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**AN ANALYSIS OF THE RELATIONSHIP OF ACHIEVEMENT,
ATTITUDE, AND SOCIOLOGICAL ELEMENT OF
INDIVIDUAL LEARNING STYLE OF STUDENTS
IN AN INTERACTIVE TELEVISION COURSE**

by

Thomas A. Burkman

**A Dissertation
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Doctor of Education
Department of Educational Leadership**

**Western Michigan University
Kalamazoo, Michigan
June 1994**

**AN ANALYSIS OF THE RELATIONSHIP OF ACHIEVEMENT,
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Thomas A. Burkman, Ed.D.

Western Michigan University, 1994

This study examined the relationship of individual learning style with achievement and attitudes of students receiving instruction via two-way interactive television. The technology of interactive television is making it possible for school districts to cooperate and share instructors for low-incident courses. The technology is also helping schools to restructure and enhance programming. Knowledge of the extent to which these technologies affect the students, however, is limited.

Fifty-four students enrolled in two high school psychology classes were the study population. A quasi-experimental research design was used. In Part 1 of the data collection phase, the instructor taught a textbook unit from one high school. A pretest and posttest were used to assess achievement gain scores for both the host and remote school students. In Part 2, the instructor taught a different unit from the other school. Pretest and posttest scores provided achievement gain scores for the students from both schools. The Dunn and Dunn (1987) Learning Style Inventory was used to categorize students from the host and remote schools into three sociological preference subgroups from the "teacher motivated" element.

Data were analyzed using the one-way analysis of variance test and the t test. Results of the data analysis showed that there was a significant difference in achievement between the low-host subgroup and the low-remote subgroup ($p < .05$). There was no significant difference in achievement between the females of the three subgroups ($p < .05$). There was no significant difference between the males of the three subgroups ($p < .05$). There was no difference between the females and males ($p < .05$).

A survey was administered to assess the general attitudes of the students towards interactive television as a medium for instruction. Frequency and percentage distributions of responses to each survey item were descriptive of student attitude. Students enrolled in the interactive television psychology classes held more positive than negative attitudes toward interactive television as a medium of instruction. The one-way analysis of variance and t test were used to analyze the data on specific subgroup differences and failed to demonstrate any significant difference at the .05 level of significance.

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**One thing that I have asked from the Lord, that I shall seek:
that I may dwell in the house of the Lord all the days of my
life. To behold the beauty of the Lord, and to meditate in
His temple. Psalms 27:4**

Thomas A. Burkman

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CHAPTER I

INTRODUCTION

The purpose of this investigation was to analyze the relationship of the preferred sociological element of the individual learning style with achievement and attitudes of students receiving instruction in a psychology course via two-way interactive television. This technology allows one instructor to teach students in the host classroom as well as one or more remote classrooms. A quasi-experimental design was used for data collection and an attitude survey provided additional data for this study. The findings of this study are intended to provide a more sound basis for scheduling students into these interactive television courses.

Statement of the Problem

Today's technology is making it possible for school districts to cooperate and share low-incidence courses. This can be done without busing students or moving teachers from one school to another. With the increased availability of telecommunications technology, distance learning is used in some rural and small school districts to provide high school courses that meet the needs of the students (Libler, 1991). One method of distance learning, interactive television, is being used to provide instruction in low-incidence courses or courses where there is a shortage of certified teachers. The technology of interactive television is also helping schools to restructure and enhance programming.

Knowledge of the extent to which these technologies affect the students, however, is limited. Meanwhile, educators and researchers are learning more about the effects of certain biological and environmentally imposed characteristics that contribute to student learning. These biological and environmental characteristics are known as learning style elements (Dunn & Dunn, 1987). No studies were found that measure the effectiveness of interactive television as it relates to (a) the learning style preference of the student, (b) achievement, and (c) attitude among high school students.

The research questions for this study include:

1. Is there a difference in achievement between the students of the three sociological element subgroups (low, middle, and high) in the host classroom and the remote classroom?
2. Is there a difference in achievement between the females of the three sociological subgroups (low, middle, and high) in the host classroom and the remote classroom?
3. Is there a difference in achievement between the males of the three sociological subgroups (low, middle, and high) in the host classroom and the remote classroom?
4. Is there a difference in attitude toward learning in an interactive television (ITV) classroom between the students of the three sociological subgroups in the host and remote classrooms?
5. Is there a difference in attitude between the females of the three sociological element subgroups in the host and remote classrooms?
6. Is there a difference in the attitude between the males of the three sociological subgroups in the host and remote classrooms?

This study focused solely on students in a two-way interactive television course in psychology. The research examined the relationship of achievement and attitude toward learning in an interactive television course with one element of the sociological learning style preference of the learner. The design of the research was a quasi-experimental design. The physical presence of the instructor in the classroom was the experimental factor. The dependent variables were achievement and attitude toward the two-way interactive television course as a medium of delivery of instruction. The independent variables in this study were the preferred sociological element of the student's individual learning style and the gender of the students. The students were categorized by an element of sociological stimuli they preferred in their learning style. This was determined by administering the Learning Style Inventory (LSI) (Dunn, Dunn, & Price, 1987).

Significance of the Study

Schools and communities will restructure as they move through this present decade. The success of this restructuring will be dependent upon access to and sharing of quality teaching and information (Barker, 1986a).

A way of meeting this challenge is through interactive television technologies. Appropriately applied, this technology can be used to share outstanding teachers, increase access to postsecondary education, enhance many other programs, and support restructuring (Decker & Krajewski, 1985; Kruh & Murphy, 1991; Nytes & Musegades, 1985). Schools will restructure as more requirements are legislated for them to

meet the needs of students and to meet the criteria for accreditation within their states. Giles (1989) stated, "to those who envision the twenty-first century, there is only one over-riding issue facing education today: the transformation to communication age learning systems" (p. 49). As with all new programs and technology, the two-way interactive systems have caused some apprehension and doubt among traditional educators. Cable instructional television, a type of ITV, however, has been accepted and perceived as the medium of instruction of the future (Siegmund & McFadden, 1985).

This study is significant because it adds to the existing knowledge of learning style preferences of learners. It will also add to the body of information on the use of interactive television as an instructional tool. Educational leaders have the responsibility to seek out the best possible tools. They should also allow for the best possible experiences for teachers and students. Students should, when appropriate, learn about technology, learn from technology, and learn with technology (Mohn, 1985). Rogers and Southworth (1985) stated that technology is the greatest thing that ever happened to education. They went on to pose a very appropriate question: "What do we know about the real and potential impacts of technology on education and does this knowledge support a continuing and enthusiastic endorsement of the value of technology to schooling?" (p. 1). Because the two-way television technology is relatively new, little evaluative data has been collected to assess student level of achievement and student attitude toward the technology and the course content when taught through interactive television (Libler, 1991).

Only one study was found relating individual learning style preferences and student achievement in a two-way interactive television course. Nadel (1988) studied the relationship between learner preference and student achievement and attitude using college level courses and students and found that learner preference influenced student perception of course content. Robinson and West (1986) held forth that learning by technology may not be conducive to the learning styles of all students. Some students in interactive television classrooms do not feel comfortable learning from a teacher who is distant from the classroom. They may also experience difficulty in getting to know classmates in other schools. "Interactive television systems can not eliminate the problems of geographic distance" (Robinson & West, 1986, p. 7). Libler (1991) stated: "Regardless of what specific system technology is used for the delivery of interactive television courses, there is a lack of reported evaluation studies for its use in K-12 settings" (p. 60).

The lack of empirical data related to the effectiveness of two-way interactive television as a mode of instruction at the secondary level showed a need for this study. This was particularly true as it related to individual learning style preferences of secondary students. Given the above facts, a need exists to determine the viability of interactive television as an alternative to the traditional classroom for schools. This study helped close this gap of information between the relationship of the individual learner's preferred learning style and the effectiveness of interactive television courses.

Technology Description

The term interactive television (ITV) in this study means a two-way interactive video and two-way interactive audio system working in conjunction with one another. Two-way interactive television resulted from the desire during the 1950s to provide educational and instructional programming to people in remote areas. An early attempt occurred when an airplane circled a specific area while transmitting educational programs. The Public Broadcasting System (PBS), with support from universities, expanded this process by providing quality instruction on a national level. The courses established by universities became known as telelectures, and could be transmitted either through line or taped presentations (Barker, 1987b).

Presentations were all one-way. The audience or participants in remote sites could not respond. The professor could not teach through the inquiry or question-and-answer method, a situation that caused much misunderstanding. This system was soon criticized as being less effective and less stimulating than traditional classrooms (Barker, 1989; Hudson & Boyd, 1984).

As the one-way television communication tends to create boredom and frustration among many students, two-way television communication creates interest (Egan & Page, 1989). Two-way interactive television stimulates challenging responses because it is live, unrehearsed, and changeable (Alford, 1991). It is dependent upon those who are being addressed for their responses and it depends upon the instructor rather than directors and producers who bring about one-way

video television. The one-way instructional program depends upon movement and motion to reduce boredom, and must be produced and scripted to try to create excitement. The two-way interactive instructional television system is most successful when it relies upon the concept of bringing students together through the television medium and having the class taught normally with teacher and student interaction (Barker & Patrick, 1988). The system is really nothing more than a delivery mechanism that relies upon the teacher. It must be flexible enough to adapt to the teacher's delivery style and to the student's needs (Lundgren, 1985).

Some researchers believe that two-way interactive systems are not expected to be as good as, or better than, having the students in the actual classroom with their teacher. Yet, according to others, this alternative is the next best thing when the actual classroom situation is not practical or possible.

Interactive television learning technologies allow an instructor from one school to teach students from several schools simultaneously. This is accomplished by using television cameras and television monitors strategically placed in the host-sending school and the remote-receiving school(s). There are four primary modes of transmitting the video signal: low-power instructional fixed signal, cable television lines, microwave frequencies, and by the more recently developed fiber-optic telecommunication lines (Minnesota State Department of Education, 1988). Microphones are placed at several locations in the classrooms to enhance the audio portion of the interactive communication. The instructor has a teaching station near the front of the room that houses all

audio controls, video controls for the cameras, a VCR, and a fax machine. The fax machine is used to send and receive written materials between classrooms. Cameras are focused on the teacher, the students, and the teacher's desktop. The camera focused on the teacher's desktop is used for viewing notes or other material that is placed on the desktop. The entire system is controlled by a master control panel and is easy to operate. The idea of the specialized classrooms is to make the courses taught in these rooms truly interactive and to simulate a "normal" classroom (Kitchen, 1987).

Instruction

Successful teaching on the interactive television system should be a team effort. It is important to have a supportive administration and a technician available to help with trouble-shooting. Students who have been well informed about the equipment and secretaries who can help when necessary are important to the team effort.

The size of the class should not exceed the normal class size. Interactive television learning is an opportunity to increase curriculum; it should not be used to overload classes. To be truly interactive all students must be on camera at all times. This cannot be possible if the student numbers exceed the boundaries of the camera (Larson, 1991).

Students at all sites need to know how to operate all the equipment. Students may need to help with trouble-shooting when problems occur. Their knowledge of the equipment is especially important when there is a substitute teacher present in the classroom.

Lessons can be taught very much like they are taught in traditional classrooms. The students are able to do small and large group projects. They may have quizzes. They may have time to do homework and students may get individual help from the instructor at any location. There are some differences, however. Visual material should be used to maintain interest and illustrate key concepts and relationships, and appropriate interactive techniques should be used to involve students in learning (Ho, 1991). Study groups may include students from different schools discussing ideas over the television system. The answers to quizzes can be given immediately using the desktop camera. Quiet study time is supervised over television and the individual help may include a conversation over the telephone along with close assistance using the teaching camera (Kitchen, 1987). It is beneficial having students from two schools working together. They develop friendships and, instead of being rivals, they support and encourage each other.

The biggest adjustment may be the use of technical equipment while teaching. Much thought must go into the planning of the courses. Because some students are at remote locations, there must be a special plan to transport papers and tests. One way of paper transport is by the fax machine. As an example, if a student is absent for a test the make-up test is faxed to that student upon return. Students can fax make-up assignments to the host school. It can be used when technical problems arise with the other equipment or when other emergencies occur. Tests and quizzes may be sent to the remote schools in a sealed envelope. A secretary delivers the packet to the room on the day of the test. The test envelope is then opened on camera and the students follow the

directions and complete the test while on interactive television. The teacher observes the classrooms as if she is physically present. When the appropriate time comes the teacher will instruct a student at each site to collect the papers and seal them in an envelope. The tests are then transported back to the host site (Smith, 1990).

The school administrators should assign the teacher nearest the telecommunications room as the adult supervisor in charge of the class when fire drills, tornado warnings, and other emergencies arise (Kampmueller, 1991).

The review of research on student learning styles in Chapter II shows that the uniqueness of the interactive television learning programs makes it essential that the students who are counseled to enroll are compatible with the system. The success of the courses taught is dependent on the success of the individual students. Students who are less likely to succeed should not be enrolled in these courses. This further adds to the significance of this project.

Definition of Terms

The following terms are relevant to this study and are defined here for the purposes of clarity and consistency. These definitions have been derived from the literature.

Coaxial cable: A metal cable consisting of a conductor surrounded by another conductor, which can carry video, audio, and data signals from point to point. This medium is capable of carrying two-way video instruction.

Distance learning: Learning that takes place when the learner is geographically distant from the instructor. The learner and the instructor are linked by some form of technology that allows for the transmission of instruction.

Facsimile (Fax) machine: A photocopy device that transmits printed information to distance sites by way of telephone connection.

Fiber optics: Thin, transparent fibers of glass that uses internal reflections of light signals to transmit audio, video, and data signals.

Host classroom: The instructional classroom of an interactive television system where the instructor is physically present and the instruction originates.

Interactive television: Technology design which provides for multiple school classrooms and allows one teacher or location to telecast instruction to several other sites and allows students to interact with the instructor.

Learning style preference: The way the learner prefers to concentrate on, process, and retain new and difficult information.

Remote classroom: The distance classroom where the instructor is not physically present but, rather, is viewed on a television monitor by the students. The instructor can see and hear the remote students by way of video cameras and microphones strategically placed in the room.

Sociological learning style preference: The degree to which a student prefers an adult authority figure present in the classroom--a continuum of variety versus patterns.

Telecommunications: A generic term to label all electronic transfer of information between two or more users.

Teleconferencing: A term used to describe an interactive delivery system employed through the use of two-way dedicated telephone lines, computer, television, radio, and other electronic methods.

Telelearning: A computer based, interactive audio and graphic-keyboard, penpad, and still frame video long distance learning system. In addition to the equipment and support resources, the system includes a proctor at the receiving end to monitor student performance by distributing the necessary materials for the program.

Organization of the Study

Chapter I began with an introductory section, followed by the statement of the problem, and a section on the significance of the study. A description of the technology and some tips on effective teaching practices along with a section on definitions of relevant terms was included to help the reader understand the study.

Chapter II contains a review of the literature that provides a detailed section on individual student learning styles to help the reader understand its relationship to learning. A section of the literature review gives the reader a summation of relative research studies on the effectiveness of interactive television as a medium of instruction. Effectiveness in this section is defined in terms of achievement and attitude of the learner.

Chapter III describes the methods and procedures used in the study. The population is described and the procedures for gathering data are detailed.

Chapter IV gives the results of the data analysis.

Chapter V presents a summary, recommendations, and conclusions. The bibliography is used to cite the primary and secondary sources used in the study, along with a few related resources.

CHAPTER II

SURVEY OF THE LITERATURE

The purpose of this investigation was to analyze the relationship of one preferred sociological element, that is, the degree of teacher motivation, of the individual learning style with achievement and attitudes of students receiving instruction in a psychology course via two-way interactive television (ITV).

Addressed in this chapter are three questions:

1. What is learning style and what research types have been done about learning styles that support the theory that students learn differently?
2. What research studies have been done relating to the effectiveness of two-way interactive television as a mode of instruction?
3. What research studies have been done linking achievement and attitudes of students in relationship to their learning style preferences in two-way interactive television courses?

Learning Style Theory

The quality of education provided for youth is a major concern in American society. Most educators are burdened with the academic success of students. It is the goal of the educator to have all students be able to learn and to apply knowledge from the various content areas of the curriculum. Yet, with all the effort put into instruction, there are

students who are academic failures and frustrated with the current educational system. The dropout rate is much too high, especially among minority youth in urban areas (Dunn & Griggs, 1988). The task of holding students in high school through graduation is critical to this nation's future. Even students who graduate from high school many times do not possess the proper knowledge and skills to succeed in college. According to the College Board, nearly half of all students enter college without the study skills to cope with the new academic tasks (Hechinger, 1982). Established teaching practices have made the American educational system successful over the first half of this century (Dunn & Dunn, 1987). But that system did not have to try and educate such a diverse group of students as it is today. High dropout rates, poorly prepared graduates, and increasing demands on schools along with the breakdown of the family and a quickly changing world are causing educators to reevaluate current educational practices. Fortunately, better design and up-to-date statistical approaches to research help point the way to making instruction more responsive to students who do not learn and retain information in ways that conventional education provides (Dunn & Dunn, 1987). Learning styles emerged as a key element of this approach to making instruction more responsive to the needs of individual students.

Bloom (1976) stated that learning is an internal process. He went on to say that learning has taken place only when a change of learner behavior is observed as a result of what has been experienced. Lewin (1951) noted that behavior is a function of the person and the environment. Learning is defined by Webster's Ninth New Collegiate Dictionary

(1984) as a modification of behavior by experience. By synthesizing these ideas, one can say that learning styles are related to the behavior of the learner. Learning styles are both a biologically and environmentally imposed set of characteristics that make the same teaching method appropriate for some and inadequate for others (Dunn & Dunn, 1987). Learning styles is a construct that examines all facets of each person's preference toward learning. It helps explain why, in the same family, certain children perform well in school whereas their siblings may not. Both Restak (1979) and Thies (1979) argued convincingly that at least one-half of learning styles is genetic. Even though the research is not conclusive, they said that the remainder develops through experience. They posited that individual responses to the environment are biological and variables, such as, sociological preference, motivation, responsibility (which correlates with conformity), and structure, are developmental. Keefe (1988) supported this by declaring that style characteristics reflect genetic coding, personality development, motivation, and environmental adaptation. It is important to note that learning styles theory proclaims that every person has a learning style and every person has learning style strengths. They are characteristic in the behavior of individual learners that persist regardless of the teaching methods or content experienced. No learning style is better or worse than another. Each style preference includes similar intelligence ranges. Sage (1984) stated it this way, "learning styles honor diversity" (p. 85). Finally, students tend to learn more when taught with their own strengths than when taught with the teacher's strengths (Buell & Buell, 1987).

