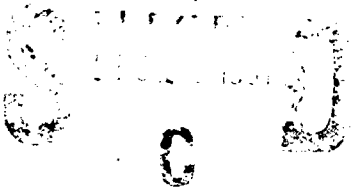
AD-A243 361



Approval Sheet

Seminar paper submitted to the faculty of the Graduate School of the University of Maryland in partial fulfillment of the requirements for the degree of Master of Science (1991)

Title of Seminar Paper:

The Application of Learning Styles to Computer Assisted Instruction in Nursing Education

Name of Candidate:

Lee Ann Harford, R.N., BSN, Major, US Air Force Nurse Corps

Seminar paper directed by:

Carole A. Gassert, R.N., Ph.D.
Assistant Professor, Nursing Informatics
Department of Education, Administration, and Health Policy

Second Reader

Camille Grosso, R.N., Ph.D. Candidate
Associate Professor, Nursing Informatics
Department of Education, Administration, and Health Policy

Date Approved:

Reproduced From
Best Available Copy

91-17929

20000901008

91 1213 179

REPORT DOCUMENTATION PAGE

Form Approved
OMB No 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
		THESIS/[redacted]

4. TITLE AND SUBTITLE
The Application of Learning Styles to Computer Assisted Instruction in Nursing Education

5. FUNDING NUMBERS

6. AUTHOR(S)
Lee Ann Harford, Major

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
AFIT Student Attending: University of Maryland

8. PERFORMING ORGANIZATION REPORT NUMBER
AFIT/CI/CIA-91-069

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
AFIT/CI
Wright-Patterson AFB OH 45433-6583

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for Public Release IAW 190-1
Distributed Unlimited
ERNEST A. HAYGOOD, Captain, USAF
Executive Officer

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

14. SUBJECT TERMS

15. NUMBER OF PAGES
81

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT

Curriculum Vitae

Name: Lee Ann Harford, Major, USAF NC

Address: 15408 Jennings Lane
Upper Marlboro, MD 20772

Degree and Date to be conferred: MS 1991

Date of Birth: 3 July 1956

Collegiate Institutions:	**Dates:**	**Degree:**
King's College Wilkes-Barre, PA	1974-1976	N/A
Widener University Chester, PA	1976-1978	BSN
University of Maryland Baltimore, MD	1989-1991	MS Major: Nursing Informatics

Professional Positions Held:
US Air Force Nurse Corps - 1979 to present

Malcolm Grow Medical Center, Andrews AFB, Washington DC
Nurse Intern
(2/79 - 8/79)

March Regional Hospital, March AFB, Riverside CA
Clinical Staff Nurse: General Surgery Unit, ICU/CCU
Assistant Charge Nurse: ICU/CCU
Charge Nurse: ICU/CCU, Emergency Services
(9/79 - 9/84)

Malcolm Grow Medical Center, Andrews AFB, Washington DC
Nurse Intern Coordinator/Assistant Staff Development Officer
(10/84 - 8/89)

DTIC
COPY
INSPECTED
6

A-1

The Application of Learning Styles to Computer Assisted Instruction in Nursing Education

Lee Ann Harford

University of Maryland

School of Nursing

Running Head: LEARNING STYLES AND CAI

Abstract

The proliferation of information systems into all areas of health care demands that nurses acquire essential computer knowledge and experience. Nursing professionals are finding the need to become computer literate and proficient with computers on a daily basis. One way to assure computer literacy among the nursing profession is to integrate computer technology into the learning process at all levels of nursing education. In order to successfully accomplish this challenge, nurse educators need to apply fundamental learning principles to computerization in the classroom to effectively enhance learning and instruction.

The need to individualize instruction is becoming increasingly apparent to educators as an essential principle of learning. Furthermore, the learning process is influenced by a variety of factors within the educational setting. One variable which can significantly affect learning is an individual's learning style. Research has demonstrated that each individual has a preferred way of learning, and learning can be facilitated by matching instructional

strategies to particular learning styles. The incorporation of computers as instructional tools in the learning environment provides an excellent means of individualizing instruction. Specifically, computer-assisted instruction (CAI) is an instructional strategy which has gained recent popularity within nursing education, and can be used to maximize an individual's learning while increasing computer literacy among the nursing profession.

This paper examines the relationship between selected learning styles and different types of CAI available to nurse educators. The four learning styles identified in Kolb's Model of Experiential Learning provides the theoretical framework for determining appropriate types of CAI to be employed with specific learners. A paradigm is postulated to illustrate the preference for particular types of CAI based on the characteristics of Kolb's learning styles. Nursing implications and future recommendations regarding learning styles and CAI are included in the concluding discussion of this paper.

Table of Contents

CHAPTER ONE

CHAPTER TWO

CHAPTER FOUR

CHAPTER ONE

Introduction

Computers in Health Care

The use of Information Systems is constantly growing and expanding within health care organizations and this trend is having a tremendous impact on the nursing profession. Consequently, it is becoming increasingly vital to integrate computerization into all area of nursing: administration, education, research and clinical practice.

