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THE INFLUENCE OF LEARNING STYLE ON THE EFFECTIVENESS OF INTERACTIVE VIDEODISC INSTRUCTION

by

Carole Dianne Little

A THESIS
SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE
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The Influence of Learning Style on the Effectiveness of Interactive Videodisc Instruction

submitted by Carole Dianne Little in partial fulfillment of the requirements for the degree of Master of Education in Adult Education.

Dr. D. Collett, Supervisor

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ABSTRACT

The use of interactive videodisc technology as a medium for accessing and processing large amounts of information is increasing. For the adult learner it offers flexible, individualized instruction through simulations which are based on real-life experiences. However questions arise as to individual learner characteristics and the implementation of this technology. In an attempt to address this concern the purpose of this study was to investigate the effectiveness of interactive videodisc instruction and the influence of learning style.

This was a quasi-experimental one group repeated measures design study based on a convenience sample of 40 Nursing I students from the April '92 Class at the University of Alberta Hospitals School of Nursing, Edmonton, Alberta. Learning styles were assessed with Kolb's (LSI) (1985). The effectiveness of the interactive videodisc instruction was measured with multiple choice criterion referenced achievement tests. The repeated measures T-test, ANOVA, Chi-square and the Kuder-Richardson formula were utilized for analysis.

Statistical analysis indicated that the subjects were distributed throughout all four learning styles but the assimilative learner was the most common. Interactive videodisc instruction was associated with a significant, immediate and long term learning gain for this sample. Analysis of learning style and pretest results strongly suggested that previous learning was not associated with learning style. Following interactive videodisc instruction, it was apparent on observation, that the convergent learners achieved the greatest learning gains followed by the accommodative and then the assimilative learners.

The lowest learning gain was demonstrated by the divergent learners. Although ANOVA analysis of learning style and posttest and retention test means did not reveal statistically significant results, the data suggested that with a larger sample the results may have been significant. Data analysis of learning style and attitude suggested that learning style was associated with enjoyment of this method of instruction, degree of difficulty in learning new material with this medium, and finding interactive videodisc instruction a convenient method of review. On observation, student comments also revealed some possible associations with learning style.

The findings of this study indicated that the interactive videodisc module was associated with significant, immediate and long term learning for the sample. Observation of the data strongly suggests that achievement was associated with learning style in that the design of the interactive videodisc employed in this study directly supported the learning styles of the convergent and accommodative learners. This study has implications for the utilization of interactive videodisc instruction in nursing education.

ACKNOWLEDGEMENT

It is with sincere appreciation that the researcher acknowledges the contributions of the people who supported and participated in this study.

My gratitude is extended to the Class of April '92 at the University of Alberta Hospitals School of Nursing, who participated in this study. Their interest, cooperation and patience demonstrated during the data collection process is greatly appreciated. I would also like to acknowledge the support and consideration of the administration and my colleagues at the School of Nursing.

Without the interactive videodisc that was generously supplied for a long period of time by Wayne Osbaldeston, President, Data Star Corporation, and the cooperation of Dr. Charles Bidwell, Director, Health Sciences Media Services, University of Alberta Hospitals, and associates who provided the appropriate hardware and expertise, this study would not have been possible. I would like to express my appreciation to all those who were involved in this aspect of the study.

To my thesis supervisor, Dr. Dave Collett, I would like to extend a special word of thanks for his guidance, patience, and continued faith in me. As a thesis supervisor he was exceptional, always providing support and just the right blend of humor and firmness to keep me on task. His expertise in assessing my learning strengths and needs during this study played a significant role in providing insight into my personal learning process. I would also like to thank the members of my committee, Dr. Dana Wertenberger, Dr. Micheal Szabo, and Dr. Fred Ilott; their guidance through constructive comments and suggestions was much appreciated.

I extend sincere appreciation to Dr. Larry Orton, who played a significant role in preventing this study from meeting it's final fate in the North Saskatchewan river. His insight and encouragement were essential to the successful completion of this study and it has been a privilege to be associated with a professional who lives and practices adult education.

During this process many friends gave generously of their time and expertise. In particular, I am grateful to the following people for their friendship and individualized support, Peggy Wilson, Mila Neuman, Cara Stark, Stephanie Dolsky and Pat Yanik.

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CHAPTER ONE

INTRODUCTION

Education is a diverse industry involving enormous amounts of money, expertise, technology, and human resources. Changing technology and the accumulation of vast amounts of new information in the health sciences have resulted in constant change and increasing requirements for efficient and effective methods to facilitate professional education. However, the emerging demographic reality is that fewer people are available for entry-level jobs, and entry-level employees are drawn from more diverse populations (Carnevele, 1989). Simultaneously, current economic restraints dictate more efficient use of resources with research on learning becoming more urgent

As nurses form the largest group of health care workers, nurse educators must face the challenge of preparing great numbers of entry-level practitioners for an increasingly sophisticated health care environment. With decreasing numbers of high school graduates available for nursing, applicants now include a heterogeneous population of adult learners. If nurse educators are to succeed in preparing this diverse population, individual learning characteristics must be considered in selecting teaching strategies and new technologies.

Current and rapidly evolving technologies have given us the ability to explore and convey knowledge with unprecedented levels of accuracy and efficiency. In the health sciences, the application of computers has intensified to such a degree that computers are now utilized in every aspect of modern health care (Happ, 1983; Andreole and Musser, 1985). A real power from an educational perspective, however, maybe in the combination of laser videodisc and computer technology. Interactive videodisc is one of the most recent and exciting developments in convergent technology and holds great promise in addressing

individual learning needs and the gap between the production and application of knowledge in nursing education (van Reenen, 1990 and Howard, 1990).

A review of the literature indicates that interactive videodisc has much to offer in nurturing individual learner progress. Bosco, (1984) indicates that the predominant method of adapting to individual differences has been the pacing of instruction. Interactive videodisc allows the learner to proceed at his/her own pace, with provisions for feedback and repetition. During this process, the learner is also able to select the most relevant content and by pass material which was learned in previous situations. Simulations developed on videodisc provide realism and the opportunity to participate in the application of knowledge. They provide an alternative to rote learning and enhance the role of decision making, reason, and imagination. The learner is able to evaluate the impact of decisions without serious consequences and receive individual feedback in privacy (Clark, 1984 & Howard, 1990).

Although costly to develop, interactive videodisc technology is utilized extensively in industry and has become more available in the health sciences and many areas of education. The literature indicates that although nursing has delayed the utilization of computer technology (Rizzolo, 1990), there has been a recent move to develop interactive videodiscs in nursing education. The Helen Fuld Trust located in Athens, Ohio has supported the development of interactive videodisc centers for nursing students throughout Canada and the United States. This is a private foundation devoted to the health, education and welfare of student nurses (van Reenen, 1990, p. 26 & The Interactive Health Care Conference, 1989, 1991). This Trust is operationalized through the Fuld Institute of Technology in Nursing Education (FITNE).

Research demonstrates that interactive videodisc technology is as effective as traditional teaching strategies and some studies have found that learning time and therefore teaching time are reduced (Ebner, 1984; Hon, 1982 and Oermann, 1990). However, few studies have attempted to identify variables that may influence learning, particularly characteristics of the learner. As the use of interactive videodisc technology requires considerable capital investment, the effectiveness of this new technology needs to be defined in terms of learners and individual learning styles.

This investigation was carried out at the University of Alberta Hospitals School of Nursing, Edmonton, Alberta to explore learning styles and the effectiveness of interactive videodisc instruction for nursing students. The participants of this study were full-time Nursing I students from the class of April 1992, who had successfully completed the pre-nursing term. A convenience sample of 40 subjects volunteered to participate in this study. Since respiratory assessment is an essential component of the Nursing I curriculum, an interactive videodisc with this content was selected for the study (See Appendix A for a description of the interactive videodisc, Nursing Care of the Elderly Patient with Chronic Obstructive Pulmonary Disease).

STATEMENT OF THE PROBLEM

The purpose of this study was to address the following general problem: Is the effectiveness of interactive videodisc instruction influenced by the learning styles of diploma nursing students?

The first three null hypotheses were developed to determine the effectiveness of the interactive videodisc module employed during this study:

Null Hypothesis I: There will be no significant difference in pretest and posttest achievement scores.

Null Hypothesis II: There will be no significant difference in posttest and retention test achievement scores six weeks following interactive videodisc instruction.

Null Hypothesis III: There will be no significant difference in pretest and retention test achievement scores six weeks following interactive videodisc instruction.

Null hypotheses IV-VI were developed to assess the interaction of learning style and achievement.

Null Hypothesis IV: There will be no significant differences among learning style groups (as defined by Kolb's Learning Style Inventory) when comparing mean pretest achievement scores.

Null Hypothesis V: There will be no significant differences among learning style groups (as defined by Kolb's Learning Style Inventory) when comparing mean posttest achievement scores.

Null Hypothesis VI: There will be no significant differences among learning style groups (as defined by Kolb's Learning Style Inventory) when comparing mean retention test scores six weeks following interactive videodisc instruction.

Null hypothesis VII investigated the association of learning style and the learner's attitude towards interactive videodisc instruction.

Null Hypothesis VII: There will be no significant relationship between learning style (as defined by Kolb's Learning Style Inventory) and selected attitudinal responses regarding interactive videodisc instruction.

LIMITATIONS

The following limitations will influence the degree to which the results of this study can be generalized to all Nursing I, basic diploma nursing students attending the University of Alberta Hospitals School of Nursing and other populations of basic diploma nursing students.

1. The size of the sample was relatively small, consisting of 40, Nursing I students (see definitions p. 8) who volunteered to participate in the study. As this sample was not randomly selected it is possible that some bias does exist because students who volunteer to participate in additional learning experiences are often the most dedicated learners.
2. This study was also limited by the specific selection of the interactive videodisc courseware. However, this interactive videodisc was considered to be a good representative of what was available for level III software at the time of this study. Content experts from the University of Alberta Hospitals School of Nursing evaluated this courseware in terms of subject matter. The general design and format of this interactive videodisc were informally assessed by qualified computer experts from the University of Alberta faculty.
3. Another limitation concerned the inequity of instructional time required by each subject. Individual learning time was not recorded.

DELIMITATIONS

In an attempt to define the central focus of the problem, the specific parameters of this study were stated in the following delimitations:

1. The study utilized only one level III (see definitions) interactive videodisc program on assessment of the respiratory system (Nursing Care of the Elderly Patient with Chronic Obstructive Pulmonary Disease).
2. The study did not attempt to evaluate the quality of the interactive videodisc program.
3. The study utilized only one method of assessing learning styles (Kolb's Learning Style Inventory, 1985).
4. The study included only one class (April '92) of Nursing I "students" who commenced the diploma program at the University of Alberta Hospitals in January of 1990.
5. The study did not evaluate the training and preparation of nurses.

DEFINITIONS OF TERMS

Definitions were included for educational and technical terms specific to this study.

Interactive Videodisc (IVD) - is a disc with a mirror-like rainbow surface on which audio and video signals are stored. The disc is protected by a clear plastic coating. A laser beam on the videodisc player reads the signals and plays back the information as a video image with sound (Clark, 1984, p. 13). Interactive videodisc provides "a valid learning environment" through the use of video, audio, slides, graphics, animation, and interactivity (Beautement, 1991).

Level III Interactive Videodisc - In this mode the IVD player is controlled by an external computer. The learner interacts with the IVD and computer program via the computer. This level of interaction facilitates the most sophisticated applications such as real-life simulations in which the learner is coached through or experiences discovery learning (Clark, 1984 p. 13).

Kolb's Learning Styles - Kolb has defined four different styles of learning based on the four modes of the experiential learning process.

1. Divergent learning composed of concrete experience and reflective observation.
2. Assimilative learning which includes abstract conceptualization and reflective observation.
3. Convergent learning which is based on abstract conceptualization and active experimentation.
4. Accommodation which includes concrete experience and active experimentation (Kolb, 1984, p. 77-78).

Nursing I Student - A student nurse who has met the requirements for the pre-nursing term and received instruction in anatomy and physiology of the respiratory system. This learner is enrolled as a full-time student (April '92 Class) in the diploma program at the University of Alberta Hospitals School of Nursing.

ASSUMPTIONS

Underlying assumptions were defined in an attempt to clarify a basic understanding of the study.

1. It was assumed that the criterion referenced multiple choice examinations utilized in this study, measured previous learning, immediate learning and retention of learning.
2. It was assumed that the demographic survey would provide accurate information regarding education, work experience and other demographic characteristics.

THE IMPORTANCE OF THE STUDY

Nursing education has evolved over time from clinical hospital programs with incidental lectures, to the present day variety of hospital, college and university programs with many combinations of theory, laboratory and clinical experience. Traditionally, clinical experience has facilitated problem-solving and decision-making processes through exposure to the real-life situations that nurses faced in the clinical setting. However, applying new information in the clinical setting for the first time is very stressful for both students and patients and carries with it considerable risk (Persaud, 1986).

In recent years, the decreased length of nursing programs and increased emphasis on theory has decreased clinical experience, and thus the opportunity to practice clinical decision-making skills. Additional factors which have contributed to the lack of clinical experience include increased numbers of learners competing for the existing clinical space and a new awareness of patient rights. It is no longer acceptable for learners to practice skills in the clinical setting unless the patient is informed and safety is ensured.

Some of the consequences of reduced clinical time include decreased opportunities for processing information, lack of experience in common emergency situations, and few or no opportunities to practice some basic skills. It is now possible for students to graduate from a nursing program without exposure to many common health problems and perhaps

no opportunity to perform some essential nursing skills in the clinical setting. In some institutions, inservice programs have provided the necessary skills which enable nurses to function independently as registered nurses. However, in other institutions, the new graduate may not have the benefit of instruction or supervision and the patient remains at risk.

Although existing programs are based on a prescriptive curriculum with defined outcomes for certification, there is still great potential for individualizing instruction. Currently interactive videodisc is the most versatile technology for facilitating skills acquisition, problem-solving and information processing. Through individualized or classroom instruction, interactive videodisc could be utilized to prepare students for clinical practice and in some instances expand clinical experience (Mirr, Sparks, and Golembiewski, 1986). Careful integration of this technology into the curriculum would facilitate application of knowledge in a safe environment and may result in decreased stress for the learner.

Considerable research has been undertaken to determine the differential effects of interactive videodisc instruction and traditional instruction on application of learning. However, few studies have evaluated the effects of interactive videodisc associated with individual learning styles.

SUMMARY

This chapter addressed the general research question of this investigation: to determine the influence of learning style on the effectiveness of interactive videodisc instruction. The problem was defined in terms of the null hypotheses to be tested and both

limitations and delimitations were presented. Pertinent definitions, assumptions and the rationale for the study were also included.

The following chapter provides a review of the literature pertaining to the general problem and research questions. This review includes the background for the study and describes related research in this area. The third chapter describes the setting and design of the study and the methodology employed in the data collection process. The fourth chapter presents the results of the data analyses collected in the investigation. The fifth chapter discusses the data analysis in terms of theoretical and practical implications, including suggestions for further research.

CHAPTER TWO
LITERATURE REVIEW

INTRODUCTION

This study examined the learning styles of diploma nursing students and the effectiveness of interactive videodisc instruction. Criterion referenced multiple choice tests were employed for pretesting, posttesting and the assessment of retention of learning. The literature review for this investigation includes the following subject areas: nursing education, the nurse as an adult learner, learning styles, applications of interactive videodiscs, and research related to interactive videodisc instruction.

NURSING EDUCATION

Historically, nursing education involved clinical experience which varied greatly in terms of quantity and quality. Before standards for nursing were established, student nurses were almost entirely responsible for patient care in hospitals and teaching other students. Eventually, theory was introduced through formalized classes given by guest lecturers and head nurses. Following World War II government funding for nursing education was initiated, resulting in schools of nursing with full-time instructors and accreditation standards (Christy, 1980).

The focus of education in the majority of nursing programs followed the behavioral and systems theories of learning with emphasis on procedures and skills training. As this system became more sophisticated, there was increased emphasis on identification of objectives and measurement of learning outcomes. Considerable emphasis was placed on ensuring that every learner would proceed "through an identical sequence and content of

learning, regardless of her previous life experience" with the "assumption of a heterogeneity of learning style" (Sweeney, 1986 p. 259 & Laschinger & Boss, 1984). Learning theories applied directly to the content rather than the learner (Cross, 1981 & Sweeney, 1986). In recent years, prominent nurse educators have emphasized the need to shift from the learning outcome focus or product orientation to processing of information.

Bevis (1988) discussed the need for discovery learning and critical thinking in nursing education. These concepts are found in the more recent generative theory of learning, as developed by M.C. Wittrock and associates. This theory incorporates some concepts from the humanistic philosophies of learning and presents the learner as an active participant in the processing and understanding of information (Wittrock, 1979).

Although the move to generative learning has altered the rigid focus on learning outcomes, Tanner (1991) emphasized the role of experience in the basic preparation of nurses and in the development of increasing levels of expertise (Tanner, 1991). With this in mind, the theory of experiential learning as modified by D.A. Kolb (1984) seems to be more congruent with nursing education. Experiential learning is presented as a cycle with four different modes of learning; concrete experience, reflective observation, abstract conceptualization and active experimentation. Kolb's global perspective, which combines experience, perception, cognition and behavior, is similar to the holistic view of man which is found in most philosophies of nursing (Partridge, 1983).