Through the leadership of Dr. James Keefe, Director of Research of the National Association of Secondary School Principals' (NASSP) Learning Styles Task Force, the following definition was given: "Learning styles are characteristic cognitive, affective, and physiological behaviors that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment" (Keefe, 1988, p. 3). Dunn (1989a) maintained that learning style is the way in which each learner begins to concentrate on, process, and retain new and difficult information.

There are at least 11 learning style models including the NASSP (Keefe, 1988) model and the Dunn and Dunn (1987) model. Not all the theorists interpret learning styles in exactly the same terminology. Some models are multidimensional, encompassing cognitive, affective, and psychological characteristics. Some are limited to a single variable, most frequently from the cognitive or psychological domain (see Table 1).

Dunn and Dunn Model

The Dunn and Dunn (1987) model was selected for this study because it contains an element in the sociological stimuli portion of the model called, "teacher motivated." In an interactive television classroom, this element may be an important factor. The individual student profile indicates whether the student scores low, middle, or high for the teacher motivated preference.

Dunn and Dunn (1987) developed a diagnostic-prescriptive approach to their model. First, Dunn and Dunn believed that the individual learning styles of students must be assessed. Secondly, they believed

Table 1
Summary of Learning Style Theorists and Models

Theorists	Elements of model
Dunn and Dunn	Environmental, emotional, sociological, physical, psychological
NASSP	Environmental, emotional, sociological, physical, psychological/cognitive, study skills
Hill	Qualitative/theoretical symbols, modalities of inference, culture
Letteri	Cognitive style
Ramirez	Bicognitive style, bicultural
Reinert	Perceptual modalities
Schmeck	Cognitive processing, study methods, retention
Hunt	Need for structure, need for authority, dependent/independent
Kolb	Concrete experience vs reflective observation, abstract conceptualization vs active experimentation
Gregorc	Perception/ordering
McCarthy	Innovative/analytic/common sense/dynamic, hemisphericity

the learner must be taught in ways that are compatible to their learning style if they are to have the best opportunities to learn. This investigation looked at whether or not interactive television affected the essence of the last statement.

Keefe (1988) stated that learning style is most likely the least understood element of diagnosis in schooling. He maintained that

learning style assessment, however, opens the door to a more personalized approach to schooling. It allows for better student advisement and placement into courses. This thought is congruent with a possible outcome of this study. That is, if any significant findings occur with this study, it may help with the scheduling of students with regard to selecting ITV courses as opposed to a traditional course. Keefe (1988) then said that learning style leads to a meaningful evaluation of teaching and learning.

The Dunn and Dunn (1987) model is multidimensional and contains five stimuli. The model focuses on the process of learning and includes these stimuli: environmental, emotional, sociological, physical, and psychological. Each of the stimuli contains subcategory variables called elements. There are a total of 23 learning style elements (see Table 2). These elements do not impact the learner equally. Those that affect the learner more intensely are referred by Dunn and Dunn as strong preferences. Other elements that are important, but influence less, are called preferences (Dunn & Dunn, 1987).

This study used the Dunn and Dunn (1987) model of learning styles as the citation for the independent variable known as the sociological stimuli. The sociological stimuli of this model contains the teacher motivated element which was relevant to this study.

Learning style theory has recently caught the attention of practitioners because of the scrutiny that the educational system has come under since the early 1980s. School reform efforts have moved the importance of effective instruction to the forefront of American education. As mentioned, increasing dropout numbers and the number of

Table 2
Dunn and Dunn Learning Style Model

Stimuli	Elements
Environmental	Sound, light, temperature, design
Emotional	Motivation, persistence, responsibility, structure
Sociological	Self, pair, peers, team, adult, varied, motivated by teacher, motivated by parent
Physical	Perceptual, intake, time, mobility
Psychological	Global/analytic, hemisphericity, impulsive/reflective

graduates that are functionally illiterate have caused educators to evaluate present practices (Lerner, 1981).

Related Research

Several studies have given us valuable information about learning styles of students. Research has been conducted in order to verify the relationship between individual learning styles of students and the responsiveness of the students to learning. Research on learning styles has been conducted at more than 60 universities over the past decade.

Researchers have conducted correlational studies to establish the relationships between learning styles and birth order, cognitive development, maturation, hemisphericity, field dependence and independence, global-analytic processing, temperament, and self-concept. The studies examined learners at all levels from early elementary through adulthood. The types of learners involved ranged from learning disabled, special

education students to highly motivated and gifted students. Researchers also studied the consistency of learning styles over subject matter and time.

A number of research studies have been done using one or more of the 23 learning style elements as independent variables. Only a few research studies have been found that specifically use the sociological element of learning style preference as an independent variable. The following information reports the findings of these research studies.

These findings are important because this study used the sociological element as one independent variable and specifically, focused on the teacher motivated element. The other learning style elements may present interesting studies as they relate to achievement and attitude in an interactive distance course. In this study, however, the variable of the teacher being physically "present" and the teacher "not present" in the classroom was directly related to the findings. This independent variable was manipulated in the study to see how it affected achievement and attitude in a two-way interactive television distance learning course.

Several studies have been conducted to determine whether specific types of students indicate common sociological preferences for learning, such as (a) learning alone, (b) learning in pairs, (c) learning in teams, (d) learning with a collegial teacher, (e) learning with an authoritarian teacher, or (f) learning in varied ways or a combination of modalities.

Researchers have studied the academically gifted students in all grade levels. The results of several studies showed that gifted students

would rather learn independently than with peers or through teacher-dominated activities (Griggs, 1989; Perrin, 1984; Price, 1980). Three correlational studies have been done to identify the learning style characteristics of students who are "at risk" or those who have dropped out of high school. C. D. Johnson (1984), Thrasher (1985), and Gadwa and Griggs (1985) found that dropouts indicated a significantly stronger preference for learning in varied ways, including self, peers, pairs, and teachers. Data from these studies also reveal that the higher the grade level, the less teacher-motivated students become. These studies may help in the explanation of results and lend to further understanding of the final data analysis. This was true as the population of this study was all 11th and 12th graders.

A study by Napolitano (1986) investigated the relationship between structure preference, achievement, and attitudes of college students enrolled in an introductory psychology course. High structure has been defined as a classroom managed by a teacher with limited options and clear, specific rules (Fleming, 1989). Low structure would allow students to make more choices concerning seating, work partners, classroom rules, etc. An interactive television teacher has to be a high structure teacher given the nature of the classroom setup and the technology. Napolitano used the Learning Style Inventory (LSI) (Dunn et al., 1987) with 120 college freshmen. A two split-plot factorial 32.2 analysis of variance (ANOVA) analyzed data for achievement and attitude. A review of the LSI analysis of those students that were low preference for structure revealed that for 64% of that population, their least preferred sociological grouping was learning with teacher motivation. Also, their scores

on the responsibility subscale of the LSI indicated that 54% were nonconformist in an instructional setting that required a high degree of conformity.

Although Napolitano's (1986) investigation involved college students, the ages of the students were close to the students in this study. The course content was also similar. The focus of his study was not directly on sociological preferences, yet one result of the study showed a relationship of low structure preference with the low need for an adult authority figure to be present for learning. These nonconforming students needed less structure and their attitudes were more positive when an adult was not present during the treatment.

As indicated in Chapter I, the nature of a two-way interactive television course has a high degree of structure. The technology, the classroom setup, the necessity for strict behavior rules, and the limitations on the delivery system requires considerable confinement. It is predicted that some students in this study will have a low preference for structure and thus be nonconforming with a low preference for an adult authority figure present for learning. Indeed, their achievement may be greater and attitude more positive when they are in the remote classroom as compared with their host classroom scores. It may be entirely possible then, that those students who have a high preference for structure also have a high preference for an adult authority figure to be present for learning and a high need for the teacher to be near for motivation.

Giannitti (1988) studied the relationship of sociological preferences of middle school students with their achievement and attitude in a

social studies course. This study compared the achievement and attitudes of students with a preference for learning alone or learning-with-peers under matched and mismatched conditions. The results of the study showed that learning alone and learning-with-peers preferents performed significantly better in the treatment that was congruent with their sociological preferences, and no-preference subjects performed significantly better in the learn-alone treatment. Learning-alone and learning-with-peers preferents demonstrated more positive attitudes toward the instructional treatment that was congruent with their sociological preference. No-preference subjects demonstrated more positive attitudes toward the learn-alone instructional treatment. Giannitti concluded that the findings on achievement and attitudes for the three preference groups in her study support matching instructional procedures with the identified sociological preferences of middle school students.

A study of sociological preferences of fifth and sixth grade students was conducted by Miles (1987). She analyzed the effects of matching and mismatching instructional groupings on both career awareness and career decision-making achievement and attitude scores of students. Miles classified the students according to their learning style sociological preference. She used t tests to compare the mean scores of the students when matched on the task of career awareness and career decision making. Data revealed that the matching of sociological preferences for learning alone or learning with peers with congruent grouping patterns increased achievement significantly on career awareness ($p < .01$) and career decision making ($p < .01$). Also, the students' attitude scores were statistically higher when they were taught

the career concepts in grouping patterns that accommodate their sociological preference. Miles conducted a test-retest of the Learning Style Inventory (Dunn et al., 1987) and concluded that the subject's sociological preference for either learning alone (.79) or learning with peers (.80) remained constant throughout the investigation.

Cholakis (1986) identified the sociological learning style preferences of underachieving seventh and eighth grade students. Those who preferred to learn alone scored significantly higher ($p < .01$) in vocabulary achievement than those who preferred to learn with a partner or in small groups. All students attained statistically higher achievement ($p < .001$) and attitude scores ($p < .01$) when they had a teacher present for learning.

DeBello (1985) studied an entire eighth grade of 236 students to determine if there was a relationship between individual learning style sociological preference and improved writing skills. The students were identified by the Learning Style Inventory as those evidencing preferences for peer learning ($n = 21$), learning with an adult ($n = 27$), or learning alone ($n = 33$). All others showed no preference. Students were assigned to classes based on their sociological preference. The student wrote compositions and then experienced revision strategies that were congruent and incongruent with their learning style. The data revealed a significant interaction between learning style preference and the methods of revision ($p < .001$). Peer learners scored significantly higher when matched with the peer conference technique of revision than when mismatched with self-review. Authority-oriented learners, having revised through the teacher conference, scored significantly

higher than when mismatched. Those who preferred to learn alone achieved higher scores having revised through the self-review process. Finally, when students revised essays through approaches congruent with their sociological preferences, statistically better attitudes toward the task resulted.

Most of the literature and research on learning styles mentioned some common conclusions. Generally, the authors stated that when learning styles of students are assessed and accommodated by the instruction of teachers, students become less disruptive and more communicative, interested in learning, and competent. Some authors seem to believe that the self-concept of the students grow stronger through this process. Fleming (1989) stated that attention to learning styles is one way to make teaching a more pleasant and productive enterprise.

At least four general conclusions can be drawn from the research studies given in this review. The conclusions are expressed in the following statements:

1. No learning style is either better or worse than another (DeBello, 1985; Miles, 1987).
2. Since each style has similar intelligence ranges, a student cannot be labeled or stigmatized by having any one type of style (Cholakis, 1986; Giannitti, 1988; Miles, 1987).
3. Most children can master the same content, how they master it is determined by their individual styles (Giannitti, 1988; Perrin, 1984).
4. Students learn more and like learning better when they are taught through their identified learning styles (DeBello, 1985; Giannitti,

1988; Miles, 1987; Perrin, 1984).

These studies were reviewed to help the reader understand that there is empirical data that leads educators to believe that student learning is influenced by the sociological preferences of their individual learning style. None of the research cited specifically addressed the problem that this study addressed. The findings, however, helped formulate the conceptual hypotheses that were investigated in this study. The conceptual hypothesis that relates specifically to learning style preference may be stated in the following terms: There is a relationship between the different individual sociological learning style preferences of students and the amounts of achievement. That is, the students' sociological preference of their individual learning style will have an effect on the dependent variables in an interactive television course. The fact that this research design has a host classroom and a remote classroom as well as female and male students allowed a further breakdown of this conceptual hypothesis. A second conceptual hypothesis was stated: There is a relationship between achievement and the sociological element subgroup of females in the host and remote classrooms. The third conceptual hypothesis was stated: There is a relationship between the achievement and the sociological element subgroup of males in the host and remote classrooms.

Effectiveness of Distance Learning Technologies

During the past 20 years thousands of studies have been done on effective schools and classrooms. Schiller (1991) reported that in the decade between 1969 and 1979 alone, there were over 2,700 studies

reported in the literature. Much has been said about the traditional classroom and instruction. In comparison, much less has been said about the effectiveness of television as a mode of instruction. Cisco (1991) reported approximately 300 studies indicate academic learning is taking place through various types of television instruction. Due to the novelty of the electronic classroom, specifically the interactive television classroom, very little of current research deals with these newer technologies (Barker, 1986b). Only a small portion of these relate to interactive television as a medium of instruction.

Effectiveness, for this review and study, was defined using two factors as a result of the student receiving instruction through distance learning technology. The first factor which related to effectiveness was a gain in student achievement, as measured by an achievement instrument. The second factor which related to the definition was a positive attitude of the student toward the distance learning technology as a mode of instruction, as measured by the Interactive Television Student Survey. If one of these factors was present, then the distance learning technology was regarded as effective as a medium of instruction.

If one thinks of distance learning as a technology-based delivery system for learning, then two-way interactive television learning is one type of distance learning. This premise is important. Many studies have been done on the effectiveness of distance learning, but not many of those pertain to the effectiveness of interactive television specifically.

A brief discussion on the effectiveness of distance learning follows. This will help the reader understand the limited research done on the effectiveness of two-way interactive television as one type of

distance learning technology.

Scott (1975) researched the students' perception of the effectiveness of teachers in a long-distance teaching environment. This was done in a course using teleconferencing technology. No significant difference was found between pre- and posttest scores of remote students with students who had face-to-face instruction. Conclusions drawn from his study suggested that instruction can be appropriately delivered through distance learning technologies. Scott concluded that face-to-face delivery does not significantly impact the learning process.

A study by Nilles, Carlson, Gray, and Hanneman (1976) revealed that audio teleconferencing was significantly better than video teleconferencing as a mode of distance learning instruction. The authors even suggested that in some cases video and face-to-face instruction were felt to be less effective than just audio teleconferencing. They gave some possible explanations to this outcome. The authors reported that there was a high level of "interpersonal attraction" for audio teleconferencing along with more group cohesion than found in face-to-face or video instruction. Finally, they described a drop in irrelevant chatter with audio teleconferencing. The authors of this study even suggested that the instructor on a television monitor was distracting and, thus, negatively influenced learning.

In 1984, a study at the University of Wisconsin used audio conferencing to teach a continuing education course in public library administration (Weingand, 1984). The research compared face-to-face instruction to that taught using audio teleconferencing. A one-group pretest and posttest research design was used. The study reported that there

was no significant difference between test scores that measured the degree of effectiveness of face-to-face versus long-distance instruction. The researcher found no evidence to support the notion that a classroom with live teachers provides "the optimum model for successful instructional delivery" (Weingand, 1984, p. 18). This research challenges any research that states face-to-face instruction is significantly better than distance education.

A study done on the degree of interaction in a distance learning medium found that the instruction was significantly interactive. Students and teachers were talking back and forth to each other via the medium (Barker & Patrick, 1988). The researchers also found that teachers asked a sufficient number of low and high level questions with appropriate wait time to permit students an opportunity to process the information. They reported that the teaching behaviors occurred to the same extent that they occurred in a traditional classroom.

Ellerston (1987) contended that telelearning is highly interactive and, therefore, highly effective. She maintained this because in her words, "it is interaction itself that instructs" (p. 67). She would like to see empirical evidence to support her anecdotal evidence. Ellerston went on to say:

Almost every activity in teleclasses has an exact match in the conventional classroom. Yet the results seem to be better in our teleclasses than in the traditional classroom. There are a number of possible explanations for the greater effectiveness of teleclasses interaction. None of them has been officially researched, however. We offer them only as intuitions and hope that a study in the future will verify what we can now only suspect. (p. 67)

But there is disagreement in the literature as it relates to the effectiveness of distance learning technologies. Clark (1989) viewed some studies on the effectiveness of instructional television and their findings with skepticism, particularly those that claim that televised instruction is superior to traditional instruction. He suggested that many of the researchers have a vested interest in the technologies being studied. Clark raised another convincing argument. He stated that society has tended to accept the claims of instructional technologies because of high expectations for technology of all kinds.

Some researchers have pointed out the problems with interactive television as a mode of instruction. Alford (1991) said it is apparent that interactive television is no substitute for the presence of an in-class teacher. Students and teachers do prefer classroom environments that maximize opportunities for interaction. This does not always happen in electronic classrooms. L. N. Johnson and Tully (1989) expressed concern about students having enough personal contact with the television teacher. Given the fact that interaction between students and teachers at different locations is artificially altered in the interactive television classroom, it would appear that both the quality and quantity of communication within the interactive class is influenced. This principle would also apply to student-to-student interaction which was reported as inferior to traditional classrooms (Robinson & West, 1986). One result of a study conducted by Perrin (1984) showed that distance students experience less involvement, less ability to ask questions, and less overall enjoyment. Although some researchers give the impression that the rapid growth and apparent popularity of televised instruction

means that all students' needs are adequately met, closer scrutiny indicates that the communication and socialization aspects of schooling are being sacrificed (Robinson & West, 1986). Holznagel (1988) agreed with the others when he acknowledged that although two-way interactive television is the best replication of live in-class instruction, it still contains a level of remoteness.

The above studies indicate a contrasting view of the effectiveness of distance learning technology as a medium of instruction. None of the studies use achievement or attitude as criteria to derive their conclusions. Rather, the criticisms of the technology comes from other criteria, such as, interaction and socialization.

Effectiveness of Interactive Television

Robinson (1985), in his study of the Carroll Instructional Television Consortium, reported that the project was effective. He stated students in the remote interactive television classes achieved as well on the posttests as did students in the traditional classrooms. As a means of transmitting information, television instruction has been successful. Robinson and West (1986) stated that students learn academics well in electronic classrooms.

The U. S. Congress Office of Technology Assessment (1989) cited several studies of interactive distance learning programs in Iowa and Minnesota. Although the research base on K-12 interactive distance learning programs is limited, those studies cited reported no significant difference in student achievement between interactive distance learning delivery and traditional classrooms.

