interactive.

A study to determine differences in instructional effectiveness among three learning environments in terms of academic performance and learner attitudes was conducted by Chung (1991). The three environments were traditional classroom, with 24 learners, studio classroom with the instructor, with 13 learners, and telecourse classroom, with 33 learners. Interaction was provided through telephone calls to the instructor during the broadcast. Chung found no significant differences in academic performance and only a few differences in learner attitudes. Studio learners felt they were less active in class, while remote learners were less satisfied with instructor evaluation of their work and they felt the course was more difficult even though they had the highest overall grades.

A study to test the feasibility, as measured by training effectiveness and acceptance by learners and instructors, of using video teletraining to deliver hands-on training was reported by Simpson, Pugh, and Parchman (1992). The study consisted of 215 learners divided into local and remote conditions. Remote conditions were either one-way video and two-way audio instructional television or two-way video and two-way audio instructional television. The study found no differences in final exam scores, and learners in both conditions and both technological environments felt that video teletraining either had no effect on opportunities to ask questions or that it provided more opportunities to ask questions.

Simpson, Pugh, and Parchman (1993) conducted a study to compare training effectiveness and learner acceptance between live instruction and six instructional television technologies. The six instructional television technologies were multi-channel two-way video and two-way audio, single channel two-way video and two-way audio, one-way video and two-way audio, one-way video and one-way audio, one-way video and intermittent two-way audio, and audiographics. Subjects were 743 Navy active duty and reservist supervisors and officers. Though not reported in the study, the data provided showed a statistically significant difference in learning outcomes between multi-channel two-way video and two-way audio, single channel two-way video and two-way audio, and one-way video and two-

way audio, and between one-way video and one-way audio, one-way video and intermittent two-way audio, and audiographics. It would appear that the instructional television technologies that provided for continuous audio contact, or interaction, between the instructor and the learners and between learners contributed to significantly higher learning outcomes.

Chambers (1993) reported a case study involving graduate engineering students taking courses at their job sites with one-way video and two-way audio instructional television. Interactivity was provided through a student response system that provided both voice and data responses from learners going back to the instructor. Chambers reported that these students completed the required material in 80% of the time and had grades 17 to 19 percent higher than students who took the same courses on-campus. However, from the data provided, it is not possible to attribute these gains to interaction, interactivity, or the delivery media.

Hackman and Walker (1990) conducted a study to identify physical system design features and instructional behaviors related to effective instructional television. Questionnaires were analyzed from 102 graduate and undergraduate students taking instructional television courses. The study found that interactive systems that allow students to comment during instructor presentations positively impact perceived student learning and satisfaction with the course.

Fulford and Zhang (1993) conducted a study to determine the relationship between perceived personal levels of interaction and perceived levels of overall interaction, how well perceived personal and overall levels of interaction predict learner satisfaction, and between learners' perceived levels of both types of interaction and satisfaction. The study consisted of 233 K-6 teachers taking an instructional television course at either a one-way video and two-way audio instructional television or two-way video and two-way audio instructional television location. Results from 123 surveys found that the critical predictor of satisfaction was learner perceptions of overall levels of interaction and that perceived personal levels of interaction was only a moderate predictor of satisfaction. These findings indicate that learner satisfaction is related to their perception of the overall level of interaction, not their perceived personal level of interaction.

Zhang and Fulford (1994) reported the results of a follow-on study looking at the relationships between learner perceptions of interaction and the actual amount of time allowed for interaction. The subjects were 260 primarily K-6 teachers taking a 10 session interactive television course. Subjects received the training at either a one-way video with two-way audio site or two-way video with two-way audio site. All learners had the ability to interact with the instructor and other learners through the audio track using microphones. The study found no relationship between actual

time allowed for interaction and learners' perceptions of the amount of interaction. There was no relationship between actual time allowed for interaction and learners' satisfaction and attitudes toward interaction. However, there was a high correlation between learners' satisfaction and attitudes toward interaction and learners' overall perceptions of the level of interaction. Learners' perceptions of the overall level of interactivity was primarily based upon their perceptions of the amount of peer interaction rather than their personal amount of interaction.

In a study looking at learner satisfaction with distance learning technologies, including video with audio talk-back, Zuniga and Johnstone (1994) surveyed learners from 35 classes at 7 different institutions. A total of 550 surveys were returned. The results showed that, overall, learners felt the quality of their interaction was at least as good as or better than the quality of traditional classroom interaction. Interaction with the instructor was rated by 62% of the learners taking video with audio talk-back classes as good as or better than traditional classroom interaction. Interaction with other learners was rated as good as or better than traditional classroom interaction by 67% of the learners taking video with talk-back audio.

Larson and Bruning (1996) studied the benefits of using a satellite-based mathematics course on 204 high school students split into satellite and traditional classes. The satellite classes were one-way video with two-

way audio, although not all sites return audio systems were active at all times. Students perceptions were (1) satellite students did not have enough time to interact with the teacher, (2) satellite students could not ask questions because the broadcasts were scripted, (3) 20% of the satellite students did not like the course, (4) limited interaction contributed to negative feelings toward the satellite course, and (5) most satellite students would prefer a regular classroom, if given the choice. The study also found that while mean posttest scores were higher for students in the traditional class, students in the satellite class had greater mean growth in mathematics placement scores. The authors concluded that the students inability to ask clarifying questions of the instructor during the presentation was the main contributor to their preference for traditional classroom instruction.

Kwiatek (1982) conducted a study with 41 elementary teachers, divided into three groups, interactive cable television, one-way cable television, and traditional face-to-face training. Interactive segments were added to the cable television instruction, but not the traditional instruction. Both cable television groups could see and hear the interactive segments, but only the interactive cable television group could interact. The study found that interactive viewing yielded greater effects on learning and satisfaction than viewing one-way without interaction or traditional face-to-face interaction.

Egan, Ferraris, Jones, and Sebastian (1993) conducted a qualitative study to examine telecourse learners' perceptions and attitudes. The study consisted of interviews of 15 learners randomly selected from 1,200 learners who had completed two or more telecourses over the Utah Education Network. One of the themes identified by the study was related to interaction. Specifically, learners expressed a greater need for interaction with other learners taking the same telecourse than they had experienced.

A study to evaluate the effectiveness of a satellite training program for achieving a variety of learning requirements, from recognition and recall to specific job performance procedures, was conducted by Whetzel, Felker, and Williams (1996). The study also reported the results for two courses comparing satellite and classroom training. The learners were 1,177 supervisors and managers of the US Postal Service. The study reported the results of four survey questions related to interaction. Seventy-nine percent of the learners reported it was easy to interact with the instructor and other learners using the available equipment, and 69% said that their interaction with other sites was helpful. Seventy-one percent of the learners said that the number of participants did not keep them from interacting, and 76% said that the technology did not keep them from interacting. The authors suggested that most of the learners were

"comfortable with satellite training, even though many had not been previously exposed to it" (Whetzel, Felker, & Williams, 1996, p. 13.)

Lennon and Payne (1997) reported on a study comparing traditional resident-based classroom instruction to interactive video teletraining instruction in a Federal Aviation Administration (FAA) Quality Assurance course. Learners were 49 air traffic employees split into two control groups with a total of 31 learners and one treatment group, for interactive video teletraining, with 18 learners. Learners in the interactive video teletraining group were asked questions on a supplemental end-of-course evaluation and rated the student response system and their interaction favorably. Only two of 18 learners said they were not comfortable communicating using the student response system, only one of 18 learners said the student response system did not function properly, and only one said he was not able to get his questions answered.

A pilot study was conducted for this study with 60 undergraduate students taking a marketing principles course (Payne & Payne, 1997; Appendix E). The students were equally split into two treatment groups, one using a student response system and one using an audio conferencing system. Both treatment groups had strategies designed into their class that maximized the capabilities of the technology with which the class was presented. The study looked at both perceived and actual levels of interaction between the two treatments. There was no statistically

significant difference between learners' perceived level of interaction. Learners using the audio conference system displayed statistically significantly higher levels of actual verbal interaction than learners using the student response system. However, learners using the student response system had statistically significantly higher levels of overall interaction, or both voice and data interaction, as well as statistically significantly higher achievement levels.

The impact of interaction on students using instructional television in a distance learning environment can be summarized in the following two statements. First, learner's perceptions of interaction appear to impact their satisfaction. That is, learners that perceive high levels of overall interaction in instructional television courses appear to have higher levels of satisfaction than learners who perceive low levels of overall interaction. Also, learners' perceptions of their own level of interaction does not appear to have a great impact on their overall perceptions of the amount of interaction. Second, learners' perceptions of interaction do not appear to affect their achievement. Learners in instructional television courses appear to achieve at levels equal to or greater than their counterparts in traditional courses regardless of their perceptions of the level of interaction.

This study compared the effects of using a student response system, and the capabilities it represents, and an audio conferencing system, and

the capabilities it represents, in a video teletraining environment. The third dependent variable was the amount of perceived interaction by participants. That is, this study sought to determine if participants perceived differences in the amount of interaction during their treatments. The fourth and fifth dependent variable were the actual amount of verbal and total interactions. This study analyzed all interactions in both treatments to see if there were differences in the actual amounts of verbal and total interactions. As this is the first known study to compare the capabilities of a student response system with those of an audio conferencing system in the delivery of a distance learning class, it was possible that there may have been differences in the amounts of perceived interaction and the amounts of verbal and total interactions.

Viewer Response Systems

Viewer response technologies allow learners to interact with instructors and other learners primarily in one-way video and two-way audio instructional television systems. There are two primary types of viewer response technologies being used today. The first type, commonly known as audio conferencing systems, allows for audio, or voice communication between the learners and the instructor and between learners at different sites (Portway & Ostendorf, 1997). Audio conferencing systems typically provide one microphone for every two learners. When learners want to talk, they simple push down on the talk button and talk. The other type of

viewer response technology, commonly known as student response systems, allows for audio, or voice communication, between learners and the instructor and between learners at different sites. Student response systems also allow for data communication between learners and the instructor (Portway & Ostendorf, 1997). Student response systems provide a keypad with a built-in microphone for each learner. The instructor has the ability to display questions to learners over the video component, or television screen, and learners can answer those questions individually by using the data response function of the student response system. Instructors can ask multiple choice, true-false, and yes-no questions, as well as numeric value questions.

Currently, there is considerable debate about the educational effects of using student response systems over audio conferencing systems and vice versa. The purpose of this study was to document the differences between learners using a student response system, and the capabilities it represents, and learners using an audio conferencing system, and the capabilities it represents, on learner achievement, learner satisfaction, and the amounts of perceived and actual interaction in an interactive video teletraining class.

Numerous studies have identified a need for distance learners to interact with the instructor and other learners. Horn (1994), Ritchie and Newby (1989), Moore, Thompson, Quigley, Clark, and Goff (1990), Chute,

Balthazar, and Poston (1988), Hackman and Walker (1990), and Harper-Marinick and Gerlache (1986), all talk about the need for interaction in instructional television courses. However, the impact of interaction on learner achievement is mixed. Some researchers have found no significant difference in learner achievement (e.g., Ritchie & Newby, 1989; Simpson, Pugh, & Parchman, 1992) while others have found significant differences in learner achievement (e.g., Chambers, 1993; Hackman & Walker, 1990; Miller, McKenna, & Ramsey, 1993). The impact of interaction on learner satisfaction with instructional television courses has been well documented (e.g., Chute, Balthazar, & Poston, 1988; Fulford & Zhang, 1993; Hackman & Walker, 1990; Moore, Thompson, Quigley, Clark, & Goff, 1990; Ritchie & Newby, 1989). These authors all agree that the level of interaction has an impact on learner satisfaction in instructional television courses.

Early research conducted on the use of response systems in education and training courses focused primarily on studies using traditional courses. The results of these studies are mixed. Some reported increases in learner achievement and in levels of interaction (Beach, 1974; Casanova, 1971; Derry & Behnke, 1983; Horowitz, 1988, 1992, 1993; Kavitz & Totter, 1984; Whitehead & Bassett, 1975), and some do not (Bapst, 1971; Bessler & Nisbet, 1971; Brown, 1972; Ferrara & Thorkildsen, 1985; Rubin, 1970).

Whitehead and Bassett (1975) conducted a study using a data only response system in a traditional college level communications course. This type of response system provided only data interaction since all learners were in the room with the instructor. In a unit on self-concept, learners using the data only response system scored 5% higher on the exam than learners not using the response system. This study had interaction designed into the instruction to take advantage of the capabilities of the data only response system. The group that did not use the response system also did not have the additional interaction designed into their instruction.

Horowitz conducted several studies using a data only response system in traditional face-to-face courses. In his first study, Horowitz (1988) compared levels of learning, retention and involvement, and interaction of two groups of learners taking a traditional management development course. One group used a data only response system while the other group did not. This type of response system only provided data interaction for those learners using the response system. The study reported that learners using the data only response system had higher levels of learning, retention and involvement, and interaction. However, the differences were not as great as anticipated. The author attributed this lack of greater differences to the instructors' unfamiliarity with using the system effectively.

Horowitz (1992) reported the findings of another study conducted using management development learners in a traditional course. The course was divided into two groups, where one used the data only response system and the other one did not. Again, this type of response system only provided data interaction for those learners with a response system. The study reported that learners using the student response system had significantly higher levels of participation, interest, retention, and overall productivity.

Horowitz (1993) also reported the findings of four studies he conducted using data only response systems in traditional management development courses. He concluded that classrooms that use these response systems can be more productive with higher effectiveness than classrooms without these response systems. It should be noted that the response system used provided only data interaction capability.

In contrast to the above studies, Brown (1972) did not find differences when using a data only response system. He conducted a study of freshmen men and women in a traditional college level math course, with half of the learners using a data only response system. Brown was looking for changes in learner achievement, anxiety, or attitudes toward mathematics, but found no significant differences between the two groups. The response system used in this study provided only data interaction capability.

Ferrara and Thorkildsen (1985) identified three general causes as to why the early data only response systems failed to be adopted in traditional classes. First, they felt teachers were unable or unwilling to invest the time required to develop lessons and graphics these types of systems require. Second, early systems were expensive and unreliable. Lastly, early systems did not help instructors use the feedback effectively. Ferrara and Thorkildsen did believe that these three problems with early systems could, and would, be overcome with newer systems and teacher training (1985).

All of the previously cited studies on data only response systems were conducted in traditional, face-to-face courses. However, there have been a few studies that measured the effects of using student response systems in instructional television courses in distance learning environments. Like those studies on student response systems in traditional classrooms, the results of studies on student response systems in instructional television courses in distance learning environments are also mixed. Some studies support increased learner achievement and learner interaction (Chambers, 1993; Kwiatek, 1982; Thurman, 1995) and some do not (Britton, 1992; Garrison, 1994; Garvin-Kester, 1990; Lennon & Payne, 1997; Lucas, 1978).

Kwiatek (1982) conducted a study with 41 elementary teachers, divided into three groups, interactive cable television, one-way cable television, and traditional face-to-face training. Interactive segments were added to

the cable television instruction, but not the traditional instruction. Both cable television groups could see and hear the interactive segments, but only the interactive cable television group could interact via a data component. However, this interaction was limited to responding to questions by entering a selection on a terminal. Voice interaction was not available to either cable television group. The study found that the interactive viewing, entering selections on a terminal, yielded greater statistically significant effect on learning and interaction than viewing one-way without interaction or traditional face-to-face.

Chambers (1993) reported a case study that involved Ford Motor Company engineers taking instructional television graduate engineering courses at their job sites. Ford engineers received courses from Wayne State University professors over satellite delivered one-way video and two-way audio instruction. They communicated back to the professors using a student response system that provided both voice and data communication. Chambers reported that Ford claimed a 20 percent reduction in the time required to complete courses along with grades that were 17 to 19 percent higher than those students taking traditional courses. Chambers stated that the Wayne State University professors said that interaction was the key to the difference in performance. Unfortunately, no specific studies were cited to substantiate these claims.

Thurman (1995) reported the results of a number of nonspecific studies conducted with Ford Motor Company from Wayne State University using one-way video and two-way audio instruction. The courses were graduate level engineering courses taken by Ford engineers at their job sites from professors on the Wayne State University campus. Thurman reported that Ford engineers completed their engineering courses at a distance in 20% less time and with grades 15-17 points higher than their on-campus counterparts. These gains were attributed to the voice and data interactive capabilities provided by the student response system, according to the Wayne State University professors who taught the courses.

