INVESTIGATION OF THE EFFECT OF IVI WITH THREE MODES OF INSTRUCTION ON LEARNING AND ATTITUDE TOWARDS THE INSTRUCTIONAL MEDIA

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ABSTRACT

Social Cognitive Theory proposes educational perspectives believed to facilitate the learning process. Social learning focuses on the interactive function of person, behavior, and environment. The mechanism for learning and attitude development is claimed to be influenced by modeling and reinforcement.

Computer instruction is a technology that has the capability of incorporating both modeling and reinforcement. Interactive Video Instruction (IVI) is a branch of computer instruction comprised of video and computer components. A traditional mode for computer instruction is on an individual basis. An alternative mode of instruction through group presentation is sometimes employed in the educational arena, however, limited research supports its effectiveness, especially in nursing education. Thus, the following research question was posed: Are there differences in learning and attitude towards the instructional media when an IVI program is utilized by an individual nursing student, small group of nursing students, and a larger group of nursing students?

A Pretest-Posttest Control-Group Design was employed. A non-probability, convenience sampling
method was utilized and included students from baccalaureate nursing schools. The IVI program was presented in the respective schools to nursing students who were randomly assigned to one of three treatment groups. Mode of instruction for the program in each school was on an individual, small group, and larger group basis. A test of Intravenous (I. V.) Therapy content was administered before and after the program to measure cognitive learning. Similarly, an attitude survey was distributed before and after the program to assess attitude towards the instructional media.

Extraneous variables were controlled statistically by comparing pretest scores through ANOVA. Posttest scores were grouped according to the specific mode of instruction and sample means for each mode were computed. One way ANOVA with post hoc Scheffe test was used to test the hypothesis.

Findings revealed no significant difference in learning and attitude towards the instructional media when utilizing three modes of instruction. Therefore, group learning was at least as effective a mode as individualized learning, which has implications for issues of cost effectiveness. In addition, the majority of students indicated a generally positive reaction to IVI as an instructional strategy.
# TABLE OF CONTENTS

ACKNOWLEDGEMENTS ...................................................... iii
ABSTRACT ........................................................................ iv

## CHAPTER I INTRODUCTION ............................................. 1

- Background ................................................................... 1
- Purpose ......................................................................... 4
- Research Question and Hypotheses ................................. 4
  - Exploratory Questions ............................................... 5
  - Variables ...................................................................... 5
- Definition of Terms ..................................................... 7
- Theoretical Framework .................................................. 8
- Assumptions ................................................................... 16
- Significance ................................................................. 17

## CHAPTER II REVIEW OF THE LITERATURE ....................... 19

- Computer Instruction ................................................... 19
  - Introduction ............................................................... 19
  - Learning ....................................................................... 24
  - Attitude ........................................................................ 27
  - Learning and Attitude .................................................. 29
- Mode of Instruction ...................................................... 38
  - Individual Basis .......................................................... 38
  - Small Group Basis ....................................................... 40
  - Large Group Basis ....................................................... 53
Summary ...............................................55

CHAPTER III METHODOLOGY .................................... 57
Research Design.............................................57
Sample Selection and Size...............................58
Instrumentation.............................................68
  Data Sheets...........................................68
  Test on I. V. Therapy.................................69
    Content Validity....................................70
    Reliability.........................................73
  Pilot Study Procedure.................................74
  Pilot Study Sample Description.....................75
  Pilot Study Scoring..................................76
  Pilot Study Internal Validity.........................80
  Attitude Toward CAI Semantic Differential Tool......81
  Description of IVI Program............................84
  Procedures for Data Collection.......................85
  Data Analysis.........................................91
  Delimitations.........................................92

CHAPTER IV RESULTS .........................................93
  Frequency Distribution.................................93
    Test of I. V. Therapy Scores.......................93
    Attitude Scores....................................95
  Responses on Post-Treatment Data Sheet...96
Group Equivalence.............................102
Research Sample..............................102
Research and Dropout Sample..............103
Data Analysis.................................105
Hypotheses......................................105
Exploratory Questions......................108

CHAPTER V DISCUSSION, CONCLUSIONS, AND
RECOMMENDATIONS.............................111
Discussion......................................111
Hypotheses......................................111
Exploratory Questions........................117
Learner Perceptions............................119
Sample Size.....................................120
Dropout Sample.................................123
Conclusions.....................................125
Recommendations...............................127
REFERENCES.....................................129

LIST OF APPENDIXES
Appendix A: Pre-treatment Data Sheet........145
Appendix B: Post-treatment Data Sheet........148
Appendix C: Expected Learner Outcomes........152
Appendix D: Pilot Test on I. V. Therapy.........153
Appendix E: Approval by Widener University to
Conduct Pilot Study.........................160

viii
Appendix F: Approval by University to Conduct Pilot Study....................161
Appendix G: Letter of Explanation to Faculty Partaking in Pilot Study........162
Appendix H: Directives Regarding the Design of the Pilot Study........165
Appendix I: Letter of Explanation to Students Partaking in Pilot Study....168
Appendix J: Informed Consent Form-Pilot Study.............................171
Appendix K: Test on I. V. Therapy.................................173
Appendix L: Author Consent Permitting Use of Attitude Tool.............177
Appendix M: Attitude Toward CAI Semantic Differential Tool..............178
Appendix N: Permission to Use I. V. Therapy Program.............................180
Appendix O: Formative Evaluation Process of I. V. Therapy.................181
Appendix P: Approval by Widener University to Conduct Research Study......183
Appendix Q: Approval by Institutional or Departmental Research Committees.................184
Appendix R: Letter to Dean or Chairperson of the Nursing School........185
Appendix S: Consent from the Schools to Participate in the Study........186
Appendix T: Letter of Explanation to Liaison Faculty.........................190
Appendix U: Directives Regarding the Research Design.........................194
Appendix V: Letter of Explanation to Course Teacher(s)....................201
Appendix W: Letter of Explanation to Students..............................204
Appendix X: Informed Student Consent Form.................................208
Appendix Y: Letter of Explanation to Proctor...............................210
List of Tables

Table 1: Sample Size per School of Nursing ..........60
Table 2: Demographics of the Research Sample:
         Educational Background .....................67
Table 3: Demographics of the Research Sample:
         Employment Background ......................68
Table 4: Cognitive Levels of Behavioral Objectives and
         Test Items ..................................72
Table 5: Test Blueprint ................................73
Table 6: Discrimination Index and Difficulty Factor of
         Test Items ..................................78
Table 7: Comparison of Test Items to Test Blueprint ..79
Table 8: Alpha Reliabilities of the Attitude Towards
         CAI Instrument .............................83
Table 9: Favorableness of IVI as an Instructional
         Strategy ....................................97
Table 10: Perception about Probable Learning Outcome in
          Groups by Students who Worked Alone ....98
Table 11: Perception about Participation in Discussions
          that Occurred in Group Instruction ..........99
Table 12: Perception about Helpfulness of Interactions
          that Occurred in Group Instruction .........100
Table 13: Perception about Learning on an Individual
          Basis by Students Participating in Group
          Instruction ................................101
Table 14: Means of Pre-treatment Scores according to
          Mode of Instruction ..........................102
Table 15: Means of Scores for Research and Dropout
          Sample ......................................104

xi
Table 16: Comparison of the Means between the Research and Dropout Sample .......................105

Table 17: Means of Post-treatment Scores according to Mode of Instruction......................106

Table 18: Pearson Correlation Coefficients Between Posttest Knowledge and Attitude Scores for the Three Independent Groups.............108

Table 19: Comparison between Learning and Attitude Scores with Match/Mismatch of Preferred Mode of Instruction and Randomly Assigned Mode......................................109

Table 20: Pearson Correlation Coefficients between Knowledge, Attitude, and Group Interaction (n=40).................................110
List of Figures

Figure 1: Observational Learning.........................11
Figure 2: Processes Governing Observational Learning..........................14
CHAPTER I
INTRODUCTION

Background

A persistent issue of educational concern is facilitation of the learning process. Various schools of thought exist which offer mechanisms theorized to facilitate learning. Klausmeier and Goodwin (1966) identify, for example, functionalist theory which explores the functional relationships among independent variables occurring in schools; conditioning theory which proposes the need for reinforcement in stimulus-response learning patterns; social learning theory which suggests that learning and attitude are influenced by imitation and conditioning; and subsumption theory which explains internalization of content presented in final form to the students.

Through the past few decades, the educational arena has expanded to include diverse instructional delivery systems in order to facilitate the learning process. One such system is computer-assisted instruction (CAI). A branch of CAI that incorporates both a computer and video component is interactive video instruction (IVI). Bandura (1986) proposes that
computer technology supports learning through a mechanism of observation and reinforcement.

An assumption aligned with CAI since its inception is that learning is most effective on a one-to-one basis; that is, one student to one computer (Conklin, 1983; Levin, 1983; Ormiston, 1988). Literature addresses the high cost of hardware and software especially in reference to IVI (Abrams & Streit, 1986; Miller, 1990; Weiss & Jarvis, 1986-87). Due to cost factors, educational institutions are usually restricted in the quantity of computer systems purchased. With individualized mode of instruction, educational institutions restrict numbers of students from utilizing systems and limit the time students are permitted to work at the computer terminal (Webb, 1985). Frustration or delays in the completion of instructional programs can affect attitude towards instructional media and ultimately the learning process. In contrast, group instruction requires fewer computer systems to accommodate a comparable student enrollment.

Another consideration relating to computer instruction arises from the influence of social learning theory which challenges individual modes of
instruction by favoring group learning. Individualized instruction lacks social interaction since interactivity exists only between the computer and the student. Feedback is limited to individual student responses. In group instruction, interaction occurs among students, a consensus for an answer is determined, and the computer responds. Learning transpires on varied levels, that is, through interaction and feedback. However, large group instruction may adversely affect the learning process (Kemp & Dayton, 1985; Watson, 1966). For example, consideration must be given to distractions from other group members, diverse pacing of learning among students, and less perceived individual control on learning. Thus, this researcher was interested in investigating the effect upon learning content relating to Intravenous (I. V.) Therapy and attitude towards instructional media when utilizing an IVI program with an individual nursing student, a small group of nursing students, and a larger group of nursing students.
Purpose

The purposes of this research were to expand the knowledge base relating to learning, students' attitude towards the instructional media, and computer instruction in nursing education. More specifically, this research explored effectiveness of three modes of instruction with computer technology.

Research Question and Hypotheses

This research study addressed the following question: Is there a difference in learning and attitude towards the instructional media when utilizing an IVI program with an individual nursing student, a small group of nursing students, and a larger group of nursing students?

The hypotheses generated from this research question were:

1) Cognitive learning is greater when utilizing an IVI program with a small group of nursing students than with an individual or larger group of students.

2) Attitude towards the instructional media (computer) scores are higher when the IVI program is utilized with a small group of nursing students than
with an individual or larger group of nursing students.

3) The relationship between attitude towards the instructional media and cognitive learning is significantly stronger in a small group than with an individual or larger group of nursing students.

**Exploratory Questions.**

In addition to the research question, questions relevant to the theoretical framework were explored using data collected on a Post-treatment Data Sheet. Data concerning students' preferences for individual, small group, or large group learning and perception of degree of group interaction were collected. Data analysis addressed the following questions:

1) Did students who were randomly assigned to their preferred mode of instruction score differently on measures of cognitive learning and attitude than students who were randomly assigned to a mode of instruction that was not preferred?

2) What are the relationships among perception of group interaction, cognitive learning, and attitude scores?

**Variables.**

The independent variable was the mode of instruction used with the IVI program, that is, an individual nursing student, small group of nursing
students (2-3), and larger group of nursing students (7 or more). The dependent variables were scores of cognitive learning and attitude towards instructional media.

Several extraneous variables were identified. Students from the participating nursing schools were in different semesters based upon the location of I. V. Therapy content in the curriculum. This circumstance required utilization of the IVI program and testing during different semesters. The heterogeneous characteristics of the students were not determined until demographic data sheets were completed. Characteristics that may affect test results included prior LPN training, previous computer experience, and generic students with experience in health care settings. These variables were controlled by random assignment to three study groups. In addition, pretest scores of both cognitive learning and attitude were compared through ANOVA. If the scores were significantly different, z scores were calculated for all pretest and posttest data to standardize scores for further analysis.
Definition of Terms

In order to establish a common frame of reference, the researcher defined the following terms:

1. **Attitude towards the instructional media** is the emotional reaction, whether favorable or unfavorable, of the learner to the media as measured by the Attitude Toward CAI tool (Allen, 1986). The survey consists of 14 items and were completed before and again after the presentation of the IVI program.

2. **Cognitive learning** is the "information-processing activity in which information about the structure of behavior and about environmental events is transformed into symbolic representations that serve as guides for action" (Bandura, 1986, p. 51). Cognitive learning was measured by scores achieved on a test, designed by the researcher, that covers content on I. V. Therapy derived from the prescribed chapters of the IVI program. The test on I. V. Therapy consisted of 20 multiple choice items and was completed before and after the IVI program.

3. **IVI** is a technological media that combines the interactivity, information management, and decision-making capacity of computers with audio and visual capabilities of videodisc or tape (Bosco, 1984;

4. **IVI program** is an instructional program on I. V. Therapy comprised of six chapters and co-designed by Fuld Institute for Technology in Nursing Education (FITNE) and Hocking College. Students completed Chapters 1 and 2 in a single session as part of this research study.

5. **Mode of instruction** is the method in which baccalaureate nursing students observed the IVI program:

   - **individual basis**—one student observed the IVI program individually;
   - **small group**—2 to 3 students observed the IVI program as a group;
   - **large group**—7 or more students observed the IVI program as a group.

**Theoretical Framework**

This study investigated the effect upon learning and attitude towards the instructional media when utilizing an IVI program with an individual, small group, and larger group of nursing students. The directional hypotheses speculated more positive effects
on learning and attitude when IVI was employed with a small group of students. This effect was hypothesized based on the importance of social interaction on the learning process.

Bandura, a social psychologist, proposes a sociobehavioristic approach to the learning process which influences cognitive learning and attitude. Social cognitive theory, according to Bandura (1986), explains human functioning "in terms of a model of triadic reciprocality in which behavior, cognitive and other personal factors, and environmental events all operate as interacting determinants of each other" (p. 18). This model of reciprocal determinism emphasizes the interdependent relationship among person, behavior, and environment.

According to Bandura (1986), the factors of reciprocal determinism are bidirectional, interdependent, and affect each other. In addition, the bidirectional influences may vary in strength depending on different activities, individuals, and circumstances. Thus, reciprocal determinism is a dynamic process that varies depending upon the situation.

Reciprocal determinism supports the concept of
social interaction. "In social interactions the behavior of each participant governs which aspects of their potential repertoires are actualized and which remain unexpressed" (Bandura, 1977, p. 197).

Therefore, the milieu of social interaction in a learning environment may affect the learning process of its participants. Bandura (1977) proposes that the most effective influence on behavior is the actions of others.

According to Bandura (Bandura, 1965, 1986; Bandura & Jeffrey, 1973), the primary emphasis of social cognitive theory encompasses acquisition of cognitive skills and development of new patterns of behavior. Observational learning occurs as a result of observation and reinforcement (see Figure 1).

In observational learning, modeled information is symbolically represented and provides a guide for future action. Modeled information is conveyed, for example, through real-life models or symbolically through action, pictures, words, audio-visual media, or written or oral instructions (Klausmeier & Goodwin, 1966). Significant to modeling are psychological matching patterns and not simply mimicry of modeled behaviors (Bandura, 1986). "Observational learning
occurs through cognitive processing during exposure to modeled events before any responses have been performed..." (Bandura, 1986, p. 76). Students learn thinking skills and application by deducing rules and strategies models use during problem solving. This mechanism is most effective when "models verbalize their thought strategies aloud as they engage in problem-solving activities" (Bandura, 1986, p. 74).

**Figure 1.** Observational learning.

```
Observation of Modeled Behavior

Reinforcement

Observational Learning

Effects

instructor
inhibitor
disinhibitor
facilitator
environmental enhancer
emotional arouser

Influences or effects of modeling on observational
```
learning represented in Figure 1 are multiple. Bandura (1986) identifies the following effects which can operate separately or concurrently: instructor, inhibitor, disinhibitor, facilitator, environmental enhancer, and emotional arouser. The instructor effect aids in the acquisition of cognitive skills and novel patterns of behavior by observing the performance of models. Inhibitory/disinhibitory effects either strengthen or weaken inhibitions over previously learned behavior, thus, reduce or promote performance respectively. Inhibitions occur as a result of the observer seeing consequences of actions experienced by the model. Response facilitation effect refers to the action of others that can encourage performance of previously learned behavior that has not been performed due to insufficient inducement rather than inhibition. Environmental enhancer effect occurs since modeling "also draws the observers' attention to the particular objects or environmental settings that others favored" (p. 50). Finally, arousal effect is elicited either through social interaction inducing an emotional reaction or incitement of emotional arousal in the learner due to expression of emotion by the model.

Learning is achieved through observation and
reinforcement. Reinforcement, in part, relates to the "administration of reinforcing stimuli either to the model or to the observer" (Bandura, 1965, p. 589). Bandura (1965) adds that resultant matching responses by the learner are affected by other variables. Some of these variables are motivation, "rate, amount, and complexity of stimuli" (p. 593), and degree to which the necessary components of the behavior are in the observer's repertoire. In addition, according to Klausmeier and Goodwin (1966), anticipation of positive or negative reinforcement may either increase or decrease the probability of observing which is essential to imitation.

Social cognitive theory relates to learning as well as attitude. As previously mentioned, modeling may exert emotional arouser effects whereby social interaction or emotional reaction of the model may elicit emotional reaction by the learner. Bandura (1986) further explores influences on attitude or emotional reaction of the learner by elaboration of processes that govern observational learning represented in Figure 2. The four processes include: attention, retention, production, and motivation.
Attentional processes involve "self-directed exploration of the environment and construction of meaningful perceptions from ongoing modeled events" (Bandura, 1986, p. 53). The learner attends to and accurately perceives relevant modeled activities that are selectively determined. Mechanisms that enhance attention in the learner include attractiveness of models, informative feedback, and physical accentuation of essential features of the modeled activities.

Retention processes involve "the active transformation and restructuring of information about events" (Bandura, 1986, p. 56). Symbolization occurs whereby selective modeled information is transformed and organized into symbols. The symbolic codes preserve the relevant information and provide the operations for the translation of symbols into action.

Production processes convert "symbolic conceptions into appropriate actions" (Bandura, 1986, p. 63). This operation (Bandura, 1986, p. 52) involves cognitive
representation, observation of enactments, feedback information, and conception matching in reference to rules of action.

Motivational processes are the final operation prior to the matching response pattern of the modeled event by the observer. This operation determines "whether or not observationally acquired competencies will be put to use" (Bandura, 1986, p. 51). Various factors promote interest, an effective learning environment, and influence use of the observationally acquired competencies. These factors (Bandura, 1986) are: positive features that make tasks enjoyable, challenges through setting goals, variety that opposes boredom, personal responsibility for accomplishment of goals, feedback concerning progress, and positive incentives. In conclusion, activities perceived as self-satisfying are considered motivators which influence attitude or emotional reaction toward the learning event.

In summary, Bandura (1986) designed social cognitive theory explaining human functioning in terms of reciprocal determinism whereby person, behavior, and environment act as interacting determinants. Reciprocal determinism favors social interaction in the
learning environment, thus fostering the concept of group learning. Effective group size is not addressed by Bandura. However, proponents (Hiltz, 1990; Johnson & Johnson, 1974, 1975, 1985; Slavin, 1983a, 1983b; Whipple, 1987) of small group instruction, cooperative learning and collaborative learning have examined small group learning and validated its effectiveness.

Primary emphasis of the theory focuses on acquisition of cognitive skills and new patterns of behavior as a result of observation and reinforcement. Attitude, or emotional reaction, is elicited through social interaction and influenced by motivators. Perception of instructional media as a positive or negative motivator influences the emotional reaction of the learner and ultimately affects the learning process. Consequently, social cognitive theory provided the theoretical framework to investigate the effects upon learning and attitude towards the instructional media when using IVI with three modes of instruction.

Assumptions

The following assumptions pertained to this study:

1. Cognitive process and attitude are learned (Bandura, 1986; Johnson & Johnson, 1975).
2. Attitude of the learner affects the learning process (Bandura, 1986; Clark, 1984; Conklin, 1983).