Moore and Thompson (1990), in their summary of the literature on the effects of interactive distance learning, reported that of 503 documents only 46 related to K-12 schools. The 46 documents consisted of 22 position papers, 7 instructional papers, 3 technical papers, 5 reviewed research, and 9 primary research studies.

The results of the nine studies stated there was little or no evidence to support claims of general effectiveness. Although all claim positive results, the studies defined effectiveness in different ways.

The Minnesota Legislature, in 1983, allocated money for Technology Demonstration Site designation. This available money made planning, implementing, and evaluating a two-way interactive system a feasible alternative to traditional delivery systems. The Minnesota State Department of Education (1988) found that interactive television allowed schools to offer a wider range of courses. Results of their study showed that the medium did not seem to influence achievement, and it seemed to be most appropriate for language and math instruction.

L. N. Johnson and Tully (1989) assumed, based on the common response coming from school districts using interactive television, that students in a traditional classroom and students in an interactive television classroom are not significantly different in achievement. "Achievement seems to be more a reflection of the student group and/or the quality of the teaching than it does the medium of instruction" (p. 26).

In a study of a course offered by the College Learning System, no significant difference in test scores resulted when the course was taught either in person or by interactive two-way television (C. D. Johnson,

1984). The results of a survey also revealed no negative attitudes regarding the instructional strategy used. Graduate students studying supervision by way of interactive television had positive attitudes about the mode of instruction and learned equally as well (C. D. Johnson, 1984).

Douglas (1989) of Colorado State University researched the effectiveness of interactive television through the Interactive Satellite Delivery System (CENET). She studied achievement and attitudes of students in a continuing education course provided to the International Business Machines Corporation. Interactive courses presented on the CENET were as effective in terms of achievement and as well received as courses taught in the traditional manner.

Libler (1991) studied the effectiveness of interactive television in a high school physics course. Data were obtained from 85 students in six remote sites. The results of a one-way ANOVA test showed no significant difference in achievement between groups. Students enrolled in the interactive television physics course held slightly more positive than negative attitudes toward interactive television as the method of instruction.

In summary, earlier studies of distance learning technologies reported conflicting results on effectiveness, whereas more recent studies that focus on interactive television as a medium of instruction indicate that it is effective. Kabat and Friedel (1990) stated that it could be argued that interactive television takes us beyond education for all and toward education for each. He further summarized that the question is not whether a teacher can teach effectively on television. There can

no longer be any doubt about this, according to Kabat. He maintained that the question now is how to make the most effective use of television as an instrument of teaching.

Effectiveness of Interactive Television in Relationship to Learning Style Preference

Nadel (1988) completed the only study found in the literature that sought to establish a relationship between the learning style preference of the student with achievement and attitudes in an instructional television course. The author investigated the effects of interactive television learning with 97 subjects who were taking courses at remote sites through the University of Southern Maine. First, the students were classified into six learner preference types. These are not the same as the preference types that were used in this study. The data collected in the study included the students' attitudes toward the interactive television system at the end of the semester based on the learner preference, demographic information, and course grades. It was found that learner preference seemed to have an impact on the students' perception of the course content, although this preference appeared to be independent of the mode of instruction. Nadel's study was significant in that it is closely related to the concept of this research. The subjects were a few years older and the course content was not the same. However, the classifying of subjects into learner preference of their individual learning style and relating that to the achievement and attitude was significant.

Attitude and Interactive Television

There was a second conceptual hypothesis that needed to be addressed. Given the above findings and what is known about the individual learning style preferences, attitudes about the interactive television as a medium of delivering instruction could be influenced. Riddle (1990) pointed out that with new technologies and teaching strategies in the classroom some stress in the students may result. This comes from the changes that take place from the traditional classroom to a more "high tech" classroom. She went on to say that it is appropriate to measure the attitudes of the students as it may be important to assess students and bring them through the innovation transition. Students of the different sociological learning style preferences may have different attitudes about interactive television as a medium for delivering instruction. Wilson (1990) stated that attitudes often have a considerable effect on the perceived appropriateness and effectiveness of new material and methods. Summary Statement 4 on page 26 states that according to DeBello (1985), Giannitti (1988), Miles (1987), and Perrin (1984), students learn more and like learning better when they are taught through their learning styles. This relates back to the section defining effectiveness. Two parts of that definition were given as a measure of effectiveness. The first factor related to a gain in achievement as measured by an achievement instrument. The second factor relating to the definition was that a positive attitude must be conveyed concerning the course. If one of the two factors was present, the course and interactive television as a medium for instruction would be

considered effective.

Although the majority of recent studies suggest that interactive television is effective as a medium for delivering instruction, some questions are being raised about the effectiveness of interactive television in the affective domain. Educators have a concern that if there are students who become "invisible" in the traditional classroom, how much more will they "fall through the cracks" in a remote site classroom. It is difficult to read students' expressions and thus difficult to determine who is getting "lost" in the traditional classroom. If this is true, then what kind of atmosphere is being created with these new interactive television classrooms? Alford (1991) reported that on the student opinion survey in her study, students strongly agreed that they would prefer being in the classroom with the teacher. This supports the same findings of Nixon (1992) and Randall (1991). This preference stated by the students is also consistent with the concerns Paul (1990) expressed about depersonalization and the concerns of other researchers about remoteness. Finally, Alford (1991) explained this feeling was reemphasized in student comments about either being glad they were with the teacher, wishing they were, or not wanting to take another interactive television course unless they were at the site with the teacher.

This review of the literature helped formulate three more conceptual hypotheses related to attitudes of students in the interactive television environment. These conceptual hypotheses were:

1. There is a relationship between attitude and the sociological element subgroup of students in the host and remote classrooms.

2. There is a relationship between attitude and the sociological element subgroup of females in the host and remote classrooms.

3. There is a relationship between attitude and the sociological element subgroup of males in the host and remote classrooms.

An attitude survey was given in this study to analyze attitudes of the students in the host classroom and the remote classroom with regard to how they felt about the interactive television as a medium for instruction. This was important, as the affective aspect of education is becoming more relevant to student learning. Simonson (1979) stated that attitudes and attitude measurement are critical components of teaching and learning and the instructional developer should collect as much relevant data about that process as possible. Student attitudes do play a significant role in the acquiring of knowledge in the classroom. An attitude survey was necessary to help understand the overall results of the study.

Technology has rushed forward in a flurry of activity without promoters pausing to critically evaluate the personal impact on students. Despite some documented success of interactive television as a medium of instruction, little attention has been devoted to the affective dimension of learning. As important as it is to determine the effectiveness of an innovation, educators must invest as much energy in determining the "affectiveness" in order to assure maximum benefit of resources (Wedemeyer, 1987). The University of Kansas produced a research agenda for the Office of Technology Assessment (U.S. Department of Education) and proposed a comprehensive evaluation plan of distance learning systems which included such attitude measures as enthusiasm,

content interest, and course satisfaction (Riddle, 1990). It is becoming more evident that care must be taken in allowing students to enroll in these types of courses. Hobbs and Osburn (1989) and Williams (1978) explained that educators must learn that within the freedom to teach in new and exciting ways comes the responsibility to wisely and cautiously use the technology for student benefit. This concern for matching the right type of student with the newer technology is clearly stated in the words of a North Dakota interactive television instructor, "distance learning is not for every student, nor is it for every teacher" (Hobbs & Osburn, 1989, p. 21).

Summary

Three questions were addressed in this literature review. Learning style was first defined in relationship to the general concept of learning and then several studies were cited to support the conclusion that different students learn differently. The key statement which sums up that portion of the review stated that students tend to achieve more and have a more positive attitude toward learning when they are taught in methods congruent to their learning style preference. As a result of this review, three conceptual hypotheses were developed.

The second section of the literature review gave several studies which concluded that achievement in distance learning is not affected by the type of technology or the distance of the instructor. A few authors reported that these findings were inconclusive and confusing. They reported that students may be negatively influenced by the technology or the absence of the instructor.

Only one study was found that researched the relationship of learning style preference and achievement and attitude in a distance learning course. This study was inconclusive and not much of a help as it used a different learning style model and older students.

Regardless of what several studies report as to the effectiveness of distance learning on achievement and attitude, it can be said that technology is not as good as a live teacher in the classroom. The intangible benefits of having a live instructor in the classroom have not been studied. These intangible variables might include eye contact by the teacher, the physical closeness which promotes teacher-student bonding, personal smiles, soft-spoken and encouraging remarks, and other interpersonal communication. Inasmuch as interactive television technology is becoming increasingly more available, more studies should be encouraged to find what effects the lack of these other variables will have on student achievement and attitude.

CHAPTER III

METHODS AND PROCEDURES

The purpose of this study was to determine the relationship of learning style preference of the student with achievement and attitude. This took place in an interactive television (ITV) course with ITV as the medium for delivery of instruction. Chapter III contains an explanation of the methods and procedures that were used to determine this relationship. The study was conducted in several phases. In Phase 1, a comprehensive review of the literature on individual learning styles of students was given. The reporting of research showed the reader that when students are taught in ways that are congruent with their individual learning style preference, they tend to achieve more and have a better attitude toward learning. Also in Phase 1, studies were cited on the effectiveness of interactive television as a medium for delivering instruction. The results seem to show that interactive television used as a medium for delivering instruction is as effective as a traditional classroom. Yet, certain intangibles in a traditional classroom have never been studied; consequently, one cannot be so easily convinced that interactive television is as good as a traditional classroom.

The findings from the literature review were analyzed to provide a basis for a quasi-experimental study on the relationship of individual learning style preference with achievement and attitude in an interactive television course.

Population

Phase 2 involved the identification of the participants for this study. The population consisted of all students who were enrolled in a psychology course with Merrill High School, Merrill, Michigan, acting as the host school and Hemlock High School, located in Hemlock, Michigan, as the remote school. All students enrolled gave their permission to participate in the study. This population was from two classes taught in consecutive periods. There were 54 students in the two classes. The students were all in their junior or senior grade-level year. The female number of students in both schools enrolled in the course was 43. The number of males in both schools enrolled in the course was 11. See Table 3 for the population statistics.

Instruments Used in the Study

Learning Style

In order to determine whether there was a difference in achievement and attitude between students of the three sociological subgroups of learning style in an ITV course, it was necessary to use three types of testing instruments. One instrument used provided a method to categorize students into the three groups. The instrument was the Learning Style Inventory (LSI) written by Dunn et al. (1987). It was comprised of 100 dichotomous items developed through content and factor analysis. The LSI used a 5-point Likert scale to rate the items and required approximately 30 minutes to administer. It was a self-report instrument and it reported a Consistency Key which expresses the accuracy with which

Table 3
Population Statistics

Participants	No. of students ($n = 54$)	
	Merrill High	Hemlock High
Junior males	3	2
Junior females	14	16
Senior males	3	3
Senior females	7	6
Total males	6	5
Total females	21	22
Total number of students	27	27

Note. Statistics by Kampmueller.

each respondent had answered its questions. The LSI also reported a subscale summary that showed the number and percentage of the total group that chose a particular element as a strong preference. To be a strong preference the standard score must have been higher than 60. Elements that are called preferences report a standard score between 60 and 40. Students that showed no preference for a learning style element had a standard score less than 40 in that subscale.

Extensive research using the LSI has made it the most widely documented assessment instrument for learning styles (Dunn, Beaudry, & Klavas, 1989). Curry's (1987) review of 21 different learning and cognitive style models through psychometric analysis reported that the

Dunn and Dunn (1987) model had one of the highest reliability and validity ratings. This factor along with its ease of use and administration was the reason for using the LSI. The Ohio State University's National Center for research in Vocational Education published the results of a two-year study of learning style instruments. It reported that the LSI had impressive reliability, and face and construct validity (Kirby, 1979). Dunn et al. (1987) reported the reliability of the LSI as .83. In a recent comparative analysis of the style conceptualizations and psychometric standards of nine different learning style instruments, the Learning Style Inventory was the only one rated as having good or better reliability and validity (Dunn, Gemake, Jalali, & Zenhausern, 1990).

Since 1979, the LSI had evidenced extremely high predictive validity. The experimental and correlational research with the LSI at more than 60 universities establishes this model's research base. Keefe (cited in DeBello, 1985) identified the Dunn and Dunn model as being practitioner oriented and the most widely used assessment in elementary and secondary schools.

Achievement

The achievement data collection required two academic test instruments familiar to the students. Each test was a unit test written for the psychology curriculum used for the course and published by Harcourt Brace Jovanovich, Inc. (Engle & Snellgrove, 1984). These tests were textbook unit tests similar to the tests the students took prior to the data collection phase. The textbook unit tests were used because the

students were accustomed to them. Also, each test was a valid instrument with regard to the information being taught.

Attitude

The attitude survey used was adopted from a research study by Libler (1991). This instrument, by Libler, was developed to determine the attitude of students toward the use of interactive television as the method of instruction for a course in high school physics. The student survey consisted of Likert-type scales, semantic differentials, and open-ended questions. A modified version of the survey was developed by replacing questions specific towards physics with questions related to the psychology course of the study. Also, several additional questions were given relating to the specific environment of the two schools involved. The directions were changed in Part II of the survey. The reading level was made easier by changing some of the words and phrasing. The modified survey was field tested by administering it to a host and remote calculus class at the author's school and the remote counterpart across town.

Libler (1991) had a panel of experts consisting of Ball State University faculty and an Indiana Department of Education consultant review the survey instrument for content validity. The survey was generic enough to be used in this study without requiring the formulation of an entirely new instrument. Permission to use the modified version of the student survey was granted by the author.

Collection of Learning Style Preference Data

Phase 3 required collecting the learning style preference data. Each student who had a consent form on record was given the Learning Style Inventory (LSI) (Dunn et al., 1987). A student profile was generated from the answers reported on the LSI. The information from the LSI allowed the students to be put into one of three categories: low, middle, or high for the sociological learning style preference category, teacher motivated. This information was valuable as it was one of the independent variables of this study, the teacher's physical presence. Given the nature of the interactive television classroom arrangements, one host school and one or more remote schools, the teacher motivated element was chosen as the criterion for studying student achievement and attitude. Research on individual student learning style has shown that despite the quality of teaching, some students are incapable of learning directly from the teacher. These students likely do not desire teacher feedback or interaction while they are learning. They prefer to do things on their own. These students would score low in the teacher motivated preference. Yet, there are some students who are teacher oriented and have a difficult time learning from peers or alone. Rather, they need the option of being close to the teacher and obtaining guidance, reinforcement, or assistance; these would be the high subgroup for teacher motivated. Finally, there are students in the middle subgroup who need teacher interaction and feedback occasionally, depending on the subjects being studied. Research demonstrates that when students' sociological preferences were identified and the students

were then exposed to multiple treatments--both congruent and incongruent with their learning styles--each achieved significantly higher test scores when taught in congruent patterns (Dunn et al., 1989). Four studies were found that examined the effects of sociological preferences on attitude toward learning and found statistically higher attitude scores when students were taught according to their preferred learning style (DeBello, 1985; Miles, 1987; Perrin, 1984). This was important for this study as one of the questions was whether low, middle, or high category students for this sociological element achieved better or had a better attitude towards learning.

Collection of Achievement Data

Phase 4 of this study was conducted in two parts. The design of the study was a Compromise Experimental Group-Control Group design (pretest-posttest) as described by Kerlinger (1986) (see Table 4).

The design uses two groups: (1) the host school class and (2) the remote school class. This design is called a Compromise Experimental Group-Control Group design because it compromises a true experimental design. A true experimental design would require the random assignment of subjects to groups and the random assignment of treatment to groups. Both of these factors were lacking in this research. The population for this study was a "convenient" group, students who had signed up for the course. The independent variable, the presence of the instructor, was manipulated in this design. There was no assurance that the two groups were equivalent or matched in any way. However, the equivalency was determined by checking student information, such as,

Table 4
Compromise Before and After Control Group Design

Design:				
Part I:	M_{hb}	X	M_{ha}	X = treatments physical presence of instructor
	H_{rb}	$\sim X$	H_{ra}	
Part II:	H_{hb}	X	H_{ha}	X = treatment is physical presence of instructor
	M_{rb}	$\sim X$	M_{ra}	

Note. M = Merrill High School. H = Hemlock High School. h = host. r = remote. b = before. a = after. Design idea found in Kerlinger (1986).

grade level, age, gender, and grade point average. The t test was used by comparing the means and standard deviations of the two independent school groups. The distribution of these variables was also examined to compare equivalency. The attempt of this analysis was to find the degree of equivalency. It was predicted that there would be no evidence against the equivalency assumption. No differences were found between the remote and host classroom groups. This was examined but not a key factor as the classroom groups were broken down into three sociological element subgroups.

Table 5 shows the research design with the actual school names which visually explains Part I and Part II.

Part I had the instructor in the Merrill High School interactive television classroom for approximately 10 class days. Part II of this phase

Table 5
Compromise Before and After Control Group Design
(With Actual School Names)

Design:

Part I:

Merrill (host before)--Instructor--Merrill (host after)

Hemlock (remote before)--TV--Hemlock (remote after)

Part II:

Hemlock (host before--Instructor--Hemlock (host after)

Merrill (remote before)--TV--Merrill (remote after)

Merrill: Merrill High School, Merrill, Michigan.

Hemlock: Hemlock High School, Hemlock, Michigan.

had the instructor in the Hemlock High School interactive television classroom for approximately 10 class days.

Each part of this phase was conducted as similar as possible. A unit of instruction was selected by the instructor for each part. The units were as independent from each other in content as was possible. The reason for this independence was that each student needed to have an equal opportunity for achievement in both parts. If a student did not do well in Part I; that is, he or she did not show much achievement gain, then that lack of achievement would not affect the opportunity to achieve in Part II.

After the units were selected, a pretest for the Part I unit was given to all participating psychology students. The pretest was collected and graded by the instructor without student knowledge of results. The instructor gave at least two pretests and posttests prior to the actual data collection phase for the purpose of desensitizing the students to those conditions. The Hawthorne effect (Owens, 1987) was minimized by conditioning the students to circumstances similar to the research conditions without their knowledge. The instructor then taught the unit much the same way she had the previous units in this course. At the end of the 10-day unit, the instructor again gave the test. This was the posttest and allowed measurement of any gain in achievement for each student. This was done by subtracting the results of the pretest from the results of the posttest.

The same procedures took place in Part II. The difference in this part was the instructor traveled each day for 10 class periods to Hemlock High School. By doing this, the independent variable of the physical presence of the instructor was manipulated. Having the instructor change sites and conducting the treatment a second time had the effect of controlling an extraneous variable by building it into the design as an independent variable. Any difference in achievement which might be due to the physical presence of the instructor would show in both parts of this phase by moving the instructor to both locations. Also, any difference in the two classroom groups was negated by moving the instructor to the second site for Part II. If there was a significant difference in the two groups, the movement of the instructor caused both

groups to be treated in a similar manner. The effect was to control the variable. The result was to minimize the error variance of the study.