The nursing process, which is recognized as the basis for nursing practice, provides the framework for problem-solving and decision-making. In this process all aspects of learning are considered in reaching a maximum level of critical thinking (White, 1990). Problem-solving and the nursing process adapt easily to the experiential theory of learning, which is based on an individual's experience with the environment. Kolb (1985)

describes this process in the following statement, " identifying the problem, selecting the problem to solve, seeing the different solutions, evaluating possible results and implementing the solution" (p.8). In essence the nursing process is a problem-solving approach applied to clinical problems.

The experiential theory of learning considers the unique characteristics of the individual learner and the context in which learning takes place. The nurse as an adult learner possesses a multitude of educational and life experiences on which to base new learning. As new learning experiences are accumulated, the process of reflection, conceptualization and experimentation create individual learning (Kolb, 1984, 1986).

THE NURSE AS AN ADULT LEARNER

The majority of students in current nursing programs are adult learners with different levels of experience and education (Sweeney, 1986). They come from diverse backgrounds and have been influenced by a variety of socio-cultural factors. The average age of students in post-secondary institutions has gradually increased, consequently the range of other characteristics has multiplied. In recent years, there has been an increasing awareness of the unique characteristics of adult learners and their significance in program planning (Carnevale, 1989; Darkenwald & Merriam, 1982; Knowles, 1980).

Malcolm Knowles (1980) was a major proponent of a distinct "art and science of helping adults learn" (p. 43). The focus in teaching adults is the "enhancement of adult living" through recognition of each learner as an individual with unique life experiences. Knowles (1980) states four assumptions about adult learning:

These assumptions are that as individuals mature:

1. their self-concept moves from one of being a dependent personality toward being a self-directed human being;
2. they accumulate a growing reservoir of experience that becomes an increasingly rich resource for learning.
3. their readiness to learn becomes oriented increasingly to the developmental tasks of their social roles; and
4. their time perspective as individuals mature, from one of future application of knowledge to immediacy of application; thus an adult is more problem-centered than subject-centered in learning (Knowles, 1980, p.44-45).

The above assumptions describe adults as independent self-directed individuals who have a great wealth of learning and experience. For an adult, personal experiences establish self-identity and so are highly valued. It is also assumed that they are motivated to learn that which is relevant to their developmental tasks and immediate needs.

Cross (1981), describes the characteristics of adults as learners in terms of personal and situational characteristics. Personal characteristics describe the adult learner in terms of "physical, psychological and sociocultural dimensions" (p. 235). Situational characteristics describe the "circumstances under which individual learning takes place" (p. 235). The learner's personal and situational characteristics present a range of factors to be considered in each learning situation.

Current nursing students presently fall within the young adult and middle aged developmental groups as described by Havighurst (1972). The developmental tasks within these groups are diverse and extend along a continuum, resulting in unique, individual learning needs. Adult learners needs are related to life situations such as current developmental tasks, roles and employment (Brundage & MacKeracher, 1980).

Although nursing students do not participate in setting the goals and objectives of nursing programs, they do make the decision to attend the program that meets their specific

needs (Cranton, 1989). Most learners who attend nursing programs are highly motivated, as completion of the program will qualify them for employment. In addition, as adult learners, they participate in several roles, which create a complex and demanding life style with varying degrees of stress (Brundage & Mackeracher, 1980). As educators attempt to meet the learning needs of this heterogeneous population they must consider personal differences and variations in time, place and pace of learning (Dwyer, 1990).

The concept of learners as individuals was presented in the literature as early as 1892. Kolb (1984), refers to Carl Jung (1923) as one of the first theorists to provide a comprehensive description of individual differences in his book, Psychological Types. Currently there is a rich collection of theory describing individual differences in terms of cognitive ability, cognitive styles, traits, values, motives, and attitudes. This study is concerned with individual thinking processes or cognitive style referred to as learning style. Cognitive style must be differentiated from cognitive ability which is a "measurement of intellectual capacity or maximal performance, ... assessed through a variety of intelligence tests" (Messick, 1976, p. 7).

LEARNING STYLES

Learning differences are the result of personal and family predispositions and cultural factors. Variations are also the result of intelligence, drive, skills, and accomplishment. Learning theory containing elements of learning style appeared as early as 1892, but it was not until after World War II that research in this area developed to any great extent (Keefe, 1982, p. 43).

Learning style is a construct which attempts to explain the process of learning (Messick, 1976). It includes consistent individual patterns or differences in the

organization and processing of information and experience. Personality development, environmental adaptation, and genetic factors are reflected in a dynamic process which is unique to each individual (Dixon, 1985 ; Keefe, 1982 & Messick, 1976). Several authors have developed definitions which reflect their preference for a specific learning theory.

Kolb's definition of learning style reflects his experiential theory of learning. He defines learning style as:

> self-programming conditioned by experience which determines the extent to which the person emphasizes the four modes of the learning process: concrete experience, reflective observation, abstract conceptualization, and active experimentation" (Kolb, 1984, p. 64).

Garity (1985) states that learning style is "our preferred manner of processing information..."(p. 12). Smith (1982) introduced learning style as "people's characteristic ways of information processing, feeling, and behaving in and toward learning situations" (p. 60). Keefe incorporates many of the concepts of learning style into the following definition:

> ...cognitive, affective, and physiological traits that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment (Keefe, 1982, p. 44).

Although learning styles are not static, there are certain consistent factors which reflect an individual's thinking process.

Efforts to explain the underlying process of learning have resulted in a rich collection of theory and research, which can be categorized into cognitive, affective, and physiological domains (Claxton & Ralston, 1978; Keefe, 1982 & Partridge, 1983). The author has provided a brief description of each category, including a relevant model.

Cognitive Styles

Cognitive styles are described by Messick (1976) as "consistent individual differences" in organization and information processing habits representing the learner's "typical mode of perceiving, remembering, thinking, and problem solving" (p. 5). More than 20 different dimensions of cognitive style have been presented in the literature. Some of these dimensions include field independence versus field dependence, reflection versus impulsiveness and perception versus reception (systematic versus intuitive) (Claxton & Ralston, 1978). A more detailed presentation of cognitive styles is included in Figure 1.

The most extensively researched dimension of cognitive learning style focuses on the individual's analytic versus global perception of his environment. The literature refers to this as field independence versus dependence. One of the measurements of this cognitive function is the group embedded figures test, which was developed by Herman Witkin. The field independent person identifies figures as discrete from their backgrounds on this test and the environment is approached in an analytical manner. The field dependent individual has difficulty differentiating objects from their contexts and experiences the environment in a global manner (Messick, 1976; Claxton & Ralston, 1978; Witkin et al., 1977 & Keefe, 1982).

Affective Styles

Affective styles are presented by Keefe (1982) as " motivational processes viewed as the learner's typical mode of arousing, directing and sustaining behavior" (p. 48). Affective styles are personality traits that involve attention, emotions and values. Assessment of this domain often involves an informal subjective judgement of motivation. For example, students who do not experience success in teacher directed learning activities are frequently labeled as lazy or unmotivated. One aspect of affective style includes locus

FIGURE 1

MODELS OF COGNITIVE STYLES

Model	Description	Key References	Instruments
1) Field dependent - independent	A global versus analytic way of perceiving. Entails the ability to perceive items without being influenced by the background.	Witkin & others (1954): Witkin (1976)	Embedded Figures Test, Rod & Frame Test; Body Adjustment Test
2)Analytical - nonanalytic conceptualizing	Analytic style entails differentiating attributes or qualities. Nonanalytic style responses may be more relational or thematic.	Kagan & others (1960); Messick & Kogan (1963)	Conceptual Style Test
3) Impulsivity - reflectiveness	Impulsivity is characterized by quick responses, reflectivity by more deliberate, slower responses. The impulsive person is quicker but makes more errors.	Kagan (1965)	Matching Familiar Figures; Identical pictures
4) Risk taking-caution	Risk taking is characterized by taking risks even when the odds for success are poor. Caution is characterized by reluctance to take chances except when the probability of success is great.	Kogan & Wallach (1964)	Cost-payoff games
5) Preceptive / receptive - systematic / intuitive	The inclination to assimilate data into concepts, or precepts, previously held (preceptivity) versus the tendency to take in data in raw form (receptivity). The inclination to develop clear sequential plans (systematic) versus the tendency to develop ideas freely from data and to skip from the part to the whole (intuitive).	McKenney & Keen (1965)	Tasks Assessing each mode: e.g., Identical Pictures (Receptive), Elaboration (Preceptive), Paper Folding (Systematic), Scrambled Words (Intuitive)
6) Leveling - sharpening	Individual variations in assimilation in memory. The leveler tends to assimilate new stimuli into previous categories, while the sharpener tends to differentiate new information from old.	Gardner (1959)	Schematizing Test Wagon Test
7) Cognitive complexity - simplicity	Differences in tendency to see the world in a multidimensional way. Complexity is characterized by the use of hierarchic integration, while simplicity is shown in the use of dimensions of difference.	Harvey & others (1961); Kelly (1965)	REP Test Paragraph completion This I Believe Test
8) Scanning - focusing	Entails identification of relevant versus irrelevant information in attempting to solve a problem.	Schlesinger (1954)	Twenty Questions Concept Attainment Tasks e.g., Bruner et al, in A Study of Thinking
9) Constricted - flexible control	Constricted control shows more susceptibility to distraction; flexible control is characterized by resistance to interference.	Klein (1954)	Stroop Color-Word Test
10) Broad-narrow	Preference for broad categories containing many items, rather than narrow categories containing few items.	Bruner & Tajtel (1961); Kogan & Wallach (1964) Pettigrew (1958)	Category Width Tasks, Object Sorting Tasks
11) Tolerance for incongruous or unrealistic experiences	Individual willingness to accept perceptions which vary from the conventional experience. Tolerance is characterized by a greater adaptation to unusual perceptions. Intolerance is revealed by the demand for more data before the unusual is accepted.	Klein, Gardner, & Schlesinger (1962)	Aniseikonic lenses; reversible figures

Adapted from: Clayton and Ralston, 1978; Nelson 1975.

of control. An instrument designed to assess locus of control was developed by Julian Rotter. This instrument, the I/E Scale, determines the internal and external factors which direct or stimulate action for an individual (Keefe, 1982).

Physiological Styles

This domain includes " biologically based modes of response that are founded on sex-related differences, personal nutrition and health, and reaction to the physical environment " (Keefe p. 49). Although instruments have not been developed to assess all aspects of physiological style, elements such as time rhythms have been assessed by Rita and Kenneth Dunn (1982). Other factors such as illness, hunger, environmental temperature, noise and lighting are easily observed by the educator.

The Myer-Briggs Model (1967)

This integrated model is based on Jung's theory of psychological types and reflects learning style and personality structure. It describes mental activity as two perception processes (sensing and intuition) and two judgement processes (thinking and feeling) represented on a continuum. If the preferred process is **intuitive perception,** sensory input receives minimal attention. The preferred style therefore involves abstract thought, theorizing and the search for inspiration, meaning, and new ideas. **Sensing perception** as the dominant process results in a practical approach to immediate experience and concrete facts. This learner needs to be able to apply information in a practical sense. **Thinking judgement** is associated with logical analysis, testing and organizing. People who predominantly use this mode view life objectively. Thinkers require organization and opportunities to analyze. **Feeling judgement** involves the area of human values, feelings and beliefs (Lawrence, 1982; Myers & Myers, 1985).

In addition to these processes, each individual has an introverted or extroverted orientation. If the preferred process is used in the inner private world, the orientation is introverted. Use of the dominant mode in the external world with people and activities is an extroverted process (Lawrence, 1982; Myers & Myers, 1985; Claxton & Ralston, 1978).

The Myers-Briggs Type Indicator consists of four scales which correspond to the four dimensions of type theory. Within each type, there are four different possible combinations, which represent a dominant and an auxiliary process. This instrument has been available since 1975 and has been used extensively for adults in community college settings (Briggs-Myers & Myers, 1985; Lawrence, 1982).

Kolb's Learning Styles

Kolb's concept of learning involves a process of person-environment interaction throughout life. He defines learning as " the process whereby knowledge is created through the transformation of experience" (Kolb, 1984, p. 38). The experiential learning cycle is presented with two distinct dimensions which intersect at the center. The abstract/concrete factor represents two opposite processes of perceiving or grasping experience:

1. comprehension or abstract conceptualization - emphasizing symbolic representation or concepts; and
2. apprehension or concrete experience - which emphasizes sensing and feeling experience.

The active/reflective dimension describes transformation or processing of experience. The opposed processes are:

1. intention - or internal reflection and

2. extension - or active experimentation which involves experimenting and trying out new information (Kolb, 1984, LaFollette, 1986).

Experiential learning is presented as a four stage cycle. In the process of learning, the learner becomes involved in an experience (concrete experience) which is followed by reflection about this experience (reflective observation). After identifying relationships or patterns, the next step is concept formation about the original experience (abstract conceptualization). The learner experiments with the new concepts (active experimentation) creating new experiences and the cycle moves on as a continuous process (Refer to Figure 2 for further detail). Knowledge then becomes "the transformation of experience, resulting in development of the learner" (Kolb, 1984, p. 38; 1986).

Kolb (1984) describes individuals as "continually recreating their reality by interacting with their environment. Patterns of individuality emerge, which influence choices of experience." Learning style, as defined by Kolb, is based on his experiential theory of learning. He states that " self-programming conditioned by experience determines the extent to which the person emphasizes the four modes of the learning process: concrete experience, reflective observation, abstract conceptualization, and active experimentation" (Kolb, 1984, p. 64). Thus learning style can be influenced by situations, experience, stage of development and other factors. As people tend to utilize more than one mode of learning, Kolb (1984, 1985, 1986) has combined the four types of learning; concrete experience, reflective observation, abstract conceptualization and active experimentation to develop four different learning styles. A description follows:

Converger - This learning style combines the abstract conceptualization and active experimentation modes of learning. People with this style of learning demonstrate

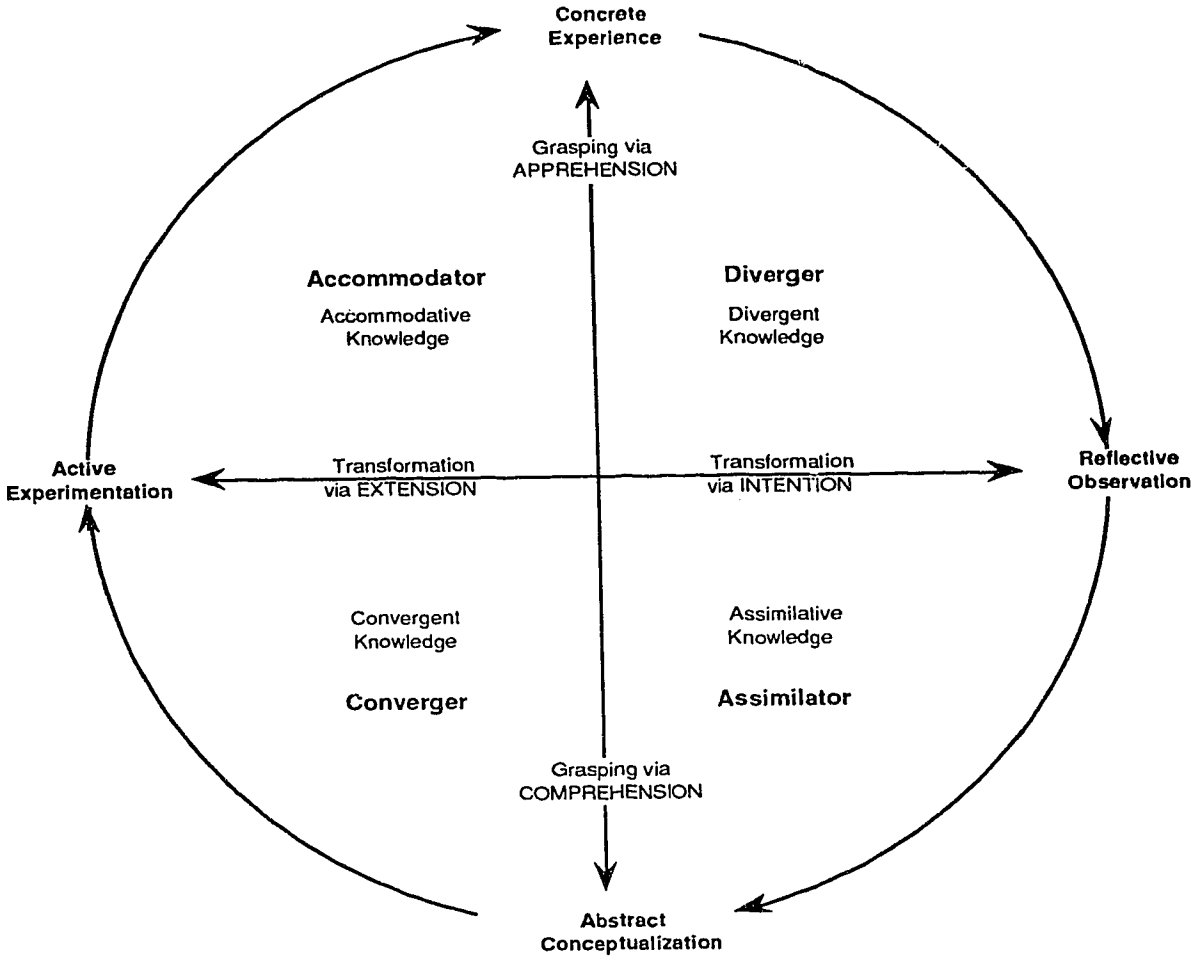
strengths in finding practical uses for ideas and theories. When presented with a task or question, they move quickly to find the one correct answer or solution. They prefer to deal with technical tasks and things rather than social issues. Convergers are attracted to careers in the physical sciences and engineering.