While a few of the studies looking at student response systems providing voice and data interaction capabilities in educational television environments have shown increased learner achievement, some do not. For example, the earliest study found using both voice and data student interaction was done by Lucas (1978). He compared achievement levels of learners taking a child development course over cable television split into two groups. One group had the ability to communicate with the instructor by using the telephone to call the instructor while the other group had the same telephone calling capability but also had the ability to respond to questions posed by the instructor using a data response terminal. Both groups watched the course at the same times. No significant differences in learner achievement were found. Lucas did note that the use of data

terminals was restricted due to the fear that those without data terminals would become lost, and thus concluded that low frequency use of data terminals does not contribute to learner achievement.

Ford Motor Company engineers taking graduate level engineering courses were also the subjects in Britton's study (1992). The study examined the perceptions of learners toward the course content, satisfaction with the instructional delivery method, and learner outcomes in a distance learning program. Learners were located at three sites, a lecture hall at the originating university, a conference room at Ford Motor Company, and at individual work stations at Ford Motor Company. Instruction was delivered by one-way video, two-way audio instructional television to the students at Ford, with learners at all sites able to respond to questions asked by the instructor by using a student response system with both voice and data capabilities. Britton found no differences in perceptions of course content or instructional delivery methods based on the site of the learners. Additionally, Britton found no differences in learner outcomes, while the grade distribution was reported as typical for a graduate engineering class.

Garrison (1994) also studied results of using a student response system with one-way video and two-way audio instructional television. The population studied was four graduate classes in computer sciences, electrical engineering and mechanical engineering. The study focused on

only the digital data response capability of the student response system and not the voice capability. Garrison found that higher graded learners used the response unit faster and more often than middle and low graded learners. However, Garrison did not report differences in learning outcomes.

Garvin-Kester (1990) studied the effects of student response system questions on learner attention and performance in a corporate television environment. The student response system provided both voice and data interaction capabilities. Subjects of the study were 181 line sales personnel from a major telecommunications firm. The study examined several variables, including high and low order questions. Garvin-Kester found no differences in learner achievement between groups given frequent high order (use level) questions and groups given less frequent low order (remember level) questions.

Twerdy and Berstene (1993) started a study to compare four groups taking the same course over instructional television at a major insurance company. Two groups were to have had a student response system, with both voice and data interaction capabilities, and two groups were not. The study was stopped by management, who considered the project a success, after the two groups using the student response system had completed their courses. Unfortunately, there were no comparative results from the study. However, this study apparently convinced decision makers that

student response systems were worth the investment, as the company did invest in the technology.

Lennon and Payne (1997) reported on a study comparing traditional resident-based classroom instruction to interactive video teletraining instruction in a Federal Aviation Administration (FAA) Quality Assurance course. Learners were 49 air traffic employees split into two control groups with a total of 31 learners and one treatment group, for interactive video teletraining, with 18 learners. The learners in the interactive video teletraining group were at four remote sites and each used a student response system keypad to communicate by voice and data with the instructor and by voice to learners at other sites. There were no statistically significant differences in learner achievement as measured by posttest scores or in learner satisfaction as measured by the standard FAA Academy end-of-course evaluation.

A pilot study was conducted for this study with 60 undergraduate students taking a marketing principles course (Payne & Payne, 1997; Appendix E). The students were equally split into two treatment groups, one using a student response system, with both voice and data interaction capabilities, and one using an audio conferencing system, with only a voice interaction capability. Both treatment groups had strategies designed into their class that maximized the capabilities of the technology with which the class was presented. This study found that learners using the student

response system had statistically significantly higher achievement scores and higher levels of overall interaction while learners using the audio conferencing system had significantly higher levels of verbal interaction. There were no statistically significant differences in learner satisfaction or in perceived levels of interaction.

The results of the research on student response systems is limited, mixed, and primarily related to traditionally delivered courses. From the studies identified so far, it would appear that student response systems, that provide both voice and data interaction capabilities, used with instructional television in distance learning environments can, in some instances, increase learner achievement, learner satisfaction, and the amount of interaction, both real and perceived.

This study provides comparative data between the effects of using student response system, and the capabilities it represents, and the effects of using an audio conferencing system, and the capabilities it represents, on four dependent variables. They are learner achievement, learner satisfaction, the amount of perceived interaction, and the amount of actual interaction in an interactive video teletraining class. As these two technologies had not been previously compared, this is the first study to provide data on the effects of such a comparison.

## Summary

This chapter hypothesized a conceptual framework for this study that stated there was a relationship between interaction, both real and perceived, and learner achievement and learner satisfaction. The literature review revealed that students learning from educational television in distance learning environments learned as much if not more than they could have expected to learn in traditional courses. However, student response systems that provide both voice and data interaction capabilities may be capable of increasing both the verbal and total amounts of interaction for educational television in distance learning environments. If using student response systems, and the capabilities they represent, can increase the amount of verbal interaction, total interaction, and the amount of perceived level of interaction, between learners and between learners and instructors, then it is possible that learner achievement and learner satisfaction with educational television courses will both be increased. It appears to make intuitive sense to argue that the more learners think about a subject and talk about a subject, the more that subject becomes integrated into the learners' memories and experiences, and the more learners come to know the subject and act upon it accordingly (Kwiatek, 1982).

# CHAPTER 3 - METHODOLOGY

This chapter discusses the methodology selected for the study. More specifically, it explains the design, procedure, instrumentation, sample, and data analysis aspects of the study. Each of these five components is discussed in a separate section below, complete with an explanation of why the particular aspect described was selected.

## Design

The methodology selected for this study was a non-equivalent control group, quasi-experimental design. The two distinguishing features of the non-equivalent control group design are the nonrandom assignment of subjects to treatment groups and the administering of a pretest and a posttest to all treatment groups (Borg & Gall, 1989). This design was selected because of the inability to randomly assign subjects to treatment groups. As the purpose of this study was to compare differences between a group using a student response system and a group using an audio conferencing system, and since the non-equivalent control group design does not require a no-treatment control group due to the administering of a pretest and a posttest to all groups (Borg & Gall, 1989), a no-treatment control group was not used in this study. Table 1 depicts the study design.

The use of a student response system, and the capabilities it represents, and the use of an audio conferencing system, and the

Table 1

Study Design

| | | | |
|---|---|---|---|
| Treatment Group 1 | Pretest | Class with Student Response System | Posttest & End-of Class Survey |
| Treatment Group 2 | Pretest | Class with Audio Conferencing System | Posttest & End-of-Class Survey |

capabilities it represents, were incorporated into two intact classes of the Principles of Marketing course at Langston University. One class was designated as treatment group 1 and was instructed on a discrete unit of the marketing principles course with the use of a student response system designed into it. The other class was designated as treatment group 2 and was instructed on the same discrete unit from the marketing principles course with the use of an audio conferencing system designed into it. The instructor was the regular instructor for the Principles of Marketing course, and designed and taught both treatments.

## Procedure

Each class met for approximately 50 minutes of instruction on a discrete unit of the Principles of Marketing course. Both classes were given the pretest one week before their respective treatments. Both classes were given their respective treatment during the sixth week of their semester. Treatment group 1 was given instruction on how to use the student response system keypad during the class meeting before their treatment class. Treatment group 2 was given instruction on how to use the audio conferencing system microphone during the class meeting before their treatment class.

Principles of Marketing is the basic course in marketing that introduces students to the comprehensive and integrated coverage of traditional and contemporary marketing topics. This course is typical of marketing principles courses taught by most schools and colleges of business at colleges and universities in the United States. The specific, discrete marketing unit taught was *Marketing Services*. The objectives for this unit of instruction are listed below. Each objective is also classified into one of Gagné's five domains of learning (Gagné & Briggs, 1974).

1. Describe four unique elements of service. This is a verbal information task. Verbal information outcomes are characterized by

stating or communicating information in some manner (Gagné & Briggs, 1974).

2. Recognize how services differ and how they can be classified. This is an intellectual skill task. Intellectual skill outcomes are characterized by showing how to carry out an intellectual operation in a specific application (Gagné & Briggs, 1974).

3. Understand the way in which consumers view and judge services. This is an intellectual skill task.

4. Understand how customer contact audits are used to identify service advantages. This is a verbal information task.

5. Understand the importance of internal marketing of services in organizations. This is a verbal information task.

6. Explain the role of the four "P's" in the services marketing mix. This is a verbal information task.

Treatment group 1 received instruction that had the voice and data capabilities of a student response system incorporated into the design and delivery of the Marketing Services unit. Two specific instructional strategies were incorporated that maximized the use of the student response system. One instructional strategy had six multiple choice questions imbedded into the instruction so that each student was provided the opportunity to answer using the data response capability of the student response system. The six preformatted data response questions

are shown in Appendix B. The other instructional strategy had the instructor verbally asking students questions and asking for and answering students' questions using the audio capability of the student response system. Six preplanned verbal questions were asked during the instruction to which students had the opportunity to respond verbally. These six preplanned verbal questions are at Appendix C.

The instructor received three training sessions on the operation of the student response system. The first session was a general orientation to the studio and all of its associated equipment. During this session, the instructor was given one-on-one instruction on the operation of the student response system by the Technical Director of the studio. This training session lasted approximately 45 minutes. The second training session consisted of the instructor conducting several walk-throughs of the class with the Technical Director. During this session, Instructional Systems Designers (ISD's) participated. The ISD's provided feedback on the instructor's presentation skills and use of the technology. The ISD's also provided responses to the instructor using the student response system as the students were anticipated to do during the class. This session lasted approximately 90 minutes. The third training session consisted of the instructor conducting a dress rehearsal of the class, with the ISD's acting as students and responding to the instructor using the student response system. The ISD's also provided feedback to the instructor on her

presentation skills and on her use of the technology upon completion of the rehearsal. This training session lasted approximately 60 minutes.

Treatment group 1 students were randomly assigned to one of two classrooms for the treatment. No students were in the studio with the instructor. Both classrooms were identical in terms of technological capabilities. The group was divided into two classrooms to allow for learner to learner interaction using the student response system. Data from the two classrooms using the student response system were combined and reported as treatment group 1.

Treatment group 1 was administered the end-of-class survey immediately following the treatment. The posttest was administered by the instructor during the first class period after the treatment. Students were provided feedback on their outcomes on the pretest and posttest upon completion of the posttest by the instructor.

Treatment group 2 received instruction that had the voice interaction capability of an audio conferencing system incorporated into the design and delivery of the Marketing Services unit. One specific instructional strategy was incorporated that maximized the use of the audio conferencing system. This instructional strategy had the instructor verbally asking students for questions and asking and answering students' questions using the audio capability of the audio conferencing system. The six data response questions asked in treatment 1 were also asked in

treatment 2 (Appendix B). The difference being the students in treatment 2 responded verbally. The same six preplanned verbal questions were also asked during the instruction (Appendix C).

The instructor received three training sessions on the operation of the audio conferencing system. The first session was a general orientation to the studio and all of its associated equipment. During this session, the instructor was given one-on-one instruction on the operation of the audio conferencing system by the Technical Director of the studio. This training session lasted approximately 45 minutes. The second training session consisted of the instructor conducting several walk-throughs of the class with the Technical Director. During this session, the ISD's participated by providing feedback on the instructor's presentation skills and use of the technology. The ISD's also provided responses to the instructor using the audio conferencing system as the students were anticipated to do during the class. This session lasted approximately 90 minutes. The third training session consisted of the instructor conducting a dress rehearsal of the class, with the ISD's acting as students and responding to the instructor using the audio conferencing system. The ISD's also provided feedback to the instructor on her presentation skills and on her use of the technology upon completion of the rehearsal. This training session lasted approximately 60 minutes.

Treatment group 2 students were randomly assigned to one of two classrooms for the treatment. No students were in the studio with the instructor. Both classrooms were identical in terms of technological capabilities. The group was divided into two classrooms to allow for learner to learner interaction using the audio conferencing system. Data from the two classrooms using the audio conferencing system were combined and reported as treatment group 2.

Treatment group 2 was administered the end-of-class survey immediately following the treatment. The posttest was administered by the instructor during the first class period after the treatment. Students were provided feedback on their outcomes on the pretest and posttest upon completion of the posttest by the instructor.

## Instrumentation

This section describes the instruments used to measure each of the five dependent variables of learner achievement, learner satisfaction, perceived level of interaction, actual level of verbal interaction and actual level of total interaction. Each dependent variable had its own measurement instrument. The first instrument to be described will be for the dependent variable of learner achievement.

### Learner Achievement

A pretest and a posttest were used to measure learner achievement. These two instruments were 20 item multiple choice examinations

covering the content presented in the class. The questions on the pretest and the posttest were the same. However, the questions on the posttest were rearranged from the pretest. The reliability of the posttest was $r$ = .67, based upon the Kuder Richardson Formula 20 (Ary, Jacobs, & Razavieh, 1990). A copy of both the pretest and the posttest are at Appendix D.

Learner Satisfaction

Learner satisfaction was measured using an end-of-class survey. This end-of-class survey was a modified version of the Telecourse Evaluation Questionnaire developed specifically for evaluating interactive video teletraining courses (Biner, 1993; Biner, Dean, and Mellinger, 1994). The original survey contained 33 Likert scale type items grouped into seven primary factors of telecourse satisfaction. The items were validated with two different groups of graduate and undergraduate university students across a number of university courses (Biner, 1993). The seven primary factors, with reliability measures expressed in Cronbach's coefficient alphas in parentheses, are listed below.

1. Instructor/Instruction ($r$ = .94) was comprised of items 1 through 14.
2. Technology ($r$ = .83) was comprised of items 15 through 20.
3. Course Management ($r$ = .80) was comprised of items 21 through 24.
4. At-Site Personnel ($r$ = .89) was comprised of items 25 and 26.

5. Promptness of Material Delivery ($r$ = .74) was comprised of items 27 and 28.

6. Support Services ($r$ = .60) was comprised of items 29 through 31.

7. Out-of-Class Communication with Instructor ($r$ = .51) was comprised of items 32 and 33.

All 33 of the items comprising the end-of-class survey had a Content Validity Ratio (CVR) of between .00 and +1.00 (Biner, 1993). CVR's, like correlation coefficients, can range from +1.00 to –1.00, where a 0.00 indicates that one-half of the content judges rated an item as *essential*, when following Lawshe's procedure (Biner, 1993). Therefore, all 33 items were selected as *essential* for evaluating telecourses by at least one-half of the judges. A copy of the original end-of-class survey is at Appendix E.

A pilot of this study was conducted using students from the study population (Payne & Payne, 1997; Appendix F). During data analysis, it became clear that factors 4-7, while clearly applicable to whole courses, did not apply to a one class study like this one. The results from those four factors confounded the pilot study findings for learner satisfaction. Therefore, it was decided to delete these items from the end-of-class survey for the actual study.

Five items were added to the end-of-class survey, which comprised a new fourth primary factor of telecourse evaluation called Tele-Response

System. This new primary factor, and five items comprising it, were added based upon the results from the pilot study and were added to help measure learner perceived levels of interaction. The five new items comprising Tele-Response System are listed below.

Item 25 - The Tele-Response System Let Students Know Whether They Were Comprehending the Material,

Item 26 - The Tele-Response System Let the Instructor Know Whether the Students Were Comprehending the Material ,

Item 27 - The Tele-Response System Gives the Students a Sense for Where They Stood in Relation to Other Students,

Item 28 - Use of the Tele-Response System Improved the Class Significantly, and

Item 29 - The Tele-Response System Helps Maintain Everyone's Attention.

Immediately following the treatment for each group, learners were asked to complete the end-of-class survey. Learners were asked to rate each item from 1 (Very Poor) to 5 (Very Good). The modified end-of-class survey used in this study is at Appendix G.

Perceived Level of Interaction

Measures of perceived levels of interaction were collected using the interaction related items on the end-of-class survey. There were eight

survey items covering perceived level of interaction. These items, with their respective survey item numbers, were:

Item 6 - Instructor Made Site Students Feel That They Were Part of Class,

Item 11 - Instructor Encouraged Participation,

Item 14 - Time Taken to Answer Site Calls During Class,

Item 25 - The Tele-Response System Let Students Know Whether They Were Comprehending the Material,

Item 26 - The Tele-Response System Let the Instructor Know Whether the Students Were Comprehending the Material ,

Item 27 - The Tele-Response System Gives the Students a Sense for Where They Stood in Relation to Other Students,

Item 28 - Use of the Tele-Response System Improved the Class Significantly, and

Item 29 - The Tele-Response System Helps Maintain Everyone's Attention.

These eight elements comprised the measure for perceived level of interaction. These elements were modified after the pilot study (Payne & Payne, 1997; Appendix F). The pilot study included six items (6, 11, 14, 18, 19, and 21) on the original end-of-class survey as measures of perceived level of interaction (Appendix E). However, upon closer review of the data from the pilot study, it was determined that items 18 - Clarity

of the Tele-Response System, 19 - Talkback Delays of Tele-Response System, and 21 - Ease of Operating Equipment at Sites were more related to tele-response system operation than to perceived level of interaction and thus they were not included as items for measuring perceived level of interaction for this study.