Collection of Attitudinal Data

Phase 5 involved the collection of data on student attitude toward two-way interactive television as a medium for delivery of instruction. The student attitudinal survey was given after Part II of Phase 4, approximately 12 weeks into the semester. It was given one time after all achievement data had been collected. A cover sheet was attached to the attitude survey for the purpose of collecting other pertinent information. This information included the student code number, school, age, grade, gender, and overall grade point average. These data served two purposes. One purpose was to help determine the equivalency of the two groups. The other purpose was to match the attitudes and other information with the various sociological subgroups. The attitude survey was used to determine if students of a particular sociological learning style preference had different attitudes than the other groups.

Analysis of Data

Phase 6 was the analysis of data obtained to determine if there was a relationship between individual learning style sociological preference and achievement and attitude in an interactive television course. The statistical analysis consisted of testing several null hypotheses derived from operational hypotheses for each research question.

Statistical Test

Each conceptual hypothesis was related to the six research questions given in Chapters I and II. An operational hypothesis and a null hypothesis is given in this section for the purpose of data analysis. These operational hypotheses were derived from the six conceptual hypotheses.

1. There is a difference in mean achievement gain scores between the three sociological element subgroups in the host and remote classrooms. Null Hypothesis 1 was stated: There will be no difference in the mean achievement gain scores between the students of the three sociological subgroups in the host and remote classrooms. The achievement gain data were the mean (X) scores for each sociological preference subgroup for the element teacher motivated. This allowed for the testing of the null hypotheses using the analysis of variance (ANOVA) (Norusis, 1990).

The achievement gain scores for each individual sociological preference subgroup student in the host and remote classroom were converted into a mean score. The scores of the sociological preference subgroups of the two periods that the psychology course was taught were joined together for the purposes of data analysis. This allowed for a larger number of participants in each subgroup. All statistical analyses were done on the Western Michigan University VAX computer system using the Statistical Package for Social Science (SPSS, Norusis, 1990) statistical program. The alpha level for all the tests in this study was set at .05. This is the probability of making a Type I error, that is, rejecting

a null hypothesis when it is true.

The ANOVA provided the ability to determine only if some means were indeed different. It did not pinpoint where the differences occurred. The Modified Least Significant Difference (LSD) procedure was used to help determine where the differences were between mean scores of the groups when they existed. The Modified LSD procedure was used because by design it was not sensitive to various sample sizes assumption and reported a good probability.

2. There is a difference between mean achievement gain scores of the females in the three sociological element subgroups in the host and remote classrooms. Null Hypothesis 2 was stated: There will be no difference in the mean achievement gain scores between the females of the three sociological subgroups in the host and remote classrooms. The ANOVA procedure was used to analyze the data for this null hypothesis. The Modified LSD procedure was used to test this null hypothesis as a post hoc test.

3. There is a difference in achievement gain scores of males in the three sociological element subgroups in the host and remote classrooms. Null Hypothesis 3 was stated: There will be no difference in the mean achievement gain scores between the males of the three sociological subgroups in the host and remote classrooms. This null hypothesis was tested using the ANOVA procedure.

Null Hypothesis 4 was stated: There will be no difference in the mean achievement gain scores between the females and males overall. This null hypothesis was tested using the t test for independent means.

4. There is a difference in attitudes of students in the three sociological element subgroups in the host and remote classrooms. The null hypothesis with this operational hypothesis was stated: There will be no difference in the mean attitude scores between the students of the three sociological subgroups in the host and remote classrooms. This null hypothesis was tested using the ANOVA procedure.

5. There is a difference in the attitudes of the females of the three sociological subgroups in the host and the remote classrooms. Null Hypothesis 6 was stated: There will be no difference in the mean attitude scores between the females of the three sociological subgroups in the host and remote classrooms. This hypothesis was tested using the ANOVA procedure.

6. There is a difference in the attitudes of the males of the three sociological element subgroups in the host and remote classrooms. Null Hypothesis 7 was stated: There will be no significant difference in attitudes between the males of the three sociological subgroups in the host and remote classrooms. This null hypothesis was tested using the ANOVA procedure and was further analyzed using the Modified LSD post hoc test.

Null Hypothesis 8 was stated: There will be no difference in attitude between the females and males overall. This null hypothesis was tested using the t test for independent means.

Summary

In Chapter III, the methods and procedures were discussed that were used to generate the data for analysis in this study. The

population was identified along with the instruments used for the data collection. The design of the research was described with explanation of the methodology. Six conceptual hypotheses were identified and eight corresponding null hypotheses were given. These were derived from six research questions formulated from the review of the literature. Finally, the statistical test was given with the addition of post hoc tests named to help identify any relationship that existed in this study.

Chapter IV describes the results of the data analysis along with various tables to show the statistical outcomes resulting from the analysis.

CHAPTER IV

FINDINGS

Purpose of Study

The purpose of this investigation was to analyze the relationship of the preferred sociological element of the individual learning style with achievement and attitudes of the students receiving instruction in a psychology course via two-way interactive television. A quasi-experimental design was used for the data collection. Procedures for the data collection and analyses were designed to test six operational hypotheses:

1. There is a difference in mean achievement gain scores between the students of the three sociological element subgroups (low, middle, and high) in the host classroom and the remote classroom.
2. There is a difference in mean achievement gain scores between the females of the three sociological element subgroups (low, middle, and high) in the host classroom and the remote classroom.
3. There is a difference in mean achievement gain scores between the males of the three sociological element subgroups (low, middle, and high) in the host classroom and the remote classroom.
4. There is a difference in mean attitude scores between the students of the three sociological subgroups (low, middle, and high) in the host classroom and the remote classroom.

5. There is a difference in mean attitude scores between the females of the three sociological element subgroups in the host classroom and the remote classroom.

6. There is a difference in the mean attitude scores between the males of the three sociological element subgroups in the host classroom and the remote classroom.

Chapter IV seeks to answer the above stated research questions by presenting an analysis of data to test the null hypotheses derived from the questions. This chapter presents a statistical analysis of the data gathered for the study to determine whether the null hypotheses were accepted or rejected at the .05 level of significance. All data analyses were completed on the mainframe VAX computer through Western Michigan University.

Null Hypotheses

There were a total of eight null hypotheses that were derived from the research questions. Each is listed below. The three sociological subgroups stated in the null hypotheses are: (1) students who scored low in the teacher motivated element, (2) students who scored in the middle for the teacher motivated element, and (3) students who scored high for the teacher motivated element. The null hypotheses were stated as follows:

1. There will be no difference in the mean achievement gain scores between the students of the three sociological subgroups in the host classroom and the remote classroom.

2. There will be no difference in the mean achievement gain scores between the females of the three sociological subgroups in the host classroom and the remote classroom.

3. There will be no difference in the mean achievement gain scores between the males of the three sociological subgroups in the host classroom and the remote classroom.

4. There will be no difference in the mean achievement gain scores between the females and males overall.

5. There will be no difference in the mean attitude scores between the students of the three sociological subgroups in the host classroom and the remote classroom.

6. There will be no difference in the mean attitude scores between the females of the three sociological element subgroups in the host classroom and the remote classroom.

7. There will be no difference in the mean attitude scores between the males of the three sociological element subgroups in the host classroom and the remote classroom.

8. There will be no difference in the mean attitude scores between the females and males overall.

Analysis of Data

The following section gives the results of the testing of each null hypothesis. Data were coded for the analyses with six groups compared for mean achievement gain differences. The six groups consisted of all the students from both schools and from both periods the course was

taught. The low, middle, and high groups were students who scored at that level for the sociological element, teacher motivated. The six groups were: (1) low-host group, (2) low-remote group, (3) middle-host group, (4) middle-remote group, (5) high-host group, and (6) high-remote group.

The first conceptual hypothesis was: There is a relationship between achievement and the sociological element subgroup of students in the host and remote classrooms. The corresponding null hypothesis and data are presented in Tables 6 and 7.

As a result of analyzing the null hypothesis about the six means, the Modified LSD post hoc multiple comparison test was used to determine between which pairs the differences occurred. Table 7 contains the results of this test.

Results from the test indicated a significant difference in achievement between at least two of the six sociological subgroups. Table 7 showed a significant difference between Group 2 (low-remote) and Group 4 (middle-remote). These two groups were located at the same school, which was the remote school. This fact does not answer the question of whether there was a difference between the host and remote schools, but the test was set up to find a difference among all groups. Therefore the null hypothesis was rejected. Concerns about the population size are stated as a limitation in Chapter V.

Null Hypothesis 1

There will be no difference in the mean achievement gain scores between the students of the three sociological subgroups in the host classroom and the remote classroom.

Table 6

Analysis of Variance of Mean Achievement Gain Scores by Subgroups (Low, Middle, and High) in the Host Classroom and the Remote Classroom

Summary ANOVA					
Group	<u>n</u>	Mean	<u>SD</u>	Standard error	95% confidence interval for mean
1	11	14.36	5.68	1.71	10.55 to 18.18
2	11	8.91	4.11	1.24	6.15 to 11.67
3	33	14.21	5.41	0.94	12.29 to 16.13
4	32	15.53	6.40	1.13	13.22 to 17.84
5	10	14.50	6.38	2.02	9.94 to 19.06
6	9	10.33	7.28	2.43	4.74 to 15.93

Note. 1 = low-host group; 2 = low-remote group; 3 = middle-host group; 4 = middle-remote group; 5 = high-host group; 6 = high-remote group. Test for Homogeneity of Variances. Cochran's C = Max. Variance/Sum(Variances) = .2487, $p = .409$.

* $p = .022$. Significant at the .05 level ($p < .05$).

Table 7

Multiple Range Test--Modified LSD Procedure--for Independent
Means of Achievement Gain Scores Between the
Students of the Six Sociological Subgroups

Mean	Group	Group					
		2	6	3	1	5	4
8.909	Group 2 (low-remote)						
10.333	Group 6 (high-remote)						
14.212	Group 3 (middle-host)						
14.364	Group 1 (low-host)						
14.500	Group 5 (high-host)						
15.531	Group 4 (middle-remote)	*					

*Denotes pairs of groups significantly different at the .05 level.

The second conceptual hypothesis was stated: There is a relationship between achievement and the sociological subgroup of females in the host and remote classrooms. Tables 8 and 9 display the corresponding null hypothesis and subsequent data analysis.

The relationship of gender and academic achievement with technology has been the source of recent research studies. Although the results of these studies are inconclusive as to whether males achieve more academically or whether females achieve more academically in classroom environments enriched with technology, this study examined the data for a possible relationship between achievement and the subgroups for females and males.

Null Hypothesis 2

There will be no difference in the mean achievement gain scores between the females of the three sociological subgroups in the host classroom and the remote classroom.

Table 8

Analysis of Variance of Mean Achievement Gain Scores by Subgroups (Low, Middle, and High) Between Females in the Host Classroom and the Remote Classroom

Summary ANOVA					
Group	<u>n</u>	Mean	<u>SD</u>	Standard error	95% confidence interval for mean
1	11	14.36	5.68	1.71	10.55 to 18.18
2	11	10.18	6.79	2.05	5.62 to 14.75
3	25	13.16	4.89	0.98	11.14 to 15.18
4	25	15.24	6.47	1.29	12.57 to 17.91
5	8	16.00	6.52	2.31	10.55 to 21.45
6	6	9.67	8.38	3.42	0.87 to 18.46

Note. 1 = low-host group; 2 = low-remote group; 3 = middle-host group; 4 = middle-remote group; 5 = high-host group; 6 = high-remote group.

* $p = .115$. Not significant at the .05 level ($p > .05$).

Because the p value ($p = .115$) was approaching the level of significance, the Modified LSD procedure was used to determine any

significant differences at less conservative or powerful standards. The Modified LSD procedure is given in Table 9.

Table 9
Multiple Range Test--Modified LSD Procedure--for
Independent Means Between the Females
of the Six Sociological Subgroups

Mean	Group	Group					
		6	2	3	1	4	5
9.6667	Group 6 (high-remote)						
10.1818	Group 2 (low-remote)						
13.1600	Group 3 (middle-host)						
14.3636	Group 1 (low-host)						
15.2400	Group 4 (middle-remote)	*	*				
16.0000	Group 5 (high-host)	*					

*Denotes pairs of groups significantly different at the .05 level.

Although the post hoc procedure displayed a significant difference between three subgroups, there was not enough evidence with the ANOVA procedure to reject the null hypothesis. The post hoc, Modified LSD procedure gave an indication of the subgroups that may demonstrate a difference in achievement gain.

The third conceptual hypothesis was: There is a relationship between achievement and the sociological element subgroup of males in the host and remote classroom.

The third null hypothesis was tested using the ANOVA procedure. Because of the high p value, no post hoc multiple comparison test was used. There was no significant difference at the .05 level of significance. The null hypothesis was not rejected. See Table 10.

Null Hypothesis 3

There will be no difference in the mean achievement gain scores between the males of the three sociological subgroups in the host and remote classrooms.

Table 10

Analysis of Variance of Mean Achievement Gain Scores by Subgroups (Low, Middle, and High) Between Males in the Host and Remote Classrooms

Summary ANOVA					
Group	n	Mean	SD	Standard error	95% confidence interval for mean
3	7	16.14	4.91	1.86	11.59 to 20.69
4	7	16.57	6.53	2.47	10.53 to 22.61
5	2	13.50	3.53	2.50	-18.27 to 45.27
6	3	12.33	6.81	3.93	-4.58 to 29.24

Note. 1 = low-host group; 2 = low-remote group; 3 = middle-host group; 4 = middle-remote group; 5 = high-host group; 6 = high-remote group. Cochran's $C = \text{Max. Variances} / \text{Sum(Variances)} = .3389$, $p = .812$. Groups 1 and 2 were not used in the data analysis because of insufficient numbers in the groups.

* $p = .803$. Not significant at the .05 level ($p > .05$).

The result of the t -test analysis of null Hypothesis 4 indicates that there is no significant difference in achievement between the females and males for this study ($p > .05$). The null hypothesis is not rejected at the .05 level of significance. See Table 11.

Null Hypothesis 4

There will be no difference in the mean achievement gain scores between the females and the males overall.

Table 11

t Test for Independent Means of Achievement Gain Scores
Between the Female and Male Students Overall

Summary t Test for Independent Means				
Variable	No. of cases	Mean	<u>SD</u>	Standard error
Females	85	13.682	6.331	0.687
Males	22	15.454	5.189	1.106

* $p = .181$. Not significant at the .05 level ($p > .05$).

Analysis of Attitudinal Data

The review of the literature helped formulate three conceptual hypotheses related to attitudes of students in the interactive television environment. The operational hypotheses were:

1. There is a difference between the mean attitude scores and the sociological element subgroup of students in the host and remote

classrooms.

2. There is a difference between the mean attitude scores and the sociological element subgroup of females in the host and remote classrooms.

3. There is a difference between the mean attitude scores and the sociological element subgroup of males in the host and remote classrooms.

The final four null hypotheses were derived from the three conceptual hypotheses and were related to the data collected from the Interactive Television Student Survey. Tables 12 through 16 give the results of data analysis of the mean attitude scores of females, males, and all students between the host classroom (Merrill High School) and the remote classroom (Hemlock High School). The mean attitude scores were derived by calculating the mean score of Items 6 through 18 on the survey of each student; and then, the mean was calculated for the various sociological element subgroups.

Table 12 shows that there is no significant difference in mean attitude scores between the students of the six subgroups. The null hypothesis was not rejected ($p > .05$)

Table 13 indicates that there is no significant difference in mean attitude scores between females of the six subgroups ($p > .05$). The null hypothesis was not rejected.

Null Hypothesis 5

There will be no difference in the mean attitude scores between the students of the three sociological subgroups in the host classroom and the remote classroom.

Table 12

Analysis of Variance of Mean Attitude Score by Subgroups
(Low, Middle, and High) Between the Students
in the Host and Remote Classrooms

Summary ANOVA					
Group	<u>n</u>	Mean	<u>SD</u>	Standard error	95% confidence interval for mean
1	6	3.33	1.37	0.56	1.89 to 4.77
2	4	1.50	0.58	0.29	0.58 to 2.42
3	13	2.92	1.71	0.47	1.89 to 3.95
4	18	3.11	1.97	0.46	2.13 to 4.09
5	6	2.50	1.05	0.42	1.39 to 3.61
6	4	2.50	1.29	0.65	0.45 to 4.55

Note. 1 = low-host group; 2 = low-remote group; 3 = middle-host group; 4 = middle-remote group; 5 = high-host group; 6 = high-remote group. Cochran's $C = \text{Max. Variances} / \text{Sum(Variances)} = .3395$, $p = .238$.

* $p = .535$. Not significant at the .05 level ($p > .05$).

Null Hypothesis 6

There will be no difference in the mean attitude scores between the females of the three sociological subgroups in the host and remote classrooms.

Table 13

**Analysis of Variance of Mean Attitude Score of Females
by Subgroup (Low, Middle, and High)
in the Host and Remote Classrooms**

Summary ANOVA					
Group	<u>n</u>	Mean	<u>SD</u>	Standard error	95% confidence interval for mean
1	5	3.00	1.22	0.55	1.48 to 4.52
2	4	1.50	0.58	0.29	0.58 to 2.42
3	10	2.70	1.77	0.56	1.44 to 3.96
4	13	3.54	2.15	0.59	2.24 to 4.83
5	3	2.33	1.53	0.88	-1.46 to 6.13
6	4	2.50	1.29	0.64	0.45 to 4.55

Note. 1 = low-host group; 2 = low-remote group; 3 = middle-host group; 4 = middle-remote group; 5 = high-host group; 6 = high-remote group. Cochran's $C = \text{Max. Variances} / \text{Sum(Variances)} = .3395$, $p = .238$.

* $p = .436$. Not significant at the .05 level ($p > .05$).

Table 14 indicates that there is no significant difference in mean attitude scores between the males of the six subgroups ($p > .05$). The null hypothesis was not rejected.

Null Hypothesis 7

There will be no difference in the mean attitude scores between the males of the three sociological subgroups in the host classroom and the remote classroom.