Significance

Nursing research pertinent to educational methodology is limited in the use of varied modes of instruction with computer technology and determining its effect upon learning and attitude. This research broadened the knowledge base regarding the effectiveness of computer instruction. More specifically, the research findings enhanced current limited knowledge of effective modes of instruction related to IVI. The study also contributed to the further development of social learning theory. Although a group mode of instruction is favored by Bandura, the actual size, whether small or large, is not specified. This study investigated the effectiveness of different group sizes, thereby expanding current research on social learning theory. Finally, the research contributed to issues of cost effectiveness since fewer hardware systems and software
programs were required if group learning was at least as effective a mode of instruction as individualized learning.
CHAPTER II
REVIEW OF THE LITERATURE

Computer Instruction

Introduction.

CAI is an instructional delivery system designed to facilitate the learning process. Historically, CAI has been in use in industry since the late 1950's for personnel training and education (Kulik, Kulik, & Cohen, 1980).

IVI is a technological media that combines the interactivity, information management, and decision-making capacity of computers with audio/visual capabilities of videodisc/tape (Bosco, 1984; Levenson, Morrow, & Signer, 1985-86; Schaffer & Hannafin, 1986; Weiss & Jarvis, 1986-87). Levenson (1983) described an IVI system as consisting "of a microcomputer and disc drive, coupled to a video player (either tape or disc) and a television monitor or receiver through an interface unit" (p. 36). In the 1970's, interactive videodisc was introduced by industry (Bosco, 1984) and employed for instructional and training purposes (Milheim & Evans, 1987).

Conklin (1983) differentiated between CAI and IVI
in that IVI "offers a diversity of stimuli but also provides the nursing student with practice in the visual and audio discriminations required in nursing practice" (p. 105). Due to the audio-visual capability of the program, a model is present, as suggested by Bandura, to facilitate observational learning through symbols while the computer affords feedback to learner responses. Hansen (1989) referred to IVI as the novel symbol system providing machine-based instruction. IVI was proposed to be "best suited for modeling effective teaching presentations" (Hofmeister, Engleman, & Carnine, 1986, p. 39) as well as simulating real-life situations and providing appropriate behavioral models (Browning, White, Nave, & Barkin, 1986).

In addition to modeling effects as a result of audio-visual components of IVI, Copeland (1988) suggested that the success of IVI as an instructional media depends upon the quality of the program. Some of the additional features of IVI which contribute to the quality of programs include questioning, reinforcement, remediation, and practice (Browning, White, Nave, & Barkin, 1986; Copeland, 1988; Evans, 1986). IVI also has the capability of branching the learner to the videotape or to the print-screen for information (Hoth,
Levenson, Morrow, and Signer (1985-86) associated effectiveness of IVI to the capability of interactivity through questioning the learner, providing appropriate feedback and/or remediation, informing the learner of progress, as well as practicing use of information taking various stands before applying to real life situations.

Withrow (1985-86) offered indications for use of IVI. They included: provision of programs in areas characterized by teacher shortage; allowance for experimentation of potentially dangerous or costly activities; and development of instructional content suited for audiovisual presentations. Smith and Jones (1986) described use of IVI to teach college level chemistry. Hon (1983) related use of his CPR Computer/Videodisc Learning System for purposes of cardiopulmonary resuscitation (CPR) certification and recertification training. The CPR program permitted a larger population to be trained while not increasing the number of instructors nor compromising standards (Levenson, 1983).

Likewise, Miller (1990) explored utilization of IVI in the legal profession, for example: students in law school; lawyers in order to acquire continuing
education and/or skill training not received in law school; and inexperienced lawyers to obtain additional instruction. To its credit, IVI has the capability of mimicking real-life decision making skills whereby unwise decisions would not be detrimental to a client.

A strong impediment to more extensive adoption of IVI in educational institutions has been the cost of both hardware and software (Abrams & Streit, 1986; Jones & Smith, 1989; Reisman & Swanson, 1990; Straker, 1988). Abrams and Streit (1986) cited the cost of an IVI system to be more than twice the cost of a linear video system while development and production costs exceed CAI or linear video by four times. Hoth (1985) stated a cost of $20,000 or more for production of a videodisc program and a production cost for out of institution fees by an interdisciplinary team at $500/hour.

In addition, Miller (1990) suggested a cost of higher than $55,000 to design and complete an IVI program and a time commitment of approximately two years. Weiss and Jarvis (1986-87) reported the cost of a videodisc system to be $1500-7500 depending on type of hardware and level of interactivity. Smith, Jones, and Waugh (1986) listed an IBM InfoWindow consisting of
a touch screen and voice synthesizer at approximately $4200.

Recommendations to reduce costs are suggested by educators and professionals in educational technology. Miller (1990) advocated cost reduction by establishing program rentals while Levenson, Morrow, and Signer (1985-86) recommended use of authoring systems by educators to diminish programming costs. Weiss and Jarvis (1986-87) noted a possible reduction up to 80% in hardware costs by group paced rather than individual mode of instruction.

Another deterrent related to adoption of IVI as an instructional strategy has been compatibility. Rizzolo (1989) reported that the nursing profession has been involved in using IVI programs since the early 1980’s. Since software programs were designed for specific hardware systems, programs can not readily be shared between institutions. The author also summarized the results of a survey conducted by the American Journal of Nursing investigating the use of IVI in nursing schools and hospitals. Neither the year of the survey nor the location of the institutions were furnished. Seventy-five of the 661 hospitals and nursing schools acknowledged current use of IVI while over 49% planned
on purchasing IVI systems in the future. These results revealed that approximately 9% of the responding institutions use IVI.

An attempt to promote utilization of IVI in nursing curricula was ventured by Fuld Institute for Technology in Nursing Education (FITNE). Burke (1990), managing director of FITNE, reported distribution of 77 hardware systems to 46 nursing schools. Neither the year of the distribution nor the location of the schools were identified. Each nursing school was allocated one or two IVI computer systems and an IVI program entitled "Intravenous Therapy." These schools were required to purchase two additional software programs. FITNE also awarded 134 grants worth $4,232,000 to nursing schools and of this total, $1,355,000 was distributed to 33 schools for purchase of IVI hardware and software.

Learning.

Bandura (1986) promoted learning as a process involving behavioral changes, acquisition of cognitive skills and new patterns of behavior. Learning occurred as a result of transformation of information into symbols which act as a guide for future action. In addition to modeling, reinforcement facilitates the
learning patterns (Bandura, 1965). Consequences, whether reward or punishment of the responses to either the model or observer, influence learning (Huckabay, 1980; Klausmeier & Goodwin, 1966).

The learning effectiveness of CAI, based upon student achievement gains, is not conclusive and research studies relative to IVI are limited. Kulik, Kulik, and Cohen (1980) reported small but significant achievement gains in their meta-analysis of 59 studies of computer based college instruction. A 3% point difference in the average examination score existed between the computer-based class (60.6%) and the conventional class (57.6%). Standard deviation was 6.5. These results were statistically significant at $p < .01$.

Clark (1983), in a review of studies and meta-analyses relating to influence of media on learning, found increased learner attention to instructional media that were novel to the students. At times, this increased attention concluded in greater effort or persistence by students resulting in achievement gains. The author also suggested that media is a vehicle for instruction and that the content of the media is the factor that influences achievement.
Finally, Edwards and Hannah (1985) examined the effectiveness of an IVI program by the American Heart Association to teach cardiopulmonary resuscitation (CPR) to the lay community. Employees of a major oil company (N=65) were the population for the pilot study. Two groups were employed. The experimental group was taught CPR with the IVI program while the control group was taught through the traditional instruction method. Neither the mechanism for assigning the participants to the groups nor the number of subjects in each group (n) was reported.

The dependent variables in the pilot study consisted of a test to measure cognitive knowledge and a skill performance test to ascertain psychomotor competence relating to CPR. The subjects were tested immediately after instruction, in three months, and in a year. Data were analyzed by determining gain scores and completing t test analysis. Findings revealed no significant difference in gain score between the two groups (p=0.68) and in skill performance testing after the initial training period. Both the three month and the one year retention testing results indicated a decrease in cognitive knowledge and skill performance that was not significantly different between the
experimental and control groups. Therefore, the results of this study suggested that learning CPR content through IVI was at least as effective as the traditional instruction method (Edwards & Hannah, 1985).

**Attitude.**

Attitude, as cited in nursing education literature, refers to reaction or response of the learner to an experience or object, such as, computer instruction (Brudenell & Carpenter, 1990; Conklin, 1983; Hamby, 1986; Neil, 1985). Attitude is considered a learned predisposition to react to a person, object, or idea in a consistent way, favorable or unfavorable (Fishbein & Ajzen, 1975; Klausmeier & Goodwin, 1966). Bandura (1986), according to the arousal effect of modeling, related attitude to an emotional reaction or arousal in the learner due to social interaction or expression of emotion by the model. Thus, attitude can be affected by social interaction and membership in groups can influence acquisition of attitudes (Klausmeier & Goodwin, 1966).

Kulik, Kulik, and Cohen (1980) in their meta-analysis of 59 independent evaluations of computer-based college instruction found that CAI produced small
but positive effects on attitude towards instruction. Eleven of the 59 studies pertained to attitude toward instruction in computer-based and conventional classes. Eight of the computer-based ratings were higher than the conventional ratings. Also, course quality was rated 3.77 in computer-based instruction and 3.50 in conventional classes (on a five point attitude scale with five representing the most favorable attitude). The difference between the ratings was small and the probability level was not reported. Generalization of these findings was limited since the number of studies pertaining to CAI and attitude were limited (11 out of 59). Thus, it is difficult to establish a strong, consistent relationship between use of CAI and attitude of the learner toward instruction.

Bosco (1986) in an analysis of 29 reports evaluating IVI found positive results regarding user attitude. The reports reflected studies of experimental design consisting of a treatment and control group. The statistical analysis most frequently used was ANOVA or t-test. When examining reports providing statistical tests, five studies identified benefits associated with user attitude while two studies reported no benefits. Measurement of
academic achievement was less prevalent with an approximate 50-50 split (benefits versus no benefits reported). Probability levels were not reported and the sample size of 29 studies was limited, thereby reducing generalizability of findings.

Other authors cited positive responses to IVI. Evans (1986), in a review of published research relating to IVI, found that IVI was well received by both faculty and students and did not detract from attitude of the students toward learning the content. Manning, Balson, Ebner, and Brooks (1983) related "a highly significant degree of student satisfaction" (p. 108) toward IVI when teaching administration of an intramuscular injection in a group-paced, instructor-controlled environment of a combat medic program. A description of the method employed to measure the variables and the statistical analysis were not provided when comparing the effects on performance and satisfaction with an experimental and control group.

Learning and attitude.

A relationship is suggested between cognitive learning and attitude towards instructional media. Clark (1984) proposed that positive attitude enhances learning. Bloom (1971) cited that the method of
instruction affected attitude towards learning and outcome. Also, interest in the subject was both a cause (to master content) and effect (resulting in mastery of content). Attitude towards an instructional strategy was crucial to the learning process and achievement (Conklin, 1983; Hamby, 1986). Hamby (1986) asserted that attitude was significant to the learning process due to influence on learning rate, retention and application, and motivation.

Research findings vary regarding the effect of computer instruction on learning and attitude. Hamby (1986) examined effects of CAI on attitude and achievement with vocational nursing students. Content focused on a pharmacology mathematics course with establishment of two groups; one utilizing lecture/CAI (n=32) and the other, lecture/worksheets (n=32). The groups were randomly selected. ANOVA was employed to analyze posttest scores for cognitive achievement and attitude toward CAI. Analysis revealed no significant difference in achievement.

However, findings indicated a significant difference in posttest attitude scores toward CAI. A significant difference in attitude toward CAI between the groups was established through ANOVA (df=1, p <
.05). The difference may be attributed to the significant decrease in attitude scores by the lecture/worksheet group. Disappointment in not being selected for the CAI group may have been a contributing factor in the significant decrease. This researcher questions the rationale for administering a CAI attitude survey to a group of students who were not exposed to the CAI instructional strategy (Hamby, 1986).

Abrams and Streit (1986) conducted a study in the acquisition of basic photography skills on the college level. The study compared attitude and learning effectiveness between linear video (LV) (n=64) and IVI (n=64). The results indicated larger achievement gains with the IVI group determined by difference between pre and post testing. The IVI group acquired a change score of 35.81 compared to 29.70 for the LV group. The statistical analysis, however, did not include the level of statistical significance pertaining to larger achievement gains.

The IVI group also demonstrated more positive attitude than the LV group. Results revealed higher agreement levels for the IVI group (21 levels) compared to seven with the LV group. A possible explanation for
more positive attitude is linked to the primary
difference between the two instructional strategies.
LV involved passive learning since the program
continued despite the level of comprehension while IVI
required active involvement due to testing and learner
control throughout the program (Abrams & Streit, 1986).

Levenson, Morrow, and Signer (1985-86) compared
cognitive and affective responses to a lesson on
smokeless tobacco in undergraduate students. Students
(N=205) were randomly assigned to the control group
(n=59) or to one of the three experimental groups. The
control group did not receive any lesson regarding the
content. The experimental groups included viewing a
videotape as a class group (n=43) or individually
(n=61), or viewing an interactive video version of the
lesson content by students on an individual basis
(n=42). Group size could have been more evenly
distributed to promote equivalence. To ascertain
cognitive achievement, an 18 item information
instrument was administered after the lesson to
participants in the four groups. A high degree of
internal consistency was established through Kuder-
Richardson 20 (r=.83).

Additional questions were used with the IVI group
to determine learner satisfaction to the interactive hardware and software. Perhaps, the questions should have been more generic to determine learner satisfaction with all of the instructional strategies rather than focusing only on the interactive video version. A comparison among the groups regarding learner satisfaction could have been examined (Levenson et al., 1985-86).

Results of the omnibus ANOVA revealed that variation among the groups was not due to chance ($F_{3,201} = 85.00; p < .0001$). The IVI group achieved the highest mean score (15.1; $SD=1.8$). In addition, each of the seven post hoc contrasts was significant ($p < .005$) indicating that each of the four groups differed significantly from the others and the average of the experimental groups differed from the control group. Learner responses regarding satisfaction with the IVI system and lesson yielded 88.1% agreement that IVI held their interest. The combination of computer and videotape with the interactive video version was found to be satisfactory by 90.5% of the students. Thus, the IVI group acquired higher cognitive achievement and expressed positive responses towards the instructional media (Levenson et al., 1985-86).
Bunderson, Baillo, Olsen, Lipson, and Fisher (1984) conducted studies comparing attitude and student learning with IVI and traditional lecture in an introductory, college-level biology course. One study consisted of 25 students who volunteered to use the IVI program. The remainder of the class constituted the lecture group. Random assignment should have been the preference, in order to reduce the possibility of volunteer bias.

A pretreatment questionnaire and pretest were completed by the participants to assess equivalence between the groups. Chi-square revealed no significant differences between the groups relating to categorical variables, such as, age, sex, college class, GPA, self-reported interest in biology, attention in biology, or role commitments. The IVI (n=25) and the lecture (n=24) groups were comparable in size. A t-test comparing pretest scores found no significant difference between the groups, therefore, the groups were considered equivalent. In addition, the IVI group completed a postquestionnaire on attitudes towards the instructional media (Bunderson et al., 1984).

The same test was administered on three occasions which could present a threat to the internal validity...
of the study. Since the posttest was completed one day after the instruction and the retention test one week after the posttest, testing effects should be minimized. Analysis revealed that pretest scores were similar for both groups. The gain scores of the IVI group were higher than the lecture group on the pre-posttest comparisons ($t=3.04; p < .05$) and pre-retention test comparisons ($t=2.20; p < .05$). In addition to greater achievement, the IVI group spent less time studying and expressed greater levels of confidence in subject content. The authors did not further elaborate on results from the attitude questionnaire (Bunderson et al., 1984).

Likewise, Schare, Dunn, Clark, Soled, and Gilman (1991) determined the effects upon cognitive learning and attitude when using IVI and traditional lecture but acquired different results. The sample consisted of 83 third year baccalaureate nursing students who were randomly assigned to a control group ($n=41$) or an experimental group ($n=42$). A t-test determined no statistical difference in academic ability, therefore, the groups were academically equivalent. The instructional content focused on Diabetic Health Assessment and the instruments included a paper and
pencil objective test to ascertain cognitive achievement and Allen’s (1986) Attitude Toward Computer Assisted Instruction tool to determine attitude towards the instructional strategy.

A pretest-posttest control group design was employed. The methodology comprised a pretest measuring cognitive learning and attitude 2 1/2 weeks prior to lecture for all subjects. The control group had a 90 minute lecture, viewed slides contained in the IVI program, had a reading assignment, and completed the posttest on attitude toward the instructional strategy immediately after the lecture. The experimental group had a 3 week period of time starting the same week the lecture was given to individually view the IVI program, had the same reading assignment, and completed the posttest on attitude after finishing the IVI program. The average time to complete the program was 2 hours. The posttest on cognitive achievement was administered to all subjects 3 weeks after the lecture (Schare et al., 1991).

Limitations in the study comprised a primarily female generic sample. Inequities also existed with a longer time span between lecture and posttest in the control group than in the experimental group. The
instructional strategies were not equivalent in time
duration with lecture taking 90 minutes and the IVI
approximately 2 hours to complete. Finally, the
control group was allocated 90 minutes while the
experimental group had 3 weeks to complete the learning
task (Schare et al., 1991).

"Multivariate analysis of covariance with two
criteria and the pretest as the covariate" (p. 109) was
followed by univariate analyses for each criterion. In
conclusion, the univariate F for cognitive achievement
was nonsignificant (p=.283, df=2, 72) indicating no
significant difference in learning between IVI and
lecture. The univariate F for attitude was significant
(p=.000, df=2, 72) indicating a more positive attitude
with IVI than with lecture. Thus, neither IVI nor
lecture significantly affected cognitive achievement
while students responded more favorably to learning
with IVI than with lecture (Schare et al., 1991).

Sutter and Reid (1969) conducted a study randomly
assigning male, college level students (N=100) taking a
CAI problem solving course. A limitation of the study
was the use of all male subjects. Instruction was
presented to one control group (n=18) who did not take
the course and two experimental groups. The
experimental groups consisted of students who viewed the program individually (n=40) and those who viewed it in pairs (n=42). The purpose was to compare achievement and attitudes towards instructional media when taking the course with a partner or alone, thus, considering effects of personality variables on learning and attitude.

Achievement in the study was measured by a five problem test designed in two forms, a pretest and a posttest. Attitude was measured by a questionnaire administered before and after the course. The tool had a high test-retest reliability coefficient of .96. When excluding personality variables, such as, interpersonal or non-interpersonal conditions, no significant difference between the groups was found in achievement or attitude as determined by ANOVA. Since there was no significant difference between groups, pairing permitted twice as many students to be taught at the same number of computers (Sutter & Reid, 1969).

Mode of Instruction

Individual Basis.

As previously mentioned in the FITNE report by Burke (1990), aggressive adoption of IVI technology by
nursing education is evident. A subsequent issue of concern in the educational arena after acquiring hardware and software is mode of instruction.

From its inception, computer instruction was designed to promote individualization of the learning process and adaptation of instruction to individual student needs. The literature cites numerous references identifying the use of computer instruction on an individualized basis, that is, one student to one computer (Hawkins, Sheingold, Gearhart, & Berger, 1982; Hoth, 1985; Johnson, Johnson, & Stanne, 1985; Noell & Carnine, 1989; Ormiston, 1988; Thorkildsen & Friedman, 1984).

Smith and Jones (1986) proposed using IVI on an individual basis when teaching college level chemistry. The authors suggested that in self-pacing, the lessons were tailored to the level and learning style of the individual learner. In addition, reinforcement, feedback, and learner control fostered motivation of the learner to learn.

Conklin (1983) added that varied academic backgrounds and learning styles of students can be addressed only through individualized mode of instruction. Levin (1983) suggested that learner's
interest level, rate of learning, and knowledge base were acknowledged through individualization. While Reid, Palmer, Whitlock, and Jones (1973) stated that the emphasis with CAI was individualization, the authors added there was "little reason for arbitrarily limiting usage to the individual" (p. 65).

Similarly, Bangert, Kulik, and Kulik (1983) conducted a meta-analysis integrating the findings of 51 studies. The studies examined individualized systems of instruction limited to grades 6 through 12. Findings revealed that 2/3 of 14 studies indicated a more positive attitude toward subject content when using individualized systems, although, only two of the 14 studies had an effect large enough to be regarded as statistically significant. Effect on student achievement varied from study to study with only 13 of 49 studies reporting statistically significant differences in achievement due to teaching methodology. Of the 13 studies, 70% favored individualized instruction while 30% favored conventional instruction. Thus, a small effect on student achievement and attitude was evident at the secondary level.