Items 25 through 29 were added as measures of perceived level of interaction after the pilot study. These items comprise a new fourth primary factor of telecourse evaluation, called Tele-Response System, and were added to increase the depth and breadth of the survey on perceived level of interaction. These items came from recommendations made in a Skill Dynamics (1993) study on the use of student response systems in interactive classrooms. The modified end-of-class survey used in this study is at Appendix G.

Actual Level of Verbal Interaction

Actual levels of verbal interaction were measured using observational data collected by video taping each treatment group. The video tapes were reviewed by two trained evaluators and each interaction event was classified according to Flanders Categories for Interaction Analysis (Amidon & Flanders, 1967). Flanders Categories for Interaction Analysis consists of ten categories. Seven categories are related to *Teacher Talk*, two are related to *Student Talk*, and one is related to *Silence and*

*Confusion.* The seven *Teacher Talk* categories are further divided into four interaction categories with *Indirect Influence*, in which the teacher is responding to students, and three interaction categories with *Direct Influence*, in which the teacher initiates interaction with students. The two *Student Talk* categories consist of one interaction category with *Indirect Influence*, in which the student is responding to the instructor or another student, and one interaction category with *Direct Influence*, in which the student is initiating interaction with the instructor or another student. The tenth category is *Silence and Confusion.* A copy of Flanders Categories for Interaction Analysis is contained in Appendix A.

Three instruments for analyzing verbal interaction were reviewed before Flanders Categories for Interaction Analysis was selected for this study. The other two instruments were modified forms of the Flanders instrument. The Cognitive Interaction Analysis System (CIAS) is very similar to Flanders except for the two categories for *Student Talk* (Johnson, 1976). CIAS student talk categories are *Cognitive Student Talk* and *Non-Cognitive Student Talk.* As this study was only interested in the amount of interaction and not whether student interaction was cognitive or non-cognitive in nature, Flanders Categories of Interaction Analysis was selected over CIAS.

The other instrument reviewed was the Distance Interaction Analysis System (DIAS) (Murphy, 1995). DIAS is identical to CIAS except for the two student talk categories. DIAS divides each of the two student talk categories of *Cognitive Student Talk* and *Non-Cognitive Student Talk* into two categories based upon the student's location as being either *local* or *remote*. The *local* location was defined as the same classroom as the instructor while the *remote* location was defined as a site where the instructor was not located (Murphy, 1995). As this study was only interested in the amount of interaction, and since a *local* condition did not exist, Flanders Categories of Interaction Analysis was selected over DIAS.

Flanders' (1970) use of this tool required the coding of categories about every three seconds. However, a number of researchers (Borg & Gall, 1989; Fulford & Zhang, 1994; Murphy, 1995; Vietor, Brubaker, Milford, & Johnson, 1985) found advantages to using video tape recordings rather than using live observations. They found video tape analyses allowed the rater to record the exact time a category occurred, allowed the replaying of the instruction to ensure that all coding was captured, and helped to ensure that all coding was accurate without developing the level of expertise required to do so under the constraints imposed by a live classroom. For this study, video taping allowed the coding of events,

defined as each occurrence of a category, instead of recording the instruction into three second bits.

Two trained evaluators used the video tape of each treatment group class to record each interaction event for each of the two treatments. For each treatment group, the evaluators watched each tape separately and then together. The result of the second viewing provided a single listing of the amounts of the different types of interaction as agreed to by both evaluators for each treatment group.

Actual Level of Total Interaction

Actual levels of total interaction were measured using the same data collected for the actual level of verbal interaction, and by adding the total number of data responses from treatment group 1 to their total number of verbal interactions. The total number of data interactions for treatment group 1 were obtained by downloading the number from the student response system host computer which automatically records each data interaction for each students. Treatment group 1's total amount of interaction consisted of their verbal interactions plus their data interactions, while treatment group 2's total amount of interaction was the same as their total amount of verbal interaction.

## Sample

The study sample consisted of 70 primarily upper division, or junior and senior level, students at Langston University taking the Principles of

Marketing course. Two intact classes of the Principles of Marketing course were used for this study, with one class being designated as treatment group 1 and the other class being designated as treatment group 2. As students are not randomly assigned to treatment groups in a nonequivalent control group study, it is important to describe the characteristics of each group. This description is to help the reader determine if any observed group differences may have been caused by preexisting group differences on some variable or by the treatment (Borg & Gall, 1989).

Student characteristics for treatment group 1, with a total of 35 subjects, are listed below.

1. Twenty-nine percent of the subjects were male and 71% were female.
2. Average age was 21.5, with ages ranging from 19 to 31 years of age.
3. Three percent of the students were married and 9% had children.
4. Eighty percent of the students were African-American, with the remaining percent being split between African, with 11% and Caucasian, with 9%.
5. Sixty-nine percent were employed either full or part-time.
6. Average grade point was 2.3, with a range from 2.0 to 3.2.
7. Sample students were majoring in business, journalism, health administration, or physical therapy.

8. This was the first class taken over interactive video teletraining for 86% of the subjects.

Student characteristics for treatment group 2, with a total of 35 subjects, are listed below.

1. Exactly 25.7% of the subjects were male and 74.3% were female.
2. Average age was 21.8, with ages ranging from 19 to 32 years of age.
3. Nine percent of the students were married and 17.1% have children.
4. Eighty-two percent of the students were African-American, with the remaining percent being split between African, with 13%, and Caucasian, with 5%.
5. Fifty-one percent were employed either full or part-time.
6. Average grade point was 2.4, with a range from 2.0 to 3.1.
7. Sample students were majoring in business, journalism, health administration, or physical therapy.
8. This was the first class taken by interactive video teletraining for 89% of the subjects.

This population was chosen because Langston University was considering expanding its distance learning offerings, and in particular, its interactive video teletraining courses, as well as selecting new technology to deliver distance learning courses. As Langston University currently does not offer interactive video teletraining courses, most of the students had not previously been exposed to either technology and thus did not

have preconceived opinions about the technologies. Also, the students were available in the area for testing and the instructor was willing to participate in the study.

## Data Analysis

In order to determine treatment effects and differences between the use of a student response system, and the capabilities it represents, and an audio conferencing system, and the capabilities it represents, a non-equivalent control group, quasi-experimental design was used. Pretest data, in the form of multiple choice test results, was collected one week before the treatment and posttest data was collected during the first class meeting following the treatment for both groups. The end-of-class survey was administered to each group immediately after their treatment. Both treatment groups were video taped to allow for analyzing the verbal interaction.

### Securing Informed Consent

Voluntary participation was secured from the instructor and all of the students. In accordance with the Institutional Review Board's protocol for the use of human subjects, an Informed Consent Form was distributed to all students in each class. Arrangements were made with the instructor to collect the consent forms. An Informed Consent Form was received from each student participating in this study. A copy of the Informed Consent

Form is at Appendix H. Written permission to video tape each class was also received from the instructor.

Study Variables

This study had one independent variable and four dependent variables. The independent variable was the variable to be manipulated. Dependent variables were those variables measured to determine the effects of the independent variable, or the experimental treatments (Borg & Gall, 1989).

Independent variable. The independent variable for this study was the experimental treatment, which had two levels. The Marketing Services unit of instruction with the capabilities of a student response system designed into it was one level of the independent variable. The other level of the independent variable was the Marketing Services unit of instruction with the capabilities of an audio conferencing system designed into it.

Dependent variables. There were five dependent variables in this study. They were learner achievement, learner satisfaction, perceived level of interaction, actual level of verbal interaction and actual level of total interaction. These five dependent variables were what was measured to determine the effects of the two experimental treatments.

Hypotheses

This section presents the hypotheses for this study. Each research question was converted into a null hypothesis. Each null hypothesis is

followed by the measure and the procedure that was used to test each hypothesis, and thus, answer each research question.

1. There will be no significant difference between the mean posttest scores of learner achievement for learners using a student response system and learners using an audio conferencing system in an interactive video teletraining class.

Descriptive statistics (means and standard deviations) were calculated for the pretest and posttest for both groups. Analysis of covariance (ANCOVA) was calculated in which the posttest means were compared while controlling for pre-existing group differences using pretest scores. Lack of internal validity, caused by pre-existing differences between the groups, is the main weakness with the non-equivalent control group design. ANCOVA was used to make adjustments to the posttest means of the two groups to reduce any effect of initial group differences and to test for statistical significance (Borg & Gall, 1989). The level of statistical significance for testing the effects of the treatment on learner achievement was $p < .05$. A power analysis, the statistical ability of the experiment to reject the null hypothesis when it is actually false (Moore & McCabe, 1993), was also calculated for this test.

2. There will be no significant difference in mean ratings of satisfaction between learners using a student response system and

learners using an audio conferencing system in an interactive video teletraining class.

Descriptive statistics (means and standard deviations) were calculated from the end-of-class survey responses. Significant group differences were examined statistically using the *t*-test for differences between group means. The *t*-test is used most frequently for analyzing differences between group means (Borg & Gall, 1989). The *t*-test was conducted for the total questionnaire means, the four primary factors of telecourse satisfaction means, and for each of the individual items comprising any of the four primary factor means that were significantly different. The level of significance for testing this hypothesis was $p < .05$. A power analysis was also calculated for this test.

3. There will be no significant difference between the mean levels of perceived interaction for learners using a student response system and learners using an audio conferencing system in an interactive video teletraining class.

Descriptive statistics (means and standard deviations) were calculated from the responses to the eight perceived level of interaction related items on the end-of-class survey. Significant group differences were examined statistically using the *t*-test for differences between the group means for total perceived level of interaction scores (Borg & Gall, 1989). According to

Borg and Gall (1989), the *t*-test is the most commonly used statistical procedure used to make theses types of analytical comparisons. Additional *t*-tests were also conducted for each of the eight elements comprising the overall perceived level of interaction scores between the groups. The level of significance for testing this hypothesis was $p < .05$. A power analysis was also conducted for this test

4. There will be no significant differences between the mean levels of verbal interaction for learners using a student response system and learners using an audio conferencing system in an interactive video teletraining class.

Each treatment class was video taped. Two trained evaluators viewed each video tape individually and classified each interaction event into one of the ten Flanders Categories for Interaction Analysis. They then viewed each video tape together and reconciled their evaluations to come up with one set of classifications for each treatment group.

The frequency counts from the classifications for each treatment group were compared for significant differences using the Chi-Square test. This test was selected since the research data are in the form of frequency counts and the categories into which the data fall are discrete. For this type of situation, the Chi-Square test should be used according to Borg and Gall (1989). The total frequency count for all interactions as well as for

each of the ten individual categories from the two groups were compared for significant differences. The level of significance for testing this hypothesis was $p < .025$. A power analysis was also conducted for this test.

5. There will be no significant differences between the mean levels of total interaction for learners using a student response system and learners using an audio conferencing system in an interactive video teletraining class.

Each treatment class was video taped. Two trained evaluators viewed each video tape individually and classified each interaction event into one of the ten Flanders Categories for Interaction Analysis. They then viewed each video tape together and reconciled their evaluations to come up with one set of classifications for each treatment group. Additionally, the total number of data responses for treatment group 1 was added to their total number of verbal interactions to account for treatment group 1's total amount of interaction.

The total frequency counts from the classifications for each treatment group were compared for significant differences using the Chi-Square test. This test was selected since the research data are in the form of frequency counts and the categories into which the data fall are discrete. For this type of situation, the Chi-Square test should be used according to Borg and Gall (1989). The total frequency count for all interactions as well as for

each of the ten individual categories from the two groups were compared for significant differences. The level of significance for testing this hypothesis was $p < .025$. A power analysis was also conducted for this test.

Controlling Potential Sources of Bias

Bias refers to systematic errors in a research study which produce results that are slanted in a single direction, usually in the direction favored by the researcher (Borg & Gall, 1989). All researchers are products of their environments, which shape and distort their perceptions in many ways. These perceptions shape the actions and beliefs of researchers and affect the methods, techniques and procedures they select. Therefore, biases can influence the work of even the most competent researchers (Borg & Gall, 1989). An effort was made to control potential sources of bias that could affect the results of this study. The potential sources of bias included novelty effect, experimenter bias, instructor bias, and observer bias.

Novelty effect with new technology was one source of potential bias. Novelty effect results from the increased effort and attention research subjects tend to give technology that are new to them (Clark, 1983, Clark & Sugrue, 1991). As Langston University does not offer courses delivered by these technologies, any novelty effect could have impacted students

from both treatments. However, any effect should have affected both groups approximately the same, thus canceling out any difference.

Experimenter bias was another potential source of bias that could affect the results of this study. Researchers often have expectations about the outcomes of their studies and these expectations sometimes get transmitted to subjects in some way that affects their behavior (Borg & Gall, 1989). This source of bias is best controlled by the researcher and the subjects not working directly together. For this study, the researcher did not have direct or indirect contact with the subjects either before or during data collection.

Another potential source of bias for this study was instructor bias. This type of bias results from the instructor having a bias toward or against one of the treatments and transmits that bias to the subjects. For this study, the instructor was selected due to her relative neutrality towards both of the technologies. Training in the use of both technologies was done to stress the capabilities of each technology and not as a comparison between the two technologies. After the study, the instructor stated that she remained indifferent to both technologies.

Observer biases were another potential source of errors for this study. Five potential types of observer biases were identified and controlled (Borg & Gall, 1989).

1. The effect of the observer on the observed occurs when subjects change their behavior because they realized they were being observed (Borg & Gall, 1989). Both treatment classes took place at Federal Aviation Administration facilities. However, since there were no observers in the room with the students, this type of observer bias was neutralized.

2. The effect of the observer on the setting occurs when the presence of the observer changes the setting of the observation (Borg & Gall, 1989). Since no observers were in the classrooms with the students during the treatment, this effect was canceled.

3. Rating errors, such as error of leniency and error of central tendencies could also have affected the outcome of this study (Borg & Gall, 1989). Error of leniency occurs with observers who tend to rate individuals at the higher ends of the rating scale. Since the scale used in Flanders Categories of Interaction Analysis was nominal, this type of error did not apply.

4. Error of central tendency occurs with observers who tend to rate individuals in the middle of the scale rather than make difficult decisions about placing them at either end (Borg & Gall, 1989). Again, since the scale used in Flanders Categories of Interaction Analysis was nominal, this type of error also did not apply.

5. Errors of omission occur when the observer overlooks some behavior that should have been recorded (Borg & Gall, 1989). This type of bias was

neutralized by the use of two observers, first reviewing the video tapes individually and then together to arrive at a single set of observations for each treatment.

## Summary

This was a non-equivalent control group, quasi-experimental study. The design was selected due to the inability to randomly assign subjects to treatment groups. Each group was administered a pretest and a posttest, as well as an end-of-class survey. Subjects were students enrolled in the Principles of Marketing course at Langston University. The procedure involved one group receiving a unit of instruction on Marketing Services with the capabilities of a student response system designed into the instruction and the other group receiving the same unit of instruction with the capabilities of an audio conferencing system designed into the instruction. Each treatment group had instructional strategies designed into the instruction that maximized the capabilities of each of the two technologies being compared. The same instructor taught both treatment groups and received adequate instruction and practice on the use of both systems. Both classes were video taped for interaction analysis to compare the amount of interaction between the two treatments. One independent and five dependent variables for the study were identified. Null hypotheses were constructed to test for differences between the two treatment groups on the dependent variables of learner achievement,

learner satisfaction, perceived level of interaction, and the actual level of interaction. Instruments to measure the effect of the independent variable on each of the dependent variables were identified. Statistical procedures were identified to analyze the data collected for each of the dependent variables. Potential sources of bias were identified and addressed for this study.

# CHAPTER 4 - FINDINGS

This chapter presents the findings of the study. It reviews each research question, its corresponding hypothesis and the results achieved for each of the five dependent variables. Findings for each of the five dependent variables are presented in separate sections.

## Learner Achievement

This section presents the results for learner achievement. Learner achievement was measured by scores on the 20-item multiple choice posttest. The posttest was administered the first class meeting after each group's treatment. The research question for learner achievement was, *Will the use of a student response system in an interactive video teletraining class increase learner achievement more than the use of an audio conferencing system?* The null hypothesis used to test this research question was, *There will be no significant difference between the mean posttest scores of learner achievement for learners using a student response system and learners using an audio conferencing system in an interactive video teletraining class.* The results of the pretests and the posttests for the two groups are shown in Table 2.