Table 14

Analysis of Variance of Mean Attitude Score of Males
by Subgroup (Low, Middle, and High)
in the Host and Remote Classrooms

Summary ANOVA					
Group	<u>n</u>	Mean	<u>SD</u>	Standard error	95% confidence interval for mean
3	3	3.67	1.53	0.88	-0.13 to 7.46
4	5	2.00	0.71	0.32	1.12 to 2.88
5	3	2.67	0.58	0.33	1.23 to 4.10

Note. 3 = middle-host group; 4 = middle-remote group; 5 = high-host group. Groups 1, 2, and 6 are not reported because these groups had either 0 or 1 member--not sufficient for data analysis.

* $p = .059$. Not significant at the .05 level ($p > .05$).

The p value of .059 in Table 14 was approaching the level of significance (.05). Post hoc analysis was conducted to determine if less strict standards would yield a significant difference in mean attitude

scores between the males of the six subgroups. Post hoc analysis of the null Hypothesis 7 ANOVA results show a significant difference in attitude between the males of three sociological subgroups. See Table 15.

Table 15 shows that Subgroup 3 (middle-host) differs from Subgroup 4 (middle-remote) and Subgroup 1 (low-host) differs significantly from Subgroup 4.

Table 15
Multiple Range Test--LSD Procedure--for Independent Means
of Attitude Scores Between the Males of the Six
Sociological Subgroups

Mean	Group	Group			
		4	5	3	1
2.000	Group 4 (middle-remote)				
2.667	Group 5 (high-host)				
3.667	Group 3 (middle-host)	*			
5.000	Group 1 (low-host)	*			

*Denotes pairs of groups significantly different at the .05 level.

As shown in Table 16, the males had a slightly higher mean attitude score than the females. It was determined that this difference, however, was not statistically significant.

Null Hypothesis 8

There will be no difference in the mean attitude scores between the females and males overall.

Table 16

**t Test for Independent Means of Attitude Scores Between
the Female and Male Students Overall**

Summary t Test for Independent Means				
Variable	No. of cases	Mean	<u>SD</u>	Standard error
Females	39	2.880	0.914	0.146
Males	12	3.252	0.760	0.219

* $p = .173$ (not significant at the .05 level ($p > .05$)).

Analysis of Interactive Television Student Survey

Frequency and percentage distributions of responses to each item on the Interactive Television Student Survey were completed for both the host school and the remote school. This was done to describe the general attitude of the students of the host school and the remote school toward interactive television.

Tables 17 through 71 display the data on each item of the survey. The total number of student responses in this phase was slightly less than the total number of student responses in the achievement data phases because of absences at the time of survey administration.

The results of the first five items on the survey show that a large percentage of students had a positive attitude toward ITV before taking the course. Nearly one third of the Merrill High School students had taken an ITV course before and only one student of 26 at Hemlock High School had taken an ITV course. Most all students said that they would take another ITV course. See Tables 17 through 21.

Table 17

Student Survey Item 1--Merrill High School: What Was Your
Opinion of ITV Classes Before Taking This Course?

Value/response	Frequency	%
1/no opinion	7	28.0
2/poor idea	3	12.0
3/average idea	10	40.0
4/above average idea	5	20.0
Total	25	100.0

Note. Mean = 2.52. Median = 3.00. Mode = 3.00. Standard deviation = 1.12.

Table 18

Student Survey Item 1--Hemlock High School: What Was Your
Opinion of ITV Classes Before Taking This Course?

Value/response	Frequency	%
1/no opinion	10	38.5
2/poor idea	1	3.8
3/average idea	8	30.8
4/above average idea	7	26.9
Total	26	100.0

Note. Mean = 2.46. Median = 3.00. Mode = 1.00. Standard deviation = 1.272.

Table 19
Student Survey Item 3: Have You Ever Taken an ITV Course Before?

School	Total number	No. of yes	% of total
Merrill (host)	25	8	32.0
Hemlock (remote)	26	1	3.8
Total	51	9	17.6

Table 20
Student Survey Item 4: Would You Take Another ITV Course?

School	Total number	Total yes	% of total
Merrill	25	23	92.0
Hemlock	26	22	84.6
Total	51	45	88.2

Table 21
Student Survey Item 5: Would You Take Another Psychology Course?

School	Total number	Total yes	% of total
Merrill	25	18	72.0
Hemlock	26	22	84.6
Total	51	40	78.4

Table 22 shows that 80% of the Merrill students who are in the host school believe that the presentation of the course material was as effective as other courses in their school.

Table 22

Student Survey Item 6--Merrill High School: The Presentation of the Course Materials Was as Effective as I Have Found in Other Courses I Have Taken in This School

Value/response	Frequency	%
1/strongly agree	2	8.0
2/agree	13	52.0
3/mildly agree	5	20.0
4/no opinion	4	16.0
5/mildly disagree	1	4.0
6/disagree	0	0.0
7/strongly disagree	0	0.0
Total	25	100.0

Note. Mean = 2.56. Median = 2.00. Mode = 2.00. Standard deviation = 1.00.

Table 23 indicates that fewer students (69%) from Hemlock High School (the remote school) believe that the presentation of the course material was as effective as other courses in their school as compared with Merrill High School students.

Table 23

**Student Survey Item 6--Hemlock High School: The Presentation
of the Course Material Was as Effective as I Have Found
in Other Courses I Have Taken in This School**

Value/response	Frequency	%
1/strongly agree	2	7.7
2/agree	10	38.5
3/mildly agree	6	23.1
4/no opinion	4	15.4
5/mildly disagree	3	11.5
6/disagree	1	3.8
7/strongly disagree	0	0.0
Total	26	100.0

Note. Mean = 2.96. Median = 3.00. Mode = 2.00. Standard deviation = 1.311.

Tables 24 and 25 show that approximately 15% of the remote school students mildly disagree with the statement that the reception of the picture was good enough for following the teacher's presentation, while 20% of the host school students mildly disagree. This may be due to the fact that the Merrill students had only a short period of time exposed to the remote aspect of the course and thus were better used to the host conditions.

Table 24

Student Survey Item 7--Merrill High School: The Reception
of the Picture Was Good Enough for Following the
Teacher's Presentations, Taking Notes, etc.

Value/response	Frequency	%
1/strongly agree	1	4.0
2/agree	7	28.0
3/mildly agree	9	36.0
4/no opinion	3	12.0
5/mildly disagree	5	20.0
6/disagree	0	0.0
7/strongly disagree	0	0.0
Total	25	100.0

Note. Mean = 3.16. Median = 3.00. Mode = 3.00. Standard deviation = 1.17.

Table 25

Student Survey Item 7--Hemlock High School: The Reception
of the Picture Was Good Enough for Following the
Teacher's Presentation, Taking Notes, etc.

Value/response	Frequency	%
1/strongly agree	3	11.5
2/agree	12	46.2
3/mildly agree	5	19.2
4/no opinion	2	7.7
5/mildly disagree	4	15.4
6/disagree	0	0.0
7/strongly disagree	0	0.0
Total	26	100.0

Note. Mean = 2.69. Median = 2.00. Mode = 2.00. Standard deviation = 1.25.

Tables 26 and 27 show that 68% of the host school (Merrill) students rated the talkback feature as either a "no opinion" or disagreed with the statement. This might be due to the fact that they were used to the physical presence of the instructor. Likewise, over 50% of the remote school students (Hemlock) rated the statement as "no opinion" or disagree to some extent.

Table 26

Student Survey Item 8--Merrill High School: The Talkback Feature Allowed Me to Participate as Effectively in This Class as in Regular Classes

Value/response	Frequency	%
1/strongly agree	1	4.0
2/agree	4	16.0
3/mildly agree	3	12.0
4/no opinion	8	32.0
5/mildly disagree	7	28.0
6/disagree	2	8.0
7/strongly disagree	0	0.0
Total	25	100.0

Note. Mean = 3.88. Median = 4.00. Mode = 4.00. Standard deviation = 1.33.

Table 28 shows that 64% of the host students agreed with the statement that they felt comfortable learning from the ITV teacher, while 24% disagreed. Some students may have been discontented with the

Table 27

**Student Survey Item 8--Hemlock High School: The Talkback
Feature Allowed Me to Participate as Effectively in
This Class as in Regular Classes**

Value/response	Frequency	%
1/strongly agree	5	19.2
2/agree	5	19.2
3/mildly agree	1	3.8
4/no opinion	3	11.5
5/mildly disagree	8	30.8
6/disagree	3	11.5
7/strongly disagree	1	3.8
Total	26	100.0

Note. Mean = 3.65. Median = 4.00. Mode = 5.00. Standard Deviation = 1.91.

classroom setup and were, therefore, uncomfortable learning from the ITV teacher.

Table 29 shows that only 15% of the remote school students disagreed with the statement that they felt comfortable learning from the ITV teacher, while another 8% had no opinion. A vast majority of remote students felt as comfortable learning from the ITV teacher as when the teacher was physically present.

Table 30 shows that 80% of the students in the host classroom had ample opportunity to ask questions during class.

Table 28

Student Survey Item 9--Merrill High School: I Felt as
Comfortable Learning From the ITV Teacher as I
Did From the Teacher in the Class

Value/response	Frequency	%
1/strongly agree	4	16.0
2/agree	8	32.0
3/mildly agree	4	16.0
4/no opinion	3	12.0
5/mildly disagree	4	16.0
6/disagree	1	4.0
7/strongly disagree	1	4.0
Total	25	100.0

Note. Mean = 3.08. Median = 3.00. Mode = 2.00. Standard deviation = 1.68.

Table 29

Student Survey Item 9--Hemlock High School: I Felt as
Comfortable Learning From the ITV Teacher as I
Did From the Teacher in the Class

Value/response	Frequency	%
1/strongly agree	6	23.1
2/agree	11	42.3
3/mildly agree	3	11.5
4/no opinion	2	7.7
5/mildly disagree	2	7.7
6/disagree	1	3.8
7/strongly disagree	1	3.8
Total	26	100.0

Note. Mean = 2.61. Median = 2.00. Mode = 2.00. Standard deviation = 1.62.

Table 30

Student Survey Item 10--Merrill High School: I Had Ample Opportunity to Ask Questions During Class Time

Value/response	Frequency	%
1/strongly agree	4	16.0
2/agree	12	48.0
3/mildly agree	4	16.0
4/no opinion	3	12.0
5/mildly disagree	1	4.0
6/disagree	0	0.0
7/strongly disagree	1	4.0
Total	25	100.0

Note. Mean = 2.56. Median = 2.00. Mode = 2.00. Standard deviation = 1.38.

Table 31 shows that five students (20%) from Hemlock disagreed with the statement and felt that they did not have ample opportunity to ask questions in class.

As shown in Tables 32 and 33, most all the students (88%) from the host school agreed with the statement that their papers, exams, and assignments were returned on a timely basis, while a lesser number of the remote students (73%) agreed with the statement. This would make sense given the nature of the ITV distance program.

Tables 34 and 35 show a vast majority of students from both schools (Merrill, 73%, and Hemlock, 92%) agree with the statement that

Table 31

Student Survey Item 10--Hemlock High School: I Had Ample
Opportunity to Ask Questions During Class Time

Value/response	Frequency	%
1/strongly agree	6	23.1
2/agree	9	34.6
3/mildly agree	5	19.2
4/no opinion	1	3.8
5/mildly disagree	4	15.4
6/disagree	1	3.8
7/strongly disagree	0	0.0
Total	26	100.0

Note. Mean = 2.65. Median = 2.00. Mode = 2.00. Standard deviation = 1.49.

they received materials in time for assignments. In fact, a higher percentage of remote students from Hemlock agreed which is a slight reversal of statement Item 11 in which a smaller percentage of remote students felt that papers were returned in a timely manner.

Table 36 shows that a large number of Merrill students (44%) had no opinion on the statement that visual/instructional aids were useful. Table 37 shows a fairly even distribution of student opinions regarding visual/instructional aids being useful.

Table 32

Student Survey Item 11--Merrill High School: My Papers/
Exams/Assignments Were Returned on a Timely Basis

Value/response	Frequency	%
1/strongly agree	5	20.0
2/agree	10	40.0
3/mildly agree	7	28.0
4/no opinion	2	8.0
5/mildly disagree	1	4.0
6/disagree	0	0.0
7/strongly disagree	0	0.0
Total	25	100.0

Note. Mean = 2.36. Median = 2.00. Mode = 2.00. Standard deviation = 1.03.

Table 33

Student Survey Item 11--Hemlock High School: My Papers/
Exams/Assignments Were Returned on a Timely Basis

Value/response	Frequency	%
1/strongly agree	5	19.2
2/agree	11	42.3
3/mildly agree	3	11.5
4/no opinion	3	11.5
5/mildly disagree	0	0.0
6/disagree	4	15.4
7/strongly disagree	0	0.0
Total	26	100.0

Note. Mean = 2.36. Median = 2.00. Mode = 2.00. Standard deviation = 1.03.

Table 34

Student Survey Item 12--Merrill High School: I Received
Hand-Outs and Other Materials in Time
for Assignments

Value/response	Frequency	%
1/strongly agree	4	16.0
2/agree	15	60.0
3/mildly agree	4	16.0
4/no opinion	2	8.0
5/mildly disagree	0	0.0
6/disagree	0	0.0
7/strongly disagree	0	0.0
Total	25	100.0

Note. Mean = 2.76. Median = 2.00. Mode = 2.00. Standard deviation = 1.65.

Table 35

Student Survey Item 12--Hemlock High School: I Received
Hand-Outs and Other Materials in Time
for Assignments

Value/response	Frequency	%
1/strongly agree	7	26.9
2/agree	15	57.7
3/mildly agree	2	7.7
4/no opinion	1	3.8
5/mildly disagree	1	3.8
6/disagree	0	0.0
7/strongly disagree	0	0.0
Total	26	100.0

Note. Mean = 2.00. Median = 2.00. Mode = 2.00. Standard deviation = 0.938. Standard error = 0.184.

Table 36

Student Survey Item 13--Merrill High School: The Visual/
Instructional Aids Used in This Class Were Useful
in Helping Me Understand the Course Content

Value/response	Frequency	%
1/strongly agree	1	4.0
2/agree	6	24.0
3/mildly agree	3	12.0
4/no opinion	11	44.0
5/mildly disagree	3	12.0
6/disagree	1	4.0
7/strongly disagree	0	0.0
Total	25	100.0

Note. Mean = 3.48. Median = 4.00. Mode = 4.00. Standard deviation = 1.22.

Table 37

Student Survey Item 13--Hemlock High School: The Visual/
Instructional Aids Used in This Class Were Useful
in Helping Me Understand the Course Content

Value/response	Frequency	%
1/strongly agree	2	7.7
2/agree	6	23.1
3/mildly agree	6	23.1
4/no opinion	6	23.1
5/mildly disagree	2	7.7
6/disagree	4	15.4
7/strongly disagree	0	0.0
Total	26	100.0

Note. Mean = 3.46. Median = 3.00. Mode = 2.00. Standard deviation = 1.52.

Table 38 indicates that 19 of 25 (76%) students in the host school (Merrill) classroom felt that sufficient assistance was available when needed. As shown in Table 39, a lower percentage of students (65%) from the remote school (Hemlock) agreed with the statement regarding sufficient assistance which is consistent with the literature and nature of the distance learning environment.

Table 38

Student Survey Item 14--Merrill High School: Sufficient Assistance Was Available When I Needed It for Me to Successfully Complete Tests and Other Assignments

Value/response	Frequency	%
1/strongly agree	2	8.0
2/agree	11	44.0
3/mildly agree	6	24.0
4/no opinion	3	12.0
5/mildly disagree	2	8.0
6/disagree	0	0.0
7/strongly disagree	1	4.0
Total	25	100.0

Note. Mean = 2.84. Median = 2.00. Mode = 2.00. Standard deviation = 1.37.

Tables 40 and 41 show that a higher percentage of students from the remote classroom (Hemlock, 27%) disagree with the statement that the television system is an effective way to teach the course. Table 40

Table 39

**Student Survey Item 14--Hemlock High School: Sufficient
Assistance Was Available When I Needed It for
Me to Successfully Complete Tests and
Other Assignments**

Value/response	Frequency	%
1/strongly agree	2	7.7
2/agree	10	38.5
3/mildly agree	5	19.2
4/no opinion	5	19.2
5/mildly disagree	2	7.7
6/disagree	1	3.8
7/strongly disagree	1	3.8
Total	26	100.0

Note. Mean = 3.07. Median = 3.00. Mode = 2.00. Standard deviation = 1.49.

shows that 16% of the host classroom students disagreed with the statement.

Tables 42 and 43 show that approximately the same percentage of students from both schools agreed with the statement that they liked taking the course by television. It should be noted, however, that four students from Hemlock (remote school) disagreed or strongly disagreed to the statement, while only one Merrill (host school) student disagreed and no student from Merrill strongly disagreed with the statement.

Table 40
Student Survey Item 15--Merrill High School: The Television
System Is an Effective Way to Teach This Course

Value/response	Frequency	%
1/strongly agree	0	0.0
2/agree	10	40.0
3/mildly agree	7	28.0
4/no opinion	4	16.0
5/mildly disagree	1	4.0
6/disagree	3	12.0
7/strongly disagree	0	0.0
Total	25	100.0

Note. Mean = 3.20. Median = 3.00. Mode = 2.00. Standard deviation = 1.35.

Table 41
Student Survey Item 15--Hemlock High School: The Television
System Is an Effective Way to Teach This Course

Value/response	Frequency	%
1/strongly agree	5	19.2
2/agree	8	30.8
3/mildly agree	4	15.4
4/no opinion	2	7.7
5/mildly disagree	6	23.1
6/disagree	0	0.0
7/strongly disagree	1	3.8
Total	26	100.0

Note. Mean = 3.00. Median = 2.50. Mode = 2.00. Standard deviation = 1.67.

Table 42

Student Survey Item 16--Merrill High School: I Liked
Taking This Course by Television

Value/response	Frequency	%
1/strongly agree	4	16.0
2/agree	8	32.0
3/mildly agree	5	20.0
4/no opinion	3	12.0
5/mildly disagree	4	16.0
6/disagree	1	4.0
7/strongly disagree	0	0.0
Total	25	100.0

Note. Mean = 2.92. Median = 3.00. Mode = 2.00. Standard deviation = 1.47.

Table 43

Student Survey Item 16--Hemlock High School: I Liked
Taking This Course by Television

Value/response	Frequency	%
1/strongly agree	7	26.9
2/agree	7	26.9
3/mildly agree	4	15.4
4/no opinion	4	15.4
5/mildly disagree	0	0.0
6/disagree	3	11.5
7/strongly disagree	1	3.8
Total	26	100.0

Note. Mean = 2.84. Median = 2.00. Mode = 1.00. Standard deviation = 1.80.