Diverger - Concrete experience and reflective observation are combined to form strengths in observation and generation of ideas. This learner is creative and is able to observe concrete situations from many different perspectives. Other characteristics include sensitivity to feelings and an active imagination. Divergers tend to be people oriented, emotional and demonstrate sensitivity to feelings. They have an active imagination and seem to specialize in areas such as teaching, social work and nursing.

Assimilator - The assimilator learning style includes the abstract conceptualization and reflective observation modes of learning. These people are more focused on abstract ideas and are less concerned with people. Their strengths involve the understanding and assimilation of a wide range of information. Assimilators are attracted to careers in research, planning, science and math.

Accommodator - The concrete experience and active experimentation modes of learning are combined to form this learning style. Accommodators are usually risk- takers, action-oriented and tend to act on feelings or intuition. Information and logical analysis is usually obtained from other sources and problem-solving usually occurs on a trial and error basis. This learner enjoys new and challenging experiences (Claxton & Ralston, 1978; Kolb, 1984, 1986 & Messick, 1976).

Figure 2



Adapted from: Experiential Learning: Experience as the Source of Learning and Development by David A. Kolb, 1984, p. 42. Reprinted by permission of Prentice Hall, Englewood Cliffs, New Jersey.

Although the majority of people identify a preferred learning mode, a more comprehensive or integrated approach in which all four modes are utilized tends to occur with increased experience (Kolb, 1984, p. 141). Kolb (1984) states that "more powerful and adaptive forms of learning emerge when these strategies are used in combination" (p. 65). This concept has important implications for the implementation of learning styles information. The assessment of learning style can be carried out quickly and efficiently for large numbers of people by using Kolb's Learning Style Inventory (LSI) (1985). See

Chapter Four for a detailed description of this instrument (an example is included in Appendix D). This is the most recent version of a comprehensive instrument which assesses cognitive and experiential elements.

Learning Styles in Health Sciences Education

Interest in learning style has been stimulated by the increased diversity of the student population and the reduced effectiveness of traditional instruction. The majority of students entering many nursing programs are older and present a greater variety of individual characteristics. Assessment of learning style has received growing acceptance as a method of identifying individual learning strengths in an effort to maximize learning. During the past decade nursing literature has included investigations of learning style which have addressed classroom and clinical instruction (Dixon, 1985; Garity, 1985; King, 1986; Partridge, 1983; Remington & Kroll, 1990).

The majority of research addressing learning style in the health sciences has employed a version of Kolb's LSI. Although Kolb (1986) postulated that service occupations such as nursing would attract people with the divergent learning style, further research has revealed that this is not always a consistent finding (p. 84).

Laschinger and Boss (1984) conducted a study to assess learning styles and career choices of nursing students using the Kolb's LSI (version of LSI not indicated). They selected a large sample of 268 nursing students attending first and second years of a community college program and the first and fourth years in a university program. This investigation revealed that nursing students were represented in all four learning style categories. The most frequent learning style in the first year group was the diverger with 59% of this group demonstrating a concrete learning style such as accommodator or diverger. Fourth year students were found to have a significantly greater incidence of

concrete learning style than first year students. In the second and fourth year groups 73% were accommodators or divergers. Sixty percent of the students with concrete learning styles indicated person-oriented factors as having the greatest influence on career choice as compared to 40% of students with abstract styles. Consistent with Kolb (1984, 1986), this study suggests that learning style is influenced by increased exposure to the discipline of nursing.

A study by Merritt (1983) assessed learning style of basic and post-basic baccalaureate nursing students. A sample of 466 students completed a questionnaire containing items from Kolb's LSI (1979) and Canfield's LSI (1980). The findings of this investigation may have been influenced by the revisions in scoring, even though they were tested in a pilot study. The results indicated that there was no significant relationship between age, length of employment in nursing and learning style. Tests of significance on the Kolb data indicated that the mean score of the post-basic students for the reflective observation scale was significantly different from the other three scales. There was no significant difference in the learning style of post-basic versus basic students even though post-basic students would have had previous nursing experience. These findings contradict Kolb's contention that learning styles are influenced by exposure to a specific discipline (Kolb, 1984, 1986).

King (1986) investigated the similarities and differences among basic and post-basic nursing students in terms of learning style and developmental patterns. She concluded that there were significant variations in life stage and ego development but the differences in learning style, as assessed by Kolb's LSI (1974) were less distinct. Although students were represented in all learning style categories, over 75% of both basic and post-basic students were either accommodative or divergent learners. This finding again demonstrates that most nursing students demonstrate concrete learning styles.

The learning styles of nurse practitioner graduates were assessed with Kolb's LSI (1976) by Christensen et al. (1979). Although the sample was limited (n-53), it was revealed that 70% of this group were either accommodators or divergers, and were employed in primary health care. Primary health care is concerned with routine outpatient care (Miller & Keane, 1987). These findings were consistent with those of Plovnick (1975) who reported that medical students with accommodative or divergent learning styles also tended to choose careers in primary health care.

Kolb's LSI (1981) was used by Remington and Kroll (1990) to identify characteristics of the "high risk" nursing student. Kolb's LSI (1981) was administered to a sample of 50 junior and senior baccalaureate nursing students with a grade point average 2.99 or less. Students were represented in all learning styles but the diverger was the most common learning style of this high-risk group. Divergers tend to observe concrete situations from several points of view and they perform best in learning experiences which call for generation of ideas and implications. In this study, learning experiences that involved demonstrations and interaction were most preferred by the high-risk students. This study did indicate that learning style assessment can provide useful information for select groups of students in specific situations that require a prescriptive approach to application.

Implementation of Learning Styles

Regardless of the available theory which addresses learning styles, application of this information has been delayed in most educational settings. Factors which may have influenced this delay involve the complexity of learning styles and the difficulty in implementing this information for large numbers of students within the constraints of any given institution. Learning styles tend to vary in different situations and in some cases

from subject to subject. There is also evidence that they are influenced by cultural factors and exposure to specific areas of employment or career development. (Kolb, 1984, 1986; Partridge, 1983; Dixon, 1985; for, 1984; Atkinson, 1989; Ferrell, 1983 & Lesser, 1976).

The available instruments also pose problems in that they lack comprehensiveness and tend to demonstrate other deficiencies. In acknowledging these factors, Thompson (1982) states:

> these shortcomings, however, should not preclude the application of current levels of knowledge for two reasons: (1) sufficient data exist at the applications level to assure that the diagnostic instruments now available do provide valuable guidance to teachers, particularly with students who are not achieving as expected; and (2) valuable insight results from the feedback that practitioners provide to the research community (p. 221).

With these comments in mind, the practical application of learning style information would require careful and serious consideration from many perspectives.

Implementation of learning style information can be undertaken on an institutional level, with educators or with individual students. The factors which influence decisions regarding level of implementation include resources, personnel, time and space. Implementation at the institutional level requires " analysis and reorganization of staff, facilities and resources" (Claxton & Ralston, 1978, p 4). Implementation with educators can be carried out on a classroom level without total institutional commitment. In this situation the educator assesses student learning styles and provides a variety of instructional modes. Implementation for individual students involves educating the learner regarding learning styles assessment and interpretation of results. Regardless of the level of commitment, the synthesis and implementation of this information has been left to the educator (Claxton & Ralston, 1978; Messick, 1976; Partridge, 1983).

Claxton and Ralston (1978) discuss learning styles and their educational implications in terms of matching or mismatching educational strategies. Although the benefits of matching learning styles with congruent educational modes seem to offer the most immediate benefits of decreased stress and increased learning, they suggest that the "purpose of the educational endeavor must be considered before prescribing an educational mode" (p. 3). The purpose may be "developmental, to increase the student's learning potential" by encouraging the use of alternate learning styles or "instrumental", utilizing the dominant learning style to complete a task (p. 3).

Models for prescribing individualized instruction were initially proposed by Messick (1976) as a form of treatment. A brief description follows:

Corrective Matches - This model involves "repetition of the same instruction, that was not effective initially," at perhaps a slower pace but without alteration in presentation (p. 313).

Compensatory Matches - Compensatory matches are "designed to circumvent the debilitative effects of learner deficiencies without trying to remove or improve them" (p. 313-4).

Capitalization Matches - This treatment is designed to draw on the strengths of the learner by emphasizing his/her preferred style of functioning (p. 314).

Combination Matches - A combination of the above treatments can be used simultaneously to both enhance learning strengths and circumvent deficiencies (p. 314).

Challenge Matches - This model of treatment provides mismatches which challenge the learner to use new learning styles or learning modes (p. 314).

Even Messick (1976) expressed concern regarding prescriptive matches and emphasized the need to consider four factors in this process: "(1) the developmental level

of the learner, (2) the subject matter, (3) the surrounding environmental, personality and psychological context, and (4) the goals of education" (p. 319).

There is consensus among theorists that implementation of learning styles information should actively involve the learner. It is felt that the student should be encouraged to know him/herself as a learner and thus select learning experiences which are most beneficial. The educator's role would be to provide learning style information, facilitate learning style assessment and interpretation of the results, and encourage self-investigation of learning as a continuous process (Dixon, 1985; Smith, 1982; Messick, 1976; Partridge, 1983). Dixon, (1985) discusses five ways in which an educator can facilitate this process:

1. helping individuals understand themselves as learners,
2. encouraging individuals to expand their learning styles,
3. using a variety of instructional approaches,
4. creating an environment in which diversity can thrive, and
5. creating a climate in which collaboration exists (p. 16).

Potentially, learning style awareness increases appreciation of individual differences and enhances the self-concept of the adult learner (Dixon, 1983; Partridge, 1983). Witkin (1977) tends to support these concepts in his following statement: "`... for the educator, the development of greater diversity in behaviors within individuals seems as important an objective as the recognition and the utilization of diversity among individuals" (p. 53).

The 4Mat System, a teaching approach based on Kolb's experiential learning theory was developed by McCarthy (1987) in 1980. Although this system was developed for the K-12 levels of education, it has much to offer adult educators in that; the traditional system teaches to the analytic learner (assimilator) and the majority of students do not usually fall within this category (p.12).

In addition to Kolb's four learning styles, the 4 Mat System also addresses left and right-brain information processing. According to McCarthy (1987) "The left brain does a lineal type of processing, a sequential type, while the right brain uses a global process in which data is perceived, absorbed, and processed even while it is in the process of changing."(McCarthy, 1987, p.70). Left brain processing or "verbal thinking" involves "analytic, sequential, discrete and objective processes." (71). Right brain processing or "nonverbal thinking" includes holistic, subjective and visual-spatial processes. Each learner, regardless of learning style is viewed as being left or right brain dominant (p. 71).

The 4Mat System is designed to promote the development of the four learning styles utilizing both right and left brain processing. Mc Carthy (1987) states that the instructor's role "changes as he/she facilitates the learner's movement through the cycle," or teaches to the most comfortable learning style (p. 25). To illustrate this process the divergent learner needs to analyze his/her personal involvement with the learning experience through discussion. The instructors role in this situation is one of motivator and observer. The assimilative learner prefers to synthesize information and reflect on it. This learner is most comfortable in the traditional classroom receiving large amounts of information.

Conversely the the convergent learner prefers to be coached through practice experiences, and learns through role-modeling, feedback and manipulation of abstract information. Self-discovery is the preferred mode of learning for the accommodative learner, who enjoys incorporating new information into real-life experiences. The instructor in this learning situation functions in a remediating and evaluative role (McCarthy, 1987).

The concept of teaching to all learning styles, so that each learner can "shine" at least 25% of the time, regardless of brain orientation, has much to offer the adult learner in nursing education. (McCarthy, 1987, p. 47). Each learner has the opportunity to relax and learn focusing on their most comfortable learning style and at other times they are challenged to emphasize the other three learning modes.

INTERACTIVE VIDEODISC TECHNOLOGY

During the past 10 years a tremendous volume of literature regarding interactive videodisc technology has been generated. This literature can be categorized into three areas. One category describes the nature of interactive videodisc and existing applications. A second category contains descriptions of specific developmental projects with anecdotal reports and the third category addresses evaluations of interactive videodisc. The following review presents a description of interactive videodisc, applications of this technology, and current evaluations of interactive videodisc as an instructional medium.

Description

The development of the interactive videodisc has evolved from the combination of CAI and laser disc technology. Interactive videodisc has been described as a "state- of-the-art teaching machine" (Levin, 1983, p. 11), which utilizes the logical control and flexibility of computer software and the superb audio-visual characteristics of the laser videodisc. One 12-inch videodisc can store visual images from film, videotape, slides, photographs, computer graphics, animation and data screens in a maximum of 54,000 frames on each side. These frames can be accessed quickly via a laser beam and translated to visual images. It is the addition of animated visual images and sound to computer text-based simulations that has created the realism required for application of knowledge. Several

different levels of control have been developed, with the most sophisticated offering the ultimate in learning creativity and assessment (Clark, 1984).

Control is determined in part by the degree of interaction with the system. Interaction involves some form of communication between two people or, in the case of interactive videodisc, between a person and the system. As the elements of effective communication have not been identified and defined, technologists have encountered difficulties in replicating this process. Hon (1983) discusses human interaction as a process which occurs on several levels at one time. He states that "our affective sense knows when the interaction has been good" (p. 22). Significant elements of effective interaction include "...spontaneity, choice and absence of distractors "(Hon, 1983, p. 22). The capacity for interaction between the user and system is determined by the technology and program design. Level of interactivity has been defined as follows:

Level I - The first level is the most simplistic in design. It provides for linear play of the disc and freeze-frame only. This level provides for efficient long term storage of slides and videotape, but does not include branching.

Level II - A microprocessor which is incorporated into the videodisc player provides for a simple level of branching. The videodisc includes a computer program which is loaded into the microprocessor and the user interacts with the videodisc via a keypad. The user may repeat designated sections of the disc and answer questions. However, the learner is unable to select individual content areas to study or review due to the limited branching capabilities.

Level III - Interaction for this level is facilitated through the combination of laser disc technology and a microcomputer. The user interacts with the computer through a

keyboard, mouse, touch screen or light pen. Recently, voice recognition technology has provided a new dimension for communication. This level of interactivity is limited only by the imagination of the designer. Multiple branching and a careful blend of system controls provides for individual selection of text, graphic design, stereo sound and motion picture. (Hoekema, 1983; Bunderson, 1983).

This multisensory medium provides clear pictures of settings, subjects, and equipment, plus sound, animation and interaction. The simulation of reality is the feature that allows the learner to experience a situation and learn from it. The instruction is personalized and the learner is required to make judgements and take action. It is possible to make mistakes, visualize the consequences and correct them in a safe environment. Role modeling allows the learner to observe appropriate affective behavior, technical skills and effective problem-solving in action.

Applications

Modern society has found many imaginative uses for interactive videodisc. Successful applications of this technology have been well documented in business (Lippke, 1987; Drake, 1987 & Bunderson, 1983) and the military (Bunderson, 1983; Ebner et al., 1984). In fact, the military and the private sector have been the largest producers of interactive videodisc (Bosco, 1986; Bunderson, 1983). The availability of interactive videodisc programs in education has also improved (Dalton & Hannafin, 1987; Stevens, 1987 & Castro, 1990). However, some of the most exciting simulations have been developed in the medical sciences (Harless et al., 1990 & Henderson et al., 1986).

Business and industry have employed interactive videodisc for focused technical topics and complex instruction involving human relations, problem-solving and decision making. Such applications demonstrate the versatility of this medium. Interactive

videodisc technology has been employed in the airline industry to train pilots in the use of flight-guidance systems and recently American Airlines incorporated interactive videodisc technology into their flight simulator. Certified 727 pilots are allowed to complete all of their training for the 767 on this system and fly a real 767 for the first time with passengers (Pribble, 1985, p. 97). In another training situation at Goodyear Tire and Rubber Company in Tyler, Texas, it was found that journeymen mechanics preferred interactive videodisc instruction over traditional class-room lectures (Drake, 1987, p. 16). General Motors and the United Auto Workers were also successful in providing their employees with interactive videodisc instruction on hazardous wastes (Bosco, 1988). Continued development and use of interactive videodisc is sustained by subjective opinions of users, decreased learning time, retention, skills mastery, and transfer of learning (Drake, 1987).

The military and defence industries have utilized interactive videodisc in many areas of training including: maintenance and operation of defense weapons (including missiles), diagnosis and repair of technical problems and equipment malfunction, and combat trauma (Bunderson, 1983; Henderson et al.,1986 & Drake, 1987).

In the health sciences, creative uses for interactive videodisc technology have included archival recording and still storage, scientific and medical analysis, and many aspects of training and education (Bunderson, 1983; Harless et al., 1990; van Reenen, 1990; Howard, 1990; Rizzolo, 1990; Hon, 1982; Barker, 1988). Complex topics such as assessment and management of specific cardiac and respiratory conditions, involve audio components such as the reproduction of realistic heart and lung sounds, in addition to the video components with real patient situations. Recent interactive videodiscs such as one designed by Data Star, Edmonton, Alberta, include complex branching which will accommodate more than one professional (personal communication, September 10, 1990). For example, a videodisc with content focusing on airway management would have one

system of branching designed for respiratory technologists, one for nurses and one for physicians.

Innovative nursing programs have incorporated interactive videodisc instruction to enhance problem-solving skills and to assist in accommodating different learning styles (Persaud, 1986). Other applications include preparation for and supplementation of critical care experience (Mirr et al., 1986). The generic videodisc is presented by Mitchell (1987) as a valuable resource for expanding the clinical experience available to students in graduate and undergraduate nursing programs.