As shown in Table 2, both treatment groups had the same exact score on the pretest ($M = 6.89$). However, treatment group 1 ($M = 11.26$) scored higher than treatment group 2 ($M = 9.57$) on the posttest. The results of

the analysis of covariance show that the posttest means were statistically significantly different, $F(1, 67) = 8.13, p < .05$. That is, treatment group 1, the group that used the student response system, scored statistically significantly higher on the posttest than did treatment group 1. The power of this test was 0.72.

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Table 2

Learner Achievement Results

| | Treatment Group 1 ($n = 35$) | Treatment Group 2 ($n = 35$) | $F$-Value |
|---|---|---|---|
| Pretest | | | |
| Standard Deviation | 2.29 | 2.11 | |
| Mean | 6.89 | 6.89 | |
| Posttest | | | |
| Standard Deviation | 2.75 | 2.49 | |
| Mean | 11.26 | 9.57 | 8.13* |

* $p < .05$.

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Based upon the results of the analysis of covariance performed on the posttest scores measuring learner achievement, the null hypothesis was rejected. Learners using a student response system had statistically significantly higher scores on the posttest than did learners using an audio conferencing system. Based upon the results of this study, the answer to the research question is yes, the use of a student response system did

increase learner achievement more than the use of an audio conferencing system in an interactive video teletraining class.

## Learner Satisfaction

This section presents the results for learner satisfaction. Learner satisfaction was measured by the administration of a 29 item Likert-type end-of-class survey. The survey was administered immediately after the treatment for each group. Students were asked to rate each item from 1 (Very Poor) to 5 (Very Good). If an item was left unanswered, no score was entered for its rating. The research question for learner satisfaction was, *Will learners completing an interactive video teletraining class using a student response system report higher levels of satisfaction than learners using an audio conferencing system?* The null hypothesis used to test this research question was, *There will be no significant difference between the mean levels of perceived interaction for learners using a student response system and learners using an audio conference system in an interactive video teletraining class.* Table 3 shows the results for each of the four primary factors comprising learner satisfaction as well as for the overall survey results. The mean score and standard deviation for each of the 29 items contained in the end-of-class survey are shown in Appendix I.

The results in Table 3 show treatment group 1 ($M = 4.47$) rated their overall satisfaction level higher than did treatment group 2 ($M = 4.46$), but

not statistically significantly higher, $t$ (70) = 0.27, $p < .05$. The power of this test was 0.05. Also, while treatment group 1 rated three of the four primary factors higher than treatment group 2, there were no statistically significant differences between any of the mean scores for any of the four primary factors that comprise the measure of learner satisfaction.

Table 3

End-of-Class Survey Results by Factor

| Factor | Treatment Group 1 ($n$ = 35) | Treatment Group 2 ($n$ = 35) | $t$-Value |
|---|---|---|---|
| 1 - Instructor/Instruction | | | |
| Standard Deviation | 0.63 | 0.59 | |
| Mean | 4.58 | 4.63 | 1.14 |
| 2 - Technology | | | |
| Standard Deviation | 0.84 | 0.81 | |
| Mean | 4.35 | 4.31 | 0.44 |
| 3 - Course Management | | | |
| Standard Deviation | 0.67 | 0.69 | |
| Mean | 4.41 | 4.28 | 1.43 |
| 4 - Tele-Response System | | | |
| Standard Deviation | 0.80 | 0.72 | |
| Mean | 4.36 | 4.31 | 0.59 |
| Total Survey | | | |
| Standard Deviation | 0.73 | 0.69 | |
| Mean | 4.47 | 4.46 | 0.27 |

Based upon the results of the $t$-test measuring learner satisfaction, the null hypothesis cannot be rejected. Learners using a student response system did not rate their level of satisfaction higher than learners using

an audio conferencing system in an interactive video teletraining class. Based upon the results of this study, the answer to the research question is no, learners completing an interactive video teletraining class using a student response system did not report higher levels of satisfaction than learners using an audio conferencing system.

## Perceived Level of Interaction

This section presents the results for perceived level of interaction. Perceived level of interaction was measured by eight items on the end-of-class survey. The survey was administered immediately after the treatment for each group. Learners were asked to rate each item from 1 (Very Poor) to 5 (Very Good). If an item was left unanswered, no score was entered for its rating. The research question for perceived level of interaction was, *Will learners using a student response system in an interactive video teletraining class perceive higher levels of interaction than learners using an audio conferencing system?* The null hypothesis used to test this research question was, *There will be no significant difference between mean levels of perceived interaction for learners using a student response system and learners using an audio conferencing system in an interactive video teletraining class.* Table 4 shows the results for perceived level of interaction as well as for each of the eight items comprising perceived level of interaction.

Table 4

Perceived Level of Interaction Results

| Item | Treatment Group 1 ($n = 35$) | Treatment Group 2 ($n = 35$) | $t$-Value |
|---|---|---|---|
| 6 - Instructor Made Students Feel They Were a Part of the Class | | | |
| Standard Deviation | 0.74 | 0.46 | |
| Mean | 4.60 | 4.72 | 0.72 |
| 11 - Instructor Encouraged Participation | | | |
| Standard Deviation | 0.58 | 0.52 | |
| Mean | 4.69 | 4.76 | 0.51 |
| 14 - Time Taken to Answer Site Calls During Class | | | |
| Standard Deviation | 0.84 | 0.58 | |
| Mean | 4.23 | 4.60 | 1.90 |
| 25 - The Tele-Response System Let Students Know Whether They Were Comprehending the Material | | | |
| Standard Deviation | 0.66 | 0.75 | |
| Mean | 4.44 | 4.29 | 0.80 |
| 26 - The Tele-Response System Lets the Instructor Know Whether the Students Were Comprehending the Material | | | |
| Standard Deviation | 0.65 | 0.68 | |
| Mean | 4.60 | 4.25 | 2.00 |
| 27 - The Tele-Response System Gives the Students a Sense for Where They Stood in Relation to Other Students | | | |
| Standard Deviation | 0.78 | 0.72 | |
| Mean | 4.26 | 4.42 | 0.80 |

| | | | |
|---|---|---|---|
| 28 - Use of the Tele-Response System Improved the Class Significantly | | | |
| Standard Deviation | 0.83 | 0.71 | |
| Mean | 4.29 | 4.38 | 0.43 |
| 29 - The Tele-Response System Helps Maintain Everyone's Attention | | | |
| Standard Deviation | 1.00 | 0.78 | |
| Mean | 4.23 | 4.21 | 0.08 |
| Total | | | |
| Standard Deviation | 0.78 | 0.68 | |
| Mean | 4.42 | 4.46 | 0.59 |

Table 4 shows the mean rating for treatment group 2 ($M = 4.46$) on the eight items comprising perceived level of interaction was higher than the mean rating for treatment group 1 ($M = 4.42$). However, the difference was not statistically significant, $t\ (70) = 0.59$, $p < .05$. The power of this test was 0.06. Based on the results, there was no statistically significant difference in the overall amount of perceived interaction between the two groups. Also, there were no statistically significant differences between the mean scores for any of the eight items comprising the measure of perceived level of interaction.

Based upon the results of the *t*-test measuring perceived level of interaction, the null hypothesis cannot be rejected. There was no statistically significant difference between mean levels of perceived interaction between the two groups. Based upon the results of this study,

the answer to the research question is no, learners using a student response system in an interactive video teletraining class did not perceive higher levels of interaction than learners using an audio conferencing system.

## Actual Level of Verbal Interaction

This section presents the findings for the actual level, or amount, of verbal interaction. The actual level of verbal interaction was measured using video taped recordings of each treatment session to record the total number of verbal interactions overall and to classify each verbal interaction into one of ten Flanders Categories for Interaction Analysis. Two trained evaluators watched each video taped treatment separately, classifying each interaction event into one of the ten Flanders Categories for Interaction Analysis. The two evaluators then watched each treatment group video tape together to resolve any differences and came up with a final set of total interactions for each treatment group. The research question for actual level of verbal interaction was, *Will learners completing an interactive video teletraining class using a student response system display increased levels of verbal interaction over learners using an audio conferencing system?* The null hypothesis used to test this research question was, *There will be no significant differences between the mean levels of verbal interaction for learners using a student response system and*

*learners using an audio teleconferencing system in an interactive video teletraining class.* The final number of interactions for each category and for the overall number of verbal interactions for each treatment group are shown in Appendix J.

Appendix J shows that treatment group 2 (274 interactions) had a statistically significantly greater total number of verbal interactions than did treatment group 1(101 interactions) as recorded in Flanders Categories for Interaction Analysis, $\chi^2$ (1, $N$ = 70) = 79.81, $p$ < .025. The power of this test was 0.95. A further analysis of the data shows that this effect is attributable to the number of verbal interactions in Category 3 - Accepts or Uses Ideas of Students, $\chi^2$ (1, $N$ = 70) = 27.77, $p$ < .025, Category 4 - Asks Questions, $\chi^2$ (1, $N$ = 70) = 24.24, $p$ < .025, and Category 8 - Student Talk - Response, $\chi^2$ (1, $N$ = 70) = 66.13, $p$ < .025. The results in Appendix J show that treatment group 2 had a statistically significantly greater total number of overall verbal interactions than did treatment group 1.

Based upon the results of the chi-square test on the data collected using Flanders Categories for Interaction Analysis, the null hypothesis is rejected. Learners using an audio conference system had a greater number of overall verbal interactions than learners using a student response system. Based upon the results of this study, the answer to the research question is no, learners completing an interactive video

teletraining class using a student response system did not display increased levels of verbal interaction over learners using an audio conferencing system. In fact, learners using an audio conferencing system had a greater number of overall verbal interactions than did learners using a student response system.

It should also be noted that while treatment group 2, the group using the audio conferencing system, had a higher number of students talk than did treatment group 1, the actual number of students talking was very small. Only 9 out of 35 students, or 26%, accounted for all of the student talk for treatment group 2, and of those nine students, only six spoke more than once. Only 6 of 35 students, or 17%, accounted for all of the student talk in treatment group 1, with five of the six students speaking more than once.

### Actual Level of Total Interaction

This section presents the findings for the actual level, or amount, of total interaction. The actual level of total interaction was measured using video taped recordings of each treatment session to record the total number of verbal interactions overall, plus the data interactions provided by treatment group 1. Treatment groups 1's total amount of interaction consisted of their number of verbal interactions plus the number of data interactions. Treatment group 2's total amount of interaction was equal to the total number of verbal interactions. The research question for actual

level of total interaction was, *Will learners completing an interactive video teletraining class using a student response system display increased levels of total interaction over learners using an audio conferencing system?* The null hypothesis used to test this research question was, *There will be no significant differences between the mean levels of total interaction for learners using a student response system and learners using an audio teleconferencing system in an interactive video teletraining class.* The final number of total interactions for each treatment group are shown in Appendix J.

As shown in Appendix J, treatment group 1 had six questions asked for which the 35 students had the opportunity to respond using the data response capability of their keypad. Students in treatment group 2 had these same questions asked, but could only respond verbally. Thirty-four of 35 students in treatment group 1 responded to questions one and two, and all 35 students responded to questions three through six, providing 208 total data responses to the six questions. These 208 total data responses were added to treatment group 1's number of verbal interaction events as recorded in Flanders Categories of Interaction Analysis, to give treatment group one a 309 total interaction events.

Treatment group 1 (309 interactions) had a greater amount of total interaction than did treatment group 2 ( 274 interactions), but the not

statistically significantly greater, $\chi^2$ (1, $N$ = 70) = 2.10, $p$ < .025. The power of this test was 0.58. The results in Appendix J show that there was not statistically significant difference between the two groups on actual level, or amount, of total interaction.

Based upon the results of the chi-square test on the data collected using Flanders Categories for Interaction Analysis, the null hypothesis cannot be rejected. Learners using a student response system did not have a greater number of total interactions than learners using an audio conferencing system. Based upon the results of this study, the answer to the research question is no, learners completing an interactive video teletraining class using a student response system did not display increased levels of total interaction over learners using an audio conferencing system.

The audio and data interaction capability provided by the student response system used by treatment group 1 resulted in a greater total number of students interacting during the instruction than did the audio only interaction capability used by treatment group 2. In fact, all 35 students used the data interaction capability of the student response system multiple times, taking advantage of the opportunity to interact. While students using the student response system were encouraged as a group to interact using the data capability by the instructor, they were not

required to do so. It appears that students using the student response system took advantage of the opportunity to interact using the data interaction capability.

## Summary

This chapter presented the findings for the study. The research question and null hypothesis for each of the five dependent variables were reviewed, followed by the study results. The impact of the results upon the null hypothesis and the research question for each dependent variable was presented.

There was a statistically significant difference in learner achievement. Treatment group 1, the group that used the student response system, scored significantly higher on the posttest than did treatment group 2. The null hypothesis for the dependent variable of learner achievement was rejected.

There was no statistically significant difference in learner satisfaction. That is, neither group scored significantly higher than the other group on the end-of-class survey measuring learner satisfaction. The null hypothesis for the dependent variable of learner satisfaction could not be rejected.

There was no statistically significant difference in perceived level of interaction. That is, neither group scored higher than the other group on the mean score for perceived level of interaction. The null hypothesis for

the dependent variable of perceived level of interaction could not be rejected.

There was a statistically significant difference in the actual level, or amount, of verbal interactions in favor of treatment group 2. That is, the group using the audio conferencing system displayed a significantly greater number of total verbal interactions than the group using the student response system, as measured by Flanders Categories for Interaction Analysis. The null hypothesis for the dependent variable of actual level of verbal interaction was rejected.

There was no statistically significant difference in the actual level, or amount, of total interactions. That is, neither group displayed a significantly greater number of total interactions. The null hypothesis for the dependent variable of actual level of total interaction could not be rejected.

# CHAPTER 5 - DISCUSSION, CONCLUSIONS & RECOMMENDATIONS

The purpose of this chapter is to provide a summary of the study and a discussion on the study's findings. Based upon the discussion of the findings, conclusions are drawn about the study. Recommendations for further research are made based upon the findings and conclusions of the study.

## Study Summary

The purpose of this study was to investigate the effects of using a student response system on learner achievement, learner satisfaction, and the amount of perceived interaction, the amount of verbal interaction, and the amount of total interaction. This study compared the effects of using a student response system, and the capabilities it represents, to the effects of using an audio conferencing system, and the capabilities it represents, on learner achievement, learner satisfaction, the amount of perceived interaction, the amount of verbal interaction, and the amount of total interaction in an interactive video teletraining class.

This study used a non-equivalent control group, quasi-experimental design, in which two intact Principles of Marketing classes at Langston University served as the treatment groups. Treatment group 1 ($n$ = 35) had the capabilities of a student response system designed into its delivery. Treatment group 2 ($n$ = 35) had the capabilities of a student

response system designed into its delivery. The same instructor designed and taught both classes. Both groups were administered a pretest and a posttest to measure learner achievement, and an end-of-class questionnaire to measure learner satisfaction and perceived level of interaction. Actual level, or amount, of verbal interaction was determined using Flanders Categories for Interaction Analysis. Actual level, or amount, of total interaction was determined using Flanders Categories for Interaction Analysis and the total number of data interactions as recorded by the student response system host computer.

## Discussion and Conclusions

This section discusses the results of the study based upon the findings for each of the five dependent variable. Conclusions for each dependent variable were drawn from the findings. Implications of the findings for practice are provided if such implications appear to exist. This section will begin with a discussion of the findings related to the dependent variable related to learner achievement.

### Learner Achievement

Learner achievement was measured using a posttest that was administered the first class meeting following the treatment. Analysis of covariance was used to analyze pretest and posttest data to determine statistically significant differences between adjusted group mean posttest scores. This study found a statistically significant difference in learner

achievement for treatment group 1, the group that had the use of a student response system designed into their instruction, $F(1,67) = 8.13$, $p < .05$.

This statistically significant difference between the two groups is a potentially noteworthy finding. It contradicts the generalized media comparison studies' finding of no statistically significant difference of Salomon and Clark (1977) and others. It also contradicts the generalized educational television studies' finding of no statistically significant difference of Chu and Schram (1967, 1975) and others. This finding is, however, consistent with more recent studies comparing the use of student response systems in interactive video teletraining environments with traditional classroom instruction (e.g., Kwiatek, 1982; Thurman, 1995). While the pilot study for this study is the only known research comparing two interactive video teletraining groups using different viewer response technologies, the results from this study are consistent with the findings from the pilot study (Payne & Payne, 1997; Appendix F). If this finding holds across repeated studies, it could then be argued that learners using a student response system have an advantage of learners using an audio conferencing system in interactive video teletraining classes. Decision makers should carefully consider this finding when making decisions

about which viewer response technology to select for their interactive video teletraining system.