Tables 44 and 45 show that 80% of the students in the host classroom said they agree to some extent with the statement that they would take another television course if given the choice, while 70% of the remote students agreed with the statement. A larger percentage of students (23%) from the remote school disagreed with the statement while 12% from the host school disagreed.

Table 44

Student Survey Item 17--Merrill High School: If I Had a Choice, I Would Take Another Television Course

Value/response	Frequency	%
1/strongly agree	3	12.0
2/agree	10	40.0
3/mildly agree	7	28.0
4/no opinion	2	8.0
5/mildly disagree	2	8.0
6/disagree	0	0.0
7/strongly disagree	1	4.0
Total	25	100.0

Note. Mean = 2.76. Median = 2.00. Mode = 2.00. Standard deviation = 1.39.

Table 46 indicates that 68% of the Merrill students like school, in general. Table 47 shows that 62% of the Hemlock students agreed with the statement that they like school. Tables 46 and 47 show that more Merrill students rated the statement with a 1 or 2 rating.

Table 45

Student Survey Item 17--Hemlock High School: If I Had
a Choice, I Would Take Another Television Course

Value/response	Frequency	%
1/strongly agree	5	19.2
2/agree	9	34.6
3/mildly agree	4	15.4
4/no opinion	2	7.7
5/mildly disagree	2	7.7
6/disagree	4	15.4
7/strongly disagree	0	0.0
Total	26	100.0

Note. Mean = 2.96. Median = 2.00. Mode = 2.00. Standard deviation = 1.73.

As shown in Table 48, 80% of the Merrill students rated the remote portion of the ITV at 5 or better on the scale of 1 to 10 (1 being best) for when they were the remote school. Five students out of 25 rated the remote portion of the class as a negative experience. This took place as Part 2 of the data collection phase.

A summary of Table 49 shows that nearly 90% of the Hemlock students rated the remote portion of the ITV course at 5 or better on the scale of 1-10 (1 being best). This was 8.5 points more than the Merrill students. Only 3 students out of 26 rated the remote portion of the class as a negative experience.

Table 46
Student Survey Item 18--Merrill High School:
In General, I Like School

Value/response	Frequency	%
1/strongly agree	3	12.0
2/agree	12	48.0
3/mildly agree	2	8.0
4/no opinion	2	8.0
5/mildly disagree	2	8.0
6/disagree	1	4.0
7/strongly disagree	3	12.0
Total	25	100.0

Note. Mean = 3.12. Median = 2.00. Mode = 2.00. Standard deviation = 1.94.

Table 47
Student Survey Item 18--Hemlock High School:
In General, I Like School

Value/response	Frequency	%
1/strongly agree	7	26.9
2/agree	5	19.2
3/mildly agree	4	15.4
4/no opinion	4	15.4
5/mildly disagree	0	0.0
6/disagree	3	11.5
7/strongly disagree	3	11.5
Total	26	100.0

Note. Mean = 3.23. Median = 3.00. Mode = 1.00. Standard deviation = 2.10.

Table 48

Student Survey Item 19--Merrill High School: On a Scale of 1-10
(1 Being Best), How Would You Rate the Overall Quality
of the Remote (the Instructor on TV) Portion
of the Television Course?

Value/response	Frequency	%
1	0	0.0
2	4	16.0
3	7	28.0
4	2	8.0
5	7	28.0
6	1	4.0
7	0	0.0
8	2	8.0
9	1	4.0
10	1	4.0
Total	25	100.0

Note. Mean = 4.50. Median = 4.00. Mode = 3.00. Standard deviation = 2.23.

As shown in Tables 48 and 49, the vast majority of students felt that the quality of instruction and learning from an instructor on a television monitor was good. Having the ability to interact with the instructor helped make this remote portion of the course a positive experience. These data were also reflected in the Student Attitude Survey.

Table 49

Student Survey Item 19--Hemlock High School: On a Scale of 1-10
(1 Being Best), How Would You Rate the Overall Quality
of the Remote (the Instructor on TV) Portion
of the Television Course?

Value/response	Frequency	%
1	6	23.1
2	2	7.7
3	6	23.1
4	5	19.2
5	4	15.4
6	2	7.7
7	0	0.0
8	1	3.8
9	0	0.0
10	0	0.0
Total	26	100.0

Note. Mean = 3.38. Median = 3.00. Mode = 1.00. Standard deviation = 1.85.

Table 50 shows that approximately 75% of the Merrill students rated the host portion of the course at 5 or better on the scale of 1-10 (1 being best). Of the 24% of students that responded on the negative side of the value scale, clearly most of them rated the host portion of the course only slightly negative, with just one student responding with a value of 8.

Table 50

Student Survey Item 20--Merrill High School: On a Scale of 1-10 (1 Being Best), How Would You Rate the Overall Quality of the Host (the Instructor Present) Classroom Portion of the Course?

Value/response	Frequency	%
1	2	8.0
2	4	16.0
3	8	32.0
4	5	20.0
5	0	0.0
6	3	12.0
7	2	8.0
8	1	4.0
9	0	0.0
10	0	0.0
Total	25	100.0

Note. Mean = 3.76. Median = 3.00. Mode = 3.00. Standard deviation = 1.89.

Table 51 indicates that 73% of the Hemlock students rated the host portion of the ITV course at 5 or better on a scale of 1-10 (1 being best). This figure was nearly the same as the Merrill students' response. Two students did, however, rate the host portion of the class at the worst level, that being a value of 10.

Table 51

Student Survey Item 20--Hemlock High School: On a Scale of 1-10 (1 Being Best), How Would You Rate the Overall Quality of the Host (the Instructor Present) Classroom Portion of the Course?

Value/response	Frequency	%
1	8	30.8
2	3	11.5
3	0	0.0
4	4	15.4
5	4	15.4
6	3	11.5
7	2	7.7
8	0	0.0
9	0	0.0
10	2	7.7
Total	26	100.0

Note. Mean = 3.92. Median = 4.00. Mode = 1.00. Standard deviation = 2.76.

Frequency and percentage distributions of the student responses to the semantic differential scales were calculated to analyze the attitude of the population studied toward the content of the psychology course.

The directions to students answering the Interactive Television Student Survey were:

Thinking only of the content of the course, place an X in the one space of the seven that best describes your opinion of the content of this course. The closer you place your X toward one word or the other, the more you think that word describes the course content.

In rating the course content from interesting to boring, the student responses for Item 1 (Tables 52 and 53) were about the same for both schools, Merrill, the host, and Hemlock, the remote. The majority of students from both schools thought that the content of the course was interesting.

Table 52

Merrill High School--Student Survey Content Semantic Differential
Item 1: Interesting 1 2 3 4 5 6 7 Boring

Value/response	Frequency	%
1	4	16.0
2	8	32.0
3	3	12.0
4	3	12.0
5	4	16.0
6	2	8.0
7	1	4.0
Total	25	100.0

Note. Mean = 3.20. Median = 3.00. Mode = 2.00. Standard deviation = 1.78.

Table 53

Hemlock High School--Student Survey Content Semantic Differential
Item 1: Interesting 1 2 3 4 5 6 7 Boring

Value/response	Frequency	%
1	7	26.9
2	7	26.9
3	2	7.7
4	3	11.5
5	3	11.5
6	2	7.7
7	2	7.7
Total	26	100.0

Note. Mean = 3.07. Median = 2.00. Mode = 1.00. Standard deviation = 1.99.

In rating the course content from important to unimportant, as shown in Tables 54 and 55, the student responses from both schools were again about the same for Item 2. Over 90% of the students from each school responded on the important side of the semantic differential scale.

In rating the course content from powerful to weak, Tables 56 and 57 indicate that although students from both schools had nearly identical cumulative percentages at the 4 value, a larger number of Merrill students (76%) rated the course content at a 3 or 4 rating. Six Hemlock students (23%) rated the course content at the highest possible rating.

Table 54

Merrill High School--Student Survey Content Semantic Differential
Item 2: Important 1 2 3 4 5 6 7 Unimportant

Value/response	Frequency	%
1	5	20.0
2	8	32.0
3	6	24.0
4	4	16.0
5	2	8.0
6	0	0.0
7	0	0.0
Total	25	100.0

Note. Mean = 2.60. Median = 2.00. Mode = 2.00. Standard deviation = 1.22.

Table 55

Hemlock High School--Student Survey Content Semantic Differential
Item 2: Important 1 2 3 4 5 6 7 Unimportant

Value/response	Frequency	%
1	7	26.9
2	5	19.2
3	5	19.2
4	8	30.7
5	1	4.0
6	0	0.0
7	0	0.0
Total	26	100.0

Note. Mean = 2.25. Median = 2.00. Mode = 2.00. Standard deviation = 0.96.

Table 56

Merrill High School--Student Survey Content Semantic Differential
Item 3: Powerful 1 2 3 4 5 6 7 Weak

Value/response	Frequency	%
1	0	0.0
2	3	12.0
3	10	40.0
4	9	36.0
5	1	4.0
6	1	4.0
7	1	4.0
Total	25	100.0

Note. Mean = 3.60. Median = 3.00. Mode = 3.00. Standard deviation = 1.15.

Table 57

Hemlock High School--Student Survey Content Semantic Differential
Item 3: Powerful 1 2 3 4 5 6 7 Weak

Value/response	Frequency	%
1	6	23.1
2	2	7.7
3	3	11.5
4	12	46.2
5	2	7.7
6	0	0.0
7	1	3.8
Total	26	100.0

Note. Mean = 3.23. Median = 4.00. Mode = 4.00. Standard deviation = 1.55.

As indicated in Tables 58 and 59, in rating the course content from worthless to valuable, Hemlock (remote) students rated the course content slightly more valuable. Nearly 60% gave it a 6 or 7 rating, while 48% of the Merrill (host) students rated this course content differential item at 6 or 7.

Table 58

Merrill High School--Student Survey Content Semantic Differential
Item 4: Worthless 1 2 3 4 5 6 7 Valuable

Value/response	Frequency	%
1	0	0.0
2	1	4.0
3	2	8.0
4	2	8.0
5	8	32.0
6	8	32.0
7	4	16.0
Total	25	100.0

Note. Mean = 5.28. Median = 5.00. Mode = 5.00. Standard deviation = 1.30.

In rating the course content from good to bad, Tables 60 and 61 show that the overall ratings from both schools were again approximately the same. However, a larger number of students from Hemlock High School rated the course content the best rating they could.

Table 59

Hemlock High School--Student Survey Content Semantic Differential
Item 4: Worthless 1 2 3 4 5 6 7 Valuable

Value/response	Frequency	%
1	0	0.0
2	2	7.7
3	1	3.8
4	4	15.4
5	4	15.4
6	10	38.5
7	5	19.2
Total	26	100.0

Note. Mean = 5.30. Median = 6.00. Mode = 6.00. Standard deviation = 1.46.

Frequency and percentage distributions of the student responses to the semantic differential items about the medium of instruction were calculated to analyze the attitude of the population studied toward interactive television as a medium for the delivery of instruction. Directions to the students were:

Now thinking only of the medium (interactive television), place an X in the one space of the seven that best describes what you think the medium of instruction was like in this course. The closer you place the X toward one word or the other, the more you think that word better describes the medium (interactive television).

Table 60

Merrill High School--Student Survey Content Semantic Differential
Item 5: Good 1 2 3 4 5 6 7 Bad

Value/response	Frequency	%
1	3	12.0
2	11	44.0
3	6	24.0
4	5	20.0
5	0	0.0
6	0	0.0
7	0	0.0
Total	25	100.0

Note. Mean = 2.52. Median = 2.00. Mode = 2.00. Standard deviation = 0.96.

Table 61

Hemlock High School--Student Survey Content Semantic Differential
Item 5: Good 1 2 3 4 5 6 7 Bad

Value/response	Frequency	%
1	7	26.9
2	8	30.8
3	5	19.2
4	4	15.4
5	2	7.7
6	0	0.0
7	0	0.0
Total	26	100.0

Note. Mean = 2.46. Median = 2.00. Mode = 2.00. Standard deviation = 1.27.

Table 63 shows that 50% of the Hemlock (remote) students rated the ITV medium a 1 or 2 on the differential scale as opposed to 32% of the Merrill (host) students as shown in Table 62.

Table 62

Merrill High School--Student Survey Medium Semantic Differential
Item 1: Good 1 2 3 4 5 6 7 Bad

Value/response	Frequency	%
1	2	8.0
2	6	24.0
3	9	36.0
4	4	16.0
5	1	4.0
6	1	4.0
7	2	8.0
Total	25	100.0

Note. Mean = 3.28. Median = 3.00. Mode = 3.00. Standard deviation = 1.59.

Tables 64 and 65 indicate that when rating interactive television as a medium from weak to powerful, a slightly higher percentage of students from Merrill rated the ITV medium above a 4 on the differential scale which was towards the powerful end.

As Tables 66 and 67 show, more students (61%) from the remote school, Hemlock, rated the ITV medium as pleasing compared to 44% of the host school students, Merrill.

Table 63

Hemlock High School--Student Survey Medium Semantic Differential
Item 1: Good 1 2 3 4 5 6 7 Bad

Value/response	Frequency	%
1	6	23.1
2	7	26.9
3	5	19.2
4	4	15.4
5	3	11.5
6	1	3.8
7	0	0.0
Total	26	100.0

Note. Mean = 2.76. Median = 2.50. Mode = 2.00. Standard deviation = 1.47.

Tables 68 and 69 show that a slightly higher percentage of students from Hemlock High School (88.5% to 84%) rated the ITV medium as successful (4 or less on the scale).

As shown in Tables 70 and 71, a slightly higher percentage of students (68%) from Merrill High School rated the ITV medium as positive compared to 62% of the students from Hemlock High School.

The students from Hemlock High School were more evenly distributed among the positive value ratings, whereas 12 of the 17 positive Merrill High School respondents rated the medium at a value of 6.

Table 64

Merrill High School--Student Survey Medium Semantic Differential
Item 2: Weak 1 2 3 4 5 6 7 Powerful

Value/response	Frequency	%
1	1	4.0
2	2	8.0
3	4	16.0
4	5	20.0
5	11	44.0
6	2	8.0
7	0	0.0
Total	25	100.0

Note. Mean = 4.16. Median = 5.00. Mode = 5.00. Standard deviation = 1.28.

Table 65

Hemlock High School--Student Survey Medium Semantic Differential
Item 2: Weak 1 2 3 4 5 6 7 Powerful

Value/response	Frequency	%
1	0	0.0
2	3	11.5
3	1	3.8
4	11	42.3
5	3	11.5
6	5	19.2
7	3	11.5
Total	26	100.0

Note. Mean = 4.57. Median = 4.00. Mode = 4.00. Standard deviation = 1.47.

Table 66

Merrill High School--Student Survey Medium Semantic Differential
Item 3: Annoying 1 2 3 4 5 6 7 Pleasing

Value/response	Frequency	%
1	1	4.0
2	2	8.0
3	5	20.0
4	6	24.0
5	6	24.0
6	5	20.0
7	0	0.0
Total	25	100.0

Note. Mean = 4.16. Median = 4.00. Mode = 4.00. Standard deviation = 1.40.

Table 67

Hemlock High School--Student Survey Medium Semantic Differential
Item 3: Annoying 1 2 3 4 5 6 7 Pleasing

Value/response	Frequency	%
1	2	7.7
2	2	7.7
3	0	0.0
4	6	23.1
5	8	30.8
6	6	23.1
7	2	7.7
Total	26	100.0

Note. Mean = 4.61. Median = 5.00. Mode = 5.00. Standard deviation = 1.62.

Table 68

Merrill High School--Student Survey Medium Semantic Differential
Item 4: Successful 1 2 3 4 5 6 7 Unsuccessful

Value/response	Frequency	%
1	0	0.0
2	11	44.0
3	7	28.0
4	3	12.0
5	3	12.0
6	1	4.0
7	0	0.0
Total	25	100.0

Note. Mean = 3.04. Median = 3.00. Mode = 2.00. Standard deviation = 1.20.

Table 69

Hemlock High School--Student Survey Medium Semantic Differential
Item 4: Successful 1 2 3 4 5 6 7 Unsuccessful

Value/response	Frequency	%
1	3	11.5
2	8	30.8
3	8	30.8
4	4	15.4
5	2	7.7
6	1	3.8
7	0	0.0
Total	26	100.0

Note. Mean = 2.88. Median = 3.00. Mode = 2.00. Standard deviation = 1.27.

Table 70

Merrill High School--Student Survey Medium Semantic Differential
Item 5: Negative 1 2 3 4 5 6 7 Positive

Value/response	Frequency	%
1	0	0.0
2	1	4.0
3	2	8.0
4	5	20.0
5	4	16.0
6	12	48.0
7	1	4.0
Total	25	100.0

Note. Mean = 5.08. Median = 6.00. Mode = 6.00. Standard deviation = 1.25.

Table 71

Hemlock High School--Student Survey Medium Semantic Differential
Item 5: Negative 1 2 3 4 5 6 7 Positive

Value/response	Frequency	%
1	0	0.0
2	1	3.8
3	1	3.8
4	8	30.8
5	6	23.1
6	5	19.2
7	5	19.2
Total	26	100.0

Note. Mean = 5.07. Median = 5.00. Mode = 4.00. Standard deviation = 1.35.

Open-Ended Questions

The Interactive Television Student Survey gave students an opportunity to respond to open-ended questions in two parts. In Part I of the survey students were asked to list as many strengths and as many weaknesses as they could. In Part II, the last question asked students if they had any additional comments to make about the course.

Analysis of the responses toward the strengths showed that many of the students from both schools assessed the teacher as a good teacher. They felt that the ITV course allowed them to have an opportunity that they may not have had if the course was only taught in a traditional manner. The course would not have been offered in their school. Many students from both schools saw this course as an opportunity to meet and learn with new people. Several students from the remote classroom stated that this type of course (ITV) helped build character in them by instilling confidence and responsibility.

Some of the weaknesses reported were related to the technology, such as, poor reception, poor sound (audio) quality, interference, and poor picture (video) quality. Some students from each school reported that a lack of one-to-one interaction with the teacher was a weakness. Seven students from the remote school stated that there was less classroom control because of the ITV system. At least three students from the host classroom (Merrill) and eight students from the remote classroom (Hemlock) stated that the teacher favored the other classroom by giving them more attention.

Additional comments at the end of the survey were similar to the strengths and weaknesses comments. One comment stated that the teacher was so concerned with the possibility of ignoring the remote classroom, that she over-compensated and paid too much attention to them. Overall, the students had more positive comments than negative.

Summary

Chapter IV was used to present the findings of the study. Several statistical procedures were used to determine if there was any statistically significant difference between the students of the three sociological element subgroups in achievement. ANOVA statistical procedure was used to compare the mean achievement gain scores between students who scored low, in the middle, or high for the teacher motivated element of the individual learning style assessment.