Evaluation of Interactive Videodisc Instruction

Although there are many studies which report subjective information on the effectiveness of interactive videodisc instruction, this review includes both formative and summative evaluations, with an emphasis on the latter. The majority of the research compares interactive videodisc instruction with some form of traditional lecture or lab presentation in terms of achievement, learning and instructional time, and affective factors (Drake, 1987 & Schare, 1991). However, empirical studies which address these factors are limited.

Bosco (1986) conducted an extensive review of the evaluation literature on interactive videodisc. The studies included in this report addressed instructional applications, were data based, and were available in the public domain. Bosco (1986) reviewed 29 formative and summative evaluations which were published within the previous five years. Most of these studies compared interactive videodisc instruction with traditional methods and reported findings on achievement, performance, learning time and attitude.

Nine out of 11 studies reported a reduction in training time associated with interactive videodisc instruction, but there was also some increase in the standard deviation. It is speculated that this could have resulted from accommodation of individual differences. Learner differences such as cognitive variables, amount of education, prior training and age generally had no influence on learning outcome. Thirteen out of 16 studies determined that interactive videodisc instruction was as effective as traditional methods in facilitating learning and three studies reported that it was not as effective. Formative evaluations revealed minimal information for the development of interactive videodisc (Bosco, 1986).

In addition to cognitive achievement and attitude, observational data were also recorded in a study by Stevens (1987). This investigation involved a high school science class, in which one group received interactive videodisc instruction prior to the lab and the second group received it after the lab. The findings revealed no significant difference between achievement or attitude scores of the two groups. However, observational data revealed reduced learning time, increased accuracy and reduced waste with the group who received interactive videodisc instruction prior to the lab. Other relevant factors for implementation of interactive videodisc instruction in the classroom were also discovered.

Bosco (1988) compared the effectiveness of interactive videodisc and classroom video tape for safety instruction at General Motors. He felt that this comparison was more credible than others which used existing lectures, as the two programs were designed and produced simultaneously to cover the same content. The data revealed that achievement following interactive videodisc instruction was significantly higher than that following instruction via linear video tape. Assessment of attitude indicated that the workers felt that interactive videodisc instruction was more effective and more interesting. The mean training times for each method were not statistically different, but there was a wide range of time taken by workers using the interactive videodisc.

Some early studies utilizing interactive video tape, investigated the effectiveness of this medium in reference to types of learning, locus of control, and practice. Although the random access time for this technology is not as efficient as that for interactive videodisc, it does attempt to provide similar interaction. In a study which addressed the effects of lesson control and practice on college students, Hannafin and Colamaio (1987) found no significant difference between the designer-control and the learner-control in terms of learning. Scores on practiced items were significantly higher for factual and problem-solving types of learning for cardiopulmonary resusitation. In another study which used interactive video tape, Dalton, Hannafin and Micheal (1987) studied the effects of knowledge versus context-based design strategies on acquisition of factual information and application learning. The findings of this study supported the use of context-based lesson strategies such as simulation for factual and application level content.

A more recent study explored interactive videodisc instruction and the learning styles of field dependence and field independence. Burwell (1991) conducted a quasi-experimental study with 87 college students. The content, introductory astronomy, was presented in a program control and learner control interactive videodisc design. Field dependent and field independent subjects were assigned to the different treatments. The analysis revealed that there was no significant difference in mean posttest scores of field dependent and field independent students in relation to the treatments. However, there was a significant interaction between learning style and the treatments. The field dependent learner performed better with the learner control method and the field independent learner excelled with the program control method. The results of this study indicate that the traditional thinking about control options and how field dependent and field independent students learn can not be applied directly to interactive videodisc instruction.

Interactive Videodiscs in the Health Sciences

One of the first interactive videodiscs designed for instruction in this area was produced by Hon (1983). He developed a level III system to teach basic CPR for the American Heart Association. Fifty students took the interactive videodisc course and 50 students completed the traditional instruction. The passing rate for this evaluation was three times higher for the interactive videodisc group. Anecdotal information revealed a higher quality of performance and reduced learning time.

Lyness (1987) also compared traditional and interactive videodisc instruction for CPR in a study which involved 96 students. This evaluation demonstrated a slight increase in knowledge which was not statistically significant and increased performance was noted. Learning times were variable but total learning time was reduced. It was observed that learning time reflected factors such as difficulty with the material, level of interactivity and personal approaches to the material.

At the U.S. Army Academy of Health Sciences, Fort Sam Houston, Texas, researchers completed an experimental study which compared traditional instruction and interactive videodisc instruction for intramuscular injection. A randomly selected sample of 70 military medics were randomly assigned to two groups. They reported that initial performance testing was improved with interactive videodisc instruction but the results were not statistically significant. Retention, however, was significantly improved and training time was reduced by 43% (Ebner at al., 1984).

Harless et al. (1990) presented data on the effectiveness of a high-tech interactive videodisc with voice recognition technology. This interactive videodisc was designed for patient-centered teaching in the medical school classroom. Interaction with the simulated

patient involved talking to the patient, whose color video images appeared on a large screen. No other technology was visible during the class (p. 327).

The evaluation of this interactive videodisc was a pretest, posttest design, conducted with 306 second year medical students at three different universities. The data revealed that there was a significant gain in knowledge of essential content (the mean difference of the pretest, posttest difference was 11.1 points, significant at the .02 probability level). Questionnaires validated with videotape revealed that the majority of the students were "intellectually challenged and emotionally involved with the patients presented" (p. 330). The data indicated individual commitment of the majority of the students to the care and management of the simulated patient. The authors concluded that significant learning had occurred and the simulation model was validated in terms of simulating a real patient. This study is interesting in that it investigates a new dimension of affective factors which demonstrate involvement of the learner.

Oermann (1990) examined a wide range of research in nursing education on teaching methods from 1965-1988. From this review she formed some generalizations regarding the effectiveness of CAI. Most studies found that CAI was as effective as other teaching methods in terms of knowledge gain and retention. However, only one study by Rickelmann et al. (1988) specifically addressed interactive videodisc instruction. One author, Chang (1986) recommended further research on the impact of interactive videodisc instruction on students, faculty, and settings. Few studies attempted to identify characteristics of the learner and other variables that influence learning. Oermann (1990) recommended further research on "the relationship of different learner characteristics, attributes of the teaching method, and learning outcomes" (p. 24).

The research by Rickelmann (1988) addressed the content area of therapeutic communication, in a comparison of lecture plus interactive videodisc instruction and lecture and video tape. Seventy-five baccalaureate nursing students were randomly divided into two groups for a quasi-experimental pretest, posttest study. The findings demonstrated that interactive videodisc instruction significantly enhanced the learner's application of knowledge in this area, however, no significant differences for state anxiety scores were found between the two groups

Another study which addressed cognitive learning and affective behaviors was conducted by Schare et al. (1991). In this pretest, posttest experiment 83 baccalaureate nursing students were divided into two groups. One group received traditional lectures regarding diabetic health assessment and the second group received interactive videodisc instruction for the same content. The analysis of posttest means revealed no significant difference in student achievement, indicating that interactive videodisc instruction was at least as effective as lectures. The analysis of the affective factors produced significant positive results regarding interactive videodisc instruction.

SUMMARY

Recent literature on adult learning and development has emphasized the differences between learners in terms of learning preferences, previous experiences and life-style commitments (Cross, 1981 & Knowles, 1980). As the student population in nursing has become increasingly diversified, nurse educators must place increased emphasis on the personalization of learning. One of the most salient processes involves knowing the student as a learner and assisting the student in identifying his/her learning strengths. Learning style awareness enhances self-concept and assists the learner in utilizing the

multiple resources of the learning society (Cross, 1981; Knowles, 1980; Dixon, 1985; Partridge, 1983).

Although there is growing consensus that assessment of learning style reveals important information, educators have delayed implementation. Some of the factors which have contributed to this delay include the questionable reliability and validity of available instruments which measure different aspects of style. Secondly researchers have found that learning styles are influenced by a variety of factors and tend to change in different situations. The concept of assessing learning style and prescribing an educational treatment for learners who are not successful in the traditional setting has demonstrated some benefit. However recent brain research indicates that more comprehensive balanced learning occurs when both hemispheres of the brain are stimulated to develop (Blakeslee, 1982). Kolb (1984) supports this finding with his recommendation that learners develop all four learning styles in his statement "more powerful and adaptive forms of learning emerge when these strategies are used in combination" (p. 66).

The process of education in nursing requires a variety of teaching methods to achieve many types of learning outcomes. Experiential teaching methods provide for individual participation in relevant content or experiences, through simulation or clinical practice. As the demand for thoroughly prepared practitioners has increased and the availability of clinical experiences has diminished, educators have provided alternative learning experiences. However, it is recognized that more research is needed regarding all experiential teaching methods and strategies for teaching problem-solving and clinical judgement (Oermann, 1990, p. 23).

One of the most recent and promising resources involves the use of interactive videodisc technology. As modern society has entered the visual information age, the

learner of today has been exposed to movies and television of exceptional quality. Recognizing the need to produce educational media with similar standards, business, industry, the military and educational institutions have made large financial commitments to the development of interactive videodisc software.

Current research demonstrates that interactive videodisc instruction is as effective and in many situations more effective than traditional methods, regarding academic achievement and performance. Data regarding attitude assessment also indicates that the majority of learners involved in these studies prefer interactive videodisc instruction. It was demonstrated that learners were "intellectually challenged and emotionally involved with the patients presented" in the interactive videodisc simulation (Harless, 1990, p. 330). The large variations in learning time point out that individual learners utilize this technology to approach content in several different ways, while at the same time total learning time is reduced. The findings of this research indicate that further exploration of this technology is required in terms of individual learning characteristics.

CHAPTER THREE
DESIGN AND METHODOLOGY

INTRODUCTION

This was an experimental study which focused on learning styles and the effectiveness of interactive videodisc instruction. The following chapter includes a description of the research design including the setting, subjects, and instruments. The next section includes a discussion of the methodology including the procedure for data collection and data analysis employed in this investigation.

RESEARCH DESIGN

As it was not possible to select a true random sample, this evaluation was considered to be a quasi-experimental one-group repeated measures design, as described by Leedy (1980). Data regarding characteristics of the sample were collected with the demographic survey and learning styles were assessed with Kolb's LSI (1985). The treatment consisted of individual instruction with a level III interactive videodisc. Previous learning, achievement and retention of learning following interactive videodisc instruction were assessed with multiple choice criterion referenced exams (see Appendix A for a description of the interactive videodisc). This research was conducted with Nursing I students at the University of Alberta Hospitals School of Nursing, Edmonton, Alberta.

Setting

The University of Alberta Hospitals School of Nursing is a department within the University of Alberta Hospitals (referred to hereafter as UAH) complex, Edmonton, Alberta. The UAH is a tertiary care facility which serves the Edmonton area and acts as a

referral center for northern Alberta, the Yukon, Northwest Territories and northern British Columbia. Funding for the School of Nursing is provided by the Government of Alberta through the Department of Advanced Education.

The UAH School of Nursing offers a 96 week diploma nursing program and accepts an enrollment of 90 students twice a year. The total enrollment at any one time is approximately 450 students. Students enrolled in this program have met the minimal admission requirements as set by the Regulations Governing Schools of Nursing (Universities Coordinating Council, 1982). These regulations stipulate that each student must:

a. possess an Alberta High School Matriculation Diploma (or its equivalent), including English 30 and two science courses at the same level; and

b. have an average of 60% in five Grade 12 courses with no mark below 50%.

Mature students (over 21 years of age) must meet slightly different requirements. They must have a minimum of 50% in three Grade 12 subjects (English 30 and Biology 30 with the remaining subject chosen from Chem 30, Physics 30, Math 30, 31 or 33, Social Studies 30, or a second language at the same level). Each individual must have a final grade of at least 50% in a Grade 12 mathematics course or a final grade of at least 65% in a Grade 10 or 11 mathematics course.

The UAH School of Nursing is designed to provide the student with the knowledge, skills and attitudes necessary to give safe, individualized nursing care to the hospitalized patient. In addition to the above, the student is to continue development as a responsible, self-directed individual and meet the registration requirements for the province of Alberta (UAH School of Nursing Program Information, 1990).

The curriculum of this program is comprised of five levels as indicated below:

1. Pre-nursing Semester - 14 weeks;
2. Nursing I - 17 weeks;
3. Nursing II - 22 weeks;
4. Nursing III - 19 weeks;
5. Nursing IV - 22 weeks.

All five levels must be completed prior to taking the registration exam.

Subjects

All students in the April 1992 Nursing I Class agreed to complete Kolb's (1985) LSI. Forty students, from the total of 73 students in this class, volunteered to participate in this study. All students had met admission requirements for entry into the program in addition to the requirements for the Pre-nursing semester. Three of the subjects withdrew from the study after completing the Kolb's LSI; therefore, 37 subjects in total comprised the sample for this study. Nursing I students were the most appropriate subjects for this investigation as respiratory assessment is introduced in this level as a required component of the program.

Selection of a Learning Style Instrument

The selection of a learning style instrument requires careful consideration of the student population, availability and validity of the instrument, practical aspects of administration and interpretation of findings. However, the most important factor to consider is: how the information or data will be utilized to enhance learning (Messick, 1976; Gregoric, 1982).

The Kolb's Learning Style Inventory (LSI) (1985) was selected for this investigation because it is based on the experiential learning theory, which can be directly applied to the adult learner in nursing. A review of current research indicates that the Kolb's Learning Style Inventory is the most popular instrument for assessment of learning styles in nursing education. This instrument is also one of the most established learning style instruments and is readily accessible from the publisher (McBer & Company, Boston, U.S.A.).

The LSI (1985) was tested on an ethnically diverse sample of 1,446 adults selected from a variety of occupations and/or careers. The average education was two years of college education (Kolb, 1986). Kolb's LSI has been tested in a variety of settings, including: education, health sciences education and management. Several theorists have documented that Kolb's LSI is a valid and reliable instrument (Plovnick, 1975; Thompson, 1983 & Pigg, 1980). However, some recent authors question the popularity of this instrument. DeCoux (1990) indicates that Freedman & Stumpf (1978) reported low test-retest reliability and Fox (1984) found problems with construct validity.

Kolb's Learning Style Inventory (LSI) (1985)

The LSI is a 12-item questionnaire, designed by David A. Kolb to assess preferred learning style. This instrument can be self-administered and self-interpreted by the learner. For each item, the learner "rank orders four sentence endings" in the manner that best describes their learning style (Kolb, 1986, p. 1). One of the four learning modes corresponds with each of the sentence endings. The four columns are totalled and each score is identified as concrete experience, reflective observation, abstract conceptualization, and active experimentation. These scores are plotted on a graph representing the learning cycle, to demonstrate the learning preferences of the individual (Kolb, 1985, 1986). See Appendix D for an example of this instrument.

Plotting learning preferences on the learning cycle usually indicates that the learner prefers more than one mode of learning; in fact each individual's learning style is a combination of the four basic learning modes. To identify one specific learning style the scores are combined to identify two dimensions which are plotted on a different graph. For example, the score for concrete experience is subtracted from the score for abstract conceptualization and the score for reflective observation is subtracted from the score for active experimentation. The learner will be identified as a converger, diverger, assimilator or an accommodator (Kolb, 1984, 1985, 1986).

Demographic Survey

A questionnaire which was developed by the researcher, was administered to the sample to determine demographic data. These data included factors such as age, sex, place of residence, education, and work experience. A brief attitude survey was included to collect information from the subjects about their learning experience with this medium. The questionnaire was given to each participant after completing the interactive videodisc instruction (see Demographic Survey, Appendix D).

Achievement Testing

Achievement testing serves a significant role in the enhancement of learning and assessment of learning outcomes. Essentially, "an achievement test determines the amount a student has learned" (Gronlund, 1982, p.1). The interpretation of achievement tests is either norm referenced or criterion referenced. Norm referenced tests provide information on individual differences in achievement within a specific group or with a comparison group. Test items are kept within an average range of difficulty, resulting in elimination of those which most students master or answer correctly. This test provides a method of ranking students (Gronlund, 1982).

Criterion referenced tests are usually employed to assess learning following interactive videodisc instruction because they are based on specified course objectives and determine the areas in which each learner can perform successfully. It is therefore possible to determine the level of performance and the areas of difficulty. Multiple choice criterion referenced exams based on the objectives of the interactive videodisc module were utilized for this study. The questions were designed to measure cognitive achievement in terms of recall, interpretation, analysis, and application of information. The measure of achievement was defined as the score, in percentage, that a student attained on tests written to demonstrate mastery of Part I (respiratory assessment) of the interactive videodisc on Nursing Care of the Elderly Patient with Chronic Obstructive Pulmonary Disease.

Bergman (1981) describes the use of pretests and posttests in the process of evaluating learning. A pretest establishes the level of knowledge before instruction or measures prerequisite entry skills. It can be based on pre-course objectives or course objectives to determine whether students have already mastered the content. Posttests assess the impact of the instruction on the student by assessing the amount of learning in a specific content area. The posttest may be identical to the pretest or it may be modified slightly (Bergman, 1981 & Gronlund, 1982).

Achievement Instruments

The achievement instruments were developed by the researcher for this study. Each examination consisted of a hard copy pretest, posttest and retention test. Each test consisted of 15 criterion-referenced multiple choice questions. The pretest and posttest were slightly different but designed with similar questions to assess the content of the interactive videodisc. The content of the courseware included chest assessment, laboratory values, interpretation of findings and immediate nursing care. The retention test was the

same as the posttest. Each test was coded from a marking key and entered for data analysis.