Learner Satisfaction

Learner satisfaction was measured using the 29 item, Likert scale, end-of-class evaluation. The 29 items were grouped into four primary factors. Differences between group means for the total end-of-class survey and for each of the four primary factors were analyzed using the *t*-test. This study found no statistically significant differences between group means on the end-of-class survey, $t\ (70) = 0.27, p < .05$, or for any of the four primary factors comprising the end-of-class evaluation. This finding would appear to be consistent with the available research comparing learner satisfaction in interactive video teletraining courses with traditional classroom instruction (e.g., Chung, 1991; Simpson, Pugh, & Parchman, 1993). While the pilot study for this study is the only known research comparing two interactive video teletraining groups using different viewer response technologies, the results from this study are consistent with the findings from the pilot study (Payne & Payne, 1997; Appendix F). Decision makers should exercise caution in selecting a viewer response technology based upon the belief that one system will increase learner satisfaction more than the other system in interactive video teletraining classes.

Perceived Level of Interaction

Perceived level of interaction was measured using the eight interaction related items on the end-of-class survey. Treatment group means were compared for the total ratings of perceived level of interaction and for each of the eight items comprising the overall rating for perceived level of interaction. This study found no statistically significant differences between treatment group means for perceived level of interaction, $t$ (70) = 0.59, $p < .05$, or for any of the eight items that comprised this measure. This finding would appear to be consistent with Fulford and Zhang's (1994) conclusion that learners' perceptions of interaction are based upon the total amount of interaction by the whole class and not their own individual levels of interaction. Neither treatment group 1 ($n = 6$) nor treatment group two ($n = 9$) had a large number of different students verbally interact during the class and while treatment group 1 (101 verbal interactions and 208 data interactions) had a slightly higher total number of interactions that did treatment group 2 (274 verbal interactions), both treatment group 1 ($M = 4.42$) and treatment group 2 ($M = 4.46$) rated their perceived levels of interaction fairly high. As this is the first known study to compare these two viewer response technologies, it is difficult to draw conclusions from these results. While the pilot study for this study is the only known additional research comparing two interactive video

teletraining groups using different viewer response technologies, the results from this study for perceived level of interaction are consistent with the findings from that pilot study (Payne & Payne, 1997; Appendix F). Decision makers should exercise caution in selecting one of these two technologies based upon the hope or belief that it will increase learner perceptions of interaction.

Actual Level of Verbal Interaction

Actual level, or amount, of interaction was measured using Flanders Categories for Interaction Analysis and a video tape of each treatment class. The total number of verbal interactions were compared, as were the number of interactions for each of the ten interaction categories contained in Flanders. This study found a significant difference in favor of treatment group 2, the treatment group with the audio conferencing system designed into its class presentation, $\chi^2$ (1, $N$ = 70) = 79.81, $p$ < .025. Treatment group 2 also had statistically significantly greater number of verbal interactions in two Teacher Talk categories, Accepts or Uses Ideas of Students, $\chi^2$ (1, $N$ = 70) = 27.77, $p$ < .025, and Asks Questions, $\chi^2$ (1, $N$ = 70) = 24.24, $p$ < .025, and in one Student Talk category, Response, $\chi^2$ (1, $N$ = 70) = 66.13, $p$ < .025. From this study, it appears that learners using an audio conferencing system had a greater total number of verbal interactions than learners using a student response system. As this was

the first known study to compare theses two technologies, and the capabilities they represent, it is difficult to draw an overall conclusion from this finding. This finding is, however, consistent with the findings from the pilot study conducted for this study (Payne & Payne, 1997; Appendix F). Decision makers may want to consider the findings of this study in selecting a viewer response technology for use in their interactive video teletraining system.

The verbal interaction results reported for learners was provided by a relatively small number of learners. Treatment group 2 (274 interactions) had statistically significantly greater number of verbal interaction events than did treatment group 1 (101 interactions). However, all of the verbal interaction for treatment group 2 was provided by only 9 learners, or 26% of the group, while all of the verbal interaction for treatment group 1 was provided by 6 learners, or 17% of the group. This rather low level of participation in verbal interaction opportunities is consistent with other studies looking at levels of interaction (Hillocks; 1981; Ritchie, 1991) and with the pilot study conducted for this study (Payne & Payne, 1997; Appendix F). Decision makers need to acknowledge the relatively low number of students who actually interact verbally during interactive video teletraining classes. While the number of students who actually interact does not appear to effect learner perceptions of interaction (e.g., Fulford & Zhang, 1993; Zhang & Fulford, 1994), it is still strongly recommended that

opportunities and activities that encourage learner interaction be designed into interactive video teletraining classes.

Actual Level of Total Interaction

Actual level, or amount, of total interaction was measured using the data from Flanders Categories for Interaction Analysis and the total number of data interactions recorded by the student response system host computer. Treatment group 1's total number of interactions (309 interactions) consisted of the total number of verbal interactions plus their total number of data interactions. Treatment group 2's total number of interactions was the same as their total number of verbal interactions (274 interactions). This study did not find a statistically significant difference between the two groups on total amount of interaction, $\chi^2(1, N = 70) = 2.10, p < .025$. Again, as this was the first known study to compare theses two technologies, and the capabilities they represent, it is difficult to draw an overall conclusion from this finding as well. However, this finding is also consistent with the findings from the pilot study conducted for this study (Payne & Payne, 1997; Appendix F). Decision makers may want to consider these findings in making decisions about viewer response technologies for use in their interactive video teletraining systems.

## Recommendations

This section provides recommendations for further research. These recommendations are based upon the findings and the limitations of this study. It is hoped that these recommendations will lead research to be conducted to answer questions related to or identified by this study.

It is recommended that this study be replicated using an entire course as opposed to a single class. The relatively high learner satisfaction and perceived level of interaction mean scores may have been due to the novelty effect of the newness of interactive video teletraining, and of the technologies, to the subjects. Clark (1983) contends that the impact of novelty effects tend to disappear as students become more familiar with new technologies. Conducting semester long, or longer, studies should help to minimize any impact of a novelty effect and may help to reveal possible relationships between perceived level of interaction and learner achievement and learner satisfaction, and between actual level of interaction and learner achievement and learner satisfaction.

It is recommended that this study be replicated using different subjects. It may be that the findings of this study resulted from the subjects used in the study. The subjects were predominantly African-American or African. It is possible their previous exposure to interactive video teletraining, and to education as a whole, was significantly different

from other segments of society. Repeating this study with different subjects would increase the external validity of this and other studies.

It is recommended that this study be replicated with both treatment groups receiving exposure to both technologies. As this study was a one-class treatment with each treatment group being exposed to only one technology and since neither treatment group had been previously exposed to either technology, it appears likely that a novelty effect may have contributed to the lack of differences on the dependent variables. Clark (1983) contends that the impact of novelty effects tend to disappear as students become more familiar with new technologies. By conducting this study over a semester and by exposing both treatment groups to both technologies for at least six weeks, two issues can be addressed. First, the issue of novelty effects for new technology can be minimized by increasing exposure to each technology. Second, the students can compare the two technologies on those factors related to tele-response systems on an end-of-course evaluation. This would allow for a more direct comparison between and evaluation of the capabilities of these two technologies.

It is recommended that this study be replicated with a modified version of Flanders Categories for Interaction Analysis that accounts for data interaction. Newer response technologies provide students with the opportunity to respond with data responses as well as with verbal responses. If the true measure of overall interaction is to be collected, then

a category in which to record data responses must be provided. This study demonstrated that when data and verbal interactions are included in the analysis, a very different outcome can be obtained for the total amount of interaction. Without data interaction, treatment group 2 clearly had significantly more verbal interaction than did treatment group 1 (274 interaction events to 101 interaction events). However, when data interaction is included in the total interaction count, there was no statistically significant difference between the two groups (309 interaction events to 274 interaction events). Additionally, there were no significant differences between the treatment groups on their perceived levels of interaction, even though there was a significant difference in the actual level, or amount, of verbal interaction. It would appear that learners do consider data interaction as interaction, and therefore, it should be included when analyzing interaction in video teletraining courses.

It is recommended that this study be replicated with same-site student interaction data being collected. Classroom monitors were in each classroom during each treatment. Their duties were to ensure students knew where to go and passed out and collected the end-of-class survey. The monitors reported there were a number of conversations between students within each classroom prior to that classroom providing verbal responses to the verbal questions asked by the instructor. The impact of this within classroom group interaction needs to be studied to determine if

it affects learner achievement, learner satisfaction, or both actual and perceived levels of interaction. Also, if within classroom group interaction does positively impact learner achievement or learner satisfaction, then it needs to be determined how within classroom interaction can be increased and if there is a level of within classroom interaction at which learners feel it decreases their ability to attend to the instructor.

## Summary

This chapter provided a short summary of the study, discussed the study's findings and their potential practical significance, and provided recommendations for further research. This is the first known study to compare the differences between the capabilities provided by a student response system and an audio conferencing system on learner achievement, learner satisfaction, and interaction in an interactive video teletraining class. As such, all findings of this study should be applied cautiously.

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# Appendix A

## Flanders Categories for Interaction Analysis

**Teacher Talk**

*Indirect Influence*

1. ACCEPTS FEELING: accepts and clarifies student feelings in nonthreatening manner. Predicts or recalls feelings both positive and negative.
2. PRAISES OR ENCOURAGES: praises or encourages student behavior. Uses humor to release tension, but never at the expense of others. Nods head, says "um hum" or "go on."
3. ACCEPTS OR USES IDEAS OF STUDENTS: clarifies, builds on, or develops student ideas. (May shift to category 5)
4. ASKS QUESTIONS: asks questions about content or procedures with the expectation that students will answer.

*Direct Influence*

5. LECTURING: giving facts or opinions about content or procedure; expressing his own ides, asking rhetorical questions.
6. GIVING DIRECTIONS: directions, commands, or orders.
7. CRITICIZING OR JUSTIFYING AUTHORITY: statements intended to change student behavior to more acceptable pattern; bawling someone out; stating why he is doing what he is doing in a defensive manner.

**Student Talk**

8. STUDENT TALK-RESPONSE: talk by students in response to teacher. (Teacher has initiated this exchange)
9. STUDENT TALK-INITIATION: talk by students which they initiate. (May include teacher calling on student only when this is teacher's response to student's desire to speak. Otherwise, category 4.)

10. SILENCE OR CONFUSION: pauses, short periods of silence in which communication is blocked or unclear.

There is NO scale implied by these numbers. Each number is intended to classify. It designates a particular kind of communication event. To write these numbers down during an observation is merely to enumerate, not to judge on a value scale.

From: Amidon, E. J. & Flanders, N. A. (1967). *The Role of the Teacher in the Classroom.* Minneapolis: Association for Productive Teaching, p. 14.

## Flanders Categories for Interaction Analysis

In order to more fully understand the meaning of each category, a further discussion of each is included below. All of the following information came from Flanders (1970). No scale is implied by the numbers given to each interaction category. The numbers are for classification purposes and used to designate a particular type of communication event. The recording of these numbers during an observation is to enumerate and not to evaluate a position on a scale.

Category 1 -- Accepts Feelings

This category is comprised of instructor statements which accept and clarify attitudes or feelings of learners in a nonthreatening manner. The learners' attitudes or feelings may be negative or positive. This also includes the predicting or recalling of feelings or attitudes by learners. These are types of instructor statements are usually rare and infrequent.

Category 2 --Praises or Encourages

Instructor praise and encouragement are statements that carry the value judgment of approval. While both categories 1 and 2 use statements with overtones of warmth and friendliness, this category also adds instructor approval.

Category 3 --Accepts or Uses Ideas of Pupils

The instructor can respond to learner ideas in five ways. First, is to acknowledge the idea by repeating it. Second, is to modify the idea,

rephrase it, or to restate it in the instructor's own words. Third, is to apply the idea, use it to reach an inference, or to take it to the next step in the logical solution of a problem. Fourth, is to compare the idea with ideas expressed earlier by the instructor or other learners. Fifth, is to summarize what was said.

Category 4 -- Ask Questions

This includes questions that are asked by the instructor to move the conversation to a next step, to introduce a new element, and to include ideas the instructor believes are important. This category also requires that the instructor expects an answer to the question asked.

Category 5 -- Lecturing

This category includes lecturing as well as the expressing of opinions, giving facts, interjecting thoughts, and off-hand comments made by the instructor. This category is a sort of catch-all for instructor statements. It normally has the highest frequency. Incorrect tallies in this category are least likely to distort the instructor profile.

Category 6 -- Giving Directions

Statements in category are intended to produce compliance to the instructor. They direct the learners to do something.

Category 7 -- Criticizing or Justifying Authority

Statements in this category are intended to produce compliance and to enhance the authority of the instructor. Many of these statements tend to identify deficiencies or problems learners are having.

Category 8 -- Pupil Talk - Response

Statements in this category include responses by learners to direct questions from the instructor.

Category 9 -- Pupil Talk - Initiation

Statements in this category include statements from learners that demonstrate the expression of will by the learners. These statements contain an element of creativity and higher mental processes.

Category 10 -- Silence or Confusion

This category is used when there is silence or when there is noise and confusion on the part of the learners.

## Appendix B

## Preformatted Questions

1. Since services depend on the people who provide them, their quality varies. This is a example of:
   a. Intangibility
   b. Inconsistency
   c. Inseparability
   d. Inventory
2. Which one of the following is an example of a non-profit organization?
   a. AT&T
   b. KFOR-TV
   c. United Way
   d. Homeland
3. Consumers evaluate services in all of the following areas except:
   a. Experience
   b. Credence
   c. Courtesy
   d. Return on investment

4. Internal Marketing is based on the notion that a service organization must:
    a. Be influenced by the competition
    b. Focus on employee development
    c. Patent their services
    d. Disregard product in the 4 P's
5. Pricing services plays an essential role in:
    a. Affecting consumer perceptions
    b. Capacity management
    c. Both a and b
    d. None of the above
6. Services generally do NOT take advantage of:
    a. Patents
    b. Promotion
    c. Publicity
    d. Trademarks

## Appendix C

## Preplanned Verbal Questions

1. Can you give me an example of an intangible item?
2. What does inseparability mean?
3. What do we mean by inventory?
4. Who can give me the definition of a non-profit organization?
5. What are the four I's in marketing services?
6. What are the four P's in marketing services?

## Appendix D

## Pretest and Posttest

# Principles of Marketing
## Marketing of Services
## Educational Technology
## Pretest

1. Services are:

   a. tangible activities or benefits provided to consumers in exchange for money or some other value.
   b. intangible items provided by an organization to consumers in exchange for money or something else of value.
   c. philanthropic activities performed in exchange for monetary remuneration.
   d. any activity, either tangible or intangible provided by an organization in exchange for monetary remuneration.
   e. none of the above.

2. The elements that make services unique are the four I's, which are:

   a. inflexibility, intangibility, inconsistency, and inseparability.
   b. intangibility, inconsistency, inseparability, and inventory
   c. incompatibility, inconsistency, inseparability, and inventory
   d. invisibility, inconsistency, inseparability, and intangibility
   e. inflexibility, incongruity, inconsistency, and inventory

3. Intangibility of services means:

   a. the value of the service provided can only be determined using subjective criteria.
   b. the services can't be held, seen, or touched before the purchase decision.
   c. the service cannot be described only experienced.
   d. the quantity can vary.
   e. none of the above.

4. Organizations attempt to reduce the inconsistency of the delivery of services through:

   a. higher incentives to employees for satisfactory performance.
   b. automation.
   c. the reduction of customer contact points in the service delivery process.
   d. standardization and training.
   e. all of the above.

5. In which of the following firms should there be the greatest management concern for the inseparability of the service from the service provider?

   a. Automobile dealership
   b. Shoe manufacturer
   c. Fast food restaurant
   d. University marketing class
   e. Hardware retailer

6. Capacity management in the airline industry can be achieved by all of the following tactics EXCEPT:

   a. higher prices during peak periods.
   b. advertising to inform consumers of low demand periods.
   c. accumulating and storing flights during low demand periods.
   d. training employees to "switch" from low to high demand activities.
   e. offering service premiums during low demand periods.

7. The type of organization which has the GREATEST inventory carrying costs is:

   a. hospitals.
   b. telecommunications.
   c. utilities.
   d. airlines.
   e. all of the above.

8. A service continuum is:

   a. the points along the customer contact audit.
   b. the channel from service concept, to service provider, to ultimate consumer.
   c. a concept that a service is inseparable from the service provider.
   d. a range of tangible to intangible or good-dominant to service-dominant offerings.
   e. the range of organizations from nonprofit to for-profit.

9. Services can be classified by:

   a. whether they are delivered by equipment or people.
   b. whether they are offered for profit or nonprofit.
   c. whether they are government sponsored.
   d. all of the above.
   e. none of the above.