When a comparison of two independent means was necessary, t tests were used to compare the mean scores of achievement gain or attitude. This occurred when the mean scores were compared between females and males and when total mean scores were compared between the two schools. Frequency and percentage distributions were given for the host school and the remote school on most of the survey items on the Interactive Television Student Survey. Descriptive analysis was given comparing the responses of both schools on the items when appropriate.

The results of the analysis of data are presented along with the conclusions, implications, and recommendations of the study in Chapter V.

CHAPTER V

SUMMARIES, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Summary of the Purpose

The purpose of the study was to analyze the relationship of the preferred sociological element of the individual learning style with achievement and attitudes of students receiving instruction in a psychology course via two-way interactive television (ITV). A quasi-experimental design was used to gather achievement gain scores from pretest and posttest administration. The mean achievement gain scores of three sociological element subgroups of the host school and the remote school were statistically compared. An Interactive Television Student Survey was administered to all students in two ITV psychology classes to describe the general attitude of the students in the host classroom and the remote classroom toward ITV. The findings of this study are intended to provide a more sound basis for scheduling students into these interactive television courses.

The study attempted to accomplish the purpose in three ways. First the study sought to describe interactive television as a unique and new medium for the delivery of instruction and show that a need exists to determine whether all students learn as well in this type of environment. This was also accomplished by describing the theory of individual learning style and the model used for this study. Second, the study

sought to report and evaluate current research on individual learning style theories and interactive television effectiveness as a medium for delivery of instruction. Third, the study sought to systematically collect and analyze data to show a relationship between individual learning style with achievement and attitude in an interactive television course.

Summary of the Literature

A comprehensive review of the literature gave the following point:

Interactive Television

1. Although interactive television is no substitute for the presence of an in-class teacher, it is considered by most researchers in this field to be an effective medium for the delivery of instruction.

2. Students enrolled in interactive television (ITV) courses held slightly more positive than negative attitudes toward ITV as a medium of instruction.

Learning Styles

3. No learning style is better or worse than another.

4. Since each style has a similar intelligence range, a student cannot be labeled or stigmatized by having any one type of style.

5. Most children can master the course content; how they master it is determined by their individual styles.

6. Students learn more and liked learning better when they were taught through their identified learning styles.

Summary of Procedures

The study was designed to compare mean achievement gain scores among three sociological element subgroups between the host and remote schools. The students were placed into a subgroup dependent upon how they scored in the teacher motivated element of their individual student profile. The three subgroups were:

1. Students who scored low on the Learning Style Inventory (LSI) (Dunn et al., 1987) for the sociological element, teacher motivated.
2. Students who scored in the middle range on the LSI for the sociological element, teacher motivated.
3. Students who scored high on the LSI for the sociological element, teacher motivated.

The instructor taught a 10-day unit from her original-host school classroom and data were collected using a pretest and posttest method. The instructor then traveled each day to the other school and taught a different 10-day unit, making that school the temporary host school. The purpose of this design was to minimize the effect of having data collected from only one source; that being one host classroom and one remote classroom. This design enabled each school classroom to be a host classroom and each to be a remote classroom. The data that were collected from each phase was used as host data and remote data. This design also helped reduce any error variance due to one class of students being uniquely different from the other class. The physical presence of the instructor helped to minimize any variance in the data that could have occurred had she stayed at one school for the entire data

collection phase.

Statistical techniques for analyzing the data included analysis of variance (ANOVA), t tests for independent means, and the Modified LSD multiple-comparison procedures. All null hypotheses were tested at the .05 level of statistical significance.

Several weeks after the achievement data were collected, the Interactive Television Student Survey was given to each student present in school that day. These data were used to test the null hypotheses regarding the attitudes of the students. Also, frequency distributions and cumulative percentages were reported.

Summary of Findings

Procedures for the data collection and analysis were designed to answer six research questions:

1. Is there a difference in achievement between the students of the three sociological element subgroups (low, middle, and high) in the host classroom and the remote classroom?
2. Is there a difference in achievement between the females of the three sociological element subgroups (low, middle, and high) in the host classroom and the remote classroom?
3. Is there a difference in achievement between the males of the three sociological element subgroups (low, middle, and high) in the host classroom and the remote classroom?
4. Is there a difference in attitude between the students of the three sociological subgroups (low, middle, and high) in the host and remote classrooms?

5. Is there a difference in attitude between the females of the three sociological subgroups (low, middle, and high) in the host and remote classrooms?

6. Is there a difference in the attitude between the males of the three sociological element subgroups (low, middle, and high) in the host and remote classrooms?

There were six conceptual hypotheses and eight corresponding null hypotheses that were derived from the six research questions. These null hypotheses were proposed to direct the analytical procedures outlined in this study. The findings from these procedures are summarized in this section. In addition, results from subanalysis related to the hypothesis testing are summarized with the respective conceptual hypothesis.

Conceptual Hypothesis 1

The ANOVA procedure compared mean achievement gain scores and found that there was a significant difference between the six subgroups (three from the host school and three from the remote school); see Table 6.

A significant F probability statistic indicates that the population means are probably unequal. It does not show where the differences are. A multiple comparison procedure was used for determining which population means were different from each other. Norusis (1990) stated that multiple comparison procedures protect against calling too many differences significant. The procedures set up more stringent criteria for declaring differences significant than does the t test. The difference

between two sample means must be larger to be identified as a true difference. The Modified LSD procedure was used for post hoc analysis.

The results of the Modified LSD procedure showed a significant difference in mean achievement gain scores between the low-remote subgroup and the middle-remote subgroup (see Table 7).

Based on the fact that the ANOVA is a powerful test and has a good chance of finding differences when they are there was enough evidence to reject the null hypothesis, meaning that there is fairly high confidence in the conceptual hypothesis.

The alternative hypothesis that there is a difference in mean achievement gain scores between the students of the three sociological subgroups in the host and remote classrooms is supported. The differences were found between the subgroups at the same location, the remote classroom, and not across the ITV network as might have been expected. The research question was only answered in part. Differences do occur, but not across the ITV network.

Conceptual Hypothesis 2

The analysis of variance was used to compare the mean achievement gain scores between the females of the three subgroups in the host classroom and the remote classroom. There was no significant difference found at the .05 level of significance (see Table 8). The number of population participants (N) in each subgroup was small. This small number of students per subgroup may have affected the statistical analysis of the data. Hinkle, Wiersma, and Jurs (1988) stated that when the sample size is small the standard deviation may be large; therefore,

the normalcy assumption may not be met. The concern was that with small groups, the data analysis may not have detected any differences or relationships even though they may have existed. This is further addressed in the section on limitations.

Parenthetically, the results of the nonparametric, Kruskal-Wallis test showed no significant difference in the mean achievement gain scores between the females of the subgroups. It should be mentioned that the p value was approaching the level of significance at .0984. Although not significant, there appeared to be large differences between the females of the low-host subgroup and the low-remote subgroup, and females of the high-host subgroup and the high-remote subgroup. In both cases, the mean achievement gain scores for the females in the host classroom was much higher than their counterparts in the remote classroom.

The results of the Modified LSD procedure showed a significant difference in mean achievement gain score of the females between the middle-remote subgroup and high-remote subgroup, between the middle-remote subgroup and low-remote subgroup, and between the high-host subgroup and the high-remote subgroup (see Table 9).

The evidence was inconclusive to reject the second null hypothesis. The alternative hypothesis that there is a difference in achievement between the females of the subgroups is rejected. The result of analyzing the data for this research question and accepting the null hypothesis is that one cannot be sure of the situation. It cannot be said that the conceptual or alternative hypothesis was proved to be false.

Conceptual Hypothesis 3

The results of the ANOVA test for comparing the mean achievement gain scores of the males of the three sociological subgroups in the host and remote classroom showed no significant difference. The number of males in this study was small and thus could have affected the statistical outcome of the hypothesis testing. The population size of the subgroups may have been too small to detect any differences even though they may have existed (see Table 10).

A Modified LSD procedure was used with the data and yielded no significant differences at the .05 level of significance.

The null hypothesis was not rejected. The alternative hypothesis that there were differences in achievement between the males of the subgroups was rejected. Until this study is replicated with a larger male population, the answer to the research question is that one cannot be sure if there are differences in achievement between the males of the three sociological subgroups.

Conceptual Hypothesis 4

A t test for independent means was used to compare the mean achievement gain scores between all females and all males. The results showed no significant difference between the two groups. The mean score of the males was higher than the females, but was not significant (see Table 11).

No post hoc test was used as the large p value did not warrant it. The null hypothesis was not rejected. Consequently, the conceptual

hypothesis that there were differences in achievement between females and males was not supported.

Analysis of Attitudinal Data

The final four conceptual hypotheses relate to the data collected from the Interactive Television Student Survey. The next set of findings were the result of statistical hypothesis testing of mean attitude scores derived by calculating the mean score of Items 6 through 18 on the survey for each student. The mean attitude score for the subgroup was determined by calculating the group mean from the individual means.

Conceptual Hypothesis 5

The analysis of variance (ANOVA) was used to compare the mean attitude scores of the three subgroups in the host classroom and the remote classroom. It was found that no significant difference existed between the subgroup means (see Table 12); thus, the null hypothesis was not rejected and the alternative was not supported.

No post hoc analysis was done as a result of the large p value.

Conceptual Hypothesis 6

The ANOVA test was used to calculate the difference between the mean attitude scores of the females of the three sociological subgroups in the host and remote classrooms. There was no significant difference in mean scores of females between the subgroups (see Table 13).

The Modified LSD procedure showed a significant difference between the middle-remote group and the low-remote group. With the ANOVA test being a powerful test, there was not enough evidence to reject the null hypothesis. The conceptual or alternative hypothesis was not supported. The research question could only be answered by stating that one is not sure of the situation in this case.

Conceptual Hypothesis 7

To test whether the mean attitude scores between the males of the three subgroups in the host classroom and the remote classroom were significant, the ANOVA test was used. The results showed no significant difference with the F probability of .0596 (see Table 14).

The results of the Modified LSD procedure showed a significant difference in mean attitude scores between three subgroups. The low-host subgroup was significantly different than the middle-remote subgroup. The middle-host subgroup was significantly different than the middle-remote subgroup (see Table 15).

In using the ANOVA test to draw conclusions, the evidence was inconclusive to reject the null hypothesis for the alternate. There may indeed be some differences; however, with these small population numbers, one cannot say for sure.

Conceptual Hypothesis 8

The hypothesis that there would be a relationship in mean attitude score between the females and males overall was tested with the t test for independent means. It was determined that there was no significant

difference in the means of the two groups overall (see Table 16).

No post hoc analysis was done for this hypothesis.

There was not enough evidence to reject the null hypothesis. Therefore, the alternative or conceptual hypothesis that there was a difference in attitudes was not supported.

Analysis of Interactive Television Student Survey

The Interactive Television Student Survey was administered to all students who were present in class the day it was given. Two students from Merrill High School and one student from Hemlock High School were absent the day of administration.

Generally, the students from both the host school and the remote school had positive attitudes about the interactive television course before and at the completion of this study. This was seen by the fact that the majority of students from both schools would take another ITV course in the future. Of the negative attitudes expressed, the students from the remote school registered the most. This was consistent with the literature.

Limitations

This study was subject to limitations. The following were limitations found to be with this study:

1. The actual data collection phase of this study was delayed 7 months as construction delays and problems at Hemlock High School interrupted the flow of this investigation. All preliminary work was done in the fall of 1992 with expectations of collecting data during the late

winter or early spring of 1993. No data were collected during the 1992-1993 school year, rather, the data collection phase was delayed until the latter part of October and November 1993. The expectations of collecting data in the 1992-1993 school year and then subsequent disappointment was only experienced by the teacher and researcher. All new students enrolled in the course in the 1993-1994 school year.

2. The interactive television classes were limited in enrollment due to the nature of the technology system as described in Chapter I. As a result, the population size was limited and was considered a "convenient" population, as it was made up of all students who enrolled in the course. The small population may have affected the statistical analysis. Hinkle et al. (1988) stated that when the sample size is small the standard deviation may be large. The concern was that with the small groups the data analysis may not detect any differences or relationships even though they may exist.

3. The investigator had little control over the teaching methods and the administering of the achievement pretests and posttests due to the geographic distance to the schools from the researcher's home. The investigator was present for the administering of the Learning Style Inventory and the Interactive Television Student Survey.

4. The technology itself was a limitation. The equipment was subject to periodic failure during the instructional days of the data collection phase. The equipment does not work equally well in all classrooms in an interactive television system. That is, one room may have inferior equipment to other rooms on the system.

5. Even though steps were taken to minimize the Hawthorne effect, some potential existed for the novelty to affect the study. In Part II of the data collection phase, the teacher traveled each day to the remote school and taught the unit from that location. This would lend to a "novelty effect." As defined by Gay (1981), the novelty effect is a type of reactive arrangement resulting from interest, motivation, or participation by subjects simply because they are doing something different. It was difficult to measure how much the uniqueness of the study design and the system affected the performance of the students. If the interactive television system had a "novel" effect on the participants, it is likely to be common in studies similar to this.

6. It is recognized by the investigator that group means may not be the most accurate method for measuring differences in individual learning style preferences as it relates to achievement gain and attitude scores. Individual learners are unique and any attempt to place groups of students into categories may obscure any special cases. Using group means for this study allowed for statistical testing of null hypotheses and intended to give trends by subgroups. Individuals within the subgroups may vary from the trend.

Conclusions

Based on the findings presented in Chapter II, Chapter IV, and summaries in the preceding sections of this chapter, the following conclusions have been drawn:

1. There were sociological element subgroups that did not perform as well in achievement gain as the other subgroups in the

interactive television course. These subgroups with lower mean achievement gain scores were in the remote classroom part of the interactive television course. Students in the remote classroom who were in the low subgroup for the teacher motivated element scored significantly less achievement gain than the low, middle, and high subgroups in the host classroom. Studies reported in the literature concluded that students taught in interactive television courses achieved as well as students taught in the traditional classroom setting. This study showed that there are some students who do not achieve as well in the remote portion of the interactive television course.

Examination of these results could possibly suggest that they are not congruent with the expected or predicted results derived from the literature. However, closer analysis would suggest a plausible reason for the low-remote subgroup achieving significantly less than the other subgroups. Students who were in the low category for the element teacher motivated reported that they did not prefer teacher feedback or teacher closeness when learning. This group of students would tend to have less interaction with the teacher and initiate less student-teacher contact even when having difficulty in learning. Students in the low-remote subgroup who were having difficulty learning the material would tend to "slip through the cracks." The remoteness of the classroom plus the characteristics of this subgroup would mean that these students would retreat even further into their preference than in the traditional classroom environment.

2. Students in two of the three sociological subgroups (low and high) for the teacher motivated element in the remote classroom tended

to have lower mean achievement gain scores than the students of the three subgroups in the host classroom. This may imply that the ITV system was less effective than the literature reports.

3. The males in the three sociological subgroups tended to have higher mean achievement gain scores than the females, although not significant at the .05 level of significance.

4. There was no difference in attitude between the students of the different subgroups and between the males and females. The general attitudes of the students were similar to those found in the literature. That is, students in the interactive television courses tend to be slightly more positive than negative in their attitudes. In this study it was found that of the negative responses on the student survey, the remote school students had recorded more of them than the host school students. It was also reported on the student survey that more students from the host classroom responded favorably when asked if they would take another interactive television course.

In summary, the results collectively suggest that the interactive television system may function less satisfactorily as a delivery system for instruction than was first reported in the literature. However, schools should base decisions concerning implementation of interactive television courses on their particular needs. The alternative may be that some courses would not be offered without it.

Implications

Schools are restructuring and will continue to improve the quality of education as they move through this present decade. Technology is

making this job easier. It is possible for school districts to cooperate with one another and share resources without busing students or moving teachers from one school to another. Interactive television is making this a reality. As one reads through the various studies on ITV effectiveness, one must remember that this new technology is making a positive impact on schools. Appropriately applied, this technology can be used to share outstanding teachers, increase access to postsecondary education, enhance many other programs, and support restructuring (Decker & Krajewski, 1985; Kruh & Murphy, 1991; Nytes & Musegades, 1985). This study examined the achievement and attitudes of students enrolled in a high school psychology course to see if indeed the technology was effective for everyone.

It has been determined from the literature that interactive television is effective as a medium for the delivery of instruction. Also, achievement for large groups, such as classrooms of students, has not been significantly different between the host classrooms and remote classrooms or ITV classes and traditional classes. This study has shown, however, that the achievement gain may not be the same for all students in the remote portion of the system as compared to students in the host portion of the system. Students with certain learning style preferences may have a more difficult time in the remote classroom.

School administrators and guidance counselors should take care with the enrolling process of students for courses in the interactive television classrooms such as the psychology course in this study. In a day when educators are concerning themselves with student success and achievement, every opportunity for success should be given the student.

Enrolling a student who may have a tendency to struggle in an interactive television course would not be sound educational practice.

Recommendations

There are several recommendations that come as a result of working through this study. Based on the study limitations and factors that became apparent well into this study, the following recommendations are presented:

1. Given the results found in the data analysis, the conclusions, and the implications, schools should continue to investigate the feasibility of using interactive television as a medium for delivery or receiving instruction. This technology is providing more educational opportunities for high school students in various regions across the United States and enhancing curricular options in the small schools. The results of this study suggest that some students may not do as well in the remote portion of the interactive television course; yet, having the course available to students makes the technology more than desirable.

2. This study should be replicated with a larger population. The larger population would allow for more precise statistical analysis and, thus, more confidence in the findings.

3. This study design should be followed using different Learning Style Profile elements as the criteria for dividing the students into subgroups. Structure, learning with peers or alone, and adult authority are just three examples of learning style element categories that would be relevant to students in these types of courses and classrooms.

4. This study should be replicated with the investigator on site for the majority of the data collection phase. This would allow for close monitoring of teacher presentations, case studies, and other qualitative data.

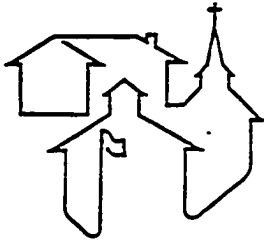
5. Correlational studies could be used to research the relationships between the learning style preferences of students and achievement.

6. A study of effective teaching styles would be potentially beneficial to learning more about what is effective in this type of classroom environment and how that may affect students' outcomes.

7. A study involving the observance and recording of student-teacher interaction with regards to the teacher motivated subgroups may further the existing knowledge of differences of learning style preferences and interactive television.