Small Group Basis.

Bandura, in his social cognitive theory,
emphasized the importance of social interaction in the learning process relative to cognitive learning and attitude toward instructional media. As previously mentioned, the most effective influence on behavior is the actions of others (Bandura, 1977). Thus, while group learning is fostered, the effective group size is not discussed. The literature is inconclusive regarding effective group composition (Simpson, 1986).

Before addressing group composition, a common theme of student interaction in group learning was examined by educators. The literature cited student interaction under various guises. Collaborative learning, according to Whipple (1987) and Hiltz (1990), presented the educational process as active participation by both teacher and students. Knowledge emerged through interaction rather than solely by delivery of subject content by the teacher.

Hiltz (1990) further elaborated on a computer-mediated communication system entitled a Virtual Classroom Project. Access into the system is acquired "by typing into, and reading from, a personal computer which connects by telephone to a mini-or mainframe computer operating the Virtual Classroom (VC) software" (p. 59). Group learning occurred through communication
and interaction between faculty and students utilizing a computer-mediated system. Students who experienced higher levels of interaction with other students and the professor rated this instructional strategy superior to the traditional classroom. Due to other students reading comments, 55% rated higher motivation with this strategy; 56% felt more active participation in the course; 58% reported better access of their professor with this strategy.

Likewise, Simpson (1986) suggested that student-student interaction was significant to the learning process. Observation of activity with computer use demonstrated more social interaction which can be directed at attaining educational goals. Group learning involved more than grouping students to accomplish a task. Teachers were needed to facilitate and ensure group productivity. Similarly, Hawkins, Sheingold, Gearhart, and Berger (1982) observed that more interaction occurred with school age children when focused on computer associated activities than with non-computer related tasks.

Bouton and Garth (1983) suggested that two major elements must be present for learning groups to be effective. The elements comprised structured tasks
under the guidance of faculty and peer interaction. Emphasis was placed upon active involvement and dialogue in order to construct knowledge. Interaction permitted formulation, sharing, and reaction to ideas.

Another strategy focusing on student interaction was described by Collins (1990). The study-group approach was designed in 1975 by Uri Treisman, a mathematics professor at the University of California at Berkeley and is currently employed on 50 campuses, such as, University of Pennsylvania, Temple University, Rutgers University, and Pennsylvania State University. The approach was initiated to assist minority students in successful completion of courses, such as calculus, which were characterized by a high percentage of failure.

Treisman studied the learning habits of 40 students enrolled in calculus. Twenty Black students who came from middle class families and many of whom were in the top of their high school class were doing poorly in the course. Twenty Chinese students were observed who were at the top of the calculus class. Analysis revealed that the Black students separated academic activities from social activities, studied alone, and did not discuss class activities. The
Chinese students were observed to study together, complete assignments in groups, compare answers, review, and work together as a team to solve problems. From this observation, Treisman established workshops for groups of Black students to work in teams. This resulted in diminished failure rate from 60% to 4%. Some educational institutions have expanded this concept beyond minority students and have incorporated the study-group approach as a segment of their curriculum (Collins, 1990).

Milheim and Evans (1987) stressed the significance of group instruction by "stimulation of thought and group discussion" (p. 36). The authors presented use of IVI through group instruction whereby input was determined by group consensus; absence of consensus permitted opportunity to try different choices and view the consequences. Group instruction stimulated interaction and discussion while social interaction was lost with individualized use.

However, a significant concern with group learning was unequal contribution by group members which can foster resentment, thus, undermine the learning process (Simpson, 1986). Slavin (1983a) identified diffusion of responsibility whereby individuals were rewarded for
minimum contribution which can diminish performance. A
focus, therefore, was to develop methods of team effort
to ensure equal member participation primarily through
individual accountability.

Slavin (1983b), associated with cooperative
learning, addressed the concern for equal member
participation by promoting group rewards dependent on
members' academic performance. Individual
accountability was fostered through a sense of
responsibility for accomplishment of a group goal.
Group success was ascertained by a sum of the members' 
learning performance, thus, encouraging individual
member involvement.

Watson (1966) identified factors that facilitated
as well as impeded group performance. Facilitating
factors included: stimulation by the presence of
others or social stimulation; combination of resources
contributed by each member; probability of having
members with higher ability or motivation to provide
insight; rectify individual blindspots; "security in
risk taking" (p. 113); and "canceling of chance errors"
(p. 113). Impeding factors included: lack of unity;
frustration encountered with interference and
criticism; rambling talk by some participants; leaving
tasks for others to accomplish; lack of motivation; opposing goals; failure to communicate with other members.

Group composition, as previously mentioned, has been addressed by educational authorities who are proponents of small group instruction. For example, Bejarano (1987) prescribed groups of two to six students to facilitate interaction, reciprocal interdependence, and mutual help. Bloom (1971) advocated two or three students to a small-group study session in order to promote learning in a cooperative rather than competitive fashion. Watson (1966) added that groups beyond eight or nine foster domination by a few and passivity by other members. Johnson and Johnson (1985), associated with cooperative learning, advised two to four students in a group whereby students served as models for each other, assisted in analysis and diagnosis of problems, explained content, taught, encouraged others to remain on task, shared satisfaction and accomplishment. Finally, Bouton and Garth (1983) recommended learning groups of two to seven members to ensure active participation.

Effectiveness of small groups has been examined by many professionals, such as, educators of cooperative
learning, collaborative learning, elementary, secondary, and special education. Although, limited research is available regarding learning effectiveness of computer technology with group instruction (Webb, 1984, 1985; Weiss & Jarvis, 1986-87). Therefore, the researcher is presenting a general review of the literature pertaining to educational effectiveness as well as any studies examining computer technology with group mode of instruction.

Small group instruction, according to Johnson and Johnson (1985), referred to students interacting together in order to accomplish shared goals "while ensuring that all group members master the material" (p. 11). Conway and Gow (1988) presented a study focusing on the course value of small group instruction when mainstreaming mildly handicapped students. Ladd suggested that group instruction provided an environment for asking questions, as well as tutoring and supporting peers which could elicit positive changes (cited in Conway & Gow, 1988). The authors advised that group instruction encouraged sharing of information through peer interaction. In addition to problem solving in the event of conflict and contradiction, members may have to convince other group
members that the solution is acceptable.

Likewise, Bejarano (1987) attributed small group presentation as more effective due to social interaction and active participation of team members. Wizer (1987) proposed that exchange of ideas among members of a small group facilitated problem solving. The process rather than only the correct answer was advantageous to the learning process. As well, cost is contained when utilizing the group mode with CAI since fewer hardware systems are required (Fletcher, 1985; Milheim & Evans, 1987; Noell & Carnine, 1989). In addition, Miller (1990) cited use of IVI with small groups (2 to 3) of law students. This mode fostered consultation among students, strategizing, and a sharing of information.

Various research studies have been conducted investigating effects upon individual versus small group learning. Fletcher (1985) examined the effects of verbalization with individuals and small groups in 9 to 11 year olds. Subjects (N=55) came from one school which limited generalizability of results. The sample consisted of silent individuals (n=11), verbalizing individuals (n=11), and verbalizing groups (n=11) composed of three members who were instructed to reach
a consensus.

The task consisted of a computerized spaceship game. Two of the three dependent variables comprised time per decision in problem solving task and problem solving ability during task measured by the number of decisions needed to reach specified target values. MANOVA was employed to analyze data pertaining to time per decision and problem solving performance. Results indicated that silent individuals took an average of nine seconds less than verbalizing individuals or verbalizing groups to reach a decision ($F(2,30)=4.8$, $p < .016$). Verbalizing individuals and groups required fewer decisions than silent individuals to reach specified target values ($F(2,30)=8.8$, $p < .001$), although results varied depending on task. Thus, these results suggested that verbalization, common to both groups and verbalizing individuals, may have improved problem solving performance (Fletcher, 1985).

Noell and Carnine (1989) explored instructional effectiveness and efficiency when delivering IVI to individual students ($n=14$) and groups with an average of 4.8 members ($n=19$). Subjects were in grades 9 through 11 ($N=33$). Instructional content focused on the structure and function of blood. Each student had
a keyboard which accessed a single computer system. Group responses were considered correct if 65% of group members answered correctly. Social interactions were observed in group mode which were usually, though not always, supportive. Instructional effectiveness was ascertained by 18 short answer test items. Reliability and validity measurements were not presented. Results indicated an average score of 8.9 with SD=4.67 for group mode and an average score of 9.0 with SD=4.62 for individuals. There was no significant difference in achievement between the two groups. Learning time measured 40 minutes for a group of five and 30 minutes for an individual with five individuals requiring 150 minutes. Findings implied that the group mode of instruction was more time efficient without experiencing a loss in achievement.

Baird and Koballa (1988) examined student perception of success as well as the effects of mode of computer instruction and group size on acquisition of hypothesizing skills among undergraduate students. Mode of computer instruction referred to computer simulations and textual exercises. Computer simulations contained auditory and visual stimuli and provided the opportunity to solve situational questions.
while textual exercises on the computer comprised double-space column format free of color and sound.

Elementary education majors (N=87) completed one mode of the CAI program either individually or in groups of three. Limitations of the study comprised enrollment of subjects from one large southwestern university and the majority of the subjects were female except for two. Part of the analysis revealed the highest mean of perceived success (4.65) was acquired by students using simulations in groups and the lowest (3.28) by individuals interacting with textual exercises. Level of statistical significance was not reported. Software ratings were higher for groups than individuals (p < .005). Thus, student perception of success as well as attitude toward the instructional program may be influenced by the mode of CAI program and group size (Baird & Koballa, 1988).

Finally, Taylor and Faust (1962) studied problem-solving with individuals and small groups of two and four using a game of Twenty Questions. The game consisted of four problems per day for four successive days and on the fifth day all students completed four problems individually. College students (N=105) enrolled in an elementary psychology course were
randomly assigned to one of three groups. The groups consisted of individuals (n=15), groups of two (n=30), and groups of four (n=60). The groups of two and four were encouraged to cooperate with their team members, talk freely, and review answers.

A t-test was employed to test differences in mean score. Findings revealed no significant difference between groups of two and four in terms of efficiency on problem-solving (number of questions per problem). Individual performance was inferior to either group of two or four significant at or beyond .05 level. The score for all four days was significantly higher for both groups at .02 level than individual performance. However, based upon results of individual testing on the fifth day, there was no significant difference in mean scores, therefore, learning occurred in all three modes of instruction (Taylor & Faust, 1962).

Findings suggested a negligible difference in performance between groups of two and four which may indicate an optimum group size of four to maintain effectiveness. In addition, superiority of groups transpired due to the performance of its' best member. Consideration to group size as well as membership constituency may influence group performance (Taylor &

**Large Group Basis.**

The literature addresses comparative studies using large group instruction. Yanok (1988) addressed large group presentation as time efficient. Brockley (1979), an elementary educator, alluded to a fostering of unity and companionship with whole class instruction. Straker (1988) described utilization of videodisc for classroom use. Subjects consisted of 18 twelve-year old students viewing a mathematics videodisc lesson. Strategies involved direct instruction, student interaction, and regularly administered tests. A certain level of mastery had to be achieved by the group on the tests in order for the teacher to progress to the next section of the lesson. This learning environment permitted teacher pacing of the instruction. Observation revealed that large group mode of instruction elicited a high level of student interaction.

Kemp and Dayton (1985) stated that although large group instruction was inflexible relating to pace of learning and preference of study methods by individual learners, this form of instruction served other needs. Primarily efficiency related, this mode permitted
presentation of content to large numbers and avoided repetition. Indications for use included:
introduction of new topics and orientation to a unit of study; provision of motivation through alternate
教学 strategies, such as videotape recording;
illustration of relationships between topics;
presentation of new content too recent to have been
incorporated in a self-paced program; provision of an
enrichment experience, such as a guest speaker, which
would not be realistic for an individual or small group
experience.

Schoen (1976) reviewed 17 studies pertaining to
mathematics content which compared individualized with
group instruction on secondary and post-secondary
levels. Group instruction was traditional in nature,
that is, classes of 20 to 35 students, teacher-
centered, teacher-paced, with common tests administered
to all students. All of the studies established that
comparison groups were equivalent prior to treatment.
Criterion measures were determined by standardized
mathematics achievement tests, achievement tests
developed by the researcher, and attitude toward
mathematics scales. In order to test differences in
group means, a t-test and ANOVA were calculated with
statistically significant differences reported at $p = 0.05$.

Twelve secondary school studies were reviewed comparing individualized instruction with a control group. Details of the analysis were not reported. Findings revealed that the majority of the studies ($n=8$) had no significant difference in achievement, three acquired greater achievement in control group, and one had greater achievement in individualized group. Five postsecondary studies were reviewed regarding attitude toward mathematics content with two studies favoring individualized instruction, two with no significant difference in achievement, and one with mixed results. Since the majority of studies revealed no significant difference in mathematics achievement between groups, group instruction was considered more cost effective than individualized instruction (Schoen, 1976).

**Summary**

Bandura theorized that learning is facilitated through modeling and reinforcement. Both components are incorporated in the instructional strategy of IVI. Attitude, according to Bandura, is attributed to be an
emotional reaction or arousal in the learner due to social interaction or expression of emotion by the model. Motivators also influenced attitude. Perception of instructional media as a positive or negative motivator influenced learner emotional reaction and ultimately the learning process. Since Bandura emphasized the interactive relationship between behavior, person, and environment in the learning process, social interaction influenced both cognitive learning and attitude. Thus, the group mode of instruction is favored by Bandura.

As demonstrated in the literature review, multiple authors express a preference for small groups rather than large groups. Effectiveness of small groups has been examined and is enforced in practice by educators of cooperative learning, collaborative learning, elementary, secondary, and special education. Thus, the researcher hypothesizes that cognitive learning and attitude towards instructional media is more effective when using an IVI program with a small group of students. In addition, the relationship between attitude and cognitive learning is significantly stronger in a small group.
CHAPTER III

METHODOLOGY

Research Design

Since the researcher incorporated manipulation of the independent variable, a control group, and random assignment of subjects to groups in the study, experimental design was utilized (Polit & Hungler, 1991). The group of students viewing the IVI individually was considered the control group. The research was designed to follow a pattern of: random assignment-pretest-treatment-posttest. The pretest scores were computed in order to ascertain group equivalence. If on comparison, it was determined that the groups differed significantly, raw data were converted to standardized scores (z scores). Data analysis then proceeded using standardized scores.

The posttest scores were utilized to measure the dependent variables. Posttest rather than change scores are recommended by Burckhardt, Goodwin, and Prescott (1982). A loss of power may occur due to a lowered reliability of the change score. Alternate options to change scores include: "analysis of covariance, analysis of variance with blocking on
pretest scores, and repeated measures analysis of variance" (Burckhardt, Goodwin, & Prescott, 1982, p. 55). Thus, a pretest-posttest control-group design was employed.

**Sample Selection and Size**

A non-probability, convenience sampling method was utilized. The target population was generic baccalaureate nursing students while the accessible population was those generic baccalaureate students attending nursing schools that own the necessary computer hardware and IVI software required in the study. Fuld Institute for Technology in Nursing Education (FITNE) facilitated this research study by identifying nursing schools possessing the necessary hardware and software. The sample was comprised of those nursing students studying I. V. Therapy at these designated schools.

The following process illustrates efforts by the researcher to ascertain nursing schools eligible for participation in the study. To reiterate, criteria for inclusion in the study comprised those baccalaureate nursing schools having laser disc(s) systems, an interactive video I. V. Therapy program, a wall
projector, expressed an interest in participating in the study, and identified the Intravenous Therapy IVI program as a required assignment.

Preliminary surveys were sent to 48 schools with four schools meeting the criteria for inclusion in this study. These schools were located in Kentucky, Nebraska, Idaho, and New York. Approximately two years later, a follow-up survey was sent to these 4 schools and 16 others to re-evaluate the status for inclusion in the study. Contact, either in writing or by telephone, revealed that the original four schools no longer met the criteria for inclusion in the study. Three of the four did not have access to a projector for large group viewing and one did not receive administrative approval to conduct the study.

Based upon the follow-up survey in June, 1991, six schools met the criteria. These schools were located in Arkansas, Indiana, two in Pennsylvania, Michigan, and New Jersey. In an effort to increase the sample size, 10 additional surveys were sent to schools who acquired the I. V. Therapy program in 1989 or 1990. It was thought that these schools would have incorporated the I. V. Therapy IVI program in the curriculum as a required assignment and that the schools would have
access to a projector. However, none of these schools were eligible for or interested in participation.

The exact number of volunteer subjects was unknown until the study was implemented. However, it was determined that a minimum of 19 students was needed from each school to have three groups comparable in size, that is, six individual students, two small groups of three students each, and one large group of seven students. To enhance the generalizability of the study, a minimum of 30 subjects for each learning mode was sought.

Table 1 illustrates the approximate number of nursing students enrolled in the courses studying I. V. Therapy, those who signed the consent form, and those who completed the research study.

Table 1

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<th>Sample Size per School of Nursing</th>
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<td>Students Enrolled in Course</td>
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(table continues)
Due to the limited numbers of schools that met the initial criteria, some methodological revisions were made. Schools where the IVI program was not required but available to students as an optional assignment, and schools that had access to a wall projector or larger monitor screen permitting adequate viewing by a large group of students were added as data collection sites.

Observations about the progress of the study were relayed to the researcher by liaison faculty. The university in AR reported that six students volunteered to participate. A limited number of volunteer subjects existed due to: time constraints of approximately five days in which students were to complete the required
IVI assignment on their own time; anticipated difficulty by the students in scheduling a mutually acceptable time for a group to meet in order to view the IVI program; and work schedule of students that limited available time in which to complete assignments. The study was not implemented at this site since the number of volunteer subjects did not meet the minimum of 19 students as previously established.

The university in IN had an adequate number of volunteers (n=53) who were interested in participating as reflected in the number who signed the consent forms. When the instruments were examined after completion, some students (n=5) did not view the IVI program as randomly assigned, thus, were eliminated from inclusion in data analysis. Others (n=31) did not complete all the instruments. Again, although the IVI program was a required assignment, the students had to view the program and complete the research instruments on their own time.

The liaison faculty member attributed limited participation to major curriculum changes. According to this faculty member, students and faculty had difficulties adjusting to these changes. Another
observation was that the liaison faculty and one other faculty member who was not in direct contact with the researcher primarily collected the data. Regular telephone contacts to the liaison faculty revealed no problems. These difficulties only became apparent at the completion of the study.

Based upon the limited numbers of respondents and the fact that the actual number of respondents was not known until after completion of the data collection, the minimum requirement of 19 students was revised. Any number of subjects was acceptable provided the experimental design was followed, that is, manipulation of the independent variable, a control group, and random assignment of subjects to groups.

The university in PA, having 80 students enrolled in the course, experienced similar obstacles in obtaining subjects. The IVI program was an optional assignment. This variable was expected to affect the numbers of students who would view the program. The students also had to view the program on their own time, although, no time constraints existed regarding completion. One student did not view the IVI program as randomly assigned while 12 did not complete all the instruments.
Observations by the liaison faculty member who primarily collected the data revealed difficulties by students assigned to the large group in scheduling a mutually acceptable time for viewing the program. The large group did not complete the research study, thus only data from individual IVI use and small groups were collected at this site.

The university in PA with 24 students eligible to participate in the study had no problems with data collection. The IVI program was a required assignment that was completed during designated laboratory time and conducted primarily by the liaison faculty member. Data were collected in two sessions. The consent forms and the pre-treatment instruments were completed during the first session while the IVI was viewed and the post-treatment instruments were completed during the next session. Although not all students chose to participate, those who signed the consent form completed the study.

Similarly, at the university in MI the IVI program was a required assignment as part of a course. The data were collected in one session by the liaison faculty member. Three students decided to withdraw from the study.
The university in NJ consented to participate after determination that the departmental rather than the institutional research committee should provide approval. After numerous telephone contacts with the liaison faculty member and two telephone contacts with the coordinator of the course, the researcher was unable to ascertain whether the IVI program was a required or optional assignment. The data were collected and apparently mailed but never received by the researcher. Tracking of the box of instruments by the mail service was requested by the researcher, and was reportedly initiated by the liaison faculty member. This faculty member was unaware of the number of students who signed consent forms or completed the research instruments. The consent form signed by the associate dean of the nursing school was in the box of instruments which never arrived.