10. In nonprofit organizations, excesses in revenue over expenses are:

    a. taxed at one-half the rate of for profit organizations.
    b. distributed to shareholders.
    c. returned to the organization's treasury for continuation of the service.
    d. taxed at a reduced rate if the revenue is to be used in keeping with the organizations core mission.
    e. not taxed at all unless it is a religious organization.

11. Services such as restaurants and child care are evaluated on:

    a. search qualities.
    b. form qualities.
    c. experience qualities.
    d. credence qualities.
    e. performance qualities.

12. The difference between consumer's expectations about a service and their experience with the service are identified through:

    a. experience.
    b. contribution margin analysis.
    c. gap analysis.
    d. customer contact audit.
    e. marketing audit.

13. All of the following are dimensions of service quality EXCEPT:

    a. technology.
    b. competence.
    c. credibility.
    d. access.
    e. reliability.

14. A marketing philosophy based on the notion that a service organization must focus on its employees before successful programs can be directed at customers is called:

    a. personnel management.
    b. internal marketing.
    c. internal analysis.
    d. employee development.
    e. service integration.

15. The use of brand names is especially important for services because of:

    a. inventory.
    b. inseparability.
    c. inconsistency.
    d. invisibility.
    e. intangibility.

16. Managing the demand for a service so that a sufficient supply is available to customers is called:

    a. off-peak pricing.
    b. idle production capacity.
    c. gap analysis.
    d. capacity management.
    e. inventory management.

17. Which component of the promotional mix is particularly important for nonprofit services?

    a. Advertising.
    b. Sales promotion.
    c. Personal selling
    d. Publicity
    e. None of the above

18. A publicity tool frequently used by nonprofit services, which uses free space or time donated by the media is called a(n):

    a. promotion.
    b. advertisement.
    c. public service announcement.
    d. free standing insert.
    e. publicity stunt.

19. Which of the following professional service providers are not allowed to advertise?

    a. Lawyers
    b. Physicians
    c. Dentists
    d. Accountants
    e. none of the above

20. Which of the 4 P's is NOT a variable that health care providers could employ in their segmentation strategies?

    a. Promotion
    b. Distribution
    c. Pricing
    d. Product
    e. All of the above can be used in segmenting health care providers

# Principles of Marketing
## Marketing of Services
## Educational Technology
## Posttest

1. The elements that make services unique are the four I's, which are:

   a. inflexibility, intangibility, inconsistency, and inseparability.
   b intangibility, inconsistency, inseparability, and inventory
   c. incompatibility, inconsistency, inseparability, and inventory
   d. invisibility, inconsistency, inseparability, and intangibility
   e. inflexibility, incongruity, inconsistency, and inventory

2. Organizations attempt to reduce the inconsistency of the delivery of services through:

   a. higher incentives to employees for satisfactory performance.
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   a. the points along the customer contact audit.
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   c. a concept that a service is inseparable from the service provider.
   d. a range of tangible to intangible or good-dominant to service-dominant offerings.
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   e. marketing audit.

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   a. whether they are delivered by equipment or people.
   b. whether they are offered for profit or nonprofit.
   c. whether they are government sponsored.
   d. all of the above.
   e. none of the above.

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    c. Fast food restaurant
    d. University marketing class
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    d. taxed at a reduced rate if the revenue is to be used in keeping with the organizations core mission.
    e. not taxed at all unless it is a religious organization.

12. Which of the 4 P's is NOT a variable that health care providers could employ in their segmentation strategies?

    a. Promotion
    b. Place
    c. Pricing
    d. Product
    e. All of the above can be used in segmenting health care providers

13. Managing the demand for a service so that a sufficient supply is available to customers is called:

    a. off-peak pricing.
    b. idle production capacity.
    c. gap analysis.
    d. capacity management.
    e. inventory management.

14. Services such as restaurants and child care are evaluated on:

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    c. experience qualities.
    d. credence qualities.
    e. performance qualities.

15. Which of the following professional service providers are not allowed to advertise?

    a. Lawyers
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    c. Dentists
    d. Accountants
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    a. technology.
    b. competence.
    c. credibility.
    d. access.
    e. reliability.

17. The use of brand names is especially important for services because of:

    a. inventory.
    b. inseparability.
    c. inconsistency.
    d. invisibility.
    e. Intangibility.

18. Which component of the promotional mix is particularly important for nonprofit services?

    a. Advertising.
    b. Sales promotion.
    c. Personal selling
    d. Publicity
    e. None of the above

19. A marketing philosophy based on the notion that a service organization must focus on its employees before successful programs can be directed at customers is called:

    a. personnel management.
    b. internal marketing.
    c. internal analysis.
    d. employee development.
    e. service integration.

20. A publicity tool frequently used by nonprofit services, which uses free space or time donated by the media is called a(n):

    a. promotion.
    b. advertisement.
    c. public service announcement.
    d. free standing insert.
    e. publicity stunt.

## Appendix E

## Original End-Of-Class Survey

### END-OF-CLASS SURVEY

Please give us your candid opinions concerning the training you have just completed. Your evaluation of the interactive video teletraining experience is important to us, and will help us provide the best possible products and services to you.

Course Title: **Principles of Marketing**

Class Title: **Marketing Services**

Training Classroom: _____

For the following, please completely darken the circle appropriate to your response.

| | Very Good | Good | Average | Poor | Very Poor |
|---|---|---|---|---|---|
| 1. Clarity of Assignments | ○ | ○ | ○ | ○ | ○ |
| 2. Time Graphics Left on Screen | ○ | ○ | ○ | ○ | ○ |
| 3. Relevance of Graphics | ○ | ○ | ○ | ○ | ○ |
| 4. Quality of Graphics | ○ | ○ | ○ | ○ | ○ |
| 5. Instructional Techniques | ○ | ○ | ○ | ○ | ○ |
| 6. Instructor Made Students Feel They Were Part of Class | ○ | ○ | ○ | ○ | ○ |
| 7. Instructor Communication Skills | ○ | ○ | ○ | ○ | ○ |
| 8. Instructor Organization/Preparation | ○ | ○ | ○ | ○ | ○ |
| 9. Instructor Enthusiasm | ○ | ○ | ○ | ○ | ○ |

**(Continued on the next page)**

| | Very Good | Good | Average | Poor | Very Poor |
|---|---|---|---|---|---|
| 10. Instructor Teaching Ability | ○ | ○ | ○ | ○ | ○ |
| 11. Instructor Encouraged Participation | ○ | ○ | ○ | ○ | ○ |
| 12. Instructor Professionality | ○ | ○ | ○ | ○ | ○ |
| 13. Instructor Overall Rating | ○ | ○ | ○ | ○ | ○ |
| 14. Time Taken to Answer Site Calls During Class | ○ | ○ | ○ | ○ | ○ |
| 15. Monitor Picture Quality | ○ | ○ | ○ | ○ | ○ |
| 16. Monitor Sound Quality | ○ | ○ | ○ | ○ | ○ |
| 17. Adequacy of Monitor Screen Size | ○ | ○ | ○ | ○ | ○ |
| 18. Clarity of Tele-Response System Audio | ○ | ○ | ○ | ○ | ○ |
| 19. Talkback Delays of Tele-Response System | ○ | ○ | ○ | ○ | ○ |
| 20. Confidence That Class Will Not Be Canceled Due to Technical Problems | ○ | ○ | ○ | ○ | ○ |
| 21. Ease of Operating Equipment at Sites | ○ | ○ | ○ | ○ | ○ |
| 22. Speed of Back Up Tape Delivery to Sites When Broadcast Signal Fails | ○ | ○ | ○ | ○ | ○ |
| 23. Accessibility of Program Personnel | ○ | ○ | ○ | ○ | ○ |
| 24. Enrollment/Registration | ○ | ○ | ○ | ○ | ○ |
| 25. Conscientiousness of At-Site Personnel (e.g., tuning in broadcast) | ○ | ○ | ○ | ○ | ○ |
| 26. Accessibility of At-Site Personnel | ○ | ○ | ○ | ○ | ○ |

**Continued on the next page)**

| | Very Good | Good | Average | Poor | Very Poor |
|---|---|---|---|---|---|
| 27. Timeliness with which Papers/Tests Were Graded/Returned by Instructor | ○ | ○ | ○ | ○ | ○ |
| 28. Promptness Class Materials Were Sent to You Directly or Through Site Pers. | ○ | ○ | ○ | ○ | ○ |
| 29. Distractions at Site Classroom During Class | ○ | ○ | ○ | ○ | ○ |
| 30. Accessibility of Library When Needed | ○ | ○ | ○ | ○ | ○ |
| 31. Accessibility of Computer When Needed | ○ | ○ | ○ | ○ | ○ |
| 32. Telephone Accessibility of Instructor Outside of Class | ○ | ○ | ○ | ○ | ○ |
| 33. Means of Material Exchange Between Student/Instructor | ○ | ○ | ○ | ○ | ○ |

**(End of Survey)**

## Appendix F

## Pilot Study Summary

The purpose of this pilot study was to identify areas that need to be changed or improved before the actual conduct of the dissertation study entitled, "The Effects of a Student Response System on Student Achievement, Satisfaction and Interaction." This summary will review the procedure, the demographics of the subjects, the results of this pilot study, and recommendations for improving the conduct of the actual study.

### Procedure

The design of the study appeared to be sound. Both pilot study treatment groups were administered a pretest one week before their respective treatments. Treatment Group 1, took their pretest on November 18, 1996, and were administered their treatment and completed the end-of-class survey on November 25, 1996. The experimental treatment for Group 1 was the Marketing Services class with the use of a student response system designed into the instruction. Group 1 took their posttest on November 27, 1996. Treatment Group 2, took their pretest on January 22, 1997, and were administered their treatment and completed the end-of-class survey on January 29, 1997. The experimental treatment for Group 2 was the Marketing Services class with the use of an audio conferencing system designed into the instruction. Group 2 took their posttest on January 31, 1997.

## Subjects

The subjects of this evaluation were all undergraduate students taking the Principles of Marketing course at Langston University. A total of 67 subjects volunteered for the pilot study with usable data being collected from 56 subjects, 30 in Group 1 and 26 in Group 2. Of the 56 subjects, 9% were Sophomores, 37% were Juniors, and 54% were Seniors, while 68% were female and 32% were male. The average age was 22.4, with a range from 19 to 46 years of age. Eighty-nine percent are single, while 18% have children living at home. Forty-eight percent work in addition to going to school an average of 15.5 hours per week. Five percent of the participants were white, while 95% of the participants were African-American or African. This was the first live instructional television class for 68% of the subjects.

## Results

The results of the pilot study are reported in four sections. The sections will correspond to the four dependent variables in the proposed study, which are learner achievement, learner satisfaction, the perceived level of interaction and the actual level of interaction. The first results reported will be for learner achievement.

### Learner Achievement

Learner achievement was measured by a 20 item multiple choice pretest and posttest. The pretest was administered one week before each

treatment. The posttest was administered the first class period after each treatment. The results of the pretests and the posttests for the two groups are shown in Table F-1.

---

Table F-1

Learner Achievement Results

| | Group 1 (N = 30) | Group 2 (N = 26) | *F*-Value |
|---|---|---|---|
| Pretest Mean | 8.60 | 8.81 | |
| Posttest Mean | 13.03 | 11.77 | |
| Adj. Posttest Mean | 13.07 | 11.72 | 6.60* |

* $p < .05$ level.

---

As shown in Table F-1, Group 2 scored higher on the pretest than did Group 1. However, on the posttest, Group 1 scored higher than Group 2. The results of the analysis of covariance also show that the posttest means, adjusted to control for pre-existing group differences as reflected in the pretest, are significantly different ($F = 6.60$, df = 1, 53, $p < .05$). That is, Group 1 performed significantly better on the posttest than did Group 2.

Learner Satisfaction

Learner satisfaction was measured by the administration of a 33 item Likert-type End-of-Class Survey. The survey was administered

immediately after the treatment for each group. Students were asked to rate each item from 1 (Very Poor) to 5 (Very Good). If an item was left

Table F-2

End-of-Class Survey Results

| Factor | Group 1 | Group 2 | *t*-Value |
|---|---|---|---|
| 1 - Instructor/Instruction | | | |
| Mean | 4.63 | 4.61 | 0.24 |
| SD | 0.18 | 0.20 | |
| 2 - Technology | | | |
| Mean | 4.46 | 4.40 | 0.33 |
| SD | 0.25 | 0.32 | |
| 3 - Course Management | | | |
| Mean | 4.38 | 3.84 | 2.00 |
| SD | 0.20 | 0.51 | |
| 4 - At-Site Personnel | | | |
| Mean | 4.58 | 3.83 | 7.41* |
| SD | 0.02 | 0.14 | |
| 5 - Promptness of Material Delivery | 4.45 | 3.05 | 4.93* |
| Mean | 0.26 | 0.31 | |
| SD | | | |
| 6 - Support Services | | | |
| Mean | 3.86 | 3.06 | 2.81* |
| SD | 0.26 | 0.42 | |
| 7 - Out-of-Class Comm. w/Instructor | | | |
| Mean | 3.93 | 3.07 | 2.00 |
| SD | 0.52 | 0.33 | |
| Total Survey | | | |
| Mean | | | |
| SD | 4.43 | 4.11 | 2.42* |
| | 0.34 | 0.68 | |

* $p < .05$ level

unanswered, a "0" was entered for its rating. Table F-2 shows the results for each of the seven factors comprising the survey as well as for the

overall survey. The mean score for each of the 33 items contained in the End-of-Class Survey is shown in Appendix F-1.

The results in Table F-2 shows Group 1 rated their overall satisfaction level significantly higher than did Group 2. However, a review of the seven factors comprising the overall evaluation of learner satisfaction shows that this difference is attributed to the participants' attitudes towards Factor 4 - At-Site Personnel, Factor 5 - Promptness of Material Delivery, and Factor 6 - Support Services.

---

Table F-3

Factor 4 - At-Site Personnel Results

| Element | Group 1 | Group 2 | *t*-Value |
|---|---|---|---|
| 25 - Conscient. Of At-Site Pers. | | | |
| Mean | 4.60 | 3.73 | 2.54* |
| SD | 0.56 | 1.78 | |
| 26 - Access. Of At-Site Pers. | | | |
| Mean | 4.57 | 3.93 | 1.98 |
| SD | 0.63 | 1.66 | |
| Total | | | |
| Mean | 4.58 | 3.83 | 7.41* |
| SD | | | |

* $p < .05$ level

---

Table F-3 shows that the overall effect in favor of Group 1 for Factor 4 - At-Site Personnel, is attributable to the ratings given to Item 25 - Conscientiousness of At-Site Personnel. Apparently, Group 1 felt the

at-site personnel were more conscientientious than did Group 2. It should be noted, however, that the same personnel were at each site during both treatments.

---

Table F-4

Factor 5 - Promptness of Material Delivery Results

| Element | Group 1 | Group 2 | *t*-Value |
|---|---|---|---|
| 27 - Timeliness w/which papers/ tests were graded/ returned | | | |
| Mean | 4.27 | 2.83 | 3.19* |
| SD | 1.26 | 2.12 | |
| 28 - Prompt. Class Materials were sent to you | | | |
| Mean | 4.63 | 3.27 | 3.47* |
| SD | 0.62 | 2.07 | |
| Total | | | |
| Mean | 4.45 | 3.05 | 4.93* |
| SD | | | |

* $p < .05$ level

---

Table F-4 shows that the overall effect in favor of Group 1 for Factor 5 - Promptness of Material Delivery, is attributable to both Item 27 - Timeliness with Which Papers/Test Were Graded/Returned by Instructor, and Item 28 - Promptness Class Materials Were Sent to You Directly or Through Site Personnel. It would appear that Group 1 felt that items related to the promptness of material delivery were performed better than did Group 2. However, neither of the two items were a part of the pilot

study up to the point when the students completed the End-of-Class Survey.

---

Table F-5

Factor 6 - Support Services Results

| Element | Group 1 | Group 2 | *t*-Value |
|---|---|---|---|
| 29 - Distractions at Site Classroom During Class | | | |
| Mean | 4.07 | 3.50 | 1.37 |
| SD | 1.26 | 1.89 | |
| 30 - Access. Of Library When Needed | | | |
| Mean | 3.57 | 2.67 | 1.81 |
| SD | 1.68 | 2.16 | |
| 31 - Access. Of Computer When Needed | | | |
| Mean | 3.93 | 3.00 | 1.94 |
| SD | 1.60 | 2.10 | |
| Total | | | |
| Mean | 3.86 | 3.06 | 2.81* |
| SD | | | |

* $p < .05$ level

---

Table F-5 shows that the overall effect in favor of Group 1 for Factor 6 - Support Services, is not attributable to any of the three individual items comprising this factor, which are Item 29 - Distractions at Site Classroom During Class, Item 30 - Accessibility of Library When Needed, or Item 31 - Accessibility of Computer When Needed. Rather, it is attributed to the combined effects of all three. That is, while Group 1 rated each individual item slightly, although not significantly, higher than Group 2, it did result

in Factor 6 being rated significantly higher overall. Again, it should be noted that neither Item 30 nor 31 were applicable to this study.