Content validity of the exams was ensured by representative sampling of the courseware and consultation with content experts teaching in this area. Two instructors viewed the interactive videodisc individually and noted the content areas to ensure that they were addressed on each exam. Three content experts independently completed trial runs for further verification and proofreading.

The reliability of these instruments was checked using the split-half technique. The Pearson product moment correlation resulted in the following reliability coefficients: pretest .31, posttest .18, retention test .02. Although the traditional split-half method did not appear to be reliable, a consistency test designed to estimate reliability of criterion-referenced mastery tests, suggested that decisions were not as consistent on the pretest (51.4%) as would be expected. The results on the posttest (83.8%) and the retention test (83.8%) indicate that decisions were more consistent following interactive videodisc instruction, indicating a reasonable level of consistency (Gronlund & Linn, 1990; Mehrens & Lehmann, 1991). For examples of achievement instruments, see Appendix D.

METHODOLOGY

Data Collection

On June 27, 1990, the study was introduced to the Nursing I students following their introductory class on assessment of the respiratory system. The process of maintaining data confidentiality was presented and information sheets with consent forms (see Appendix A) were circulated to clarify information. All members of the class were

participate in the study signed the consent form and returned it with their LSI. All participants were given a research identification number. The subjects volunteered with the understanding that this study was an additional learning activity to be completed during their own time.

The InfoWindow system was set up with a touch screen in the John Scott Library University of Alberta Hospitals, Edmonton, Alberta by Dr. Charles Bidwell, Director of the Media Center. Each subject was requested to present their research number at the circulation desk in the John Scott Library anytime during library hours. At this time they were given a multiple choice pretest to complete. Upon returning with the pretest, they were given a package with instructions and a survey. They also signed out the interactive videodisc and head phones for a maximum of two hours. Upon finishing Part I of the interactive videodisc program, they returned the program to the circulation desk and obtained the posttest and demographic survey, which they completed and returned to the circulation desk. A multiple choice retention test was administered on an individual basis, six weeks after completion of the interactive videodisc content.

It was soon revealed that many subjects were reluctant to try this new technology and required a brief period of familiarization just prior to signing on the system. The same instructions were given to each subject using the written instructions as a guide. As participation in this study was voluntary, students were expected to complete the requirements on their own time. Most students were very pressed for time and as a result data collection extended over a period of six months, rather than the anticipated two and one half months. It is therefore possible that the subjects were exposed to clinical experiences which introduced unknown confounding variables.

Procedure for Data Analysis

Subject Data - The survey instrument was completed by all subjects in the sample to determine work experience, as well as demographic and educational characteristics. The data were summarized and presented in tabular format.

Learning Style Data - The Kolb's LSI (1985) was administered to the entire class of 70 students, but due to problems with students not completing the forms correctly, complete data were collected for only 67 students. Each inventory was scored according to Kolb's Learning Style Inventory User's Guide (1986), and subjects were assigned to one of the four learning styles: accommodator, diverger, assimilator and converger. Analysis of this data included identification of the mode to determine the most common learning style. The mode was also determined for the sample. Learning styles for the class and the sample were represented with a table indicating the number and percentage of learners in each category. Chi-square was used to analyze the data and determine the degree of similarity of the two groups. The data were also analyzed with Chi-square to determine any significant relationship between gender and learning style.

The problem was addressed through examination of seven null hypotheses. Each null hypothesis was tested as described below:

Achievement and Retention: The null hypotheses I - III addressed the effectiveness of interactive videodisc instruction in producing immediate and long term learning for the total sample.

Null Hypothesis I: There will be no significant difference in pretest and posttest achievement scores immediately following interactive videodisc instruction.

Null Hypothesis II: There will be no significant difference in posttest and retention test achievement scores six weeks following interactive videodisc instruction.

Null Hypothesis III: There will be no significant difference in pretest and retention test achievement scores six weeks following interactive videodisc instruction.

Percentage scores were calculated for the pretest, posttest, and retention test and the mean was determined for each exam. The data were summarized in tabular format. The means of the pretest and posttest were subjected to the repeated measures t-statistic to determine the presence of any significant, immediate learning. The repeated measures t-statistic was also used to analyze the posttest and retention test means, to determine any significant loss of learning six weeks following instruction. The total long term learning gain was assessed by analyzing the pretest and retention test means with the repeated measures t-statistic. The above data were presented in tabular format.

Learning Style and Achievement: The null hypotheses IV-VI examined the interaction of learning style, achievement and retention in terms of mean differences in each learning style group.

Null Hypothesis IV: There will be no significant differences among the learning style groups when comparing mean pretest achievement scores.

Null Hypothesis V: There will be no significant differences among the learning style groups when comparing mean posttest achievement scores.

Null Hypothesis VI: There will be no significant differences among the learning style groups when comparing mean retention test achievement scores six weeks following interactive videodisc instruction.

The means of the pretest, posttest, and retention test scores in each of the four learning style categories were calculated and compared. ANOVA was utilized to test for a possible relationship between learning style and the means for each of the above examinations. The above data and analyses were summarized in tabular format.

Learning Style and Attitude: Null hypothesis VII investigated the relationship of learning style and attitude towards interactive videodisc instruction.

Null Hypothesis VII: There will be no significant relationship between learning style and selected attitudinal responses regarding interactive videodisc instruction.

Percentages were calculated for each category of the attitude survey and the results were analyzed with ANOVA to determine any existing relationship between learning style and attitude towards interactive videodisc instruction. The results were presented in tabular format. Student comments were inspected for any obvious association with learning style.

SUMMARY

Seventy three, Nursing I students from the University of Alberta Hospitals School of Nursing completed the Kolb's LSI (1985) for this study and 40 students volunteered to participate in a quasi-experimental one-group repeated-measures study to assess learning styles and evaluate the effects of interactive videodisc instruction. This evaluation was

based on a pretest, posttest, retention test design experiment,with interactive videodisc instruction as the treatment. The independent variables were the four learning styles identified by Kolb's LSI (1985).

The next chapter will present the descriptive data, analyses, and findings obtained from the quasi-experimental repeated measures design study described in this chapter.

CHAPTER FOUR
DATA ANALYSIS AND RESULTS

INTRODUCTION

This chapter presents an analysis of the data which were obtained through the instruments and methodology described in chapter three. Data collected with the demographic survey were utilized to describe the sample in terms of work experience, educational and other demographic characteristics. The learning styles of the sample and class were compared and the relationships of learning style to gender, achievement, retention, and attitude were also explored. Data regarding assessment of achievement were analyzed for immediate learning and retention six weeks following interactive videodisc instruction. The results of the data analyses are presented in the following chapter.

SUBJECT DATA

The demographic survey, which was developed by the researcher was employed in this study to collect information regarding previous education, work experience, and other demographic characteristics. The data are presented in Table 1.

Demographic Data

The students in this sample ranged in age from 18-45 years (mean age - 27 years; mode - 25 years; median - 25 years), with 89.2 % of them over 21 years of age. Male subjects comprised 27% and female subjects 73% of this sample. The majority of this sample were not married (83.8%) and 16.2% had dependents.

Table 1

Subject Data

Characteristics	Results	
Demographic Data	**n**	**%**
Male	10	27.0%
Female	27	73.0%
Total number of students	37	100.0%
Age range	18-45 yrs	
Mean age	27 yrs	
Mature students over 21 years	33	89.2%
Married	6	16.2%
Single, separated/divorced	31	83.8%
Residents of Edmonton	34	91.9%
Residents of Alberta	37	100.0%
Previous Education		
Post-secondary education	31	83.8%
Post-secondary diplomas	8	21.6%
Post-secondary degrees	4	10.8%
Advanced standing	12	32.4%
Work Experience		
Previous work experience	28	75.7%
No previous work experience	11	24.3%
Work experience < 6 months	2	5.4%
Work experience > 6 months	26	70.2%
Work experience in health care	14	37.8%

All of the students in the sample were Alberta residents, with 91.9 % of them residing in Edmonton. There were no students from out of country.

Educational Characteristics

Data for the subjects in this study revealed that 83.8 % had previous experience in post-secondary educational programs and 21.6 % had completed a diploma or certificate program, while 10.8 % had completed a baccalaureate or higher university degree. Of all subjects in this sample, 32.4 % received advanced standing (credit for courses completed prior to admission) in the UAH School of Nursing program.

Work Experience

Prior to admission, 24.3 % of the subjects in this study had no work experience; 5.4 % had worked in a variety of settings for less than 6 months, and 70.2 % had been employed for more than six months. Students who had worked in the health care field included 37.8% of this sample; 10.8 % of which were registered nursing assistants.

LEARNING STYLE DATA

Learning style data were collected from the total class of Nursing I students (total = 70) in the the April 1992 class. Complete data for 67 students were recorded, but the researcher was unable to complete learning styles assessment for three students due to incomplete information. The data for the class of 67 students were compared with the learning styles of the 37 subjects in the sample who volunteered for this study. The mode was determined for the sample and the class to identify the most common learning style.

Learning Styles of the Class and Sample

The data for the class revealed that the subjects were distributed throughout all four learning style categories. Calculation of the mode demonstrated that the assimilator learning style was the most common. Although the mode indicated that the assimilator category was also the most common for the sample, the remaining learners were distributed evenly throughout the other categories. The assimilative learner takes in new information on an abstract level and processes it reflectively. Strengths include inductive reasoning, planning and the creation of models, theories and concepts. The descriptive data for the class and the sample are presented in Tables 2 and 3.

The class and sample data were subjected to Chi-square analysis to determine any significant relationship between the learning styles of the sample and the class. The Chi-square value of $x^2(3. n=37) = .33$, did not exceed the critical value of 7.81 and was therefore not significant at the .05 level. The data analysis is included in Table 4.

Table 2

Learning Styles of the Class

Learning Styles	N	%	Mode
Accommodator	16	23.9	
Diverger	13	19.4	
Assimilator	26	38.8	Assimilator
Converger	12	17.9	
Total	67	100.0	

Table 3

Learning Styles of the Sample

Learning Styles	n	%	Mode
Accommodator	8	21.6	
Diverger	8	21.6	
Assimilator	13	35.2	Assimilator
Converger	8	21.6	
Total	37	100.00	

Table 4

Chi-square Analysis
Learning Styles of the Class and the Sample

Group	Learning Styles				
	Accommodator	Diverger	Assimilator	Converger	
Class					Total
(Observed)	16	13	26	12	67
(Expected)	15.46	13.53	25.13	12.88	67
Sample					
(Observed)	8	8	13	8	37
(Expected)	8.54	7.47	13.88	7.12	37
Total					
(Observed)	24	21	39	20	104
(Expected)	24	21	39	20	104

Chi-square	DF	Significance
.33	3	.5016

Chi-square Value $x^2(3, n = 37) = .33, p>.05.$

Learning Style and Gender

Table 5 illustrates the descriptive data on learning style and gender. The sample contained no male subjects in the accommodative learning category and just one male (2.7%) in the convergent learning category. The majority of male subjects were divergent (20%) or assimilative learners (70%), who shared strengths in the ability to observe and reflect on new information (Kolb, 1984, 1986). As stated earlier, the assimilative learning category had the greatest number of subjects (35.2%). It was interesting to note that seven (70%) of the male subjects demonstrated this learning style. These findings indicate that the majority of male students preferred to process new information by observing and reflecting on an abstract level.

The majority (55.6%) of the female subjects were either accommodators or convergers. Accommodators and convergers share a preference for experimenting and trying out new information. The converger takes in new information on an abstract level and transforms it actively, while the accommodator accepts new information on a concrete level and transforms it actively (Kolb, 1984, 1986).

Table 5

Learning Style and Gender

Learning Style	Male		Female		Total	
	n	%	n	%	n	%
Accommodator	0	0.0	8	21.6	8	21.6
Diverger	2	5.4	6	16.2	8	21.6
Assimilator	7	18.9	6	16.2	15	35.2
Converger	1	2.7	7	18.9	8	21.6
Total	10	27	27	73	37	100.0

Crosstabs were calculated on the the variables learning style and gender and checked for significance using Chi-square. The Chi-square value of x^2 (3, n = 37) = 10.21 exceeded the critical value 7.81 and was therefore significant at the .05 level. On examination of the cross-tabulation table, it was evident that the findings were primarily due to the large number of male subjects who demonstrated the assimilative learning style and the absence of males in the accommodator category. The data analysis is summarized in Table 6.

Table 6

Chi-square Analysis - Learning Style and Gender

Group	Learning Styles				
	Accommodator	Diverger	Assimilator	Converger	
Male					Total
(Observed)	0	2	7	1	10
(Expected)	2.2	2.2	3.5	2.2	10
Female					
	8	6	6	7	27
(Expected)	5.8	5.8	9.5	5.8	27
Total					
(Observed)	8	8	13	8	37
(Expected)	8	8	13	8	37

Chi-Square Value	DF	Significance
10.21	3	.0169

x^2 (3, n = 37) = 10.21, p<.05.

ACHIEVEMENT DATA

The purpose of this study was to explore the nature of the relationship between the learning styles of diploma nursing students and the effectiveness of interactive videodisc instruction. The effectiveness of this medium was assessed in terms of level of achievement immediately following instruction and retention six weeks later. As described previously in chapter three, a consistency test designed to assess the reliability of criterion-referenced mastery exams was employed to assess the reliability of the achievement instruments. The decision consistency for the pretest was rather low (51.4%) as expected and the decision consistency for the posttest (83.8%) and retention test (83.8%) demonstrated that there was a reasonable level of consistency after instruction.

Achievement and Retention - Null Hypotheses I - III

The following null hypotheses assessed the effectiveness of the interactive videodisc instruction module in increasing competency performance scores for the total sample.

Null Hypothesis I: There will be no significant difference in pretest and posttest achievement scores following interactive videodisc instruction.
Null Hypothesis I was rejected.

Null Hypothesis II: There will be no significant difference in posttest and retention test achievement scores six weeks following interactive videodisc instruction.
Null Hypothesis II was not rejected.

Null Hypothesis III: There will be no significant difference in pretest and retention test achievement scores six weeks following interactive videodisc instruction.

Null Hypothesis III was rejected.

The descriptive data for achievement are illustrated in Table 7. The difference between the pretest and posttest means (9.57%) demonstrated that there was an immediate total learning gain, for the sample following IVD instruction. When the pretest and posttest means were submitted to a repeated measures T-test (2-tail) analysis the results revealed a T value of 4.65, which was significant at the .05 level. Based on the findings of this analysis, the first null hypothesis was rejected, indicating that there was a significant difference in pretest and posttest scores. The results of the above analysis are presented in Table 8.

Table 7

Comparison of Achievement and Retention Means

Pretest Mean	Posttest Mean	D	Retention Mean	D
60.68%	70.24%	9.57%	68.78%	-1.46%

Table 8

Repeated Measures T-Statistic For Pretest and Posttest

Variable	n	Mean	Diff Mean	SD	SE	T	DF	P (2-Tail)
Pretest	37	60.68		12.52	2.06	4.65	36	.000
			9.57					
Posttest	37	72.24						

The difference of -1.46%, between the means of the posttest and the retention test indicated that there was some minimal loss of learning. The results of the repeated measures T-test (2-tail) on the achievement scores of the posttest and retention test yielded a T value of .-61, which was not significant at the .05 level. The findings of this analysis thus failed to reject null hypothesis II, indicating that there was no significant loss of learning six weeks following the IVD instruction. These findings indicate that interactive videodisc instruction was associated with significant retention of learning for a minimum of six weeks. The analysis is summarized in Table 9.

Table 9

Repeated Measures T-Statistic
Posttest and Retention test

Variable	n	Mean	Diff Mean	SD	SE	T	DF	P (2-Tail)
Posttest	37	70.24		14.51	2.39	-.61	36	.544
			-1.46					
Retention Test	37	68.78						

The total learning gain was indicated by the difference between the pretest mean and the retention test mean (8.10%). The scores of the pretest and retention test were also subjected to repeated measures T-test analysis (2-tail) and revealed a T value of 3.03 significant at the .05 level. This analysis demonstrated a significant difference in the means of the pretest and retention test, thus rejecting null-hypothesis III. These results

demonstrated that a significant total learning gain was retained for six weeks (refer to Table 10).

Table 10

Repeated Measures T-Statistic
Pretest and Retention Test

Variable	n	Mean	Diff Mean	SD	SE	T	DF	P (2-Tail)
Pretest	37	60.68		16.29	2.68	3.03	36	.005
			8.108					
Retention Test	37	68.78						

Learning Style and Achievement - Null Hypotheses IV - VI

The interaction of learning style and achievement was assessed in terms of mean differences in each learning style group. Three null hypotheses were developed to explore this relationship. They are presented below with the data analysis.

Null Hypothesis IV: There will be no significant differences among learning style groups when comparing mean pretest achievement scores prior to interactive videodisc instruction. Null Hypothesis IV was not rejected.

Null Hypothesis V: There will be no significant differences among learning style groups when comparing mean posttest achievement scores following interactive videodisc instruction.

Null Hypothesis V was not rejected.

Null Hypothesis VI: There will be no significant differences among learning style groups when comparing mean retention test achievement scores six weeks following interactive videodisc instruction.

Null Hypothesis VI was not rejected.

The descriptive data for learning styles and achievement testing are summarized in Table 11. On observation, there were minimal differences in pretest means for each learning style, which suggested that previous learning was not associated with learning style. The analysis of variance of learning style and pretest results (Table 12) revealed a value of F .368 which was not significant at the .05 level. These results failed to reject null hypothesis IV, indicating that there was no significant relationship between learning style and pretest achievement scores.