Collation of the demographic data revealed that the research sample (N=63) comprised 58 (92%) female and 5 (8%) male nursing students attending baccalaureate schools located in IN, PA, and MI. The mean age was 23.2, with a mode of 20 and median of 21. Age ranged from 19 to 51 years with a SD of 5.7. Sixty-one (97%) students were juniors while two (3%)
were seniors. The majority (n=35) participated in the study during the Fall semester and 28 (44%) students during the Spring semester.

None of the students were RN's or LPN's and four (6%) were transfers from other professional nursing programs who did not receive any content related to I. V. Therapy. Prior to viewing the IVI program, nine students (14%) received content related to I. V. Therapy and 22 students (35%) read or viewed audio-visual aids. Five students (8%) received prior EMT training and two (3%) paramedic training. The majority (92%) had previous experience with computers while 32% had previous experience with IVI. Finally, pertaining to employment, 59% were currently or previously employed as aides/orderlies, 5% as EMT/paramedics, and 22% had some work experience with I. V. equipment.

Tables 2 and 3 present demographic data pertaining to the research sample. The tabular format is divided into educational (Table 2) and employment (Table 3) background of the sample.
Table 2

Demographics of the Research Sample: Educational Background

<table>
<thead>
<tr>
<th>Educational Background</th>
<th>Yes</th>
<th>No</th>
<th>Missing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Educational Background</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LPN</td>
<td>0</td>
<td>58 (92%)</td>
<td>5 (8%)</td>
</tr>
<tr>
<td>RN</td>
<td>0</td>
<td>62 (98%)</td>
<td>1 (2%)</td>
</tr>
<tr>
<td>a transfer student and did not receive I.V.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Therapy content</td>
<td>4 (6%)</td>
<td>58 (92%)</td>
<td>1 (2%)</td>
</tr>
<tr>
<td>a transfer student and did receive I. V.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Therapy Content</td>
<td>0</td>
<td>63 (100%)</td>
<td>0</td>
</tr>
<tr>
<td>received I. V. Therapy content prior to</td>
<td>9</td>
<td>54 (86%)</td>
<td>0</td>
</tr>
<tr>
<td>viewing the IVI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>read or saw A/V prior to viewing the IVI</td>
<td>22</td>
<td>41 (65%)</td>
<td>0</td>
</tr>
<tr>
<td>received training as:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMT</td>
<td>5 (8%)</td>
<td>56 (89%)</td>
<td>2 (3%)</td>
</tr>
<tr>
<td>Paramedic</td>
<td>2 (3%)</td>
<td>45 (71%)</td>
<td>16 (25%)</td>
</tr>
<tr>
<td>had previous experience with:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>computers</td>
<td>58 (92%)</td>
<td>5 (8%)</td>
<td>0</td>
</tr>
<tr>
<td>IVI</td>
<td>20 (32%)</td>
<td>43 (68%)</td>
<td>0</td>
</tr>
</tbody>
</table>
### Table 3

**Demographics of the Research Sample: Employment Background**

<table>
<thead>
<tr>
<th>Employment Background</th>
<th>Yes</th>
<th>No</th>
<th>Missing</th>
</tr>
</thead>
<tbody>
<tr>
<td>RN</td>
<td>0</td>
<td>61 (97%)</td>
<td>2 (3%)</td>
</tr>
<tr>
<td>LPN</td>
<td>0</td>
<td>63 (100%)</td>
<td>0</td>
</tr>
<tr>
<td>Nurse's aide/orderlie</td>
<td>37 (59%)</td>
<td>26 (41%)</td>
<td>0</td>
</tr>
<tr>
<td>EMT/Paramedic</td>
<td>3 (5%)</td>
<td>59 (94%)</td>
<td>1 (2%)</td>
</tr>
<tr>
<td>Work with I. V. equipment</td>
<td>14 (22%)</td>
<td>48 (76%)</td>
<td>1 (2%)</td>
</tr>
</tbody>
</table>

Despite efforts to increase sample size, a minimum total of 30 students for each mode was not achieved. This factor reduces the generalizability of the results. Twenty-three students viewed the IVI program alone, 18 in small groups, and 22 in large groups.

**Instrumentation**

**Data Sheets.**

Data sheets were completed by students before and after viewing the IVI program. Subject confidentiality...
was maintained since the questionnaires were anonymous and collected separately during the process. The last four digits of the student's social security number were requested on the data sheets as a coding mechanism in order to correlate data.

The Pre-treatment Data Sheet (see Appendix A) focused on demographic data. Post-treatment Data Sheet (see Appendix B) addressed student perception of learning preference toward computer instruction and mode of instruction, as well as group interaction. Social interaction was comprised of varied dynamics, that is, discussion, support, peer encouragement, and criticism. Varied social interaction was expected to occur in the small and large groups since behavior is influenced by the actions of others.

Test on I. V. Therapy.

In order to measure cognitive learning, a 20 item multiple choice test on content pertaining to the IVI program was administered. Farley (1989) cites several advantages for multiple choice testing. These include the capability of assessing an extensive range of content in a short period of time, and the fact that "they are objective, accurate, easily scored, and readily adaptable to a variety of content" (p. 10).
However, there are limitations to testing higher cognitive levels.

The number of items on the test was limited to 20 since the I. V. Therapy program and research instruments were completed in one session. Fatigue of students and diminished motivation with a lengthy test were a concern in that these factors may adversely influence test scores. The test was researcher designed and pilot tested. Content validity and Cronbach's alpha reliability was established.

**Content Validity**

To establish content validity, the researcher distributed 43 multiple choice items to a panel of five experts. While a 20 item test is planned for the final research instrument, 43 items were originally submitted with the understanding that items determined as unclear, ambiguous, or not meeting the objectives would be deleted.

The panel of experts were faculty who supervised students in the clinical area including skills related to I. V. Therapy. The experts examined the items for proper test construction and analyzed whether the items adequately measure knowledge in the area of I. V. Therapy. Their recommendations were collated and
appropriate changes in the items were incorporated in the final version of the test.

The test items were based on the behavioral objectives of the respective chapters (see Appendix C). Examination of the objectives illustrated in Table 4 reveals that the objectives focused on the knowledge, comprehension, and application levels.

Behavioral Objective 1 and 3 in Chapter I did not have corresponding test items. The researcher determined that both objectives were not appropriately measurable through multiple choice testing. Each would be more suitably tested through fill-in or short essay. Additional items (#2, 5, 6, 10, 19) relating to nursing implementations were included in the pilot study, although, none of the behavioral objectives in either chapter directly addressed these nursing measures. The researcher is interested in student response to this content indicating cognitive integration of content into nursing action.

In Chapter II, behavioral objective #5 refers to performance. The cognitive rather than the psychomotor component applied to this tool. Therefore, the application level was tested. Finally, the researcher concentrated on comprehension and application levels in
Chapter II which assumes knowledge or cognition of the content. Table 5 illustrates the test blueprint.

Table 4

**Cognitive Levels of Behavioral Objectives and Test Items**

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Behavioral Objective</th>
<th>Cognitive Level</th>
<th>Test Item that Corresponds to the Behavioral Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1</td>
<td>Knowledge</td>
<td>1, 3, 4, 7, 8</td>
</tr>
<tr>
<td>I</td>
<td>2</td>
<td>Knowledge</td>
<td>18, 22</td>
</tr>
<tr>
<td>I</td>
<td>3</td>
<td>Comprehension</td>
<td>9, 15</td>
</tr>
<tr>
<td>II</td>
<td>1</td>
<td>Knowledge</td>
<td>11, 16, 23, 30</td>
</tr>
<tr>
<td>II</td>
<td>2</td>
<td>Application</td>
<td>13, 20, 21, 24, 25, 29</td>
</tr>
<tr>
<td>II</td>
<td>3</td>
<td>Comprehension</td>
<td>14, 17</td>
</tr>
<tr>
<td>II</td>
<td>4</td>
<td>Application</td>
<td>12, 26, 27, 28</td>
</tr>
<tr>
<td>II</td>
<td>5</td>
<td>Comprehension</td>
<td></td>
</tr>
</tbody>
</table>

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Table 5

Test Blueprint

<table>
<thead>
<tr>
<th>Chapter Number of Scenes from the Script on I. V. Therapy</th>
<th>% of Items on the Test</th>
<th>Total Number of Items on the Test</th>
<th>Cognitive Level of Behavioral Objectives Corresponding to the Cognitive Level</th>
<th>Number of Test Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>32</td>
<td>18%</td>
<td>Knowledge</td>
<td>4</td>
</tr>
<tr>
<td>II</td>
<td>141</td>
<td>82%</td>
<td>Knowledge</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Comprehension</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Application</td>
<td>7</td>
</tr>
</tbody>
</table>

Analysis of the recommendations of the panel of experts resulted in the selection of 30 multiple choice items. These items comprised the Test on I. V. Therapy for the pilot study (see Appendix D).

Reliability

Cronbach’s alpha internal consistency reliability of the entire test was established based on pilot study data. Item total statistics were evaluated. Any item with an item-to-total correlation that was negative or
less than .20 was eliminated from the test or revised for improvement. Items that contributed most positively to the internal consistency reliability of the test and that fulfill the test item requirements, based on the blueprint, were included in the final version of the 20-item research instrument.

**Pilot Study Procedure**

Prior to conducting the pilot study to ascertain the reliability of the I. V. Therapy Test, the researcher received approval from the Research Committees of both Widener University (see Appendix E) and a small, private university located in PA (see Appendix F) to ensure protection of human subjects. The pilot study was conducted in a baccalaureate nursing program using a sample of 21 sophomore students.

The faculty member from the baccalaureate nursing program conducting the pilot study became apprised of the study through telephone conversation with the researcher, and by reading a letter of explanation (see Appendix G) and the directives regarding the pilot study design (see Appendix H). The methodology of the pilot study included having the students read the Letter of Explanation (see Appendix I), and complete...
the Student Consent Form (see Appendix J) and Pre-treatment Data Sheet.

The faculty member answered any questions asked by the students and collected each of the instruments separately after completion. The instruments were then placed in individual envelopes and sealed to ensure confidentiality. Any directions specified on the Directives Regarding the Design of the Pilot Study were announced.

The students then viewed the first two chapters of the I. V. Therapy Program in groups of seven or more. Group composition was contingent upon the availability of two hardware systems in the nursing department, the size of the monitors on the systems, and time constraints for completion of the instructional program. Finally, the students individually completed the Pilot Test on I. V. Therapy. The tests were placed in an envelope and sealed. Both instruments and the consent forms were returned to the researcher for analysis.

Pilot Study Sample Description

Demographic data contained on the Pre-treatment Data Sheet were collated and revealed that the respondents (N=21) were female, sophomores, and
primarily 19 years of age (57%). The remaining students were 20 years old (33%) and 21 years old (10%).

None of the students were RN’s or LPN’s and one (5%) was a transfer from another professional nursing program who did not receive any content related to I. V. Therapy. Prior to the IVI program, no respondents received content related to I. V. Therapy and 95% did not read or view any audio-visual aids. One student (5%) received prior EMT training and one student (5%) paramedic training. The majority (76%) had previous experience with computers while 95% had no previous experience with IVI. Finally, pertaining to employment, 48% were employed as aides, 5% as EMT/paramedics, and 14% worked with I. V. equipment during employment.

Pilot Study Scoring

After analysis of the demographic data, subjects’ answers to the test items were scored as either correct or incorrect. Each correct response was allocated one point. Total I. V. knowledge scores were computed by summing the points for all 30 questions. The possible range of scores was 0 to 30.

Item analysis of the answer sheets through a test
scanner revealed a range of scores from 11 (lowest) to 25 (highest), an average score of 18.3, a median score of 18.0, and a standard deviation of 3.69. The frequency distribution indicated a nearly normal distribution that was platykurtic in nature, that is, had a low flat curve.

Cronbach's alpha internal consistency reliability was computed on the pilot test data. The initial reliability of the 30 item test was .63. Item-total correlation were examined. Item # 5, 7, 10, 13, 24, 26, and 29 had a negative item-total correlation and, therefore, were eliminated from inclusion on the final tool. Alpha recomputed with the remaining 23 items was .74.

Item # 2, 5, 6, 10, and 19 were included in the pilot study, addressed nursing interventions, but were not derived from behavioral objectives of either chapter. Two items (#5 and 10) had a negative item-total correlation; one (#2) had an item-total correlation less than .2; and two (#6 and 19) had an item-total correlation greater than .2. Therefore, two of the five items contributed to the total reliability of the tool and implied cognitive integration of content into action. Since these items were not
derived from behavioral objectives, they were not incorporated in the final tool.

The discrimination index and difficulty factor of the remaining items were evaluated and are illustrated in Table 6. The remaining items had an item-to-total correlation that was positive and was 0.2 or greater with the exception of #15. If this item were deleted, the alpha would not increase substantially. Therefore, this item neither contributed to nor detracted from the total alpha, and it was retained in the final instrument.

Table 6

Disclosure Index and Difficulty Factor of Test Items

<table>
<thead>
<tr>
<th>Test Item</th>
<th>Discrimination Index</th>
<th>Difficulty Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.5</td>
<td>0.76</td>
</tr>
<tr>
<td>3</td>
<td>0.7</td>
<td>0.62</td>
</tr>
<tr>
<td>4</td>
<td>0.8</td>
<td>0.43</td>
</tr>
<tr>
<td>8</td>
<td>0.3</td>
<td>0.43</td>
</tr>
<tr>
<td>9</td>
<td>0.2</td>
<td>0.86</td>
</tr>
<tr>
<td>11</td>
<td>0.8</td>
<td>0.43</td>
</tr>
<tr>
<td>12</td>
<td>0.3</td>
<td>0.91</td>
</tr>
<tr>
<td>14</td>
<td>0.5</td>
<td>0.48</td>
</tr>
<tr>
<td>15</td>
<td>0.0</td>
<td>1.00</td>
</tr>
<tr>
<td>16</td>
<td>0.2</td>
<td>0.95</td>
</tr>
<tr>
<td>17</td>
<td>0.2</td>
<td>0.71</td>
</tr>
</tbody>
</table>

(table continues)
These remaining test items were compared to the test blueprint (see Table 5) to determine fulfillment of test item requirements. As illustrated in Table 7, the remaining items satisfied the cognitive levels pertaining to the behavioral objectives and included the required number of test items for each cognitive level as designated in the test blueprint.

Table 7
Comparison of Test Items to Test Blueprint

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Cognitive Level of Behavioral Objectives</th>
<th>Number of Test Items Corresponding to Cognitive Level</th>
<th>Test Items Corresponding to the Cognitive Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Knowledge</td>
<td>4</td>
<td>1, 3, 4, 8</td>
</tr>
</tbody>
</table>

(table continues)
<table>
<thead>
<tr>
<th>Chapter of Behavioral Objectives</th>
<th>Cognitive Level</th>
<th>Number of Test Items Corresponding to Cognitive Level</th>
<th>Test Items Corresponding to the Cognitive Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>II Knowledge</td>
<td></td>
<td>4</td>
<td>9, 15, 18, 22</td>
</tr>
<tr>
<td>Comprehension</td>
<td></td>
<td>5</td>
<td>12, 14, 17, 27, 28</td>
</tr>
<tr>
<td>Application</td>
<td></td>
<td>7</td>
<td>11, 16, 20, 21, 23, 25, 30</td>
</tr>
</tbody>
</table>

Recomputed alpha of these remaining 20 items was .73. These items contributed most positively to the internal consistency reliability of the test and fulfilled the test item requirements, based on the blueprint. Thus, these items became the final version of the 20-item research instrument (see Appendix K).

Pilot Study Internal Validity

A threat to internal validity of the final research instrument lies with testing effects resulting from the effects of the pretest on the posttest. Polit and Hungler (1991) state that testing problems are more likely to occur when subjects are being exposed to
controversial content in the pretest particularly relating to opinions of the subjects. The researcher did not view this situation as pertinent to the subjects participating in this study.

Attitude Toward CAI Semantic Differential Tool.

Written consent for use of the Attitude toward CAI Semantic Differential Tool was given (see Appendix L). The Attitude Toward CAI Semantic Differential Tool (see Appendix M) was designed to measure attitude toward computer instruction. The tool contains three subscales measuring comfort, creativity, and function (Allen, 1986). The tool consists of 14 bipolar adjective scales which specifically measure attitude towards the instructional modality rather than the content. The final "adjective pairs were selected because of their inherent logic related to the concept being rated, CAI" (Allen, 1986, p. 147).

Each bipolar adjective pair is measured on a 7 point scale reflecting attitudes which range from negative to positive with a score of 7 being the most positive. Responses to the 14 items are summed to yield a total score. For purposes of this study, the total score was employed to indicate attitude towards CAI. The possible range of scores is from 14 to 98.
Although, the tool was designed for use with CAI, the bipolar adjective pairs also pertain to IVI, a branch of computer instruction.

Content validity and reliability of the tool was established (Allen, 1986). Content validity (CVI=.80) was ascertained by a panel of five judges, four of whom are experts in computer applications in nursing and a psychometrician with expertise in the area of semantic differential tools.

Reliability of the tool was determined by computing Cronbach’s alpha coefficient of internal consistency reliability (Allen, 1986). Alpha coefficients for internal reliability of total scores were established at .85 for 107 undergraduates and .75 for 67 graduate nursing students. Subscale alpha coefficients for the three subscales were also higher for undergraduates "indicating greater subscale reliability for undergraduate students than for graduate students" (Allen, 1986, p. 148). Additional studies have established alpha reliability of the instrument as illustrated in Table 8.
Table 8

Alpha Reliabilities of the Attitude Towards CAI Instrument

<table>
<thead>
<tr>
<th>Research Study</th>
<th>N</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reardon (1990)</td>
<td>73 LPN students</td>
<td>.86</td>
</tr>
<tr>
<td>Bennett (1988)</td>
<td>294 faculty</td>
<td>.82</td>
</tr>
<tr>
<td>Allen (1990)</td>
<td>146 graduate students</td>
<td>.86</td>
</tr>
<tr>
<td>Allen (1989)</td>
<td>144 American BSN students</td>
<td>.85</td>
</tr>
<tr>
<td></td>
<td>76 Canadian BSN students</td>
<td>.84</td>
</tr>
<tr>
<td></td>
<td>43 British nursing students</td>
<td>.78</td>
</tr>
</tbody>
</table>

Reliability of the attitude tool on the research sample was determined by computing Cronbach’s alpha coefficient of internal consistency reliability. Cronbach’s alpha for the tool was .88 and all 14 items contributed positively to the total reliability of the tool.
Description of IVI Program.

Prior to utilizing the IVI program in the study, written consent by the managing director of FITNE was obtained (see Appendix N) since the program was co-designed and marketed through FITNE. I. V. Therapy, an interactive videodisc, is a competency-based learning program (Price, 1990) which teaches psychomotor skill content related to I. V. Therapy. A reference, Software Integration Plan Using: Intravenous Therapy (Price, 1990), was written to accompany the IVI program providing guidelines for use of the program, skills practice, and calculation of flow rates. Checklists are also included which guide students in the learning of psychomotor skills as well as in the evaluation of performance.

The IVI program is comprised of realistic visual demonstrations of procedures, requires active involvement and interaction by the learner, and reinforces learner responses. One purpose of the program is to assist learners to gain competency in skills related to I. V. Therapy in a non-threatening environment. Although the aim of the program is skill competency, knowledge of related content is also a part of the learning process. This cognitive learning was
one focus of this study.

The program consists of six chapters entitled: Intravenous Solutions; Preparing the Solution and Tubing; Starting the IV; Maintaining the IV; Discontinuing the IV; and Complications of IV Therapy. During the design of the program, formative evaluation occurred in various stages from 1985 to 1989 (see Appendix O). Students who are currently using the program in the demonstration centers continue to evaluate the program as an instructional tool.

In order to control for threats to internal validity, the intent of the researcher was to confine viewing of the program, as well as completion of the post-treatment research instruments, to one session. Approximate completion time for Chapters I and II was estimated at 60-100 minutes (Price, 1990). Therefore, the researcher limited the study to include only these two chapters. Skill practice of procedures in Chapter II was excluded from the study since this study focused on cognitive learning.

Procedures for Data Collection

Prior to conducting the study, written approval (see Appendix P) was obtained from Widener University
School of Nursing Research Committee to ensure protection of the rights of human subjects. Written consent (see Appendix Q) to participate in the investigation was procured from the respective institutional or departmental research committees of the participating universities. This research was exempted from review by the university in Indiana since the research involved normal educational practice and the use of educational tests whereby anonymity of the subjects was maintained. The university in Arkansas also exempted review. One university in Pennsylvania (n=24) did not require additional review board approval for the actual study since approval was obtained for the pilot study.