---

Table F-6

Adjusted End-of-Class Survey Results

| Factor | Group 1 | Group 2 | *t*-Value |
|---|---|---|---|
| 1 - Instructor/Instruction | | | |
| Mean | 4.63 | 4.61 | 0.24 |
| SD | 0.18 | 0.20 | |
| 2 - Technology | | | |
| Mean | 4.46 | 4.40 | 0.33 |
| SD | 0.25 | 0.32 | |
| 3 - Course Management | | | |
| Mean | 4.38 | 3.84 | 2.00 |
| SD | 0.20 | 0.51 | |
| Total Survey | | | |
| Mean | 4.53 | 4.45 | 0.92 |
| SD | 0.25 | 0.39 | |

NOTE: None of the *t*-Values are significant at the $p < .05$ level.

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It should be noted that virtually none of the nine items comprising Factors 4 through 7 appear to be appropriate for this one-class study. All of these items, with the possible arguable exception of Item 29 - Distractions at Site Classroom During Class, are appropriate for evaluations involving entire courses, and not just one class within a course. As shown in Table F-6, if these four factors, and the items that comprise them, are deleted from the End-of-Class Survey, and the statistics are recalculated, the difference between the two groups is no

longer significant. That is, there is no significant difference in learner satisfaction between the two groups.

Perceived Level of Interaction

The perceived level of interaction was measured by six interaction related items on the End-of-Class Survey. The six interaction related items are:

Item 6 - Instructor Made Students Feel They were Part of the Class,

Item 11 - Instructor Encouraged Participation,

Item 14 - Time Taken to Answer Site Calls During Class

Item 18 - Clarity of Tele-Response System Audio

Item 19 - Talkback Delays of Tele-Response System, and

Item 21 - Ease of Operating Equipment at Site.

The mean rating for Group 1 on the six interaction items was 4.52 and the mean rating for Group 2 was 4.48. The computed $t$-Value was 0.36, which is not significant at the $p < .05$ level. There were no significant differences in the amount of perceived interaction between the two groups. The mean score for each of the six items comprising the perceived level of interaction are shown in Appendix F-2.

Actual Level of Interaction

The actual level of interaction was measured using video taped recordings of each treatment session and Flanders Categories for

Interaction Analysis. Two trained evaluators watched each video taped treatment separately, classifying each interaction event into one of the ten Flanders Categories for Interaction Analysis. They then watched each treatment video tape together to resolve differences and came up with a final set of classifications for each treatment. The final results of those classifications are shown in Appendix F-3.

Appendix F-3 shows that Group 2, the group using the audio conferencing system, displayed significantly more interaction events than did Group 1 ($\chi^2 = 54.83$, df = 1, $p < .05$). A further analysis of the data shows that this effect is attributable to the amount of interaction in Category 3 - Accepts or Uses Ideas of Students, Category 4 - Asks Questions, and Category 8 - Student Talk - Response. The data from Appendix F-3 would appear to indicate that Group 2 had a significantly higher level of interaction than did Group 1.

Flanders Categories of Interaction Analysis does not directly provide for the classification of student data responses available through the student response system. Group 1 had six questions asked for which students were expected to respond using the data response capability of their keypad. All students present responded to each question, providing 177 total data responses to the six questions. If these 177 data responses are added to Group 1's number of interaction events, Group 1 would then

have a significantly larger overall number of interaction events than Group 2 ($\chi^2 = 4.32$, df = 1, $p < .05$).

It should also be noted that while Group 2 had a higher frequency of students talk, the actual number of students talking was very small. Only seven different students accounted for all of the student talk for Group 2, while six different students accounted for all of the student talk for Group 1. However, Group 1 had all students respond to each of the six data response questions.

## Recommendations

Recommendations will be made to improve the proposed study as they relate to the four dependent variables. These dependent variables are learner achievement, learner satisfaction, perceived level of interaction, and the actual level of interaction. The recommendations will begin with the area of learner achievement.

### Learner Achievement

It is recommended that learner achievement be measured and analyzed the same as it was done in this pilot. Analysis of covariance allows group posttest scores to be compared for significant differences while controlling for any pre-existing group differences using the pretest scores. Analysis of covariance is the recommended statistical analysis for the non-equivalent control group design (Borg & Gall, 1989).

One possible explanation for the posttest differences may have been the time in the semester when the instruction was conducted. Group 1 was late in the semester while Group 2 was early in the semester. It is possible that prior marketing instruction influenced the posttest scores for Group 1. For the actual study, the Marketing Services block of instruction will be offered at the approximate same time during the two semesters during which the study will be conducted.

The design for this study does not include a no-treatment control group. First, the non-equivalent control group design does not require a no-treatment control group, as each group can receive a treatment (Borg & Gall, 1989). The only two essential features of this design is the nonrandom assignment of subjects to groups and the administration of a pretest and a posttest to each group (Borg & Gall, 1989). Second, the questions being investigated are related to differences in any or all of the four dependent variables attributable to the use of either of the two technologies. That is, this study is seeking to determine if there is an advantage to using either the audio conferencing system or the student response system, and not to determine if there is an advantage to using interactive video teletraining or traditional face-to-face classroom instruction.

Learner Satisfaction

It is recommended that the End-of-Class Survey be modified based upon the results of this pilot study by deleting Factors 4 - 7 (At-Site Personnel, Promptness of Material Delivery, Support Services, and Out-of-Class Communication with Instructor). While these factors are appropriate for evaluating interactive video teletraining courses, they do not appear to be appropriate for evaluating a class within such a course. Deleting these factors should provide a more accurate reporting of overall learner satisfaction.

Perceived Level of Interaction

The six items that comprise the evaluation of the level of perceived interaction appear to be appropriate. The items appear to cover the areas that distance students should evaluate. Administering the End-of-Class Survey immediately after each treatment appears to be the most appropriate time. Student experiences are fresh in their minds and they have not been influenced, either positively or negatively, by taking the posttest, if they complete the End-of-Class Survey immediately after the treatment.

Actual Level of Interaction

Flanders Categories for Interaction Analysis worked well for analyzing the verbal interaction for each treatment. The ability to stop and review the video tapes of each treatment aided the accurate classification of all

interactions. Using two evaluators, working separately and then together, also appears to have increased the accuracy of the classifications. This method will work well for analyzing the verbal interactions during the actual study.

There is an issue with accounting for the data interaction provided by the student response system used by Group 1. Since Group 2 does not have a data response capability with the audio conferencing system, it would not appear to be appropriate to add a category for data interaction to Flanders Categories for Interaction Analysis. Two options appear to be possible. One is to simply add the data responses to the total number of interactions for Group 1 and then compare the results. The other possible option is to report the actual level of interaction as two measures. One measure would be the verbal interaction only while the other measure would combine verbal and data interaction into one interaction score. The second option would appear to provide a more accurate picture of the actual levels of interaction.

## Summary

The pilot study has demonstrated that the proposed study is feasible. The study design appears to be sound. The statistics selected appear to be appropriate to analyze the data collected for each of the four dependent variables. The recommendations made would appear to improve the study

and more accurately reflect responses of each group to the dependent variables.

## Appendix F-1

## End-of-Class Survey Mean Scores

| *Evaluation Item* | *Group 1* | *Group 2* |
|---|---|---|
| Factor 1 - Instructor/Instruction | | |
| 1. Clarity of Assignments | 4.53 | 4.63 |
| 2. Time Graphics Left on Screen | 4.20 | 4.20 |
| 3. Relevance of Graphics | 4.50 | 4.53 |
| 4. Quality of Graphics | 4.73 | 4.60 |
| 5. Instructional Techniques | 4.70 | 4.60 |
| 6. Instructor Made Students Feel They Were Part of the Class | 4.77 | 4.70 |
| 7. Instructor Communication Skills | 4.77 | 4.77 |
| 8. Instructor Organization/Preparation | 4.67 | 4.73 |
| 9. Instructor Enthusiasm | 4.77 | 4.70 |
| 10. Instructor Teaching Ability | 4.80 | 4.60 |
| 11. Instructor Encouraged Participation | 4.53 | 4.70 |
| 12. Instructor Professionality | 4.70 | 4.80 |
| 13. Instructor Overall Rating | 4.80 | 4.83 |
| 14. Time Taken to Answer Site Calls During Class | 4.37 | 4.20 |
| Factor 1 Mean Score | 4.63 | 4.61 |

| | | |
|---|---|---|
| **Factor 2 - Technology** | | |
| 15. Monitor Picture Quality | 4.67 | 4.70 |
| 16. Monitor Sound Quality | 4.53 | 4.40 |
| 17. Adequacy of Monitor Screen Size | 4.67 | 4.67 |
| 18. Clarity of Tele-Response System Audio | 4.53 | 4.53 |
| 19. Talkback Delays of Tele-Response System | 4.07 | 4.43 |
| 20. Confidence That Class Will Not Be Canceled Due to Technical Problems | 3.93 | 4.40 |
| Factor 2 Mean Score | 4.46 | 4.40 |
| **Factor 3 - Course Management** | | |
| 21. Ease of Operating Equipment at Sites | 4.60 | 4.57 |
| 22. Speed of Back-up Tape Delivery to Sites When Broadcast Signal Fails | 4.13 | 3.40 |
| 23. Accessibility of Program Personnel | 4.47 | 3.73 |
| 24. Enrollment Registration | 4.33 | 3.67 |
| Factor 3 Mean Score | 4.38 | 3.84 |
| **Factor 4 - At-Site Personnel** | | |
| 25. Conscientiousness of At-Site Personnel | 4.60 | 3.73 |
| 26. Accessibility of At-Site Personnel | 4.57 | 3.93 |
| Factor 4 Mean Score | 4.58 | 3.83 |

| | | |
|---|---|---|
| **Factor 5 - Promptness of Material Delivery** | | |
| 27. Timeliness with Which Papers/Tests Were Graded/Returned by Instructor | 4.27 | 2.83 |
| 28. Promptness Class Materials Were Sent to You Directly or Through Site Personnel | 4.63 | 3.27 |
| Factor 5 Mean Score | 4.45 | 3.05 |
| **Factor 6 - Support Services** | | |
| 29. Distractions at Site Classroom During Class | 4.07 | 3.50 |
| 30. Accessibility of Library When Needed | 3.57 | 2.67 |
| 31. Accessibility of Computer When Needed | 3.93 | 3.00 |
| Factor 6 Mean Score | 3.86 | 3.06 |
| **Factor 7 - Out-of-Class Communication with Instructor** | | |
| 32. Telephone Accessibility of Instructor Outside of Class | 3.57 | 2.83 |
| 33. Means of Material Exchange Between Student/Instructor | 4.30 | 3.30 |
| Factor 7 Mean Score | 3.93 | 3.07 |
| Mean Score for Total Survey | 4.43 | 4.11 |

Computed $t$-Value is 2.420*.

* $p < .05$.

Appendix F-2

Perceived Level of Interaction Mean Scores

| *Evaluation Item* | *Group 1* | *Group 2* |
|---|---|---|
| 6. Instructor Made Students Feel They Were Part of the Class | 4.77 | 4.70 |
| 11. Instructor Encouraged Participation | 4.53 | 4.70 |
| 14. Time Taken to Answer Site Calls During Class | 4.37 | 4.20 |
| 18. Clarity of Tele-Response System Audio | 4.53 | 4.53 |
| 19. Talkback Delays of Tele-Response System | 4.07 | 4.43 |
| 21. Ease of Operating Equipment at Sites | 4.60 | 4.57 |
| **Perceived Interaction Mean Score** | **4.52** | **4.48** |
| **Perceived Interaction Standard Deviation** | **0.19** | **0.24** |

Computed $t$-Value = 0.357*

* $p < .05$.

## Appendix F-3

## Actual Level of Interaction Mean Scores

| Category | Actual | Expected | $\chi^2$ |
|---|---|---|---|
| 1. Accepts Feelings | | | |
| Group 1 | 0 | 0 | |
| Group 2 | 0 | 0 | n/a |
| 2. Praises or Encourages | | | |
| Group 1 | 6 | 6.5 | |
| Group 2 | 7 | 6.5 | 0.08 |
| 3. Accepts or Uses Ideas of Students | | | |
| Group 1 | 5 | 20.5 | |
| Group 2 | 36 | 20.5 | 23.44* |
| 4. Asks Questions | | | |
| Group 1 | 11 | 32.5 | |
| Group 2 | 54 | 32.5 | 28.45* |
| 5. Lecturing | | | |
| Group 1 | 35 | 39 | |
| Group 2 | 43 | 39 | 0.82 |
| 6. Giving Directions | | | |
| Group 1 | 8 | 6 | |
| Group 2 | 4 | 6 | 1.33 |
| 7. Criticizing or Justifying Authority | | | |
| Group 1 | 0 | 0 | |
| Group 2 | 0 | 0 | n/a |
| 8. Student Talk - Response | | | |
| Group 1 | 5 | 32 | |
| Group 2 | 59 | 32 | 45.56* |
| 9. Student Talk - Initiation | | | |
| Group 1 | 11 | 9.5 | |
| Group 2 | 8 | 9.5 | 0.47 |
| 10. Silence/Confusion | | | |
| Group 1 | 10 | 10.5 | |
| Group 2 | 11 | 10.5 | 0.05 |
| TOTAL | | | |
| Group 1 | 91 | 156.5 | |
| Group 2 | 222 | 156.5 | 54.83* |

* $p < .05$ level

NOTE: For Group 1, students responded to the six questions using the data response keypad as follows, for a total of 177 data responses.

Question #1 - 29/29 responses
Question #2 - 29/29 responses
Question #3 - 29/29 responses
Question #4 - 30/30* responses
Question #5 - 30/30* responses
Question #6 - 30/30* responses

*One student showed up for class late

## Appendix G

## Modified End-Of-Class Survey

### END-OF-CLASS SURVEY

Please give us your candid opinions concerning the training you have just completed. Your evaluation of the interactive video teletraining experience is important to us, and will help us provide the best possible products and services to you.

Course Title: **Principles of Marketing**

Class Title: **Marketing Services**

Training Classroom: _____

For the following, please completely darken the circle appropriate to your response.

| | Very Good | Good | Average | Poor | Very Poor |
|---|---|---|---|---|---|
| 1. Clarity of Assignments | ○ | ○ | ○ | ○ | ○ |
| 2. Time Graphics Left on Screen | ○ | ○ | ○ | ○ | ○ |
| 3. Relevance of Graphics | ○ | ○ | ○ | ○ | ○ |
| 4. Quality of Graphics | ○ | ○ | ○ | ○ | ○ |
| 5. Instructional Techniques | ○ | ○ | ○ | ○ | ○ |
| 6. Instructor Made Students Feel They Were Part of Class | ○ | ○ | ○ | ○ | ○ |
| 7. Instructor Communication Skills | ○ | ○ | ○ | ○ | ○ |
| 8. Instructor Organization/Preparation | ○ | ○ | ○ | ○ | ○ |
| 9. Instructor Enthusiasm | ○ | ○ | ○ | ○ | ○ |
| 10. Instructor Teaching Ability | ○ | ○ | ○ | ○ | ○ |

**(Continued on the next page)**

| | Very Good | Good | Average | Poor | Very Poor |
|---|---|---|---|---|---|
| 11. Instructor Encouraged Participation | ○ | ○ | ○ | ○ | ○ |
| 12. Instructor Professionality | ○ | ○ | ○ | ○ | ○ |
| 13. Instructor Overall Rating | ○ | ○ | ○ | ○ | ○ |
| 14. Time Taken to Answer Site Calls During Class | ○ | ○ | ○ | ○ | ○ |
| 15. Monitor Picture Quality | ○ | ○ | ○ | ○ | ○ |
| 16. Monitor Sound Quality | ○ | ○ | ○ | ○ | ○ |
| 17. Adequacy of Monitor Screen Size | ○ | ○ | ○ | ○ | ○ |
| 18. Clarity of Tele-Response System Audio | ○ | ○ | ○ | ○ | ○ |
| 19. Talkback Delays of Tele-Response System | ○ | ○ | ○ | ○ | ○ |
| 20. Confidence That Class Will Not Be Canceled Due to Technical Problems | ○ | ○ | ○ | ○ | ○ |
| 21. Ease of Operating Equipment at Sites | ○ | ○ | ○ | ○ | ○ |
| 22. Speed of Back Up Tape Delivery to Sites When Broadcast Signal Fails | ○ | ○ | ○ | ○ | ○ |
| 23. Accessibility of Program Personnel | ○ | ○ | ○ | ○ | ○ |
| 24. Enrollment/Registration | ○ | ○ | ○ | ○ | ○ |
| 25. The Tele-Response System Let Students Know Whether They Were Comprehending the Material | ○ | ○ | ○ | ○ | ○ |

**(Continued on the next page)**

| | Very Good | Good | Average | Poor | Very Poor |
|---|---|---|---|---|---|
| 26. The Tele-Response System Let the Instructor Know Whether the Students Were Comprehending the Material | ○ | ○ | ○ | ○ | ○ |
| 27. The Tele-Response System Gives the Students a Sense for Where They Stood in Relation to Other Students | ○ | ○ | ○ | ○ | ○ |
| 28. Use of the Tele-Response System Improved the Class Significantly | ○ | ○ | ○ | ○ | ○ |
| 29. The Tele-Response System Helps Maintain Everyone's Attention | ○ | ○ | ○ | ○ | ○ |

**(End of Survey)**

Appendix H

## INFORMED CONSENT FORM

for Participating in Research Conducted Under the Auspices of
the University of Oklahoma - Norman Campus

INTRODUCTION

The Effects of a Student Response System on Student Achievement, Satisfaction, and Achievement, is a doctoral dissertation research study being conduct by Henry E. Payne, under the sponsorship of Dr. Connie Dillon.