APPENDICES

Appendix A
Letters to Schools/Permission Letters



Tri-unity Christian School

Christian Education at Home: Church & School

Administrative / High School Offices: 2104 - 44th St., S.W., Wyoming, MI 49509 • Phone (616) 532-6766

September 21, 1992

Cliff Crossett, Principal
Hemlock Public Schools
733 N. Hemlock, P.O. Box 260
Hemlock, MI 48626

Dear Mr. Crossett,

This is a formal request for your permission to conduct an educational study at Hemlock High School.

As per our conversation of August 11, 1992, you are aware of my intent to complete a study using students in the Interactive Television Psychology Course. A partial requirement for the doctoral degree program, through W.M.U., is the successful completion of a study and dissertation.

The purpose of the study is to analyze the achievement and attitudes of students in relationship to their learning style in a psychology course taught via the interactive two-way television technology. Through the use of an experimental design for data collection and an attitude survey, the findings of this study are intended to provide a more sound basis for scheduling students into these interactive television courses.

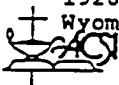
The data collection process will not actually take place until after the start of the second semester and will require approximately ten class periods when Mrs. Kampmueller will teach the course from Hemlock High. Wanita is excited about helping in this project.

The privacy of your teacher and students is assured and at no time will the identities of the subjects be used in the study. The identities of the subjects will not be made public. At the completion of the study, all data, results, and conclusions will be available to you.

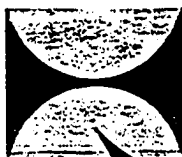
I would be very grateful to you for responding to this request in writing.

Sincerely,

Thomas A. Burkman
Doctoral Graduate Student, W.M.U.
1926 Holliday Dr.
Wyoming, MI 49509



Our school is an accredited member of the Association of Christian Schools International.



HEMLOCK HIGH SCHOOL

733 N. HEMLOCK ROAD HEMLOCK, MICHIGAN 48626

October 21, 1992

Mr. Thomas A. Burkman
Doctoral Graduate Student, W.M.U.
1926 Holliday Drive
Wyoming, Michigan 49509

Dear Mr. Burkman,

Please consider this letter as an approval of your request to conduct an educational study at Hemlock High School.

I am aware of your intent to complete a study using students in the Interactive Television Psychology Course during the second semester of this current school year. Also, that the purpose of the study is to analyze the achievement and attitudes of students in relationship to their learning style in a psychology course taught via the interactive two-way television technology.

The only caution that I must bring to your attention is that I would expect the parents of our students to be notified and their approval obtained prior to the study being undertaken.

I look forward to reading your findings of this study in the hope that they will provide a more sound basis for scheduling students into these interactive television courses.

Sincerely,

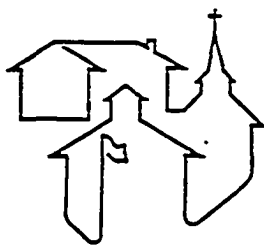
Clifford Crossett
Principal
Hemlock High School

CC/jas

Principal
517 / 642-5287

Asst. Principal
517 / 642-5287

Counselor
517 / 642-5270



Tri-unity Christian School

Christian Education at Home. Church & School

Administrative / High School Offices: 2104 - 44th St., S.W., Wyoming, MI 49509 • Phone (616) 532-6766

September 21, 1992

Ken Tesauro, Supt.
Merrill Public Schools
555 Alice
Merrill, MI 48637

Dear Mr. Tesauro,

This is a formal request for your permission to conduct an educational study at Merrill High School.

As per our conversation of August 11, 1992, you are aware of my intent to complete a study using students in the Interactive Television Psychology Course. A partial requirement for the doctoral degree program, through W.M.U., is the successful completion of a study and dissertation.

The purpose of the study is to analyze the achievement and attitudes of students in relationship to their learning style in a psychology course taught via the interactive two-way television technology. Through the use of an experimental design for data collection and an attitude survey, the findings of this study are intended to provide a more sound basis for scheduling students into these interactive television courses.

The data collection process will not actually take place until after the start of the second semester and will require approximately ten class periods when Mrs. Kampmueller will teach the course from Hemlock High. Wanita is excited about helping in this project.

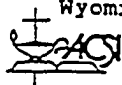
The privacy of your teacher and students is assured and at no time will the identities of the subjects be used in the study. The identities of the subjects will not be made public. At the completion of the study, all data, results, and conclusions will be available to you.

I would be very grateful to you for responding to this request in writing.

Sincerely,

Thomas A. Burkman

Thomas A. Burkman
Doctoral Graduate Student, W.M.U.
1926 Holliday Dr.
Wyoming, MI 49509



Our school is an accredited member of the Association of Christian Schools International.

MERRILL COMMUNITY SCHOOLS

431 WEST ALICE STREET • P.O. BOX 488 • MERRILL, MICHIGAN 48637

CONNIE O'TOOLE
Administrative Assistant
(517) 643-7248

DONALD N. AULBERT
Superintendent
(517) 643-7261

September 29, 1992

Thomas A. Burkman
1926 Holliday Dr.
Wyoming, Michigan 48509

Dear Tom:

I am responding to your 9/21 letter. Your study should prove to be valuable as well as interesting. Merrill Schools agrees to allow you to conduct the study under the stipulations stated in your 9/21 letter.

If you have any questions, please feel free to contact me. Best of luck in your study and dissertation.

Sincerely,



Ken Tesaro
Interim Superintendent

KT:pr



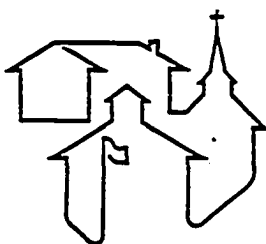
ELEMENTARY SCHOOL K-4
Cindy Komblevitz, Principal — (517) 643-7283
TRANSPORTATION/MAINTENANCE
Wanda Fay — (517) 643-7261

MIDDLE SCHOOL 5-8
Keith Clark, Principal — (517) 643-7247
ATHLETICS
Sarah Nelson, Director — (517) 643-7233

HIGH SCHOOL 9-12
Ken Tesaro, Principal — (517) 643-7231
COMMUNITY EDUCATION
Cindy Komblevitz, Director — (517) 643-7093



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Tri-unity Christian School

Christian Education at Home. Church & School

Administrative / High School Offices: 2104 - 44th St., S.W., Wyoming, MI 49509 • Phone (616) 532-6766

Principal
Merrill High School
431 West Alice Street
P.O. Box 488
Merrill, MI 48637

Dear Sir,

Approximately ten (10) months ago I requested and received permission to conduct a research project using your Interactive Television courses as the source of subjects and data.

As you know, the ITV course did not operate last school year due to construction delays, thus, the research never took place. I am planning to conduct the research early this Fall if you do not perceive any problems.

Enclosed you will find all appropriate documentation that this is an authorized dissertation research project with all necessary steps in place to protect your students and school.

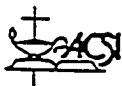
Thank you for your approval and cooperation.

Sincerely,

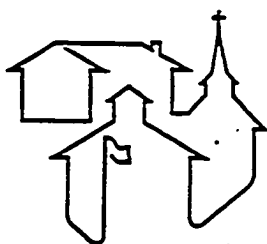
Thomas A. Burkman, Principal - Doctoral Candidate

TAB/rs

cc: Wanita Kampmuelier, Hemlock High School, Merrill High School



Our school is an accredited member of the Association of Christian Schools International.



Tri-unity Christian School

Christian Education at Home. Church & School

Administrative / High School Offices: 2104 - 44th St., S.W., Wyoming, MI 49509 • Phone (616) 532-6755

Mr. Clifford Crossett
Hemlock High School
733 N. Hemlock Road
Hemlock, MI 48626

Dear Sir,

Approximately ten (10) months ago I requested and received permission to conduct a research project using your Interactive Television courses as the source of subjects and data.

As you know, the ITV course did not operate last school year due to construction delays, thus, the research never took place. I am planning to conduct the research early this Fall if you do not perceive any problems.

Enclosed you will find all appropriate documentation that this is an authorized dissertation research project with all necessary steps in place to protect your students and school.

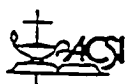
Thank you for your approval and cooperation.

Sincerely,

Thomas A. Burkman, Principal - Doctoral Candidate

TAB/rs

cc: Wanita Kampmueller, Hemlock High School, Merrill High School



Our school is an accredited member of the Association of Christian Schools International.

Appendix B
Participation Intent/Assent Forms

Dear Parent/Guardian:

We are asking permission for your son or daughter to participate in a research project involving a learning style inventory, achievement data, and a student attitude survey. The purpose of our research is to determine if all students learn equally in an interactive television course.

The research would take place during September and/or October, 1993, for approximately four (4) weeks. It will involve administering the Learning Style Inventory, an instrument that describes how students prefer to learn. Also, a pretest and posttest will be administered using tests published by the psychology textbook company that your student is using for the course. Finally, an attitude survey concerning interactive television as a mode of delivery of instruction will be given to the students. Each student will learn about their individual learning style preference through a Student Profile that will be given to them at the end of the project. If a relationship is found between learning style preference and achievement gain in an interactive television course, this information may benefit future students who enroll in these courses.

Because we will be comparing pretest and posttest scores on two unit tests and administering an attitude survey to your student, we need your permission. Rest assured that all test data and attitude data will remain confidential and safely stored. After the information has been matched to the learning style preference group, all student names will be destroyed. If these research results are published or shared in a professional manner, no names or individual scores will be used. Please note that your child may withdraw from the study at any time without any academic penalty.

If you have any questions, please call either:

Thomas A. Burkman: 1 - 616 - 530 0133
Wanita Kampmueller:

Thank you for your consideration in this manner.

Sincerely,

Thomas A. Burkman
Primary Investigator

Dr. Charles Warfield
Project Director

*** I give permission for
(student name)
to participate in the research study which includes the Learning Style Inventory,
two(2) pretests and posttests, and an Interactive Television Student Attitude
Survey.

Signature: _____

Date:

*Please return the signed form in the envelope provided.

Dear Student,

We are asking you to participate in a research project involving a learning style inventory, achievement data, and a student attitude survey. We would like to see if there are some students who have an easier time learning and like learning better in an interactive television course than other students.

The research would take place during September and/or October, 1993, for approximately four(4) weeks. If you choose not to participate, there will be no effect on your school grades. If you do choose to participate, you won't be able to earn any extra credit. Even if you sign permission today, you will still have a chance to change your mind when we begin the research data collection or at any time during the study.

You can be assured that all information and data will be held in strict confidence and that no names will be used in this research. Your teacher will not have knowledge of your individual attitude survey results.

At the end of the research study, if you request, you may receive your individual Learning Style Inventory Profile which will be explained to you. This Student Profile will help you understand how you best like to learn and some strengths and weaknesses in your learning preferences.

Once again, if these research results are published or shared in a professional manner, your name will never be used.

If you have any questions, please ask your teacher or call:
Thomas A. Burkman: 1 - 616 - 530-0133

** Only students that are 18 years old or older should sign this form. Parent/guardian does not have to sign for permission if you are 18 years old or older.

By signing my name below, I give permission to:

1. give me the Learning Style Inventory
2. allow my pretest and posttest scores to be analyzed with other student scores
3. give me the Interactive Television Student Attitude Survey

Date: Print Name here:

Sign Name here:

Age:

ASSENT FORM

I am from Western Michigan University. Although you or your parents have given me written permission to work with you, I'd like to go over everything one more time to make sure you understand what I will be doing and answer any questions you have.

I would like your permission to do three things:

1. Have you take the Learning Style Inventory.
2. Have you take a pretest and posttest for two (2) separate psychology units taught by your regular teacher and allow me to analyze your scores.
3. Have you take a confidential Interactive Television Student Attitude Survey.

This information will help determine if some students learn better and like learning better in an Interactive Television course than others.

This data collection period will take approximately four (4) weeks. If you don't want to take the Learning Style Inventory or have your achievement scores analyzed with others, or if you want to stop at anytime during the research, you can do so. There will be no extra credit given if you participate. If you decide not to participate, there won't be any effect on your school grades, either.

Only students under the age of 18 years need to sign this form. Please be aware that your parent/guardian must sign the parent/guardian form to give permission for you to participate.

If you agree, please sign below:

NAME: _____

AGE: _____

DATE: _____

Appendix C
Human Subjects Institutional Review Board Letter

Human Subjects Institutional Review Board



Kalamazoo, Michigan 49008-3899

WESTERN MICHIGAN UNIVERSITY

Date: February 12, 1993

To: Thomas Burkman

From: M. Michele Burnette, Chair *M. Michele Burnette*

Re: HSIRB Project Number 93-01-01

This letter will serve as confirmation that your research protocol, "An analysis of the relationship of the sociological elements of individual learning style, achievement, and attitudes of students in an interactive television course" has been approved after expedited review by the HSIRB. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the approval application.

You must seek reapproval for any changes in this design. You must also seek reapproval if the project extends beyond the termination date.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: February 12, 1994

xc: Warfield, EL

Appendix D
Interactive Television Student Survey
and Author's Permission Letter

INTERACTIVE TELEVISION STUDENT SURVEY

Note Students, please fill in the blanks of this survey as completely and accurately as possible. Please note that once the information has been matched to the different learning style groups, this cover sheet will be destroyed. Your teacher and other individuals will not be able to identify your answers. All information is guaranteed confidentiality!

Thank you for your cooperation.

Your Assigned Student Code: _____

Your School: _____

Your Age: _____

Your Grade Level: _____

Your Gender (male or female): _____

Your Overall Grade Point Average: _____
(your best estimate, please, using the scale below for your overall grade average):

A = 4.00
A- = 3.67
B+ = 3.33
B = 3.00
B- = 2.67
C+ = 2.33
C = 2.00
C- = 1.67
D+ = 1.33
D = 1.00
D- = 0.67

INTERACTIVE TELEVISION STUDENT SURVEY

What was your opinion of TV classes before taking this course?

1. no opinion poor idea average idea above average idea

2. Why did you have that opinion? _____

3. Have you ever taken a TV course before? yes no
If yes, please print the name of the class: _____

If yes, were you in the host classroom? _____

.....remote classroom? _____

4. Would you take another TV course? yes no

5. Would you take another psychology course? yes no

Please indicate your level of agreement with the following statements by using the scale of 1 - 7:

- | | | | | | | | | |
|-----|---|---|----------------|-------|--------------|--------------------|-----------------|-------------------|
| | 1 | strongly agree | | | | | | |
| | 2 | agree | | | | | | |
| | 3 | mildly agree | | | | | | |
| | 4 | neutral/no opinion | | | | | | |
| | 5 | mildly disagree | | | | | | |
| | 6 | disagree | | | | | | |
| | 7 | strongly disagree | | | | | | |
| | | | strongly agree | agree | mildly agree | neutral/no opinion | mildly disagree | disagree |
| | | | | | | | | strongly disagree |
| 6. | | The presentation of the course materials was as effective as I have found in other courses I have taken in this school. | 1 | 2 | 3 | 4 | 5 | 6 |
| 7. | | The reception of the picture was good enough for following the teacher's presentation, taking notes, etc. | 1 | 2 | 3 | 4 | 5 | 6 |
| 8. | | The talkback feature allowed me to participate as effectively in this class as in regular classes. | 1 | 2 | 3 | 4 | 5 | 6 |
| 9. | | I felt as comfortable learning from the TV teacher as I did from the teacher in the class. | 1 | 2 | 3 | 4 | 5 | 6 |
| 10. | | I had ample opportunity to ask questions during class time. | 1 | 2 | 3 | 4 | 5 | 6 |
| 11. | | My papers /exams/assignments were returned on a timely basis. | 1 | 2 | 3 | 4 | 5 | 6 |

Please turn the page.

12. I received hand-outs and other materials in time for assignments.

strongly agree
1 2 agree
3 mildly agree
4 neutral/no opinion
5 mildly disagree
6 disagree
7 strongly disagree 146

13. The visual/instructional aids used in this class were useful in helping me understand the course content.

1 2 3 4 5 6 7

14. Sufficient assistance was available when I needed it for me to successfully complete tests and other assignments.

1 2 3 4 5 6 7

15. The television system is an effective way to teach this course.

1 2 3 4 5 6 7

16. I liked taking this course by television.

1 2 3 4 5 6 7

17. If I had a choice, I would take another television course.

1 2 3 4 5 6 7

18. In general, I like school.

1 2 3 4 5 6 7

19. On a scale of 1 - 10 (1 being best), how would you rate the overall quality of the remote (the instructor on TV) portion of the television course.
(1-10)_____

20. On a scale of 1 - 10 (1 being best), how would you rate the overall quality of the host (the instructor present) classroom portion of the course.
(1-10)_____

21. What do you think are the strengths and weaknesses of this television course?

Strengths

Weaknesses

Please turn the page.

PART 2

Directions: Thinking only of the content of the course, place an X in the one space of the seven that best describes your opinion of the content of this course. The closer you place your X toward one word or the other, the more you think that word better describes the course content.

example: For example, if you think the content of this course was very meaningful you would place an X in the space closest to that word.

meaningful X | | | | | | | meaningless

CONTENT OF THIS COURSE

1. interesting | | | | | | | boring
2. important | | | | | | | unimportant
3. powerful | | | | | | | weak
4. worthless | | | | | | | valuable
5. good | | | | | | | bad

Please turn the page.

Directions: Now thinking only of the medium (interactive television), place an X in the one space of the seven that best describes what you think the method of instruction was like in this course. The closer you place the X toward one word or the other, the more you think that word better describes the medium (interactive television).

MEDIUM OF INSTRUCTION

- | | | |
|---------------|--|--------------|
| 1. good | | bad |
| 2. weak | | powerful |
| 3. annoying | | pleasing |
| 4. successful | | unsuccessful |
| 5. negative | | positive |

Are there any additional comments you would like to make concerning this course?

Source: Adapted by permission from "A study of the effectiveness of interactive television as the primary mode of instruction in selected high school physics classes." By Dr. Rebecca Libler.



Indiana State University

Department of Educational Administration

February 23, 1994

Mr. Thomas A. Burkman
1926 Holliday Drive
Wyoming, MI 49509

Dear Mr. Burkman:

You have my permission to modify and use the Student Survey instrument which I developed for use in my study of the effectiveness of interactive television as the primary mode of instruction in selected high school physics classes.

I am aware that University Microfilms, Inc. may supply single copies on demand.

Sincerely,

Rebecca W. Libler, Ed.D.
Assistant Professor
Department of Educational Administration

kt

Terre Haute, Indiana 47809
(812) 237-2900

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