A letter (see Appendix R) was then sent to the dean or chairperson of the nursing school requesting consent (see Appendix S) from the nursing school to participate in the study. A faculty member who was willing to act as a liaison between the researcher, course teacher(s), computer laboratory staff if needed, and subjects was indicated on the consent form. Hereafter, this faculty member was referred to as the liaison faculty. The study was conducted in each respective school under the direction of the liaison
faculty who was apprised of the research study through a letter of explanation (see Appendix T) and an overview of research methodology (see Appendix U).

Since the IVI program was a required or optional assignment in a specific nursing course, the students were made aware of the study through the course teacher(s). The course teacher(s) was informed of the study in writing by the researcher (see Appendix V).

The following process was completed separately in each school. Prior to conducting the study and in one session, students read an explanation (see Appendix W) of the investigation. Time was provided by the liaison faculty to answer questions offered by students relating to the study. Students signed an informed consent form (see Appendix X) indicating voluntary agreement to participate in the study and informing the students of their rights. The consent forms were collected by the liaison faculty, placed in an envelope, sealed, and returned to the researcher with the completed research instruments after the study was finished.

During the same or separate session based upon faculty discretion and schedule, random assignment of the students to the three study groups and completion
of the pre-treatment research instruments occurred. Volunteer subjects at each school were randomly assigned to the three study groups for IVI viewing. Through preliminary contact with the schools, the researcher verified the actual total number of students eligible to participate. A list of random digits that corresponded to the total number of students was computer generated.

As students volunteered to participate in the study by submitting their signed consent form, the forms were numbered sequentially. Students were assigned across the three groups according to the numbers identified on the computer generated list of random digits until each group was approximately equal in size.

The students then completed the pre-treatment instruments. Some of the items on the pre-treatment data sheet related to extraneous influences, such as, LPN training or experience in health care settings that may threaten internal validity. The students also completed the pretest measures of I. V. Therapy knowledge and the attitude scale to ascertain group equivalence. The completed pretest instruments were collected, placed in an envelope, sealed to assure
integrity of the pretest data, and returned to the researcher when the study was finished.

Before viewing the program and in one session, the students read directives which functioned as a guide and promoted consistency among the participants in the content viewed. Chapters I and II of the IVI program were viewed by the nursing students according to their randomly assigned mode, that is, individual, small group, or large group.

Those students who viewed the program individually were considered the control group. As previously cited in the literature review, individual mode is considered the traditional method since inception of computer instruction. Group interaction was not present, thus, the remaining two groups were considered experimental.

Due to limited hardware, individual students and groups of students had to view the IVI program at different times based upon such factors as the availability of the hardware and student schedules. However, it was critical to the study that the randomly assigned groups viewed the program as a group. Therefore, it was necessary to request that computer laboratory staff as well as liaison faculty participate in conducting the remaining portion of the study. This
individual was referred to as the proctor. Before participating in the study, the computer laboratory staff read directives from the researcher through a letter of explanation (see Appendix Y) and an overview of research methodology.

After viewing the program, the posttest measures of I. V. Therapy knowledge and the attitude scale were completed by the students and collected by the proctor. The instruments were placed in an envelope, sealed, and returned to the researcher by the liaison faculty at the completion of the study.

A post-treatment data sheet was also completed after viewing the program. The items focused on time needed to complete the IVI program, learning preference related to computer use and mode of instruction, and perceived interaction occurring in small and large groups. These data sheets along with the previously completed instruments were placed in an envelope, sealed, and mailed to the researcher by the liaison faculty for analysis. In the event that instruments were not returned, vigorous tracking occurred through follow-up telephone contacts by the researcher.
Data Analysis

Data analyses included both descriptive and inferential statistics. Sample means of I. V. knowledge and attitude towards instructional media for each treatment group was computed. ANOVA with post hoc Scheffe was utilized to test Hypothesis 1 and 2. The rationale for choice included ANOVA since this statistical test determines if there is a significant difference among the three independent groups (Polit & Hungler, 1991). Post hoc Scheffe identifies "which means were significantly different from the other means" (Dempsey & Dempsey, 1986, p. 86). Pearson correlation coefficients were used to test the third hypothesis since this test establishes any relationship that exists between two variables.

A t-test for independent means was utilized to test the first exploratory question since this statistical test determines significant differences between two means. Pearson correlation coefficients were utilized to test the second exploratory question since this test establishes the magnitude and direction of relationships that exist among the variables.
Delimitations

Delimitations of the study related primarily to the sample selection and size and included:

1) restriction of the study to nursing education; and,

2) selection of nursing students was limited to schools containing the required hardware systems and instructional program.
CHAPTER IV

RESULTS

Frequency Distribution

Test of I. V. Therapy Scores.

As previously mentioned, the pre-treatment scores acquired on the Test on I. V. Therapy were computed in order to ascertain group equivalence among the three independent groups. The post-treatment scores measured cognitive learning about I. V. Therapy. The mean of the pre-treatment scores for the research sample \((N=63)\) was 11.6 while the mode was 10 and the median 12. The minimum score was 6 and the maximum 17. The SD was 2.7 and Cronbach’s alpha coefficient for internal consistency reliability of total pretest scores was .53.

In comparison, the post-treatment scores for the research sample had a mean of 15.9, a mode of 16, and a median of 16. The range of scores was 11 to 19 with a SD of 1.8. Cronbach’s alpha coefficient for internal consistency reliability of total posttest scores was .16. Although the scores were higher on the posttest, Cronbach’s coefficient alpha was lower than the pilot
study or pretest alpha coefficient. Borg and Gall (1983) and Anastasi (1988) suggest factors that may contribute to low internal consistency reliability.

Variance, or mean square deviation, "has proved extremely useful in sorting out the contributions of different factors to individual differences in test performance" (Anastasi, 1988, p. 76-77). The pretest had a variance of 7.02 which was approximately twice the variance of the posttest (3.2). A small variance adversely affects internal consistency.

Several posttest items had negative item-to-total correlations. These items were about Hyperalimentation, I. V. equipment, priming I. V. tubing, and calculation of the amount of solution remaining in an I. V. container. The cognitive levels of the test items included knowledge, comprehension, and application. It was difficult to ascertain specific categories of the test either by content or cognitive levels that resulted in negative item-to-total correlations.

Finally, Borg and Gall (1983) described sources of error that may contribute to diminished consistency of subject performance. Sources of error may be mood,
fatigue, and attitude toward the test. The posttest was completed after viewing the IVI program. Perhaps some students were tired, losing motivation, interested in completing the study, or affected by group mood. Another source of error may be attributed to minor variations in testing despite efforts to maintain standard conditions, such as, lighting and noise. These minor variations may have been distractors to some students and a source of frustration which could affect subject performance.

**Attitude Scores.**

Pre-treatment attitude scores were computed to determine group equivalence, while the post-treatment scores measured attitude toward computer instruction. The pre-treatment scores for the research sample (N=63) had a mean of 68.6, a median of 68, and a mode of 65. The SD was 11.4 and the range of scores was 42 to 91.

The frequency distribution of the total post-treatment scores included a mean of 72.9, a median of 73, and a mode of 74. The SD was 12 and the range of scores was 44 to 97. Cronbach’s alpha internal consistency reliability of the attitude tool was .88 and all 14 items contributed positively to the
reliability.

**Responses on Post-Treatment Data Sheet.**

As previously described, the research sample (N=63) was randomly assigned to three independent groups. Twenty-three (36.5%) students viewed the IVI program alone, 18 (28.6%) in small groups, and 22 (34.9%) in large groups.

The post-treatment data sheet addressed student perception of learning preference toward computer instruction and mode of instruction as well as group interaction. The time in minutes to complete Chapters I and II of the IVI program was also requested. The frequency distribution for the time of completion revealed a mean of 47.9, and a median and mode of 45. The range was from 20 to 90 with a SD of 14.5.

Student preference for working alone or in groups while utilizing the computer for learning was computed. Of the research sample (N=63), 29 (46%) students preferred working alone, 25 (40%) in small groups (2-3 students), 3 (5%) in large groups (7 or more students), 5 (8%) had no preference of either working alone or in groups, and 1 (2%) did not like using the computer at all for learning. Thus, the majority (46%) preferred
working on an individual basis while 40% preferred small group instruction.

Reaction to the IVI program as an instructional strategy was rated. On a scale of one to five, one was considered unfavorable and five favorable. Table 9 illustrates the frequency distribution for each value on the scale. Examination of the table reveals that approximately 96% of the research sample rated the IVI program as three or higher with five being highly favorable, indicating a generally positive reaction to IVI.

Table 9

Favorableness of IVI as an Instructional Strategy

<table>
<thead>
<tr>
<th>Value</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Low</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td>4</td>
<td>37</td>
<td>59</td>
</tr>
<tr>
<td>5</td>
<td>High</td>
<td>15</td>
</tr>
</tbody>
</table>

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Students who viewed the IVI program on an individual basis (n=23) rated their perception of how their learning outcome might have differed if they participated in either a small group or in a large group. Table 10 illustrates student perception of group learning when having viewed the program alone. Only one (4%) student felt learning would have improved in small group instruction while the majority (96%) rated their learning as worse if they had participated on a large group basis. Eleven (48%) anticipated their learning would be unchanged and 11 (48%) believed it would be worse in small group instruction.

Table 10
Perception about Probable Learning Outcome in Groups by Students who Worked Alone

<table>
<thead>
<tr>
<th></th>
<th>Better</th>
<th>Same</th>
<th>Worse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Group</td>
<td>1 (4%)</td>
<td>11 (48%)</td>
<td>11 (48%)</td>
</tr>
<tr>
<td>Large Group</td>
<td>0</td>
<td>1 (4%)</td>
<td>22 (96%)</td>
</tr>
</tbody>
</table>

Students who participated in small group (n=18)
and large group (n=22) instruction rated their perception of participation in discussions. The scale ranged from one to five with one indicating no participation, three was moderate participation, and five was extensive participation. Table 11 illustrates perception of participation in discussions by the student and by other group members.

Approximately 41% of the students involved in group instruction perceived the amount of their individual participation as well as that of the other group members as moderate. Extensive participation was viewed by approximately 8% while no students perceived a total lack of participation either of themselves or other group members.

Table 11
Perception about Participation in Discussions that Occurred in Group Instruction

<table>
<thead>
<tr>
<th>Degree of Participation in Discussions</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual Student</td>
<td>0</td>
<td>7(18%)</td>
<td>15(38%)</td>
<td>13(33%)</td>
<td>5(13%)</td>
</tr>
<tr>
<td>Other Grp. Members</td>
<td>0</td>
<td>6(15%)</td>
<td>18(45%)</td>
<td>15(38%)</td>
<td>1(3%)</td>
</tr>
<tr>
<td>All Grp. Subjects</td>
<td>0</td>
<td>13(16%)</td>
<td>33(41%)</td>
<td>28(35%)</td>
<td>6(8%)</td>
</tr>
</tbody>
</table>

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A description of the interactions that occurred in the group was rated and is presented in Table 13. On a scale of one to five, one indicated a lack of helpfulness in clarifying content, critical, or easily distracted while five signified helpful in clarifying content, supportive, or focused.

Two (5%) students who participated in group instruction felt that the group got distracted easily while the majority (81%) evaluated the group as remaining moderately to highly focused. Approximately 96% rated their group interaction as moderately to highly helpful in both clarifying content and providing support.

Table 12

<table>
<thead>
<tr>
<th>Degree of Helpfulness</th>
<th>1 (none)</th>
<th>2 (5%)</th>
<th>3 (18%)</th>
<th>4 (45%)</th>
<th>5 (33%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>in Clarifying</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Content</td>
<td>0</td>
<td>2</td>
<td>7</td>
<td>18</td>
<td>13</td>
</tr>
<tr>
<td>of Support</td>
<td>0</td>
<td>2</td>
<td>8</td>
<td>22</td>
<td>8</td>
</tr>
</tbody>
</table>

*(table continues)*
Finally, the students who participated in group learning rated how their learning outcome might have been different if they had been working alone. Table 13 illustrates student perception about learning on an individual basis. The majority (55%) thought that their learning of I. V. Therapy content on an individual basis would be the same as in group instruction. Other students (35%) felt their learning would be improved on an individual basis while 10% anticipated that their learning would be worse.

Table 13
Perception about Learning on an Individual Basis by Students Participating in Group Instruction

<table>
<thead>
<tr>
<th></th>
<th>Better</th>
<th>Same</th>
<th>Worse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual Basis</td>
<td>14(35%)</td>
<td>22(55%)</td>
<td>4(10%)</td>
</tr>
</tbody>
</table>
Group Equivalence

Research Sample.

The pre-treatment scores, as previously mentioned, were computed to ascertain group equivalence among the independent groups of the research sample. Sample means of the pre-tests on I. V. Therapy and the pre-attitude scores were calculated for each treatment group and are presented in Table 14.

Table 14

Means of Pre-treatment Scores according to Mode of Instruction

<table>
<thead>
<tr>
<th>Mode</th>
<th>n</th>
<th>Mean of the Test on I. V. Therapy Scores</th>
<th>Mean of the Attitude Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alone</td>
<td>23</td>
<td>12.0</td>
<td>69.4</td>
</tr>
<tr>
<td>Sm. Grp.</td>
<td>18</td>
<td>10.8</td>
<td>68.6</td>
</tr>
<tr>
<td>Lg. Grp.</td>
<td>22</td>
<td>11.7</td>
<td>67.8</td>
</tr>
</tbody>
</table>

ANOVA with post hoc Scheffe was utilized and findings revealed that there were no significant differences among the groups at the .05 level regarding
knowledge of I. V. therapy (F (2, 60)=1.04; p=.36) or attitude towards the instructional media (F (2, 60)=.10; p=.9). Thus, group equivalence of the three treatment groups of the research sample was established for both variables. It was, therefore, unnecessary to convert raw scores to z scores, and data analyses were completed using raw scores.

**Research and Dropout Sample.**

A comparison of pre-treatment scores was computed for both the research and dropout sample. The dropout sample included those students who completed the pretest questionnaires but did not complete the study. A t-test for independent means was utilized to determine significant differences between the two samples by comparing the total means. Table 15 presents the means of the pre-treatment scores for each sample.
Table 15
Means of Scores for Research and Dropout Sample

<table>
<thead>
<tr>
<th>Sample</th>
<th>n</th>
<th>Mean</th>
<th>SD</th>
<th>n</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research</td>
<td>63</td>
<td>68.6</td>
<td>11.4</td>
<td>63</td>
<td>11.6</td>
<td>2.7</td>
</tr>
<tr>
<td>Dropout</td>
<td>48</td>
<td>70.6</td>
<td>11.4</td>
<td>53</td>
<td>10.6</td>
<td>2.6</td>
</tr>
</tbody>
</table>

The total means were then compared using a t-test. Table 16 illustrates the findings. Analysis revealed no statistical difference (p=.36) in the attitude scores between the two samples. While the Test on I. V. Therapy scores had a statistical significance of p=.04, no practical significance existed. This judgment is based upon data presented in Table 15. A mean difference of one point is noted between the two samples while the SD was the same. A standard error of .33 was rated for the research sample and .36 for the dropout sample. Thus, group equivalence was established between the research and dropout samples.
Table 16

Comparison of the Means between the Research and Dropout Sample

<table>
<thead>
<tr>
<th>Pre-Treatment Scores</th>
<th>T Value</th>
<th>2-Tail Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test on I. V. Therapy</td>
<td>2.04</td>
<td>.04</td>
</tr>
<tr>
<td>Attitude Scale</td>
<td>-.92</td>
<td>.36</td>
</tr>
</tbody>
</table>

Data Analysis

Hypotheses.

Data analyses included both descriptive and inferential statistics. Sample means of I. V. knowledge and attitude towards instructional media for each treatment group was computed and are presented in Table 17.
Table 17

Means of Post-Treatment Scores according to Mode of Instruction

<table>
<thead>
<tr>
<th>Mode</th>
<th>n</th>
<th>Mean of the Test on I. V. Therapy Scores</th>
<th>Mean of the Attitude Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alone</td>
<td>23</td>
<td>16.5</td>
<td>77.6</td>
</tr>
<tr>
<td>Sm. Grp.</td>
<td>18</td>
<td>15.4</td>
<td>71.0</td>
</tr>
<tr>
<td>Lg. Grp.</td>
<td>22</td>
<td>15.7</td>
<td>69.5</td>
</tr>
</tbody>
</table>

The results of hypotheses testing included:

Hypothesis 1: Cognitive learning is greater when utilizing an IVI program with a small group of nursing students than with an individual or larger group of students.

Analysis of data utilizing ANOVA (F (2, 60)=2.00; p=.14) revealed no statistical difference at the .05 level in cognitive learning among the three independent groups. Scheffe procedure identified that no groups were significantly different at the .05 level.

Hypothesis 2: Attitude towards the
instructional media (computer) scores are higher when the IVI program is utilized with a small group of students than with an individual or larger group of nursing students.

Analysis utilizing ANOVA ($F(2, 60) = 3.03; p = .06$) revealed that attitude, although close to statistical significance, was not statistically different among the three independent groups. Scheffe procedure identified that no two groups were significantly different at the .05 level.

**Hypothesis 3:** The relationship between attitude towards the instructional media and cognitive learning is significantly stronger in a small group than with an individual or larger group of nursing students.

Analysis utilizing Pearson correlation coefficients ($r = .105; p = .21$) did not establish a relationship between attitude and cognitive learning among the sample subjects. Table 18 presents the Pearson correlation coefficients between post-Test on I. V. Therapy and post-Attitude scores for each group.
Table 18

Pearson Correlation Coefficients Between Posttest Knowledge and Attitude Scores for the Three Independent Groups

<table>
<thead>
<tr>
<th>Mode of Instruction</th>
<th>n</th>
<th>r</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual</td>
<td>23</td>
<td>.05</td>
<td>.41</td>
</tr>
<tr>
<td>Small Group</td>
<td>18</td>
<td>.26</td>
<td>.15</td>
</tr>
<tr>
<td>Large Group</td>
<td>22</td>
<td>-.09</td>
<td>.34</td>
</tr>
</tbody>
</table>

Exploratory Questions.

Data from the Post-treatment Data Sheet were analyzed using descriptive and inferential statistics. The results of testing the exploratory questions included:

1) Did students who were randomly assigned to their preferred mode of instruction score differently on measures of cognitive learning and attitude than students who were randomly assigned to a mode of instruction that was not preferred? Students whose randomly assigned group and identified preference
matched were classified as Group 1. Students whose randomly assigned group and identified preference did not match were classified as Group 2. Table 19 illustrates t-test analysis between the two groups.

Examination of the table revealed that the sizes of the two groups were comparable. While the means of knowledge and attitude scores of the students who were randomly assigned to their preferred mode of instruction were slightly higher than students not assigned to their preferred mode, these differences were not statistically significant.

Table 19

Comparison between Learning and Attitude Scores with Match/Mismatch of Preferred Mode of Instruction and Randomly Assigned Mode

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Mean</th>
<th>t Value</th>
<th>Prob.</th>
<th>Mean</th>
<th>t Value</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>31</td>
<td>16.3</td>
<td>1.6</td>
<td>.13</td>
<td>75.3</td>
<td>1.58</td>
<td>.12</td>
</tr>
<tr>
<td>2</td>
<td>32</td>
<td>15.6</td>
<td></td>
<td></td>
<td>70.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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2) What are the relationships among perception of group interaction, cognitive learning, and attitude scores? Group interactions in the small and large groups (n=40) in relation to helpfulness in clarifying content, supportive approach, and remaining focused during discussions were explored. Table 20 presents the findings utilizing Pearson correlation coefficients.

Examination of the findings revealed a statistically significant relationship (p=.02) between knowledge and the perception of remaining focused. Thus, students who participated in group instruction and perceived discussions as remaining focused scored higher on the Test on I. V. Therapy.

Table 20

Pearson Correlation Coefficients between Knowledge, Attitude, and Group Interaction (n=40)

<table>
<thead>
<tr>
<th></th>
<th>Helpful</th>
<th>Supportive</th>
<th>Focused</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude</td>
<td>r=.11 (p=.26)</td>
<td>r=-.01 (p=.47)</td>
<td>r=.16 (p=.17)</td>
</tr>
<tr>
<td>Knowledge</td>
<td>r=.22 (p=.09)</td>
<td>r=.19 (p=.12)</td>
<td>r=.33 (p=.02)</td>
</tr>
</tbody>
</table>
Discussion

Hypotheses.

Hypothesis 1: Cognitive learning is greater when utilizing an IVI program with a small group of nursing students than with an individual or larger group of students.