DESCRIPTION OF THE STUDY

The purpose of this study is to determine if there are any differences in learner achievement, learner satisfaction, perceived level of interaction and actual level of interaction between students using a students response system and students using an audio conferencing system in an interactive video teletraining class. Subjects will receive instruction from their Principles of Marketing instructor on Marketing Services. One group will use a student response system during their class and the other groups will use an audio conferencing system during their class. Both groups will be given a pretest and a posttest, as well as an end-of-class survey. Both groups will have their instruction video taped for interaction analysis. Subjects will not be seen on the video tape, but they will be heard when speaking.

POTENTIAL RISKS AND BENEFITS OF PARTICIPATION

A. Risks. Their are virtually no risks or discomforts that you will be subjected to as a result of you participation in this study.

B. Benefits. As a participant, you will be exposed to receiving instruction conducted using an interactive video teletraining system, with the use of either a student response system or an audio conferencing system designed into it. This exposure will prepare you for receiving training on the job after graduation, as many business, industry and governmental organizations are using this technology to deliver training.

SUBJECT'S ASSURANCES

A. Conditions of Participation. Your participation is voluntary. Refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may discontinue your participation at any time without penalty or loss of benefits to which you are otherwise entitled.

B. Confidentiality. All of your test records will be kept by your instructor. None of the records' data will be recorded or maintain so as to identify individual participants. After interaction analysis has been conducted, the video tape of you class will be erased. Reporting of the study results will not identify individual participants.

C. Compensation for Injury. There is very little to no risk of injury for participating in the study. Therefore, no compensation will be available for injury while participating in the study. Additional information can be obtained by contacting Hank Payne, 954-6913.

D. Contact for Questions. If you have any questions about the research study or about your rights as a research subject, please contact Hank Payne, 954-6913.

SIGNATURE

_____ _____

Name Date

NOTE: If you are under 18 years of age, this Informed Consent Form must be signed by a parent or your legally authorize representative.

## Appendix I

### End-of-Class Survey Mean Scores

| *Evaluation Item* | *Group 1* ($n = 35$) | *Group 2* ($n = 35$) | *t-Value* |
|---|---|---|---|
| <u>Factor 1 - Instructor/Instruction</u> | | | |
| 1. Clarity of Assignments | | | |
| Standard Deviation | 0.70 | 0.50 | |
| Mean | 4.49 | 4.63 | 0.84 |
| 2. Time Graphics Left on Screen | | | |
| Standard Deviation | 0.72 | 0.76 | |
| Mean | 4.31 | 4.08 | 1.22 |
| 3. Relevance of Graphics | | | |
| Standard Deviation | 0.61 | 0.65 | |
| Mean | 4.49 | 4.40 | 0.52 |
| 4. Quality of Graphics | | | |
| Standard Deviation | 070. | 0.65 | |
| Mean | 4.51 | 4.52 | 0.03 |
| 5. Instructional Techniques | | | |
| Standard Deviation | 0.60 | 0.71 | |
| Mean | 4.60 | 4.48 | 0.70 |
| 6. Instructor Made Students Feel They Were Part of the Class | | | |
| Standard Deviation | 0.74 | 0.46 | |
| Mean | 4.60 | 4.72 | 0.72 |
| 7. Instructor Communication Skills | | | |
| Standard Deviation | 0.60 | 0.60 | |
| Mean | 4.63 | 4.76 | 0.84 |
| 8. Instructor Organization/Preparation | | | |
| Standard Deviation | 0.55 | 0.49 | |
| Mean | 4.60 | 4.64 | 0.29 |

| *Evaluation Item* | *Group 1* ($n = 35$) | *Group 2* ($n = 35$) | *t-Value* |
|---|---|---|---|
| 9. Instructor Enthusiasm | | | |
| Standard Deviation | 0.51 | 0.56 | |
| Mean | 4.74 | 4.68 | 0.46 |
| 10. Instructor Teaching Ability | | | |
| Standard Deviation | 0.44 | 0.41 | |
| Mean | 4.74 | 4.80 | 0.51 |
| 11. Instructor Encouraged Participation | | | |
| Standard Deviation | 0.58 | 0.52 | |
| Mean | 4.69 | 4.76 | 0.51 |
| 12. Instructor Professionality | | | |
| Standard Deviation | 0.46 | 0.33 | |
| Mean | 4.71 | 4.88 | 1.60 |
| 13. Instructor Overall Rating | | | |
| Standard Deviation | 0.43 | 0.47 | |
| Mean | 4.77 | 4.84 | 0.59 |
| 14. Time Taken to Answer Site Calls During Class | | | |
| Standard Deviation | 0.84 | 0.58 | |
| Mean | 4.23 | 4.60 | 1.91 |
| **Factor 1 Score** | | | |
| **Standard Deviation** | **0.16** | **0.59** | |
| **Mean** | **4.58** | **4.63** | **1.14** |

| *Evaluation Item* | *Group 1* (*n* =35) | *Group 2* (*n* =35) | *t-Value* |
|---|---|---|---|
| | Factor 2 - Technology | | |
| 15. Monitor Picture Quality | | | |
| Standard Deviation | 0.66 | 0.65 | |
| Mean | 4.54 | 4.52 | 0.13 |
| 16. Monitor Sound Quality | | | |
| Standard Deviation | 0.85 | 1.08 | |
| Mean | 4.26 | 4.00 | 1.03 |
| 17. Adequacy of Monitor Screen Size | | | |
| Standard Deviation | 0.65 | 0.69 | |
| Mean | 4.60 | 4.71 | 0.61 |
| 18. Clarity of Tele-Response System Audio | | | |
| Standard Deviation | 0.78 | 0.76 | |
| Mean | 4.26 | 4.33 | 0.37 |
| 19. Talkback Delays of Tele-Response System | | | |
| Standard Deviation | 0.80 | 0.70 | |
| Mean | 4.31 | 4.17 | 0.73 |
| 20. Confidence That Class Will Not Be Canceled Due to Technical Problems | | | |
| Standard Deviation | 1.16 | 0.74 | |
| Mean | 4.11 | 4.13 | 0.04 |
| **Factor 2 Score** | | | |
| **Standard Deviation** | **0.84** | **0.81** | |
| **Mean** | **4.35** | **4.31** | **0.44** |

| *Evaluation Item* | *Group 1* (*n* =35) | *Group 2* (*n* =35) | *t-Value* |
|---|---|---|---|
| | Factor 3 - Course Management | | |
| 21. Ease of Operating Equipment at Sites | | | |
| Standard Deviation | 0.61 | 0.78 | |
| Mean | 4.54 | 4.21 | 1.85 |
| 22. Speed of Back-up Tape Delivery to Sites When Broadcast Signal Fails | | | |
| Standard Deviation | 0.70 | 0.68 | |
| Mean | 4.36 | 4.09 | 1.43 |
| 23. Accessibility of Program Personnel | | | |
| Standard Deviation | 0.71 | 0.59 | |
| Mean | 4.29 | 4.44 | 0.84 |
| 24. Enrollment Registration | | | |
| Standard Deviation | 0.66 | 0.45 | |
| Mean | 4.44 | 4.38 | 0.33 |
| **Factor 3 Score** | | | |
| **Standard Deviation** | **0.67** | **0.69** | |
| **Mean** | **4.41** | **4.28** | **1.43** |

| *Evaluation Item* | *Group 1* ($n$ = 35) | *Group 2* ($n$ =35) | *t-Value* |
|---|---|---|---|
| Factor 4 - Tele-Response System | | | |
| 25. The Tele-Response System Let Students Know Whether They Were Comprehending the Material | | | |
| Standard Deviation | 0.66 | 0.75 | |
| Mean | 4.44 | 4.29 | 0.80 |
| 26. The Tele-Response System Let the Instructor Know Whether the Students Were Comprehending the Material | | | |
| Standard Deviation | 0.65 | 0.68 | |
| Mean | 4.60 | 4.25 | 2.00 |
| 27. The Tele-Response System Gives the Students a Sense for Where They Stood in Relation to Other Students | | | |
| Standard Deviation | 0.78 | 0.72 | |
| Mean | 4.26 | 4.42 | 0.80 |
| 28. Use of the Tele-Response System Improved the Class Significantly | | | |
| Standard Deviation | 0.83 | 0.71 | |
| Mean | 4.29 | 4.38 | 0.43 |
| 29. The Tele-Response System Helps Maintain Everyone's Attention | | | |
| Standard Deviation | 1.00 | 0.78 | |
| Mean | 4.23 | 4.21 | 0.08 |
| **Factor 4 Score** | | | |
| **Standard Deviation** | **0.80** | **0.72** | |
| **Mean** | **4.36** | **4.31** | **0.59** |

## Appendix J

## Actual Numbers of Verbal Interaction by Type

| *Category* | | *Actual* | *Expected* | $\chi^2$ |
|---|---|---|---|---|
| 1. Accepts Feelings | | | | |
| | Group 1 | 0 | 0 | |
| | Group 2 | 0 | 0 | n/a |
| 2. Praises or Encourages | | | | |
| | Group 1 | 16 | 17 | |
| | Group 2 | 18 | 17 | 0.59 |
| 3. Accepts or Uses Ideas of Students | | | | |
| | Group 1 | 7 | 26 | |
| | Group 2 | 45 | 26 | 27.77* |
| 4. Asks Questions | | | | |
| | Group 1 | 13 | 33 | |
| | Group 2 | 53 | 33 | 24.24* |
| 5. Lecturing | | | | |
| | Group 1 | 35 | 38 | |
| | Group 2 | 41 | 38 | 0.47 |
| 6. Giving Directions | | | | |
| | Group 1 | 6 | 7 | |
| | Group 2 | 8 | 7 | 0.71 |
| 7. Criticizing or Justifying Authority | | | | |
| | Group 1 | 0 | 0 | |
| | Group 2 | 0 | 0 | n/a |
| 8. Student Talk - Response | | | | |
| | Group 1 | 7 | 46 | |
| | Group 2 | 85 | 46 | 66.13* |
| 9. Student Talk - Initiation | | | | |
| | Group 1 | 4 | 5.5 | |
| | Group 2 | 7 | 5.5 | 0.82 |
| 10. Silence/Confusion | | | | |
| | Group 1 | 13 | 15 | |
| | Group 2 | 17 | 15 | 0.53 |
| TOTAL | | | | |
| | Group 1 | 101 | 187.5 | |
| | Group 2 | 274 | 187.5 | 79.81* |

* $p < .025$ level

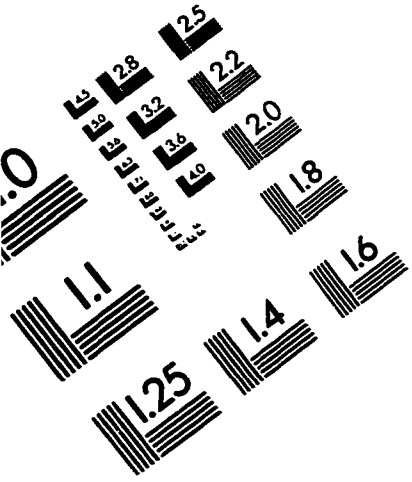
Actual Numbers of Total Interaction by Type

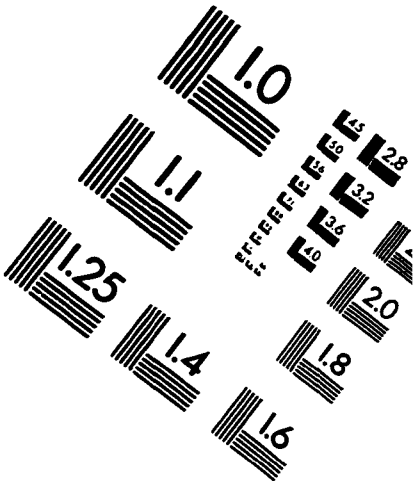
| *Category* | | *Actual* | *Expected* | $\chi^2$ |
|---|---|---|---|---|
| Verbal Interaction | | | | |
| | Group 1 | 101 | 187.5 | |
| | Group 2 | 274 | 187.5 | |
| Data Interaction | | | | |
| | Group 1 | 208 | 104 | |
| | Group 2 | 0 | 104 | |
| TOTAL | | | | |
| | Group 1 | 309 | 291.5 | |
| | Group 2 | 274 | 291.5 | 2.10 |

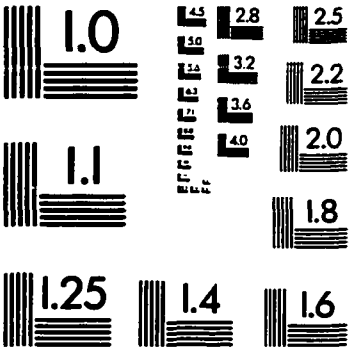
NOTE: For Group 1, students responded to the six questions using the data response keypad as follows, for a total of 208 data responses.

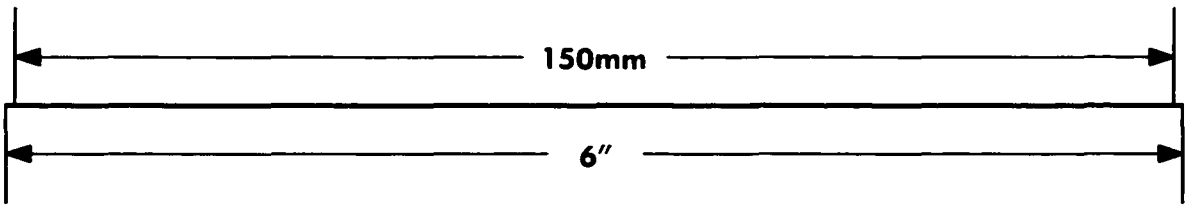
Question #1 - 34/35 responses
Question #2 - 34/35 responses
Question #3 - 35/35 responses
Question #4 - 35/35 responses
Question #5 - 35/35 responses
Question #6 - 35/35 responses

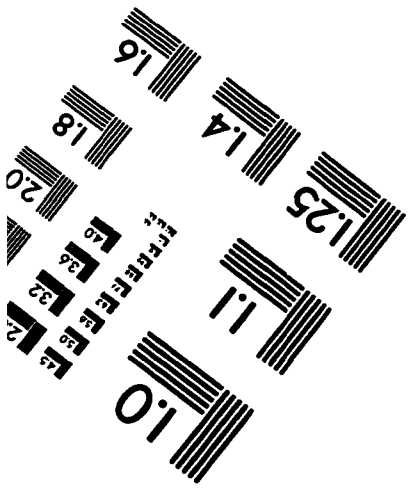
# IMAGE EVALUATION TEST TARGET (QA-3)

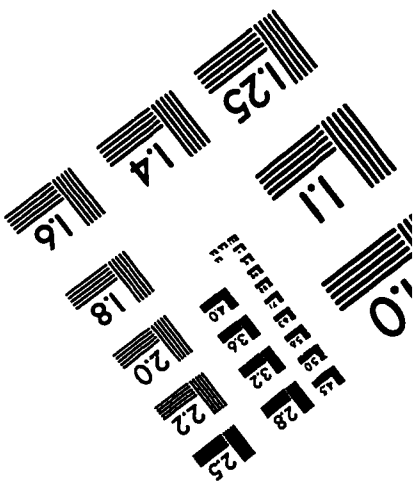



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