Table 11

Learning Style and Achievement

Learning Styles	n	Pretest Mean %	Posttest Mean %	D	Retention Mean %	D
Accommodator	8	62.38	73.38	11.00	75.75	2.37
Diverger	8	56.63	63.25	6.62	59.25	-4.00
Assimilator	13	61.54	69.69	8.15	67.54	-2.15
Converger	8	61.63	75.00	13.40	73.38	-1.63

Table 12

Analysis of Variance - Learning Style and Pretest Result

Source of Variation	S S	D.F.	Mean Square	F	Sig of F
Between	171.252	3	57.084	.368	.776
Within	5116.856	33	155.056		

Examination of the posttest means revealed that convergent learners achieved the greatest immediate learning gains (13.4%), followed by the accommodators with a gain of 11.0%. As noted previously, the convergent and accommodative learners prefer to practice and experiment with new information and material. The converger prefers to process abstract information actively by experimenting with new ideas. This learner has strengths in defining and solving abstract and technical problems but may experience difficulty with solving problems too quickly or focusing on the wrong problem. The accommodator actively processes new information on a concrete level, choosing to take action and become involved in new experiences. The hasty completion of tasks without adequate reflection may result in problems for this learner (Kolb, 1986).

The divergent learners had the lowest immediate learning gain (6.62%) followed by the assimilators with (8.15%). The diverger takes in new information on a concrete level and processes it reflectively. This learner is feeling oriented and possesses strengths in generation of new ideas, creativity and understanding people. Problems for this learner include indecisiveness, and the setting of priorities. The assimilator tends to accept new information on an abstract level and transform it reflectively. Strengths include the

organization and synthesis of large amounts of information into theories and concepts. However assi[illegible]may experience difficulty with the practical application of theories and concepts (Kolb, 1984, 1986). Regardless of the above findings, ANOVA analysis of learning styles and posttest means again failed to reveal statistically significant differences in the achievement of the four different types of learners (Kolb, 1986).

Inspection of the means of the retention test for each learning style in Table 11, indicated that there was a potential relationship between learning style and retention scores. The greatest loss of learning occurred with the divergers (-4.00%) and then the assimilators (-2.15%), the convergers demonstrated minimal loss of learning (-1.63%) and the accommodators demonstrated a small increase in learning (2.37%). One-way analysis of variance of this data, however, did not reveal a statistically significant relationship (see Table 14).

It is evident that all learners experienced significant learning gains but the convergent learners demonstrated the greatest long term learning gain, followed by the accommodative learners. The divergent learners demonstrated the lowest learning gain over the period of six weeks followed by the assimilators. Although ANOVA analysis of learning styles and pretest, posttest and retention test means failed to produce a statistically significant relationships and failed to reject null hypotheses IV - VI, the data suggested that a larger sample may have revealed significant findings (See Tables 13 - 14).

Table 13

Analysis of Variance - Learning Style and Posttest Results

Source of	S S	F.	Mean Square	F	Sig of F
Between	654.667	3	2188.222	1.685	.189
Within	4274.144	33	129.520		

Table 14

Analysis of Variance - Learning Styles and Retention Results

Source of Variation	S S	D.F.	Mean Square	F	Sig of F
Between	1304.165	3	434.722	2.597	.069
Within	5524.106	33	167.397		

Learning Style and Attitude - Null Hypothesis VII

The following null hypothesis investigated the association of learning style and the learner's attitude towards interactive videodisc instruction.

Null Hypothesis VII: There will be no significant relationship between learning style and selected attitudinal responses.

Null Hypothesis VII was not rejected for three of the six attitudinal items analyzed

The subjects of this study were very positive in their answers to three of the six questions and somewhat ambivalent about the remaining three attitudinal questions. The data indicate that the majority of learners enjoyed the interactive videodisc instruction (83.8%) and had no difficulty learning new material (64.8%) with this technology. The use of this medium as a convenient method of review was supported by 83.7% of the subjects.

Although 64.8% felt that they would have no difficulty using interactive videodisc instruction in other areas, 24.3% of the subjects were neutral. When requested to compare the effectiveness of interactive videodisc instruction with traditional methods there was some ambivalence; 35.1% agreed that it was more effective and 35.1% were neutral. The subjects were somewhat less ambivalent about the flexibility of this medium in terms of individual schedules; 56.7% were positive and 24.3% were neutral. The results from the attitude survey are summarized in Table 15.

The analysis of variance of learning style and attitude regarding enjoyment of interactive videodisc instruction produced a value of F - 3.077 which was statistically significant at the .05 level. On observation it is interesting to note that two learners (15.4%) with the assimilative learning style were the only people who did not enjoy this medium and three assimilative learners (23.1%) and one divergent learner (12.5%) were neutral. All learners with the accommodative and convergent learning styles clearly enjoyed this learning experience.

Table 15

Attitudes Regarding Interactive Videodisc Instruction

Question	Strongly Disagree %	Disagree %	Neutral %	Agree %	Strongly Agree %
1. I enjoyed this method of instruction.	0.0	5.4	10.8	67.6	16.2
2. I found it difficult to to learn new material with this method.	21.6	43.2	13.5	16.2	5.4
3. IVD provides a convenient method of review.	0.0	10.8	5.4	43.2	40.5
4. I would have difficulty using this method for other areas.	27.0	37.8	24.3	5.4	5.4
5. I found the IVD more effective than traditional instruction.	2.7	27.0	35.1	21.6	13.5
6. I found this method of learning flexible enough for my schedule.	2.7	16.2	24.3	40.5	16.2

ANOVA analysis of learning style and attitude regarding difficulty in learning new material with interactive videodisc instruction, revealed a value of F - 3.255, which was also significant at the .05 level. Inspection of the data revealed that no learners in the convergent category and only one learner (12.5%) in the accommodator category experienced difficulty with new material. The majority of the learners with a divergent or assimilative learning style were ambivalent or experienced difficulty learning new material with this medium. As a convenient method for review, interactive videodisc instruction was felt to be effective by all learners with the exception of five assimilators (38.5%). Analysis of variance produced a value of F - 3.750 significant at the .02 level. ANOVA analysis of the selected attitudinal data are presented in Table 16.

Learners who were undecided or felt that they would have difficulty using interactive videodisc in other areas again demonstrated the divergent and assimilative learning styles. However, ANOVA produced a value of F - 2.226 which was not statistically significant. Attitudes regarding traditional versus interactive videodisc instruction were also less defined and did not produce statistically significant results. Observed frequencies did however, indicate that the greatest number of learners (38.5%) who felt that interactive videodisc instruction was more effective than traditional instruction were assimilators.

The majority of learners who felt that interactive videodisc instruction was flexible enough for their schedule were convergent learners. Seven out of eight learners (85.5%) were included in this group. Five out of eight (62.5%) of the accommodative learners also found that it was flexible enough for their needs. People who demonstrated the divergent and assimilative learning styles reported a variety of opinions. ANOVA analysis of this data failed to produce statistically significant results.

Table 16

Analysis of Variance
Learning Style and Attitude

(**Question 1** - I enjoyed this method of instruction)

Source of Variation	S S	D.F.	Mean Square	F	Sig of F
Between	3.911	3	1.304	3.077	.041
Within	3.911	3	1.304	3.077	.041

(**Question 2** - I found it difficult to learn new material with this method)

Source of Variation	S S	D.F.	Mean Square	F	Sig of F
Between	11.169	3	3.723	3.255	.034
Within	11.169	3	3.723	3.255	.034

(**Question 3** - IVD provides a convenient method of review)

Source of Variation	S S	D.F.	Mean Square	F	Sig of F
Between	8.219	3	2.740	3.750	.020
Within	8.219	3	2.740	3.750	.020

(**Question 4** - I would have difficulty using this method for other areas)

Source of Variation	S S	D.F.	Mean Square	F	Sig of F
Between	7.205	3	2.402	2.226	.104
Within	7.205	3	2.402	2.262	.104

(**Question 5** - I found the IVD more effective than traditional instruction)

Source of Variation	S S	D.F.	Mean Square	F	Sig of F
Between	4.085	3	1.362	1.216	.319
Within	4.085	3	1.362	1.216	.319

(**Question 6** - I found this method of learning flexible enough for my schedule)

Source of Variation	S S	D>F	Mean Square	F	Sig of F
Between	4.099	3	1.366	1.283	.296
Within	4.099	3	1.366	1.283	.296

The above findings suggested that null hypothesis VII could be rejected on the basis of the first three questions, indicating that there was a possible association between learning style and the following:

1. enjoyment of interactive videodisc instruction;
2. difficulty in learning new material with interactive videodisc instruction; and

3. finding interactive videodisc instruction a convenient method of review.

The null hypothesis could not be rejected on the basis of the last three questions which focused on the following:

4. difficulty in using this medium for other areas;
5. finding interactive videodisc instruction more effective than traditional instruction; and
6. finding this method of learning flexible enough for their schedule.

Overall, more convergent and accommodative learners enjoyed the interactive videodisc instruction and felt that is was flexible enough for their needs. They were also more accepting of this medium for the purposes of learning new material, for use in other areas and for review. More divergent and assimilative learners were negative and ambivalent in their responses to all questions

On observation, student comments revealed some possible associations with learning style. It was clear that accommodators and convergers were the most enthusiastic about interactive videodisc instruction. Most learner types enjoyed the realism of the learning experience and found that the audio information assisted in learning the breath sounds. There was some frustration with mechanical problems such as the delayed response of the touch screen and the physical location of the equipment. The divergent and assimilative learners also stated that they would have preferred opportunities for questions, discussion and personal contact. A summary of the student comments from the survey is included in Appendix B.

SUMMARY

The results of the statistical analysis of this study revealed that the subjects of the class and the sample were distributed throughout all four learning styles. The assimilative learning style was most common for the class and the sample as indicated by calculation of the mode. The majority of subjects in the assimilator category for the sample were males and all subjects in the accommodator category were female. As described earlier, the assimilative learner combines the abstract conceptualization and reflective observation modes of learning. Learning strengths include the organization and synthesis of a wide range of information.

The analysis also indicated that interactive videodisc instruction resulted in significant immediate learning and retention six weeks following instruction for the total sample, demonstrating significant long term learning. ANOVA did not reveal a significant association between learning styles and pretest scores suggesting that previous learning was not influenced by learning style. However, it also possible that previous instructional methods may have supported all four learning styles.

Exploration of the relationships between learning styles, achievement, and retention demonstrated that convergers achieved the greatest immediate and long term learning gains, followed by the accommodators. The divergent learners had the lowest immediate learning gains followed by the assimilative learners, after interactive videodisc instruction. Divergers also demonstrated the lowest retention six weeks following instruction. Statistical analysis however, did not reveal significant results.

The attitude survey revealed that the majority of learners enjoyed interactive videodisc instruction and felt that it was effective for learning new material, review and learning in other areas. There was a statistically significant relationship between learning style and enjoyment, difficulty in learning new material with interactive videodisc instruction, and perception of this medium as a convenient method of review. The results demonstrated that accommodators and convergers were the most positive regarding the above questions.

Student comments regarding this interactive videodisc simulation were also favorable in terms of enjoyment, effectiveness as a method of review and the realism of the learning experience. The most enthusiastic comments were written by the accommodators and convergers. However, there was some frustration with the delayed response of the touch screen and the physical location of the equipment. The divergent and assimilative learners also stated that they would have preferred opportunities for discussion and personal contact. Although these findings were not subjected to statistical analysis, they offer valuable information as to why the convergers and accommodators achieved the greatest learning gains. It is also possible to gain some insight into what may assist the assimilators and divergers in utilizing this technology. A more detailed discussion is included in Chapter Five.

Demographic Characteristics

The sample consisted of adult learners with a mean age of 27 years and a range of 18 - 42 years which placed them within the young adult and middle aged developmental groups as described in the literature (Havigurst, 1972 & Partridge, 1983). Although the majority of this sample were females, 27% were males. The data also revealed that 75.7% of the participants had previous work experience and 83.8% had previously attended post-secondary educational institutions. These findings support the assumption that nursing students attending the University of Alberta Hospitals School of Nursing are adult learners with a diverse range of experience, characteristics and learning needs.

Learning Styles

Learning style data were collected with Kolb's LSI (1985). Although this is the most popular instrument in much research including nursing, some researchers have raised concerns regarding validity and reliability (DeCoux, 1990 & Fox, 1984). Current learning style instruments provide valuable information but require continued investigation and evaluation.

The subjects of the class and the sample were distributed throughout all four learning style categories but the most common of both groups was the assimilative learning style. This mode of learning involves the processing of abstract information on a reflective level. Assimilators have strengths in collecting and understanding a wide range of information and are usually attracted to information careers such as science and research. This finding refuted Kolb's hypothesis that most people attracted to the nursing profession would demonstrate a divergent learning style (Claxton & Ralston, 1978; Kolb, 1984, 1986; Messick, 1976).

Chi-square analysis revealed a significant relationship between learning style and gender. Examination of the data indicated that the majority of divergers and convergers and all accommodators were female, while the majority of assimilators were male. The significant relationship between the assimilator learning style and the male subjects may have influenced the results of this investigation as the researcher did not find studies in the literature which identified the assimilative learning style as the most common for nurses or nursing students.

Learning Style and Achievement

The data analysis strongly suggested that the interactive videodisc simulation was associated with a significant, immediate and long term learning gain for this sample. Retention scores six weeks following the instruction also indicated that there was no significant loss of learning. These findings are consistent with previous research that has found interactive videodisc instruction effective in achieving immediate and long term learning in a variety of educational settings (Bosco, 1986; Ebner et al., 1984; Harless et al., 1990; Hon, 1983 & Lyness, 1987).

When the sample was divided on the basis of learning style there were no significant differences in pretest achievement means. After interactive videodisc instruction, however, it was apparent that learners with the convergent learning style achieved the greatest immediate learning gains (13.4%) followed by those with the accommodative learning style (11.0%). Although the analysis of variance of learning style and posttest means failed to produce significant results, there is reason to believe that had the sample been larger, the results would have been significant.

In an attempt to understand why the convergent and accommodative learners achieved the greatest learning gains, the researcher reflected on the characteristics of each

learning style. It is interesting to note that both the converger and accommodator prefer to learn in situations where they can manipulate new information through experimentation and practice. The convergent learner prefers to take in new information on an abstract level and process it actively, while the accommodator accepts information on a concrete level and processes it actively (Kolb, 1984, 1986).

The converger is a common sense learner, who excels at integrating theory and practice. Strengths focus on decision-making skills and identifying the one best solution, however, problems may arise if decisions are too hasty. This learner has to know how things work and is usually attracted to technological careers or the applied sciences (Claxton & Ralston, 1978; Kolb, 1984,1986). According to McCarthy (1980), the convergent learner prefers to be coached through new learning experiences which offer opportunities to try out new information.

In retrospect, many of the features of the level III interactive videodisc program employed in this study directly supported the convergent learner. This simulation was designed to coach the learner through the management of a real-life emergency. The learner was expected to apply relevant theory to this situation and was provided with direction and feedback. Extensive opportunities were provided for practicing problem-solving and trying out new information without jeopardizing a real patient. The achievement scores no doubt reflect this almost perfect match of learning style and instructional mode.

The accommodator is an enthusiastic, flexible learner who enjoys taking risks. The strengths of this learner involve the ability to get personally involved, do things and carry out plans or tasks. The accommodator seeks learning through self-discovery, preferring mediation and evaluative instructional modes. Difficulties may occur when too much activity occurs without planning or reflection. The accommodative learner often chooses a

career in business or management (Claxton & Ralston, 1978, Kolb, 1984, 1986 & McCarthy, 1987).

The interactive videodisc program, Nursing Care of the Elderly Patient with Chronic Obstructive Lung Disease, provided the accommodative learner with self-discovery learning in a real-life situation. This simulation offered opportunities to explore new information, try out various decisions and learn the consequences in a safe environment. The interactive feature of this technology which allowed the learner to manipulate the information and discover the consequences of decisions, supported the accommodative learner's preferred mode of information processing and possibly contributed to the achievement results.

The assimilative learners experienced positive but smaller immediate and long term learning gains when compared with the convergent and accommodative learners. The assimilator combines abstract conceptualization and reflective observation to create strengths in the collection and analysis of a wide range of information. The traditional classroom setting with lectures and texts is the most preferred learning strategy for this learner. Although the assimilator can deal with large amounts of information, some difficulties may arise with the practical application of information. Assimilators are usually attracted to information careers such as science and research. As stated earlier, the interactive videodisc simulation, utilized for this study emphasized active processing and application of information and possibly compelled the assimilative learner to shift to this mode of transforming information (Kolb, 1984, 1986 & McCarthy, 1987).

The lowest learning gain and the greatest loss of learning was demonstrated by the divergent learners. This learning style is a combination of concrete experience and reflective observation, resulting in the ability to observe concrete situations from many

different perspectives. Usually people who demonstrate this learning style are creative, sensitive to feelings, and people-oriented. Their strengths include an active imagination, and the ability to understand people. With these characteristics it is obvious that this learner would prefer learning experiences which provide for generation of ideas and discussion. The preferred instructional mode is more one of motivator, observer and mentor. During this investigation the divergent learners were also required to process most information actively rather than reflectively. To maximize learning with this interactive videodisc simulation, the divergent learners could benefit from additional learning activities such as discussion or perhaps this interactive videodisc would be better implemented as only one of several learning strategies (Kolb, 1984, 1986 & McCarthy, 1987).

Developers and researchers contend that the effectiveness of interactive videodisc instruction is determined by the quality, content and design of the interactive videodisc (Hon, 1983; Henderson, J., personal communication June 3, 1989, June 27, 1991). In addition to these factors, this study suggests that achievement maybe influenced by the design of the interactive videodisc in terms of directly supporting or not supporting the preferred learning styles of the learners.