Data analysis revealed no significant difference in cognitive learning among the three independent groups, therefore, the hypothesis was rejected.

As previously mentioned, Bandura (1986) proposed that observational learning occurs as a result of observation and reinforcement (see Figure 1). Modeled information is symbolically represented and provides a guide for future action. Modeled information, as suggested by Klausmeier and Goodwin (1966), is conveyed through real-life models or symbolically through, for example, actions, words, and audio-visual media.

Reinforcement, in part, relates to the "administration of reinforcing stimuli either to the model or to the observer" (Bandura, 1965, p. 589).
Bandura (1965) adds that resultant matching responses by the learner are affected by variables, such as, motivation, "rate, amount, and complexity of stimuli" (p. 593), and degree to which the necessary components of the behavior are in the observer's repertoire.

Although, the mode of instruction did not significantly influence cognitive learning in this study, the factors constituting observational learning were provided through the instructional media. The IVI program, incorporating both a computer and video component, provided realistic visual demonstrations of procedures, required active involvement and interaction by the learner, and reinforced learner responses. Thus, both observation of modeled behavior and reinforcement were provided.

In accordance with Bandura, Hansen (1989) proposed that a model was present in IVI which facilitated observational learning through symbols while the computer furnished feedback to learner responses. It was also suggested that IVI was "best suited for modeling effective teaching presentations" (Hofmeister, Englemann, & Carnine, 1986, p. 39) as well as simulating real-life situations and providing
appropriate behavioral models (Browning, White, Nave, & Barkin, 1986).

Similar to the findings of this study, in a sample of 33 students, Noell and Carnine (1989) found no significant difference in achievement between individual learners and groups of learners, although, the group mode was more time efficient. Taylor and Faust (1962) studied problem-solving skills (N=105) with individuals and small groups of two and four. Findings revealed no significant differences in mean scores of individual testing, therefore, learning occurred in all three modes of instruction. Finally, Schoen (1976) in reviewing 17 studies comparing individualized with group instruction, found no significant difference in mathematics achievement in the majority of studies. Group instruction was considered more cost effective. There was no mention of the sample size for the 17 studies reviewed. Therefore, the effect of sample size on outcomes of these studies can not be determined.

Various factors may have contributed to the lack of significant differences in cognitive learning among the three independent groups in this study. These
factors include sample size, the experimental design, and implementation of social learning theory. According to Borg and Gall (1983), level of significance is influenced by the number of subjects. The research sample was limited (N=63) and if the sample were larger, the probability of non-significant results would decrease.

Experimental design may have been another contributing factor. Perhaps the treatment group sizes for the small and large group were not sufficiently different. To reiterate, the small group constituted 2 to 3 students while the large group contained approximately 7 to 10 students. A more unique difference in group sizes may incorporate 3 to 4 students in small groups and 15 to 20 in large groups.

A third factor may have been the implementation of social learning theory. Bandura (1977) proposed that the most effective influence on behavior is the action of others. Students assembled in small or large groups for the sole purpose of viewing the IVI program. The temporary nature of the group may have generated insufficient interaction to influence learning outcomes.
Hypothesis 2: Attitude towards the instructional media (computer) scores are higher when the IVI program is utilized with a small group of students than with an individual or larger group of nursing students.

Data analysis revealed no significant difference in attitude towards the instructional media among the three independent groups, therefore, the hypothesis was rejected.

According to Bandura (1986), modeling may exert emotional arouser effects whereby social interaction or emotional reaction of the model may elicit emotional reaction by the learner. In addition, activities perceived as self-satisfying are considered motivators which influence attitude or emotional reaction toward the learning event. Thus, emotional reaction by the learner was not necessarily due to social interaction but to the perception of the instructional media as a positive motivator. Approximately 96% of the research sample rated the IVI program as moderately to highly favorable as an instructional strategy.

Manning, Balson, Ebner, and Brooks (1983) related
"a highly significant degree of student satisfaction" (p. 108) toward IVI when teaching administration of an intramuscular injection in a group-paced, instructor-controlled environment of a combat medic program. Evans (1986) found that IVI was well received by both faculty and students and did not detract from attitude of the students toward learning the content.

Hypothesis 3: The relationship between attitude towards the instructional media and cognitive learning is significantly stronger in a small group than with an individual or larger group of nursing students.

Although the means of the post-treatment scores for both cognitive learning and attitude were highest for students working alone, no significant relationship existed among any of the three independent groups. Thus, the hypothesis was rejected.

Bandura (1977) proposed that the most effective influence on behavior is the action of others. In this study, perhaps the modeling behaviors on the instructional media rather than the social interaction influenced the learners. Clark (1984) also suggested that positive attitude enhances learning while attitude
towards an instructional strategy was crucial to the learning process and achievement (Conklin, 1983; Hamby, 1986).

Sutter and Reid (1969) compared achievement and attitudes towards instructional media when taking a CAI problem solving course with a partner or alone. Since no significant difference between the groups was found, pairing permitted twice as many students to be taught at the same number of computers.

**Exploratory Questions.**

1) Did students who were randomly assigned to their preferred mode of instruction score differently on measures of cognitive learning and attitude than students who were randomly assigned to a mode of instruction that was not preferred? The raw score mean on both the Test on I. V. Therapy and the Attitude Scale was higher for the students whose randomly assigned group and identified preference matched. Although, analysis of data revealed no significant difference in cognitive learning and attitude between the two groups. Given the small sample size, it is premature to draw conclusions based upon these findings.

2) What are the relationships among perception of
group interaction, cognitive learning, and attitude scores? Group interaction related to helpfulness in clarifying content, supportive approach, and remaining focused during discussions. According to Bandura, "in social interactions the behavior of each participant governs which aspects of their potential repertoires are actualized and which remain unexpressed" (Bandura, 1977, p. 197). Therefore, the milieu of social interaction may affect the learning process of its participants.

Analysis of the data revealed a statistically significant relationship between knowledge and the learner's perception of remaining focused. Perhaps in remaining focused, the students perceived a control over distractions which can produce frustrations, hamper group performance, and lengthen the learning process. According to Watson (1966), frustration in the learning process can ensue due to laziness of some members, confusion in goal direction, rambling talk, and interference in thought. Frustration can impede group performance.

Collins (1990) explored the concept of the study-group approach. This approach fostered studying
Calculus in teams which resulted in diminished failure rate.

**Learner Perceptions.**

Bandura (1986) proposed that attitude is elicited through social interaction or incitement of a reaction due to expression of emotion by the model. As a part of motivational processes, activities perceived as self-satisfying are considered motivators which influence attitude or emotional reaction toward the learning event. Thus, perception of instructional media as a positive or negative motivator influences the emotional reaction of the learner and ultimately affects the learning process.

The majority (46%) of the research sample preferred working alone when using the computer and students who worked alone anticipated performance would be the same or worse in small groups. The majority (42%) perceived moderate participation occurring in group instruction and group interactions as helpful in clarifying content, providing support, and remaining focused. Similar learning on an individual basis was anticipated by the majority (55%) of students who participated in group instruction. Thus, activities of
the majority seem to perceive individual instruction as a motivator which could influence attitude toward the learning event.

Sample Size.

The research sample (N=63) was limited in size despite efforts, as previously described, to increase the numbers of participants. The sample did not meet a minimum total of 30 for each mode of instruction. According to Borg and Gall (1983), "the probability that random assignment will produce initially equivalent treatment groups increases as sample size in each group increases" (p. 654). Although the sizes were small, group equivalence of the three treatment groups was established by utilizing ANOVA with post hoc Scheffe on the sample means of the pre-Tests on I. V. Therapy scores and the pre-attitude scores of each treatment group. Group equivalence also contributed to the internal validity of the study, thus, "differences between the groups on the posttest can be attributed, with a high degree of confidence, to the treatment rather than to extraneous factors" (Borg & Gall, 1983, p. 652).

A larger sample size enhances the
representativeness of the sample, decreases sampling error, and permits generalizability of the results (Polit & Hungler, 1991; Dempsey & Dempsey, 1986). Therefore, generalizing the results of this study is done with caution, although sampling bias has been controlled by establishing statistical equivalence of the groups.

Sample size was affected by a number of factors. A limited number of schools of nursing had access to the necessary equipment due to the cost of laser disc hardware systems and software programs. Of the schools (N=78) which had access to the equipment, some had not incorporated the IVI program as a required assignment in the curriculum, which affected the numbers of students who volunteered to participate. In addition, of the eligible schools who met the criteria, some schools were not interested in participating in research. Other schools (n=17) did not respond to surveys or have access to a means of projecting the IVI program to a large group of students.

Various factors may have affected the low number of students who volunteered to participate in the study. Some of these factors include the IVI
assignment, faculty involved in collecting the data, and lack of feasibility for the researcher to be on site to collect the data.

Certain factors pertaining to the IVI assignment affected the numbers of subjects who volunteered. These factors included: whether the IVI program was a required or optional assignment in the nursing curriculum; whether students had to view the IVI program on their own time or during designated lab time; and whether the students had limited or unrestricted time constraints in which to complete the assignment. Sample size was higher in those schools in which the program was a required assignment, designated lab time to complete the IVI program was provided in the course, and the students had a limited time frame in which to complete the assignment.

Factors relating to faculty may have affected the numbers of students who volunteered to participate in the study. The researcher had numerous telephone contacts with each of the liaison faculty throughout the process. In some of the schools, faculty other than the liaison faculty were involved in collecting data. Written correspondence to these faculty about
the research process was provided, although the researcher did not have direct telephone contact with these faculty. The researcher observed a higher number of respondents in those schools where the liaison faculty member was present and directly involved in collecting the data.

Finally, in order to increase the generalizability of the findings, the researcher selected out-of-state sites. In addition, collecting data was contingent upon the structure of completing the IVI assignment in the nursing course. Therefore, data collection usually involved students for two sessions. Distance of the sites and the need for more than one session limited the feasibility of the researcher to be personally present on site to collect data.

**Dropout Sample.**

The dropout sample (N=74) reflected attrition or loss of participants during the study. These students did not complete all of the instruments, did not code instruments, or did not view the IVI program as randomly assigned. Of the potential pool of students (N=451) enrolled in the course presenting I. V. Therapy, approximately 26% (n=117) signed the consent
forms, 16% dropped out of the study, and 14% (N=63) completed the research study.

Light, Singer, and Willett (1990) addressed the issue of attrition primarily with reference to longitudinal studies. Findings revealed that the longer the duration of the study, the greater the attrition. In accordance, the researcher observed a higher completion rate in those schools that had a restricted time frame for completion of the assignment, for example, one or two days, rather than permitting completion throughout the semester.

Other factors may also have contributed to the loss of participants during the study. Initially, the dropout sample consented to participate, however, certain factors intervened that affected their continuation in the process. For example, students who were randomly assigned to especially large group instruction and had to view the program on their own time, had difficulty establishing a mutually acceptable time for all the members to meet. Scheduling conflicts pertained primarily to work, family, or school responsibilities.

Some students who were assigned to group
instruction viewed the program alone and, therefore, could not be included in the research sample. These conditions conflicted with the criteria of this experimental research design.

In addition, higher attrition was noted in those schools where faculty other than liaison faculty collected data. These faculty had their own group of students and/or were located at a satellite site. Reasons for higher attrition may be attributed to a lack of or minimal investment in the research study. Telephone contacts were directed to liaison faculty which afforded the opportunity to establish a professional colleague relationship. The researcher observed a vested interest by these faculty in the completion of the study. In the future, telephone contact with any faculty involved in the process should be considered an integral component of the research methodology. In these instances, the researcher did offer to contact the other faculty which was considered unnecessary by the liaison faculty member.

Conclusions

The following conclusions were made based upon analysis of data:
1) When utilizing an IVI program with three modes of instruction, that is, individual, small group, and large group basis:
   a) Cognitive learning was not influenced by modes of instruction;
   b) Attitude towards the instructional media was not influenced by modes of instruction;
   c) Relationship between attitude towards the instructional media and cognitive learning was not influenced by modes of instruction;
   d) Students who were randomly assigned to their preferred mode of instruction did not score significantly higher in cognitive learning and attitude towards instructional media than students who were randomly assigned to a mode that was not preferred;
   e) Students who participated in group instruction and perceived discussions as focused learned more effectively than students who participated in group instruction and perceived discussions as unfocused;

2) Since group instruction was at least as effective a mode of instruction as individualized learning, group instruction may be considered more cost
effective with more students permitted at the same number of computer terminals;

3) The IVI program provided the constituents of observational learning, that is, observation of modeled behavior and reinforcement.

Recommendations

1) Recommendations concerning replication of this research are:
   a) the researcher should collect data in person, if feasible;
   b) verbal as well as written correspondence should be addressed to all faculty, not only liaison faculty, who are collecting data;
   c) the sample size should be increased to promote generalizability of the findings;
   d) the large group should be distinctly different in size from the small group, for example, 15 to 20 students in the large group and 3 to 4 in the small group; and
   e) the Post-Treatment Data Sheet should include an item establishing learner perception of the effectiveness of the role model in presenting content in the IVI program.
2) Extension of this research could include investigating the relationship between perception of group interaction and cognitive learning, which has specific implications for disciplines utilizing group process.

3) The implementation of Social Learning Theory could be enhanced by:

   a) having the students view the IVI program in more than one session so as to develop a constructive foundation for social learning; and

   b) providing guidelines for students describing group interaction and ways of working in and using groups.
REFERENCES


Burke, D. (1990). IVD and nursing education—competing with the question: Which came first, the chicken or the egg? Instruction Delivery Systems, 8, 10.


Johnson, R. T., Johnson, D. W., & Stanne, M. B.

Johnson, R. T., Johnson, D. W., & Stanne, M. B.


APPENDIX A

Pre-treatment Data Sheet

DIRECTIONS: Please complete the following items by answering on these data sheets.

Today’s Date______________________________

1. Mode of Instruction to which you were randomly assigned:
   Individual _____
   Small Group (2-3 students) _____
   Large Group (7 or more) _____

2. Social Security Number (last four digits) _____

3. Age: _____

4. Gender: Male _____ Female _____

5. Current year in the nursing program:
   Freshman _____
   Sophomore _____
   Junior _____
   Senior _____

6. Semester this study is conducted: Fall _____
   Spring _____
   Summer _____
7. Educational Background:

Please check Yes or No for each item:

Are you:

a) an LPN/VPN  

b) an RN  

c) a transfer from another professional nursing program and did not receive any content related to I. V. Therapy  

d) a transfer from another professional nursing program and did receive content related to I. V. Therapy  

Have you:

e) received content related to I. V. Therapy in class, clinical, or lab prior to viewing the interactive videodisc program
f) read or seen audio-visuals prior to viewing the interactive videodisc program

g) received training related to I. V. Therapy in another health care profession, such as,
   Emergency Medical Technician (EMT)
   Paramedic
   Other______________________________

h) had previous experience with computers

i) had previous experience with IVI

8. Please check Yes or No to the following.
   a. Were you ever or are you currently employed as:
      an RN
      an LPN/VPN
      a nurse’s aide/orderly
      an EMT or Paramedic

   b. If you are employed, do you work with I. V. equipment?
APPENDIX B

Post-treatment Data Sheet

DIRECTIONS: Please complete the following items by answering on these data sheets.

Today's Date______________________________

1. Mode of Instruction: Individual____
   Small Group____
   Large Group____

2. Social Security Number (last four digits)____

3. Total time taken to complete Chapters I and II
   ____ hours   ____ minutes

4. How do you prefer to use the computer for learning?
   (Check one)
   ____ by myself
   ____ in a small group (2-3 students)
   ____ in a large group (7 or more students)
   ____ no preference, alone or in a group
   ____ I don’t like to use the computer at all for learning.
5. After having viewed interactive videodisc instruction on I.V. Therapy, what is your reaction to IVI as an instructional strategy? Please rate by marking an X on the appropriate number on the scale.

1  2  3  4  5

Unfavorable    Favorable

IF YOU WORKED ALONE on individual computer instruction, please answer questions 6 and 7 by checking the response that most applies to you:

6. How well do you feel you would have learned I. V. Therapy with the IVI program if you had been working in a small group? I would have done:

____ better
____ about the same
____ not as well
7. How well do you feel you would have learned I. V. Therapy with the IVI program if you had been working in a large group? I would have done:

___ better
___ about the same
___ not as well

IF YOU PARTICIPATED IN EITHER SMALL OR LARGE GROUP INSTRUCTION, please complete questions 8 through 11:

8. To what degree did you participate in discussions that occurred in your group?

____

1 2 3 4 5
Not at all Moderately Extensively

9. To what degree did the other group members participate in discussions that occurred in your group?

____

1 2 3 4 5
Not at all Moderately Extensively
10. How would you describe the interactions that occurred in your group?

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11. How well do you feel you would have learned I. V. Therapy with the IVI program if you had been working alone? I would have done:

- ___ better
- ___ about the same
- ___ not as well
APPENDIX C

Expected Learner Outcomes (Price, 1990, p. 5)

Chapter I
1. Define the term intravenous infusion.
2. Select the correct purpose for using intravenous therapy in five clinical situations.
3. Critique five IV infusion orders, and explain the error made in each order.

Chapter II
1. Identify factors to be considered when selecting an IV solution for administration.
2. Identify the reasons why an IV solution is not suitable for administration in two given clinical situations.
3. Choose the IV administration tubing that is indicated by a simulated infusion order.
4. State verbally or in writing the purpose of priming IV tubing.
5. Perform all critical behaviors that are required to prime tubing for the administration of intravenous fluids, using an IV bag or IV bottle.
6. Prepare a time tape, and determine the hourly fluid level indicated by two simulated physicians orders.
APPENDIX D

Pilot Test on I. V. Therapy

Directions: Please answer test items on answer sheet and not on the test. Use a #2 pencil only. Complete the last four digits of your social security number under the section entitled Identification Number on the left side of the answer sheet. Fill in the circle that corresponds with your answer. Be careful to fill in the entire circle. If you erase, be certain to erase completely. Do not make any stray marks on the answer sheet. There is only one best answer for each test item.

(* indicates correct choice)

1. When reviewing Mr. Schmidt’s lab data, the nurse detects an electrolyte deficiency. Which I. V. solution would most likely correct the imbalance?
   a. 5% Dextrose in Water
   b. Dextran
   c. Lipids
   d. Lactated Ringers *

2. Which nursing action should be included in the plan of care for Mrs. Thomas because she is receiving an I. V. of Dextran?
   a. Weigh daily.
   b. Assess electrolyte status through lab tests.
   c. Catheterize the patient to accurately measure output.
   d. Monitor blood pressure. *

3. D5/W is classified as which type of solution?
   a. nutrient *
   b. electrolyte
   c. alkalyzing
   d. acidifying

4. Hyperalimentation is used to:
   a. promote catabolism
   b. restore plasma volume
   c. promote anabolism *
   d. restore electrolyte balance
5. The nurse observes that an I. V. is behind schedule. The most appropriate action is to first check the:
   a. container's label
   b. medication record
   c. physician's order sheet *
   d. medication label

6. Ms. Erwine is receiving hyperalimentation. Which is the best indication that this treatment is effective?
   Ms. Erwine:
   a. gains weight *
   b. resumes a normal range of electrolytes
   c. maintains her baseline blood pressure
   d. urinates more.

7. Excessive blood loss causes low blood volume. Which of the following products is a plasma volume expander given to increase circulating blood volume?
   a. Dextran *
   b. Lipid Infusion
   c. Platelets
   d. Lactated Ringers

8. Mary Lou Brown, 18 years old, is admitted in a catabolic state. In an effort to promote anabolism, the physician is likely to prescribe:
   a. Hyperalimentation *
   b. Lactated Ringer's Solution
   c. Plasma Volume Expander
   d. 5% Dextrose in Water

9. All of the following observations may be indicative of contaminated I. V. solution EXCEPT:
   a. floating particles
   b. cloudy solution
   c. colorless solution *
   d. uncovered seal
10. When inspecting an I. V. container of 5% Dextrose in Water, the nurse observes that the solution is yellow in color. The most appropriate action by the nurse is to first:
   a. consider the solution contaminated and discard it
   b. check for a medication label and additives *
   c. report to the physician
   d. consider the solution contaminated and return it to the pharmacy

11. The nurse is to administer small amounts of I. V. solution. In setting up the necessary I. V. equipment, the nurse would choose:
   a. extension tubing with a stopcock
   b. primary tubing
   c. secondary tubing
   d. a volume control set *

12. An I. V. solution is prescribed to infuse at 125ml/hour. At the end of the third hour, the fluid level will be at which mark on the 1000cc I. V. container?
   a. 500ml
   b. 375ml *
   c. 250ml
   d. 125ml

13. Which nursing action has the highest priority when priming I. V. tubing?
   a. invert filters and Y connectors
   b. fill drip chamber 1/2 full
   c. prevent contamination of solution and tubing *
   d. close clamp prior to spiking I. V. container

14. Which is the best indication that I. V. tubing has been primed properly?
   a. absence of large airspaces *
   b. filled drip chamber
   c. closing of clamp
   d. absence of small air bubbles in Y connector
15. Which assessment data may indicate a contaminated I. V. container?
   a. intact container
   b. condensation on the container
   c. uncovered seal *
   d. colorless solution

16. The physician orders 1000cc Lactated Ringer's to infuse slowly over 24 hours. The I. V. tubing that the nurse will choose is:
   a. vented
   b. non-vented
   c. microdrip *
   d. macrodrip

17. In order to avoid introducing air into the patient's vein during administration of I. V. solution, the nurse must:
   a. milk the tubing
   b. fill the drip chamber half full
   c. clamp the tubing when transporting patient
   d. prime the tubing *

18. Which size I. V. container would the nurse select for an infusion that has been ordered to infuse slowly over 24 hours:
   a. 1000cc
   b. 500cc *
   c. 100cc
   d. 50cc

19. The nurse is preparing the next I. V. container, a bottle of D5/W. 75cc remains in the infusing bottle. When inspecting the new bottle, the nurse observes a hairline crack in the bottle, the bottle is not leaking, the solution has not expired, and this is the last I. V. bottle on the unit. The nurse will:
   a. infuse the new bottle since it is not leaking
   b. discontinue the infusing bottle of solution and discard
   c. infuse the new bottle of solution until another one is located
   d. slow the infusing I. V. and obtain another bottle *
20. When priming I. V. tubing, the nurse introduces the piercing pin into the bag through the:
   a. drip chamber
   b. insertion port *
   c. injection port
   d. needle adapter

21. When priming I.V. tubing, the roller clamp is usually closed immediately:
   a. after inverting the I. V. container
   b. before inserting the piercing pin into the container *
   c. after filling the drip chamber half full with solution
   d. before passing the solution through the tubing

22. When checking the I. V. bag for integrity, the nurse is aware that:
   a. most solutions are clear
   b. condensation is initially wiped off *
   c. the seal should be uncovered
   d. particles may indicate contamination

23. Tammy Homer, 14 months old, is receiving an I. V. infusion. The I. V. tubing the nurse would choose to use is:
   a. vented
   b. macrodrip
   c. microdrip *
   d. non-vented

24. When priming I. V. tubing and the fluid level in the drip chamber is too high, the nurse:
   a. repeatedly squeezes the drip chamber
   b. inverts the container and squeezes fluid back into the container *
   c. squeezes the drip chamber which forces fluid back into the container
   d. opens the clamp and permits fluid to flow out of the tubing
25. When priming I. V. tubing and air bubbles are found near the drip chamber, the nurse should:
   a. hold the tubing taut and flick the tubing until the air bubbles rise into the injection port
   b. remove the cap and allow the bubbles to flow through the tubing
   c. hold the tubing taut and flick the tubing until the air bubbles rise into the drip chamber *
   d. aspirate the air bubbles from the injection port with a needle and syringe

26. The nurse hangs a 1000cc container of I. V. solution at 9am. The physician prescribed 125 cc/hour. The fluid has been infusing at the prescribed rate. At 12 noon, how much solution should have been infused into the patient?
   a. 375 cc *
   b. 500 cc
   c. 625 cc
   d. 750 cc

27. The nurse hangs an I. V. container of 1000cc 5% Dextrose and Water at 7:30am. The physician prescribed 100cc/hour. The fluid has been infusing at the prescribed rate. How much fluid is remaining in the container at 3:30pm?
   a. 100cc
   b. 200cc *
   c. 300cc
   d. 400cc

28. The nurse hangs a 500cc container of Lactated Ringer's Solution at 11:30am. The physician prescribed 50cc/hour. The fluid has been infusing at the prescribed rate. How much fluid is remaining in the container at 3:30pm?
   a. 200cc
   b. 250cc
   c. 300cc *
   d. 350cc
29. When priming I. V. tubing, the nurse observes air bubbles near the needle adapter. The best method for removing these air bubbles is to:
   a. release the clamp and allow the air bubbles to flow out of the tubing *
   b. insert a needle and syringe into the injection port and aspirate the air
   c. flick the tubing and move the air into the drip chamber
   d. release the clamp and allow the air to rise into the injection port

30. A non-vented bottle of Lactated Ringer’s solution is currently infusing. What type of tubing would be chosen with this container?
   a. non-vented
   b. microdrip
   c. macrodrip
   d. vented *
APPENDIX E

Approval by Widener University
to Conduct Pilot Study

WIDENER UNIVERSITY
SCHOOL OF NURSING
Review of Research Proposal for the Protection of Human Subjects

NAME OF INVESTIGATOR Antoinette Battista Calderone RN, MSN, DNSc (Candidate)

ADDRESS OF INVESTIGATOR

TITLE OF RESEARCH PROJECT Investigation of the Effect of Interactive Video Instruction (IVI) with Three Modes of Instruction on Learning and Attitude towards the Instructional Media

This is to certify that the above referenced application, which does propose activities involving human subjects, was reviewed in accordance with School of Nursing guidelines.

TYPE OF REVIEW _X__ INFORMAL

ACTION

APPROVED AS SUBMITTED

APPROVED CONTINGENT ON REVISIONS

DEFERRED FOR SUBSTANTIVE CHANGES

DISAPPROVED

If any part of the research procedure is changed during the study, a copy of the change must be submitted to the Research Committee.

Date 4/17/91
Signature, Chair, Research Committee

Date 4/17/91
Signature, Committee Member
APPENDIX F

Approval by University
to Conduct Pilot Study

Original removed from Dissertation Copy to maintain anonymity of the institution.
APPENDIX G

Letter of Explanation to Faculty

Partaking in Pilot Study

Dear Faculty,

The purpose of this research is to expand the nursing knowledge related to learning and computer instruction in nursing education through pilot testing of two instruments. To further explain, the computer technology under investigation is Interactive Video Instruction (IVI). IVI, an instructional medium, is a combination of computer and videodisc. The I. V. Therapy Program, marketed by Fuld Institute for Technology in Nursing Education (FITNE), is an IVI program.

The I. V. Therapy Program is a required assignment in your nursing curriculum. In order to keep my research to one session, I am limiting the study to Chapters 1 and 2. I am requesting that the students complete a Pre-treatment Data Sheet focusing on student demographics. The students will then view both chapters of the IVI program and complete a questionnaire measuring their knowledge of I. V. Therapy through test items. In time, completion of both questionnaires equates to approximately 35
I am requesting that you collect separately each of the completed questionnaires, place them in their individual envelopes, seal them, and return them to me. Confidentiality is maintained since the questionnaires are anonymous and are collected separately. The last four digits of the student's social security number are requested in order to correlate data and explore relationships of information provided on the questionnaires. This is a method of coding data but their identity remains unknown. The students are reminded that their responses in no way affect their course grade or their status as a nursing student.

Students are to be given the choice regarding participation in the study. If they choose not to participate, students omit signing the consent form and completing any questionnaires. If the students choose to participate, the students are to sign the consent form which will then be collected, placed in an envelope, and sealed. An overview of the pilot study and further directions are provided on the accompanying memorandum entitled Directives Regarding the Design of the Pilot Study.

Due to limited research, the findings of this
study will be significant to the nursing knowledge base related to learning and computer education. The findings will determine reliability of a researcher designed test which will be utilized in a larger scale study.

I appreciate your time and assistance in broadening the knowledge base regarding the effectiveness of computer instruction in nursing education.

Sincerely,

Antoinette Calderone RN, DNSc Candidate
APPENDIX H

Directives Regarding the Design
of the Pilot Study

To: Proctor
From: Antoinette Calderone RN, DNSc Candidate
Re: Directives

Please read the following overview which briefly describes the research method relating to the pilot study. Announce to students the starred (*) items before they view I. V. Therapy.

1) An overview of the pilot study design includes the following:

   students will read Letter of Explanation to Students
   faculty will answer questions
   students will read and sign Student Consent Form which will be collected, placed in an envelope, and sealed
   students will complete the Pre-treatment Data Sheet which will be collected, placed in an envelope, and sealed
   in one session, announce directions to the students from this memorandum before viewing the IVI program; students will view Chapters 1 and 2 of the IVI
program in a consistent fashion, that is, either individually or in a group, based upon hardware availability and time constraints for completion of the program; students will individually complete the Pilot Test on I. V. Therapy immediately after viewing the program which will be collected, placed in an envelope, and sealed; at the conclusion of the study, all instruments will be forwarded to the researcher.

* 2) Students will view Chapter 1. When viewing Chapter 2, include four sections, help sections, and both options for priming tubing and time tape. For example, with priming tubing, include both bag and bottle and with time tape, include manufacturer and handmade.

* 3) Immediately after viewing Chapters 1 and 2 of the I. V. Therapy Program, complete the Pilot Test on I. V. Therapy.

* 4) No assistance other than initial directions can be provided to students regarding the test; read the directions on the test before starting and take the test individually and without discussion; technical assistance in progressing through the program can be furnished.

5) Proctor will assess approximate time for
completion of the IVI program and each of the instruments by the students.

* 6) All questionnaires will be obtained from and returned to the proctor.

7) The proctor will then forward the questionnaires to the researcher for analysis.
APPENDIX I
Letter of Explanation to Students
Partaking in Pilot Study

Dear Student,

The purpose of this research is to expand the nursing knowledge related to learning and computer instruction in nursing education through pilot testing of two instruments. To further explain, the computer technology under investigation is Interactive Video Instruction (IVI). IVI, an instructional medium, is a combination of computer and videodisc. The I. V. Therapy Program, marketed by Fuld Institute for Technology in Nursing Education (FITNE), is an IVI program.

The I. V. Therapy Program is a required assignment in your nursing curriculum. In order to keep my research to one session, I am limiting the study to Chapters 1 and 2. I am requesting that you complete a Pre-treatment Data Sheet focusing on student demographics. You will then view both chapters of the IVI program and complete a questionnaire relating to your knowledge of I. V. Therapy through test items. In time, completion of both questionnaires equates to
approximately 35 minutes.

Data will be collected by one of your faculty who will place completed questionnaires in their individual envelopes, seal them, and return them to me. Confidentiality is maintained since the questionnaires are anonymous and are collected separately. The last four digits of your social security number are requested in order to correlate data and explore relationships of information provided on the questionnaires. This is a method of coding data but your identity remains unknown. Your responses in no way affect your course grade or your status as a nursing student in your school.

If you choose not to participate in the study, don’t sign the consent form which accompanies this letter. You will not complete the questionnaires. If you choose to participate, sign the consent form which will be collected, placed in an envelope, and sealed.

Due to limited research, the findings of this study will be significant to the nursing knowledge base related to learning and computer education. The findings will determine reliability of a researcher designed test which will be utilized in a larger scale research study.
I appreciate your time and assistance in broadening the knowledge base regarding the effectiveness of computer instruction in nursing education.

Sincerely,

Antoinette Calderone RN, DNSc Candidate
APPENDIX J
Informed Consent Form
Pilot Study
Widener University
School of Nursing
Title of Investigation: Investigation of the Effect of IVI with Three Modes of Instruction on Learning and Attitude towards the Instructional Media
Investigator: Antoinette Battista-Calderone RN, MSN, DNSc Candidate
Date: ________________

This is to certify that I, ________________, hereby agree to participate as a volunteer in a research study as an authorized part of the education and research program of Widener University, School of Nursing.

I understand that my part in the investigation has been defined and fully explained to me by ________________, and I understand the explanation. A copy of the procedure of this investigation has been provided to me and has been discussed in detail with me.

I understand that my part in the study involves viewing Chapters I and II of the IVI program on I. V.
Therapy which takes approximately 1 to 1 1/2 hours, and completing two brief questionnaires. The total time for completing the questionnaires will be approximately 35 minutes. I have been given an opportunity to ask whatever questions I may have had and all such questions and inquiries have been answered to my satisfaction.

I understand that I am free to deny any answers to specific items or questions on questionnaires.

I understand that all data or answers to questions will remain confidential with regard to my identity.

I understand that my decision to participate or not participate in the study will not influence my course grade in any way.

I FURTHER UNDERSTAND THAT I AM FREE TO WITHDRAW MY CONSENT AND TERMINATE PARTICIPATION AT ANY TIME.

__________________________  __________________________
Date                          Subject's Signature
APPENDIX K

Test on I. V. Therapy

DIRECTIONS: Please answer test items on answer sheet and not on the test. Use a #2 pencil only. Complete the last four digits of your social security number under the section entitled Identification Number on the left side of the answer sheet. Fill in the circle that corresponds with your answer. Be careful to fill in the entire circle. If you erase, be certain to erase completely. Do not make any stray marks on the answer sheet. There is only one best answer for each test item.

(* indicates correct choice)

1. When reviewing Mr. Schmidt's lab data, the nurse detects an electrolyte deficiency. Which I. V. solution would most likely correct the imbalance?
   a. 5% Dextrose in Water
   b. Dextran
   c. Lipids
   d. Lactated Ringers*

2. D5/W is classified as which type of solution?
   a. nutrient*
   b. electrolyte
   c. alkalyzing
   d. acidifying

3. Total Parenteral Nutrition is used to:
   a. promote catabolism
   b. restore plasma volume
   c. promote anabolism*
   d. restore electrolyte balance

4. Mary Lou Brown, 18 years old, is admitted in a catabolic state. In an effort to promote anabolism, the physician is likely to prescribe:
   a. Hyperalimentation*
   b. Lactated Ringer's Solution
   c. Plasma Volume Expander
   d. 5% Dextrose in Water

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5. All of the following observations may be indicative of contaminated I. V. solution EXCEPT:
   a. floating particles
   b. cloudy solution
   c. colorless solution*
   d. uncovered seal

6. The nurse is to administer small amounts of I. V. solution. In setting up the necessary I. V. equipment, the nurse would choose:
   a. extension tubing with a stopcock
   b. primary tubing
   c. secondary tubing
   d. a volume control set*

7. An I. V. solution is prescribed to infuse at 125ml/hour. At the end of the third hour, the fluid level will be at which mark on the 1000cc I. V. container?
   a. 500ml
   b. 375ml*
   c. 250ml
   d. 125ml

8. Which is the best indication that I. V. tubing has been primed properly?
   a. absence of large airspaces*
   b. filled drip chamber
   c. closing of clamp
   d. absence of small air bubbles in Y connector

9. Which assessment data may indicate a contaminated I. V. container?
   a. intact container
   b. condensation on the container
   c. uncovered seal*
   d. colorless solution

10. The physician orders 1000cc Lactated Ringer’s to infuse slowly over 24 hours. The I. V. tubing that the nurse should choose is:
    a. vented
    b. non-vented
    c. microdrip*
    d. macrodrip
11. In order to avoid introducing air into the patient’s vein during administration of I. V. solution, the nurse must:
   a. milk the tubing
   b. fill the drip chamber half full
   c. clamp the tubing when transporting patient
   d. prime the tubing*

12. Which size I. V. container would the nurse select for an infusion that has been ordered to infuse slowly over 24 hours?
   a. 1000cc
   b. 500cc*
   c. 100cc
   d. 50cc

13. When priming I. V. tubing, the nurse introduces the piercing pin into the bag through the:
   a. drip chamber
   b. insertion port*
   c. injection port
   d. needle adapter

14. When priming I. V. tubing, the roller clamp is usually closed immediately:
   a. after inverting the I. V. container
   b. before inserting the piercing pin into the container*
   c. after filling the drip chamber half full with solution
   d. before passing the solution through the tubing

15. When checking the I. V. bag for **integrity**, the nurse is aware that:
   a. most solutions are clear
   b. condensation is initially wiped off*
   c. the seal should be uncovered
   d. particles may indicate contamination

16. Tammy Homer, 14 months old, is receiving an I. V. infusion. The I. V. tubing the nurse would choose to use is:
   a. vented
   b. macrodrip
   c. microdrip*
   d. non-vented

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17. When priming I. V. tubing and air bubbles are found near the drip chamber, the nurse should:
   a. hold the tubing taut and flick the tubing until the air bubbles rise into the injection port
   b. remove the cap and allow the bubbles to flow through the tubing
   c. hold the tubing taut and flick the tubing until the air bubbles rise into the drip chamber*
   d. aspirate the air bubbles from the injection port with a needle and syringe

18. The nurse hangs an I. V. container of 1000cc 5% Dextrose and Water at 7:30am. The physician prescribed 100cc/hour. The fluid has been infusing at the prescribed rate. How much fluid is remaining in the container at 3:30pm?
   a. 100cc
   b. 200cc*
   c. 300cc
   d. 400cc

19. The nurse hangs a 500cc container of Lactated Ringer’s Solution at 11:30am. The physician prescribed 50cc/hour. The fluid has been infusing at the prescribed rate. How much fluid is remaining in the container at 3:30pm?
   a. 200cc
   b. 250cc
   c. 300cc*
   d. 350cc

20. A non-vented bottle of Lactated Ringer’s Solution is currently infusing. What type of tubing would be chosen with this container?
   a. non-vented
   b. microdrip
   c. macrodrip
   d. vented*
APPENDIX L

Author Consent Permitting Use of Attitude Tool

Lois Ryan Allen, PhD, RN

Nursing Research & Theory Development
Education & Computer Applications

December 3, 1990

Antoinette Battista-Calderone

Dear Antoinette,

I am pleased that you are interested in using my Attitude Towards Computer Assisted Instruction semantic differential tool in your doctoral dissertation research and give you full permission to reproduce and use the tool as you requested. I would ask that all copies of the tool carry my copyright notice at the bottom of the page.

For your convenience, I have enclosed full page copies of the Attitude Towards CAI tool and directions for subjects' use. Please feel free to reproduce these directly if you would like. Also enclosed is a copy of the scoring guide for the tool.

I wish you every success with your research efforts and I look forward to reading your dissertation in the near future.

Sincerely yours,

Lois R. Allen, PhD, RN
Associate Professor

Encl.
APPENDIX M

Attitude Toward CAI Semantic Differential Tool

code no. _____

COMPUTER ASSISTED INSTRUCTION

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</tbody>
</table>

Copyright 1985 by Lois R. Allen

Inquiries to: Lois R. Allen, Ph.D., R.N., Widener University, School of Nursing, Chester, PA 19013

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SEMANTIC DIFFERENTIAL SCALES

DIRECTIONS: This is not a test; there are no right or wrong answers. The purpose of the scales is to measure the meaning that certain concepts have for individuals. On the next page you will find a concept to be rated and beneath it a set of adjective scales like the one shown in the example below. Here is how you are to use these scales:

EXAMPLE:

powerful :___:___:___:___:___:___:____: weak

If you feel that the concept is very closely related to one end of the scale, you should place your mark as follows:

powerful :_X_:___:___:___:___:___:____: weak

or

powerful :___:___:___:___:___:___:____: weak

If you feel that the concept is quite closely related to one end of the scale, you should place your mark as follows:

powerful :___:___:___:___:___:___:___: weak

or

powerful :___:___:___:___:___:___:____: weak

If you feel that the concept is only slightly related to one end of the scale, you should place your mark as follows:

powerful :___:___:___:___:___:___:___: weak

or

powerful :___:___:___:___:___:___:____: weak

If you feel that the concept is neutral, equally associated with both sides of the scale, or is completely irrelevant, you should place your mark in the middle space as follows:

powerful :___:___:___:___:___:___:___: weak

Make an independent judgment on each descriptive scale. Do not try to remember how you marked similar items. Work at a fairly high speed, recording your first impression or feeling about an item. Do not skip any items. Do not put more than one check-mark on a single adjective scale.
APPENDIX N

Permission to Use I. V. Therapy Program

December 26, 1990

Annette Calderone

Dear Ms. Calderone:

The purpose of this letter is to give our permission to use Intravenous Therapy for research connected with your dissertation, with the following conditions:

In light of this permission, we ask that you acknowledge that the program was developed jointly by FITNE and Hocking College. Hocking College owns the copyright and has granted FITNE exclusive marketing rights.

The permission given in this letter is solely for the research use of the program for the dissertation and does not include permission for any other research, unless specifically asked for.

It must be clear that we provide the program in its current form, and any alterations you may make for experimental purposes are solely your responsibility.