Learning Style and Attitude

The descriptive data gathered from the attitude survey revealed that most learners enjoyed the interactive videodisc instruction (83.5%) and experienced no difficulty learning new material with it during this study (64.8%). The majority also indicated that it was a convenient method of review and felt that there would be no problems utilizing this technology in other areas (64.8%). Many subjects (56.7%) thought that this instructional method was flexible enough for their schedules but there was some ambivalence when requested to compare interactive videodisc and traditional instruction. It is significant that the greatest number of learners who felt that interactive videodisc instruction was more

effective than traditional instruction were assimilators. Current literature reports positive attitudes regarding the use of interactive videodisc instruction, and these findings are supported by this study (Bosco, 1986; 1988; Harless et al., 1990 & Schare et al., 1991).

The learners who did not enjoy this medium, who felt that they had difficulty learning new material, and who did not feel that they could utilize interactive videodisc for review purposes, all fell within the divergent and assimilative learning categories. It is evident that the assimilators and divergers were stretched to use alternate learning modes in this situation, which tended to influence the enjoyment of learning and the perceived effectiveness of the medium.

The most enthusiastic comments regarding interactive videodisc instruction were offered by the convergent and accommodative learners. As stated earlier, the interactive videodisc simulation directly supported the preferred mode of processing information for these learners and they were excited about the opportunities to practice and apply information in a realistic simulation. The divergent and assimilative learners expressed the need for more discussion and opportunities to ask questions. Again both of these learner types prefer to transform information reflectively and this simulation focused on active processing. Several negative comments from all learner types tended to focus on technical problems with the touch screen and the physical location of the equipment; problems which could be easily rectified. See Appendix B for learner comments.

IMPLICATIONS FOR NURSING EDUCATION

How can the needs of the adult learner in nursing be accommodated most effectively in the new information age? The following section looks at the the challenge facing nurse educators and the need to understand and respect the adult learner as a unique

individual with specific learning needs and learning styles. Although this study was exploratory in nature with obvious limitations, it is exciting to speculate about future development and applications of this medium. Implementation of interactive videodisc technology in nursing education is discussed here in relation to nursing education in Edmonton, Alberta.

In a society which is experiencing an unprecedented information explosion, nurse educators must face the challenge of preparing nurses for the modern health care system. This industry is described by John Naisbett (cited in Nurses prepare for the new millenium, Nurse Educators Microworld, Aug/Sept, 1988) as being the "largest growth industry in all countries" (p.1). As it is no longer possible to ensure that learners receive all the essential information during one course or program, the emphasis must shift to information access and critical thinking regarding the application of information (Bevis, 1988; Bolwell, 1990 & Polin, 1991). The findings of this study indicate that a reorganization of the infrastructure in the existing system is necessary to enhance the learning process in nursing education. Fortunately, this process was initiated with approval of the Collaborative Nursing Program, in Edmonton, Alberta as of December, 1990.

The demographic data of this study clearly demonstrate that students attending the University of Alberta Hospitals School of Nursing are adults who function within several roles. These learners have a multitude of family and work responsibilities in addition to those of a full-time student. The present economic recession has also resulted in the need for many students to work more part-time hours to survive. The result is increased stress and less time to devote to studies and school-related activities. This is a distinct change from the recent past, when hospital schools of nursing enrolled single students who received support from their parents and the institution. At this time, nursing students were

only expected to meet the role requirements of a full-time student and could, therefore, cope with the rigid structure and expectations of the program.

The literature supports the need for nurse educators to recognize students as adult learners who are self-directed and possess a wealth of experience and previous learning. Several theorists promote the concept of "learner-centered" education which emphasizes the sharing of power and information (Hansen, 1991; Howard, 1990; Parker, 1984 & Sweeney, 1986). In the process of sharing power, the educator's role changes to one of facilitator in which he/she:

> ...manages the social organization of the learning process and gains new time to function more as a resource consultant, as a guidance counselor, and above-all-as a careful observer and mentor of student learning" (Hansen, 1990, p. 20).

To ensure that learners are supported as individuals during the learning process, it is essential for instructors and students to understand themselves as learners. The findings of this study show that the learning styles of nursing students are diversified, suggesting that individual assessment of learning style should be completed for all learners. The implementation of learning style information is an important aspect of recognizing learners as individuals and promotes increased student participation. The learner can become empowered through awareness of his/her learning strengths and differences, and assume increased responsibility for selecting and participating in learning experiences.

Considering the variety of different learners and the rate at which information changes and accumulates, it is necessary to provide a greater variety of learning strategies and experiences within a more flexible schedule. Due to recent budget problems and bed closures, existing clinical space for students has decreased, increasing the need for a viable alternative. Experienced nurse educators promote technology as an effective, convenient

option for providing new learning strategies and experiences. To date the most promising medium is interactive videodisc instruction, which seems to be uniquely appropriate for nursing education. This technology has been employed successfully in a wide range of educational settings for individualized, small group and classroom instruction (Bosco, 1986; Ebner et al., 1984; Harless, 1990; Howard, 1990; Land et al., 1989; Mirr et al., 1986).

The benefits of interactive videodisc instruction have been well documented in the literature. This technology offers a flexible, cost-effective method of providing individualized, small group, and classroom instruction for carefully selected learning experiences where "detailed visual and audio information need to be conveyed" (Beautement, 1991, p. 460). It offers consistent information through different strategies such as drill and practice, in addition to coaching and discovery learning through realistic patient simulations. The combination of audio, video, slides, graphics, animation and interactivity, allows the learner to participate in the learning experience and practice decision-making skills in a safe environment. The learner proceeds at his/her own pace and may "spend as much time as necessary to learn the material (Sorge et al. , 1991, p. 26). Significant immediate and long term learning gains and positive attitudes towards this method of instruction were consistent findings with most studies (Bosco, 1986; Bunderson, 1983; Burwell, 1991; Clark, 1984; Ebner et al., 1984; Harless et al., 1990; Hon, 1982). This investigation supported existing studies in terms of the the immediate and long term learning gains and indicated that individual learner characteristics, especially learning style should be considered when integrating this technology into the curriculum.

The challenge for nurse educators involves "human support" and the selection of appropriate software (Sorge et al., 1991, p. 26). Human support involves assistance in defining the most effective means of utilization for the learner and encouraging educators

and learners to utilize this technology. The nature of this medium allows for maximum flexibility in scheduling and self-paced learning allowing the learner to work individually, with a partner or in a small group with classroom instruction as another option. It is imperative that educators and learners become more cognizant of individual learning styles as the design of the interactive videodisc must be considered when selecting programs (Sorge et al., 1991).

The criteria for successful implementation of this medium were well defined by Burk (1991). He found that faculty commitment, networking and sharing of information, planned integration, cost preparedness, adequate space, technological support and availability of appropriate software were essential elements (Burk, 1991). To maximize resources, it is obvious that a collaborative effort involving more than one institution is required for a project of this nature.

Edmonton, Alberta is an ideal setting for such an effort. The University of Alberta Hospitals is an internationally recognized health care facility which has initiated development of several interactive videodiscs through the Health Care Consortium, a group of educational facilities which develop interactive videodiscs in collaboration with IBM. Well known developers in private industry such as Data Star, The Training Group and Vicom are also located in Edmonton.

This city also has a heavy concentration of post-secondary institutions including health care programs: University of Alberta Hospitals School of Nursing, University of Alberta, Faculty of Nursing, Grant MacEwan Community College, Nursing Program, Royal Alexandra Hospital School of Nursing, Misericordia Hospital School of Nursing, Alberta College, and the Northern Alberta Institute of Technology. In addition to the above, Edmonton is also home to a creative new initiative in nursing education, the

Collaborative Nursing Program. This recent development combined the resources of the Faculty of Nursing and all hospital schools of nursing to offer a standardized program leading to an RN diploma or baccalaureate in nursing.

As each hospital school of nursing will offer the same course content, appropriate software could be selected and integrated through representatives from each institution. A working group of educational technologists could be established to share information, assist faculty, and participate in development and evaluation of new software.

RECOMMENDATIONS FOR FURTHER RESEARCH

Research and development in interactive videodisc instruction is in the early stages. The ability of this medium to enhance adaptive instruction for individual learners through the provision of a greater variety of learning strategies requires further investigation. The following recommendations flow from the literature review and the findings of this study.

1. This study should be replicated and verified using several schools of nursing and larger samples of students. In an effort to eliminate confounding factors, the instruction should be offered as a component of the curriculum to all participants at the same time.
2. Further exploration regarding learning style, interactive videodisc instruction, and factors not addressed by this study, such as transfer of learning is required before this technology can be utilized to replace exposure to certain clinical experiences.
3. The assumption that stress levels are decreased by interactive videodisc preparation prior to clinical experiences should be investigated within several specialty areas such as pediatrics, surgery and obstetrics.

4. Learner characteristics and the instructional design of software in relation to content and information processing modes, require further investigation.

CONCLUSION

In summary the researcher believes that the information explosion and the unprecedented growth in the health care industry have created an urgent need for more efficient information storage, access and transmission. As nurse educators attempt to meet the challenges of the information age, technology will play a critical role in the learning process. Although interactive videodisc technology has been available for some time, there has been a lag in the development of quality software. Developers and researchers agree that the creativity and talent of the designer determine the effectiveness of interactive videodisc learning experiences (Henderson, 1989; Hon, 1983).

To accommodate the needs of adult learners, educators must create an environment in which diversity can thrive. The results of this study strongly suggest that learning style assessment and interactive videodisc technology could become valuable components of a learning system designed to meet personal and situational characteristics of the adult learner (Cross, 1981). Learning style awareness would assist nurse educators in planning learning experiences and individual students in selecting appropriate learning experiences on an independent basis. Non-traditional learners would then be able to access educational opportunities more readily, thus increasing their participation in the learning society. The researcher views interactive videodisc technology as having great potential for facilitating change in the educational system.

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APPENDIX A

Description of Interactive Videodisc

DESCRIPTION OF INTERACTIVE VIDEODISC

TITLE: *Nursing Care of the Elderly Patient with Chronic Obstructive Lung Disease*

COPYRIGHT, 1988: The American Journal of Nursing Company

PRODUCED BY: The American Journal of Nursing Company

PROGRAM DIRECTORS: Dorothy J. Fishman, EdD, RN
Mary Ann Rizzolo EdD, RN

PROJECT DIRECTOR: Judith Nierenberg, M.A., R.N.
Director of Education Resources

DEVELOPED BY: Videodisc publishing Inc.

Nursing Care of the Elderly Patient with Chronic Obstructive Lung Disease, is a level III interactive videodisc designed for the IBM InfoWindow touch screen monitor. It will run on an IBM - PC, XT, AT or Personal System/2 Model 30, 50, or 60 with 640 KB of memory. Sony and Pioneer videodisc players are compatible with this program.

Instructional Design

This program is a simulation designed to promote discovery learning, problem-solving and decision-making skills. The learner is coached through the case study and may utilize the library and glossary for further information and guidance.

The simulation presents a case study in four parts. This investigation utilized only Part I of the case study, in which the learner manages the care of a 73 year old man in the emergency room and is required to make decisions about his care.

Contents of Case Study

Part I - the patient, Mr. Presley, arrives in the Emergency Room. The focus is on assessment, including chest assessment where the learner is able to listen to Mr. Presley's

lung sounds and identify them. Learners are required to interpret their findings and prioritize nursing interventions.

Prerequisites

Basic knowledge of:

- anatomy and physiology of the respiratory system
- an introductory class and lab on physical assessment of the chest.

Objectives

1. The learner will recognize the signs and symptoms of respiratory distress indicating a need for immediate assessment and/or intervention.
2. The learner will interpret assessment findings including:
   - laboratory values
   - percussion sounds
   - auscultation sounds
   - sounds elicited on palpation of the chest.
3. Prioritize nursing diagnoses, goals, and interventions.

APPENDIX B

Summary of Student Comments from Demographic Survey

SUMMARY OF STUDENT COMMENTS

The following comments are compiled from the attitude survey and listed according to learning style.

ACCOMMODATOR

1. Perhaps more reading of a narrator so eyes don't wander or get sore from reading monitor.

2. The screen is not sensitive enough sometimes other things light up or you really have to push on the screen.

3. Really enjoyed it, and would be interested in future learning discs.
   Felt I didn't have enough time today to really get into program - wish I could of spent more time.

5. It was very understandable and a very good review.

6. Fun, educational, outstanding method of learning. Better than labs. Almost like being with patient.

7. I found this method valuable in giving opportunity to apply theory which traditional lecture instruction does not provide. Therefore the application of theory is more effective than traditional instruction. The passing on of theory is as effective in this method as in a lecture.

8. It took along time to get through Part I of the case study because of having to touch the screen (it did not respond to my fingers) also when trying to press an answer, another answer would light up - kind of frustrating.

DIVERGER

1. I really enjoyed the videodisc in that it gave me a chance to apply what I'd learned to a real life situation and was able to point out my deficiencies immediately. I also really liked being able to see a patient and to actually hear at my convenience all the different lung sounds that I may have to assess along with their written descriptions.

   Other aspects such as lab values and certain vocabulary, I found very difficult to remember from when I read them in the videodisc library to incorporating them in the case study. I'm the type of person who needs to write specifics like that down in order to memorize them. I really learn a lot from lecture format that way. I hear, think, write. I've never learned very well from textbooks, etc. Perhaps if there had been time to write the definitions down it would have been easier, but very time consuming and not allowable in the two hour framework we had.

   I would love to see something like this as a reference or review in the library. I could test my knowledge from lectures with it, prepare for "clinical pressure", and have the opportunity of hearing and seeing different examples of patients and chest sounds that are difficult to describe in a lecture format.

2. It was very helpful. I found it a good way to learn by using both a case study that was life-like and questions afterward.

3. Excellent for learning terms and conditions.

4. I liked the program, found the information very good but I found it frustrating in the set spacing so I couldn't go at my own speed.

5. The information was very pertinent. There was too much to learn at once: perhaps if I had taken more notes it would have helped.

   It does provide a convenient means of review, however, if one wants to move on to other part it's quite difficult to do ie. in the case study, one cannot fast forward the study to the end. You have to go through the whole program.

   If I was not clear on certain points, there would not be that personal interaction with a teacher.

   I think my preference would still be the traditional aspect of teacher/pupil relationship. The interaction is there, more questions can be asked; as well personal experiences can be related which emphasize the lesson more.

6. Overall the idea of using a videodisc is quite impressionable, however, there were areas that annoyed me ie. touching the screen sometimes did not produce results. One had to make sure the touch was in exactly the right square.

ASSIMILATOR

1. This made the review of material relevant to the topic very easy and convenient. However, being a topic I have little knowledge of, I found the information to be too much to handle at one time.

2. I liked the audio aspect ie. listening to the breath sounds. But the rest of the information can be found in a book. I found that it took a long time.

3. My main dislike was not being able to ask the questions I wanted to ask ie. you can't ask the computer "why".

4. Initially I had problems operating the computer, but once I got started it was very easy for me to use.

5. Sometimes when the screen was touched it did not work, so you had to touch it more than once.
   Some of the sounds were extremely difficult to distinguish ie. dull and flat; course and medium rales.

CONVERGER

1. Very worthwhile experience and I enjoyed the learning. It is a good approach for an aid and review.

2. There was quite a bit of information to take in at one sitting. I don's feel this is appropriate for initial teaching, however, I do feel it is an excellent review guide.

   Being able to hear various breath sounds enables me to better identify each sound when in a clinical setting (ie. it is difficult to identify sounds by a description in a textbook).

3. The surroundings and setup at the library were most discouraging. The machine was stuck out in a hallway - very uncomfortable setting.

APPENDIX C

Student Information and Consent

DEAR STUDENT

WELCOME to the exciting world of interactive videodisc.

You will be given a PRETEST with this set of instructions. Please complete this test to the best of your ability. As most of you will have not have had previous instruction prior to the lab on respiratory assessment, this test may be frustrating. However, I would appreciate your effort in completing it, even if you guess at the answers.

When you have completed the PRETEST return it to the circulation desk and you will be given an envelope which contains the POSTTEST, DEMOGRAPHIC SURVEY and the interactive videodisc. Instructions for using the disc are on the next page.

Start with the INTRODUCTION and LIBRARY, then proceed to the CASE STUDY. Just complete **PART I** of the case study for this project.

After completing PART I , shut off the machine according to the directions and complete the POST TEST and DEMOGRAPHIC SURVEY.

PLEASE return the videodisc, post test and demographic survey to the circulation. desk.

NOTE: **ensure that your research number is on the pretest, posttest and demographic survey.**

A retention test will be booked for you 6 weeks from today. It will be available following one of your classes in August or September.

Thank you for your interest and participation in this study. Should you have any questions please contact me at one of the following numbers:

439-1802 - home
492-8690 - work
445-5357 - pager

CONSENT FORM

I would like to participate in the study on learning styles and interactive videodisc. I understand that this study is voluntary and is not a component of the University of Alberta Hospitals, School of Nursing, curriculum. The information will be used in a statistical study and kept strictly confidential. I understand that my anonymity is guaranteed.

I will be able to complete the requirements of this study during June or July and August or September, if the schedule is flexible.

The best time for me to participate in this study would be:

_____ Evenings

_____ Days

_____ Weekends

DATE: _____

SIGNATURE: _____

TELEPHONE NUMBER: _____

STUDENT I.D. NUMBER: _____

APPENDIX D

Instruments

DEMOGRAPHIC SURVEY

This questionnaire was designed to collect the demographic data necessary to describe the class selected for this study and to determine how Nursing I students feel about this method of learning.