We would like to receive a copy of your study after it has been completed. This may take the form of a report, rather than the complete dissertation, if that proves to be easier for you.

If any of these conditions should present problems for you, please give me a call to discuss it. I wish you luck with your study and urge you to pursue it aggressively; the technology and nursing education both need carefully conceived and well executed research to understand how effective this technology is.

Sincerely,

[Redacted]

Managing Director

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January 22, 1990

Annette Calderone
Luzerne County Community College

Dear Annette,

This letter is in response to your questions about evaluation during the design of Intravenous Therapy. There was a formative evaluation that was conducted during the development of the program. Marjorie Cambry, who is an Associate Professor at Ohio State University in the College of Education, Department of Educational Policy and Leadership, used her formative evaluation model and several instruments to give us feedback which was incorporated into the final product.

First Phase - 1985
Early versions of the script and storyboard were reviewed by the skills laboratory coordinator at Hocking Technical College. Revisions were made based on her suggestions. Also, the in-house instructional designer made several comments.

Second Phase - 1985
The scripts were sent to nurse educators at six schools of nursing across the country. These individuals had been participants at an interactive video developers' workshop which had been held a few months prior to the review. Several comments were made and were incorporated into a revision of the script.

Third Phase - 1986
Dr. Cambry had two nursing students from Ohio State University worked through the storyboard and script for Chapter 1 and tried to answer the questions. They were interviewed by the evaluator. Recommendations were made based on the students comments.

Later, four nursing students from Ohio State reviewed Chapters 2, 3, 5 and 6 by reading the scripts and answering the questions. Recommendations were made based on interviews with the students.

Fourth Phase - 1986
After revisions were made, the scripts were reviewed by Dr. Cambry and her instructional design colleagues. Detailed comments were made about each scene and suggestions were given.
Fifth Phase - 1986.1987
The scripts were revised and reviewed by a few of the faculty members at Hocking Technical College including the skills laboratory coordinator. The scripts were used to create the videotape. Faculty members watched the videotape and made comments. The videotape was re-edited after it was deemed unacceptable to show the procedures without gloves.

Sixth Phase - 1987.1988
Laserdiscs were pressed and the first version of the program was authored using Quest. Various chapters were used with nursing students at Hocking Technical College. These included students in Quarter 2, Quarter 3, Quarter 6 and the Enrichment quarter (bridge from LPN to ADN course of study). Students were observed using the program and were interviewed regarding their attitudes. Also, observations were made regarding their ability to perform the procedures based on the information learned. Faculty who worked with the students after viewing the programs were interviewed as well. Approximately 120 to 200 students in each of the four quarters used this version of the program.

Revisions were made in the script and videotape. A second version of the laserdisc was pressed and programmed.

The new version of the interactive program was used with Hocking Technical College students. Changes in the computer control program were made. It was at this time that we distributed the program to other schools of nursing. This version is officially called Version 1.0.

Eighth Phase - 1989
A second version of the computer control program was released last fall. There is no update planned in the immediate future.

The schools of nursing that have received the program have been asked to do some evaluation up to this point. A brief questionnaire for students who have viewed Intravenous Therapy was sent to the demonstration site schools and we have already received a few of those. They will be analyzed at a later date.

We plan on conducting a much more detailed evaluation of interactive video use this spring. Intravenous Therapy itself will not be evaluated but rather interactive video in general with Intravenous Therapy perhaps being one of the programs that is included in the evaluation process. Dr. Cambry will be working with us on this comprehensive project.

Enclosed is a copy of the general information that Dr. Cambry included with her evaluation summaries for Hocking Technical College. I hope this information is helpful, Annette. Please let me know if I can be of further help. Keep up the good work!

Sincerely,

Julie McAfooes

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APPENDIX P

Approval by Widener University
to Conduct Research Study

WIDENER UNIVERSITY
SCHOOL OF NURSING

Review of Research Proposal for the Protection of
Human Subjects

NAME OF INVESTIGATOR Antoinette Battista Calderone RN, MSN, DNSc (Candidate)

ADDRESS OF INVESTIGATOR

TITLE OF RESEARCH PROJECT Investigation of the Effect of Interactive Video Instruction (1992) with Three Modes of Instruction on Learning and Attitude towards the Instructional Media

This is to certify that the above referenced application, which does propose activities involving human subjects, was reviewed in accordance with School of Nursing guidelines.

TYPE OF REVIEW ☑ INFORMAL

☐ EXPEDITED

☐ FULL

ACTION ☑ APPROVED AS SUBMITTED

☐ APPROVED CONTINGENT ON REVISIONS

☐ DEFERRED FOR SUBSTANTIVE CHANGES

☐ DISAPPROVED

If any part of the research procedure is changed during the study, a copy of the change must be submitted to the Research Committee.

COMMENTS/RECOMMENDATIONS

[Handwritten notes]

Date 8/6/91

8/6/91
APPENDIX Q

Approval by Institutional or Departmental Research Committees

Original removed from Dissertation Copy to maintain anonymity of the institution.
APPENDIX R

Letter to Dean or Chairperson of the Nursing School

Antoinette Battista-Calderone RN, DNSc (Candidate)

August 6, 1991

Dear

Successful oral defense of my doctoral dissertation proposal at Widener University permits me to forward the final version of my research instruments. Enclosed is a copy for your review. Please return the enclosed School Consent Form as soon as possible in the self-addressed, stamped envelope.

Since I have had telephone contacts with , if both of you are in agreement, I ask that you consider to be the liaison faculty member. We previously discussed an overview of the research study and methods of incorporation into the structure of the nursing program at University.

I want to express my appreciation for the willingness, cooperation, cordiality, and professionalism shown by both you and . Doctoral research is certainly made more feasible when working with professionals such as yourselves.

Sincerely,

Antoinette Battista-Calderone RN, MSN, DNSc (Candidate)
APPENDIX S

Consent from the Schools to Participate in the Study

Original removed from Dissertation Copy to maintain anonymity of the institution.
Original removed from Dissertation Copy to maintain anonymity of the institution.
Original removed from Dissertation Copy to maintain anonymity of the institution.
Original removed from Dissertation Copy to maintain anonymity of the institution.
Dear Liaison Faculty,

The purpose of this research is to expand the nursing knowledge base related to learning, students' attitude towards instructional media, and computer instruction in nursing education. More specifically, this research will explore effectiveness of three modes of instruction with computer technology.

The computer technology under investigation is Interactive Video Instruction (IVI), an instructional media, which combines computer and videodisc. The I. V. Therapy Program, marketed by Fuld Institute for Technology in Nursing Education (FITNE), is an IVI program. Historically, computer instruction was designed for individual student use, that is, one student to one computer.

Educators have examined the effect of groups on learning and attitude based upon the assumption that behavior is influenced by the actions of others. Limited research exists in the study of using group mode of instruction with computer technology. Thus, I, the researcher, am interested in examining the effects
of IVI on learning and attitude towards the instructional media using three modes of instruction, that is, individual, small group (2-3), and larger group (7 or more) of nursing students.

The I. V. Therapy Program is a required assignment in your nursing curriculum. In order to keep my research to one session, I am limiting this study to Chapters 1 and 2. I am requesting that the students view both chapters according to the experimental group in which they were randomly assigned, that is, individually, in a small group, or in a larger group. I am also requesting that the students complete three brief questionnaires before and after the I. V. Therapy Program. One questionnaire relates to student demographics, one to their impression of the teaching strategy, one to their knowledge of I. V. Therapy through test items, and one on attitude towards the IVI. In time, completion of the questionnaires equates to approximately 40-60 minutes.

I am requesting that you collect each of the completed questionnaires separately, place them in their individual envelopes, seal them, and return them to me. Confidentiality is maintained since the questionnaires are anonymous and are collected.
separately. The last four digits of the student's social security number are requested in order to correlate data and explore relationships of information provided on the questionnaires. This is a method of coding data but student identity remains unknown. The students are reminded that their responses in no way affect their course grade or their status as a nursing student.

Students are given the choice regarding participation in the study. If they choose not to participate, students omit signing the consent form and completing any questionnaires. If the students choose to participate, the students are to sign the consent form which will then be collected, placed in an envelope, and sealed. An overview of the study and further directions are provided on the memorandum entitled Directives Regarding the Design of the Research Study.

Due to limited research in the area of IVI and group mode of instruction, the findings of this study will be significant especially to nursing education. The research will also contribute to issues of cost effectiveness since fewer computer systems and instructional programs will be required if group
learning is at least as effective a mode of instruction as individualized learning.

I appreciate your time and assistance in broadening the knowledge base regarding the effectiveness of computer instruction in nursing education.

Sincerely,

Antoinette Calderone RN, MSN, DNSc Candidate
APPENDIX U

Directives Regarding the Research Design

To: Proctor (Faculty and/or Computer Lab Staff)
From: Antoinette Calderone RN, MSN, DN5c Candidate
Re: Directives

Please read the following overview which briefly describes the research method. Announce to students the starred (*) items before they view I. V. Therapy.

1) An overview of the research design includes the following:

   a) students will read Letter of Explanation to Students

   b) faculty will answer questions

   c) students will read and sign Student Consent Form which will be collected, placed in an envelope, and sealed by faculty

   d) during the same or separate session, faculty will randomly assign students to an experimental group and the students will complete the Pre-treatment Data Sheet, Test on I. V. Therapy, and Attitude Toward CAI Semantic Differential Tool in one session; each instrument will be collected separately, placed in their individual envelope, and sealed by
faculty

e) structure of physical facility may necessitate at this point the involvement of computer lab staff who would proctor students during the I. V. Therapy Program and during completion of the remaining three brief questionnaires; please inform the computer lab staff in advance of the study through a Letter of Explanation to the Proctor and this memorandum entitled Directives Regarding the Design of the Research Study

f) in one session, the proctor (either faculty or computer lab staff) announces directions to students from this memorandum before viewing the IVI program; students will then view Chapters 1 and 2 as randomly assigned, that is, individually, in a small group, or in a larger group and complete the Post-treatment Data Sheet, Test on I. V. Therapy, and Attitude Toward CAI Semantic Differential Tool; each instrument will be collected separately, placed in their envelope, and sealed; at the conclusion of the study, all instruments will be given to the involved faculty member who will forward to the researcher.

2) Random assignment of students will involve the following:

a) faculty will receive a list of random
numbers from the researcher corresponding to the total number of eligible students who can participate in the study.

b) students will be numbered sequentially as they volunteer to participate in the study.

c) students will then be assigned according to the list of random numbers across the three groups until each group is approximately equal in size.

* 3) Students viewing the program individually or in a small group (2-3 students) can use a single computer terminal.

* 4) Students viewing the program in a large group (7 or more) will do so using a wall projector which projects the program on the wall for easier viewing.

* 5) Students will view Chapter 1 according to their randomly assigned experimental group, that is, individual, small group, or large group basis. When viewing Chapter 2, include the help sections and the four menu options, that is, select solution, select tubing, prime tubing, and time tape. With prime tubing and time tape, include both options. For example, with prime tubing, view priming both I. V. bag and bottle and with time tape, preparing a handmade and manufactured time tape. Students may review content in
either chapter as often as needed during this session.

* 6) Immediately after viewing the two chapters of
the I. V. Therapy Program, complete the three brief
questionnaires held by the faculty member or the
computer lab staff (proctor).

* 7) No assistance other than initial tool
directions can be provided to students regarding the
Test on I. V. Therapy or the Attitude Tool; read the
directions pertaining to each instrument before
starting; students are to complete the test and
attitude tool individually and without discussion;
technical assistance in progressing through the IVI can
be furnished.

* 8) Record the time the I. V. Therapy Program was
started and the time ended to provide total viewing
time.

* 9) All questionnaires will be obtained from and
returned to the proctor.

10) The proctor will return the questionnaires to
the involved faculty member who will then forward to
the researcher.

11) If you have any questions relating to the
random assignment of students to treatment groups or
any aspect of the data collection method, please do not
hesitate to contact me at [REDACTED] (especially during morning hours).
To: Proctor
From: Antoinette Calderone RN, MSN, DNSc Candidate
Re: List of Random Numbers

1) Number students sequentially (1, 2, 3, etc.) as they volunteer to participate in the study.

2) Refer to the following SAMPLE list of random numbers that accounts for 21 possible subjects:

   12, 9, 20, 6, 5, 15, 19, 2, 17, 11,
   3, 10, 8, 1, 4, 19, 7, 13, 14, 18, 21

3) Read across the line and assign students according to the list across the three groups until each group is approximately equal in size, for example,

   Group I | Group II | Group III
   (individual basis) | (small group) | (large group)
   12 | 9 | constitutes 20
   6 | 5 | a group 15
   19 | 2 | 17 constitutes
   11 | 3 | a group 10
   8 | 1 | 4 a group
   19 | 7 | 13
   14 | 18 | a group 21

4) If less than 21 students volunteer, disregard those numbers in the list that do not pertain to your students; for example, if 15 students volunteer using the list above, student #12 is assigned to Group I, #9 to Group II, #6 to Group III, etc.

5) Attached is your list of random numbers that accounts for the total possible number of students in

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your group. Students may not choose the treatment group. Random assignment must be followed in order to maintain the integrity of the study.
APPENDIX V

Letter of Explanation to Course Teacher(s)

Dear Faculty,

The purpose of this research is to expand the nursing knowledge base related to learning, students’ attitude towards instructional media, and computer instruction in nursing education. More specifically, this research will explore effectiveness of three modes of instruction with computer technology.

The computer technology under investigation is Interactive Video Instruction (IVI), an instructional media which combines computer and videotdisc. The I. V. Therapy Program, marketed by Fuld Institute for Technology in Nursing Education (FITNE), is an IVI program. Historically, computer instruction was designed for individual student use, that is, one student to one computer.

Educators have examined the effect of groups on learning and attitude based upon the assumption that behavior is influenced by the actions of others. Limited research exists in the study of using group mode of instruction with computer technology. Thus, I, the researcher, am interested in examining the effects
of IVI on learning and attitude towards the instructional media using three modes of instruction, that is, individual, small group, and larger group of nursing students. The students in your baccalaureate nursing school will be asked to participate in this research study.

The I. V. Therapy Program is a required assignment in your nursing curriculum. In order to keep my research to one session, I am limiting this study to Chapters 1 and 2. I am requesting that your students view both chapters according to the experimental group in which they will be randomly assigned. I am also requesting that the students complete three brief questionnaires both before and after the I. V. Therapy which take approximately 40-60 minutes in total. I need your assistance in announcing to the students that this study will be occurring during the current semester and that they will receive further information from one of your faculty who is willing to act as a liaison.

Due to limited research in the area of IVI and group mode of instruction, the findings of this study will be significant especially to nursing education. The research will also contribute to issues of cost
effectiveness since fewer computer systems and instructional programs will be required if group learning is at least as effective a mode of instruction as individualized learning.

I appreciate your time and assistance in broadening the knowledge base regarding the effectiveness of computer instruction in nursing education.

Sincerely,

Antoinette Calderone RN, MSN, DNSc Candidate
Dear Student,

The purpose of this research is to expand the nursing knowledge base related to learning, students' attitude towards instructional media, and computer instruction in nursing education. More specifically, this research will explore effectiveness of three modes of instruction with computer technology.

The computer technology under investigation is Interactive Video Instruction (IVI), an instructional media, which combines computer and videodisc. The I. V. Therapy Program, marketed by Fuld Institute for Technology in Nursing Education (FITNE), is an IVI program. Historically, computer instruction was designed for individual student use, that is, one student to one computer.

Educators have examined the effect of groups on learning and attitude, based upon the assumption that behavior is influenced by the actions of others. Limited research exists on the use of the group mode of instruction with computer technology. Thus, I, the researcher, am interested in examining the effects of
IVI on learning and attitude towards the instructional media using three modes of instruction, that is, individual, small groups (2-3), and larger groups (7 or more) of nursing students.

The I. V. Therapy Program is a required assignment in your nursing curriculum. In order to keep my research to one session, I am limiting this study to Chapters 1 and 2. I am requesting that you view both chapters according to the experimental group in which you will be randomly assigned, that is, individually, in a small group, or in a larger group. I am also requesting that you complete three brief questionnaires before and after the I. V. Therapy Program. One questionnaire relates to information about your background, one to your impression of the teaching strategy, one to your knowledge of I. V. Therapy through test items, and one on attitude towards the IVI. Completion of the questionnaires requires approximately 40-60 minutes.

Data will be collected by one of your faculty who will place completed questionnaires in their individual envelopes, seal them, and return them to me. Confidentiality is maintained since the questionnaires are anonymous and are collected separately. The last
four digits of your social security number are requested in order to correlate data and explore relationships of information provided on the questionnaires. This is a method of coding data but your identity remains unknown. Your responses in no way affect your course grade or your status as a nursing student in your school. Your responses will be analyzed along with those from nursing students in several other schools.

If you choose not to participate in the study, don’t sign the consent form which accompanies this letter. You will not be randomly assigned to an experimental group. If you choose to participate, sign the consent form which will be collected, placed in an envelope, and sealed.

Due to limited research in the area of IVI and modes of instruction, the findings of this study will be significant especially to nursing education. This research will enhance current limited knowledge of effective modes of instruction relating to IVI.

I appreciate your time and assistance in broadening the knowledge base regarding the effectiveness of computer instruction in nursing education.
Sincerely,

Antoinette Calderone RN, MSN, DNSc Candidate
APPENDIX X
Informed Student Consent Form
Widener University
School of Nursing

Title of Investigation: Investigation of the Effect of IVI with Three Modes of Instruction on Learning and Attitude towards the Instructional Media
Investigator: Antoinette Battista-Calderone RN, MSN, DNSc Candidate
Date: _________________

This is to certify that I, _____________________, hereby agree to participate as a volunteer in a research study as an authorized part of the education and research program of Widener University, School of Nursing.

The investigation and my part in the investigation have been defined and fully explained to me by _____________________, and I understand the explanation. A copy of the procedure of this investigation has been provided to me and has been discussed in detail with me.

I understand that my part in the study involves viewing Chapters I and II of the IVI program on I. V.
Therapy which takes approximately 1 to 1 1/2 hours, and completing three brief questionnaires both before and after the program. The total time for completing the questionnaires will be approximately 40-60 minutes. I have been given an opportunity to ask whatever questions I may have had and all such questions and inquiries have been answered to my satisfaction.

I understand that I am free to refuse to answer any specific items or questions on the questionnaires.

I understand that all data or answers to questions will remain confidential with regard to my identity.

I understand that my decision to participate or not participate in the study will not influence my course grade in any way.

I FURTHER UNDERSTAND THAT I AM FREE TO WITHDRAW MY CONSENT AND TERMINATE PARTICIPATION AT ANY TIME.

_____                      ________________
Date                      Subject’s Signature

_____                       ________________
Date                      Investigator’s Signature
APPENDIX Y

Letter of Explanation to the Proctor

Dear Proctor,

The purpose of this research is to expand the nursing knowledge base related to learning, students’ attitude towards instructional media, and computer instruction in nursing education. More specifically, this research will explore effectiveness of three modes of instruction with computer technology.

The computer technology under investigation is Interactive Video Instruction (IVI), an instructional media which combines computer and videodisc. The I.V. Therapy Program is an IVI program. Historically, computer instruction was designed for individual student use, that is, one student to one computer.

Limited research exists in the study of using group mode of instruction with computer technology. Thus, I, the researcher, am interested in examining the effects of IVI on learning and attitude towards the instructional media using three modes of instruction, that is, individual, small group, and larger group of nursing students.

The I. V. Therapy program is a required assignment
in the nursing curriculum. In order to keep my research to one session, I am limiting this study to Chapters 1 and 2. Students will be randomly assigned to one of three experimental groups in order to view these two chapters, that is, individually, as a small group (2-3 students), or as a larger group (7 or more students). Individual students and small groups of students can view the program at a single computer terminal. Larger groups will view the program using a wall projector. Critical to the study is that the students view the program according to the experimental group in which they were randomly assigned.

Before the students view the I. V. Therapy Program, announce directions from the memorandum entitled Directives Regarding the Research Design. The students will then view the two chapters. Immediately after viewing, you will administer three brief questionnaires entitled: Post-treatment Data Sheet, Test on I. V. Therapy, and Attitude Toward CAI Semantic Differential Tool. Please collect the individual questionnaires, place in their envelope, seal, and return to the involved faculty member. There is no time limit, although, students should be noting the time it takes to complete the two chapters of the I. V.
Therapy Program.

I appreciate your time and assistance in broadening the knowledge base regarding the effectiveness of computer instruction in nursing education.

Sincerely,

Antoinette Calderone RN, MSN, DNSc Candidate