Your participation in this survey would be greatly appreciated and is considered important. The information collected will be kept strictly confidential. Your anonymity is guaranteed and your involvement is voluntary. Again, I would like to thank you for your cooperation.

PLEASE DISREGARD THE NUMBERS IN THE RIGHT MARGIN

My research number is : _____ 1 - 5

PART I : BACKGROUND INFORMATION
****

Please complete the following statements by checking or filling in the appropriate blanks.

1. My age is : _____ 6 - 7

2. My sex is :
   ____1. Male
   ____2. Female 8

3. Marital Status :
   ____1. Single
   ____2. Married
   ____3. Other: _____ 9

4. Dependents :
   ____1. No
   ____2. Yes Number : _____ 10

5. Home Location :
   ____1. Edmonton
   ____2. Alberta
   ____3. Other Province Please specify : _____
   ____4. Other Country Please specify : _____ 11 - 12

6. Previous Education : ____1. College or Technical Institution

Area of Study _____

____A. Diploma or Certificate Granted
____B. Program not completed

____2. University

Area of Study _____

____A. Degree granted
____B. Program not completed

7. Advanced Credit: ____1. No
____2. Yes

8. Previous Work Experience: ____1. No
____2. Yes

If your answer is yes, please select one of the following.

____A. Less than 6 mos
____B. 6 - 12 mos
____C. 1 - 5 yrs
____D. 5 - 10 yrs
____E. 10 yrs +

9. Previous Health Care Experience: ____1. No
____2. Yes

If your answer is yes please select one of the following.

____A. Registered Nursing Assistant
____B. Other : Please specify :_____

13
14 - 15
16
17
18 - 19
20
21
22
23
24
25

PART II : ATTITUDE SURVEY
****

Please circle the number which expresses the extent to which you agree with each statement.

1 Strongly disagree
2 Disagree
3 Neutral
4 Agree
5 Strongly Agree

1. I enjoyed this method of instruction.	1 2 3 4 5	26
2. I found it difficult to learn new material with this method.	1 2 3 4 5	27
3. Interactive videodisc provides a convenient method of review	1 2 3 4 5	28
4. I would have difficulty using this method for other areas.	1 2 3 4 5	29
5. I found the interactive videodisc more effective than traditional instruction?	1 2 3 4 5	30
6. I found this method of learning flexible enough for my schedule.	1 2 3 4 5	31

Comments

PRETEST

I.D. # _____

PLEASE DISREGARD THE NUMBERS IN THE RIGHT MARGIN

Complete the following questions by circling the **BEST** answer. There is only one correct answer for each question.

1. Breath sounds heard on auscultation are described as normal or Adventitious. All of the following breath sounds can be described as normal <u>except:</u> 35

a. vesicular
b. rhonchi
c. bronchial
d. bronchovesicular

2. Increased fremitus is caused by substances or situations that decrease the distance vibrations must travel to reach the chest wall. Which of the following statements are <u>true</u>? 36

a. increased fremitus is normally felt near large bronchi
b. increased fremitus is caused by consolidation from pneumonia
c. some increased fremitus may be felt on the right chest (normally)
d. all of the above

3. Percussion sounds can be described as all of the following <u>except:</u> 37

a. dull
b. hyperresonant
c. flat
d. sibilant

4. When describing pleural friction rubs which of the following are <u>true</u>? 38

a. occur when pleural fluid is absent
b. heard with inspiration and expiration
c. sound like 2 pieces of leather rubbing together
d. all of the above

5. Which of the following statements is <u>not</u> true when describing wheezes? ____ 39

a. wheezes are high pitched
b. wheezes can occur on inspiration and expiration
c. wheezes often clear after coughing.
d. wheezes indicate obstruction in smaller airways

6. Crackles (rales) occur with alveolar and interstitial diseases such as: ____ 40

1. Pneumonia
2. Pulmonary edema
3. Purulent bronchitis
4. Atelectasis

Select the best answer.

a. 1,2.
b. 3,4.
c. All of the above
d. 2,3.

7. Mr. Dayton is admitted to your ward and as part of his initial assessment you complete a chest examination. Your findings are as follows: ____ 41

- Vital signs - temp 37.C, resp 16/min, pulse 78/min, B/P 136/ 70
- AP diameter is less than the transverse diameter
- Percussion - resonant throughout lung fields
- Auscultation - bilateral vesicular breath sounds to anterior, posterior and lateral aspects of chest, with bronchovesicular sounds over the main bronchus

Based on the above information, which nursing action would be the <u>most</u> appropriate?

a. Call the physician immediately
b. Make Mr. Dayton comfortable and complete his admission
c. Reassess him in 30 minutes
d. All of the above

8. Initial blood work on Mr. Dayton reveals the following results: ____ 42

1. Hct. 35%
2. Hgb. 17gm/dl
3. WBC. 10,000 c/cu, bands - 3%, Polys - 55%, Lymphs - 34%
4. Sodium 116 mmol/L

Which of the above findings indicate the presence of infection?

a. 1,2
b. 2,3
c. 3,4
d. none of the above.

9. Mrs. Butler, a 45 year old patient, presents at your clinic with a 2 year history of bronchitis. She is complaining of chest pain and shortness of breath. Her vital signs are: temp 37.9C, BP/ 109/56, pulse 92/min, resp 24/min. Your immediate nursing action should be: ____ 43

a. administer oxygen at 3L/min
b. administer oxygen at 10L/min
c. complete a chest assessment
d. notify the physician immediately

10. During your assessment of Mrs. Butler, you find that breath sounds are diminished in the lower lobe of the left lung and percussion over this area is dull. These findings indicate: ____ 44

a. that there is consolidation in the left lower lobe
b. hyperinflation of the left lower lobe
c. bilateral interstitial fluid
d. severe bilateral bronchitis

11. The following orders were left for Mrs. Butler: What test or treatment should be given the highest priority? ____ 45

a. ABGs stat
b. CBC & differential
c. electrolytes
d. Ampicillin 1Gm q6h.

12. ABGs drawn four days after admission reveal the following results: ____ 46

pH	7.36
PCO2	44 mmHg
HCO3	25meq/L
PO2	91mmHg
BE	1

What do these results indicate?

a. normal results
b. respiratory alkalosis
c. metabolic alkalosis
d. metabolic acidosis

13. Mrs. Butler's physician has written an order for discharge. Your final assessment reveals a loud Adventitious sound similar to two pieces of leather rubbing together. This sound is heard on inspiration and expiration. What should your initial nursing action be? ____ 47

a. ensure that Mrs. Butler has received complete discharge instructions
b. notify the physician that Mrs. Butler's chest assessment is abnormal
c. reassess Mrs. Butler prior to discharge
d. none of the above

14. Mrs. White is a 65 year old woman who has a long history of smoking and respiratory infections. She was diagnosed with COPD (Chronic Obstructive Lung Disease) 3 years ago. At this time, she was advised to quit smoking. While completing a physical assessment you find hyperresonance on percussion and decreased breath sounds bilaterally. There are scattered rhonchi on inspiration and expiration. These findings suggest: ____ 48

a. changes due to aging
b. consolidation
c. emphysema with spasm of the entire airway
d. none of the above

15. Mrs. White tells you that she has had bouts of coughing for the past 2 weeks. She has no appetite and is unable to sleep at night. You observe that she is dyspneic and anxious. Vital signs are temp 38C, pulse 92/min, resp 34/min, BP 158/92. Which nursing action is the most appropriate? ____ 49

a. process orders for ABGs and CBC & differential
b. position in semi-fowlers and explain what the immediate care will involve
c. inform Mrs. White that her physician will arrive later today
d. complete the admission

POST TEST

I.D. # _____

PLEASE DISREGARD THE NUMBERS IN THE RIGHT MARGIN

Complete the following questions by circling the **BEST** answer. There is only one correct answer for each question.

1. Breath sounds heard on auscultation are described as normal or Adventitious.

All of the following breath sounds can be described as abnormal except: 50

a. vesicular
b. rhonchi
c. wheezes
d. crackles

2. Decreased fremitus is caused by substances or situations that increase the distance vibrations must travel to reach the chest wall. Which of the following statements are true? 51

a. decreased fremitus is caused by pleural thickening
b. pneumothorax can result in decreased fremitus
c. decreased fremitus is caused by fluid or solid tissue in pleural space
d. all of the above

3. Abnormal percussion sounds include all of the following except: 52

a. dull
b. hyperresonant
c. flat
d. resonant

4. When describing pleural friction rubs, which statement is not true? 53

a. occur when pleural fluid is present
b. heard with inspiration and expiration
c. sound like 2 pieces of leather rubbing together
d. none of the above

5. Which statements is not true when describing wheezes? ____ 54

a. wheezes are high pitched
b. wheezes can occur in inspiration and expiration
c. wheezes do not clear after coughing
d. wheezes indicate obstruction in the larger airways

6. Wheezes occur with changes in the size of the airways. Conditions which could cause wheezes are: ____ 55

1. COPD
2. Pulmonary edema
3. Asthma
4. Complete atelectasis

Select the best answer.

a. 1,2
b. 3,4
c. 1,3
d. 2,3

7. Mrs. Keen is admitted to your ward and as part of her initial assessment you complete a chest examination. Your findings are as follows: ____ 56

- Vital signs - temp 36.2.C, resp 14/min, pulse 78/min, B/P 136/ 68
- AP diameter is less than the transverse diameter
- Percussion - resonant throughout lung fields
- Auscultation - bilateral vesicular breath sounds to all aspects of chest, with bronchovesicular sounds over the main bronchus

Based on the above information, which nursing action would be the most appropriate?

a. Call the physician immediately
b. Make Mrs. Keen comfortable and complete her admission
c. Reassess her in 15 minutes
d. All of the above

8. Initial blood work on Mrs. Keen reveals the following results. Which result indicates the presence of infection? ____ 57

a. Hct. 33%
b. Hgb. 13gm/dl
c. WBC. 22,500 c/cu, bands - 3%, Polys - 55%, Lymphs - 34%
d. Sodium 116 mmol/L

9. Mr. Wright a 45 year old patient, presents at your clinic with a 2 year history of bronchitis. He is complaining of chest pain and shortness of breath. His vital signs are: temp 37.8C, BP/ 120/56, pulse 94/min, resp 22/min. Your immediate nursing action should be: ____ 58

a. administer oxygen at 2L/min.
b. administer oxygen at 8L/min.
c. complete a chest assessment
d. notify the physician immediately

10. During your assessment of Mr. Wright, you find that breath sounds are diminished in the lower lobe of the left lung and percussion over this area is dull. These findings indicate: ____ 59

a. that there is consolidation in the left lower lobe
b. hyperinflation of the left lower lobe
c. bilateral interstitial fluid
d. severe bilateral bronchitis

11. The following orders were left for Mr. Wright. What test or treatment should be given the highest priority? ____ 60

a. ABGs stat
b. CBC & differential
c. electrolytes
d. Ampicillin 1Gm q6h.

12. ABGs drawn four days after admission reveal the following results: ____ 61

pH	7.41
PCO2	36mmHg
HCO3	23meq/L
PO2	85mmHg
BE	-1

What do these results indicate?

a. normal function
b. respiratory alkalosis
c. metabolic alkalosis
d. metabolic acidosis

13. Mr. Wright's physician has written an order for discharge. Your final assessment reveals wheezing on inspiration and expiration. Mr. Wright tells you that he is short of breath. What should your initial nursing action be? 62

a. ensure that Mr. Wright has received complete discharge instructions
b. notify the physician that Mr. Wright's chest assessment is abnormal
c. reassess Mr. Wright prior to discharge
d. none of the above

14. Mr. Doyle is a 65 year old man who has a long history of smoking and respiratory infections. He was diagnosed with COPD (Chronic Obstructive Lung Disease) 3 years ago. At this time, he quit smoking. While completing a physical assessment you find hyperresonance on percussion and decreased breath sounds bilaterally. There are scattered rhonchi on inspiration and expiration, which do not clear with coughing. These findings suggest: 63

a. changes due to aging
b. consolidation
c. emphysema with spasm of the entire airway
d. none of the above

15. Mr. Doyle tells you that he has had bouts of coughing for the past 2 weeks. He has no appetite and is unable to sleep at night. You observe that he is dyspneic and anxious. Vital signs are temp 37.9C, pulse 96/min, resp 32/min, BP 166/92. Which nursing action is the most appropriate? 64

a. process orders
b. position in semi-fowlers, stay with him and complete the assessment
c. inform Mr. Doyle that his physician will arrive within the next hour
d. complete the admission

RETENTION TEST

I.D. # _____ DATE _____

PLEASE DISREGARD THE NUMBERS IN THE RIGHT MARGIN

Complete the following questions by circling the **BEST** answer. There is only one correct answer for each question.

1. Breath sounds heard on auscultation are described as normal or adventitious. All of the following breath sounds can be described as abnormal <u>except:</u> 65

a. vesicular
b. rhonchi
c. wheezes
d. crackles

2. Decreased fremitus is caused by substances or situations that increase the distance vibrations must travel to reach the chest wall. Which of the following statements are <u>true</u>? 66

a. decreased fremitus is caused by pleural thickening
b. pneumothorax can result in decreased fremitus
c. decreased fremitus is caused by fluid or solid tissue in pleural space
d. all of the above

3. Abnormal percussion sounds include all of the following <u>except</u>: 67

a. dull
b. hyperresonant
c. flat
d. resonant

4. When describing pleural friction rubs, which statement is <u>not</u> true? 68

a. occur when pleural fluid is present
b. heard with inspiration and expiration
c. sound like 2 pieces of leather rubbing together
d. none of the above

5. Which statement is <u>not</u> true when describing wheezes? 69

a. wheezes are high pitched
b. wheezes can occur in inspiration and expiration
c. wheezes do not clear after coughing
d. wheezes indicate obstruction in the larger airways

6. Wheezes occur with changes in the size of the airways. Conditions which could cause wheezes are: 70

1. COPD
2. Pulmonary edema
3. Asthma
4. Complete atelectasis

Select the best answer.

a. 1,2
b. 3,4
c. 1,3
d. 2,3

7. Mrs. Switzer is admitted to your ward and as part of her initial assessment you complete a chest examination. Your findings are as follows: 71

- Vital signs - temp 36.2.C, resp 14/min, pulse 78/min, B/P 136/ 68
- AP diameter is less than the transverse diameter
- Percussion - resonant throughout lung fields
- Auscultation - bilateral vesicular breath sounds to all aspects of chest, with bronchovesicular sounds over the main bronchus

Based on the above information, which nursing action would be the <u>most</u> appropriate?

a. Call the physician immediately
b. Make Mrs. Switzer comfortable and complete her admission
c. Reassess her in 15 minutes
d. All of the above

8. Initial blood work on Mrs. Switzer reveals the following results. Which result indicates the presence of infection? 72

a. Hct. 33%
b. Hgb. 13gm/dl
c. WBC. 22,500 c/cu, bands - 3%, Polys - 55%, Lymphs - 34%
d. Sodium 116 mmol/L

9. Mr. Dixon, a 45 year old patient, presents at your clinic with a 2 year history of bronchitis. He is complaining of chest pain and shortness of breath. His vital signs are: temp 37.8C, BP/ 120/56, pulse 94/min, resp 22/min. Your <u>immediate</u> nursing action should be: 73

a. administer oxygen at 2L/min.
b. administer oxygen at 8L/min.
c. complete a chest assessment
d. notify the physician immediately

10. During your assessment of Mr. Dixon, you find that breath sounds are diminished in the lower lobe of the left lung and percussion over this area is dull. These findings indicate: 74

a. that there is consolidation in the left lower lobe
b. hyperinflation of the left lower lobe
c. bilateral interstitial fluid
d. severe bilateral bronchitis

11. The following orders were left for Mr. Dixon. What test or treatment should be given the <u>highest</u> priority? 75

a. ABGs stat
b. CBC & differential
c. electrolytes
d. Ampicillin 1Gm q6h.

12. ABGs drawn four days after admission reveal the following results: 76

pH	7.41
PCO2	36mmHg
HCO3	23meq/L
PO2	85mmHg
BE	-1

What do these results indicate?

a. normal function
b. respiratory alkalosis
c. metabolic alkalosis
d. metabolic acidosis

13. Mr. Dixon's physician has written an order for discharge. Your final assessment reveals wheezing on inspiration and expiration. Mr. Dixon tells you that he is short of breath. What should your initial nursing action be? ____ 77

a. ensure that Mr. Dixon has received complete discharge instructions
b. notify the physician that Mr. Dixon's chest assessment is abnormal
c. reassess Mr. Dixon prior to discharge
d. none of the above

14. Mr. Cardinal is a 65 year old man who has a long history of smoking and respiratory infections. He was diagnosed with COPD (Chronic Obstructive Lung Disease) 3 years ago. At this time, he quit smoking. While completing a physical assessment you find hyperresonance on percussion and decreased breath sounds bilaterally. There are scattered rhonchi on inspiration and expiration, which do not clear with coughing. These findings suggest: ____ 78

a. changes due to aging
b. consolidation
c. emphysema with spasm of the entire airway
d. none of the above

15. Mr. Cardinal tells you that he has had bouts of coughing for the past 2 weeks. He has no appetite and is unable to sleep at night. You observe that he is dyspneic and anxious. Vital signs are temp 37.9C, pulse 96/min, resp 32/min, BP 166/92. Which nursing action is the most appropriate? ____ 79

a. process orders
b. position in semi-fowlers, stay with him and complete the assessment
c. inform Mr. Cardinal that his physician will arrive within the next hour
d. complete the admission

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