Nurses are now, more than ever, identifying the implicit need to be knowledgeable and proficient in using these information systems in both the academic and clinical settings. Nurse educators, and the newly emerging Nursing Information Systems (NIS) Specialists (Heller & Romano, 1988), can be instrumental in successfully meeting this challenge by integrating fundamental learning principles and computer technology into all realms of nursing education. In this way, computers can be employed as an effective and efficient instructional strategy in the classroom to assist nurses in reducing or eliminating this knowledge

deficit while enhancing the processes of learning and instruction.

The term most often associated with computers in nursing education when discussing the teaching-learning process is Computer-assisted instruction (CAI) (Ball & Hannah, 1984; Hannah, 1988; Oermann, 1990; Saba & McCormick, 1986). One of the earliest reported uses of CAI as a method of teaching in the health care area was that of Bitzer & Bitzer in a school of nursing over two decades ago (Hamby, 1986; Hmelo, 1989). Yet, despite the reported increase in use of CAI in the literature since that time (Aiken, 1990; Hebda, 1988; Sparks, 1989; Thomas, 1985; Thomas, 1986), nurse educators have not fully employed this valuable technology as an effective and efficient instructional strategy. This paper explores one of the possible reasons for the limited integration of CAI into nursing education; specifically, individual differences in learning styles.

Computer Literacy among Nurses

Computer literacy, or illiteracy as may be the case, is a frequent topic of discussion within the

health care profession, especially within the nursing field. Yet, despite the popularity of computer literacy, there is no agreement on the definition of this term found in the literature; in fact, many authors refer to the term without ever assigning any meaning to it. Generally, an individual is thought to be computer literate if one can demonstrate competencies in basic knowledge and skills related to the fundamental operations, functions and applications of a computer system (Armstrong, 1989; Little, Hannum & Stuck, 1989). Computer literacy includes the vast array of possible competencies for which there is no prevailing agreement among members of any profession. Similarly, there are varying degrees of computer literacy among individuals in any particular profession which fall along a continuum from novice to expert. Furthermore, it is important to specifically define the competencies for computer literacy along this continuum.

In the nursing profession, computer literacy has been identified as both a problem and a goal by a number of authors for many years (Hannah 1988; Heller,

Romano, Damrosch, & Parks, 1985; Reynolds & Ferrell, 1989; White-Delaney, 1989). It has only been recently that nursing leadership has acted on the need for computer literacy among nursing students, faculty and staff through actions by the National League for Nursing (NLN) Council for Nursing Informatics. In June of 1991, the Council plans to introduce a resolution that purports the fact that nurses in all areas of practice (i.e. administration, education, research, and clinical practice) must identify ways to meet the learning needs of nurses regarding computer systems (C. A. Gassert, personal communication, March 18, 1991). Since NLN has yet to stipulate any guidelines or requirements with regard to computer literacy in nursing education programs, this resolution is an initial step in achieving computer literacy among the nursing profession; approval of the resolution could significantly enhance computer literacy among nurses.

Since computer literacy is an identified need among the nursing profession, nurses will require the acquisition of both knowledge and skills of computer systems within the educational setting. Therefore,

nurse educators must integrate the computer into the classroom and the curriculum if the issue of computer literacy among nurses is to be resolved.

Current Computer Applications in Nursing Education

Up to the present time, computers in nursing education have most frequently been used by faculty and students for non-instructional purposes, such as literature searches and administrative tasks. These non-instructional methods focused on the collection of information and methods of increasing productivity (Sparks, 1989).

A number of studies have been conducted to determine the type and frequency of computer applications used in nursing education. Thomas (1986) reported word processing (30%) as the most frequent application used by nursing faculty, students and staff among 157 NLN accredited programs. Similar results were found by Walker (1986) with a slightly higher reported word processing usage of 36.8% among the sample of 125 schools of nursing using computer technology. Other frequently reported non-instructional computer applications include database

management, electronic spreadsheets, and statistical analyses (Aiken, 1990; Newbern, 1985; Thomas, 1986; White-Delaney, 1989). Overall, CAI was ranked as third or fourth when compared to these other computer applications used in nursing education, with reported usage between a range of 14% to 38% of the educational institutions surveyed (Thomas, 1985; Thomas, 1986; Walker,1986; White-Delaney, 1989).

Until the end of the last decade, the use of computers as an instructional tool in nursing education was generally reported as minimal. However, among those institutions that did use computers as an instructional tool, CAI was the predominant form of instructional strategy performed by a microcomputer for learning activities in the classroom (Aiken, 1990; Sparks, 1989; Thomas, 1986; White-Delaney, 1989). Additionally, in a study by Arnold & Bauer (1988), nurse educators reported CAI as being the most preferred computerized learning experience among a variety of computer applications available to nursing education as well as nursing administration. Consequently, the focus of computer use in nursing

education has recently shifted from the office into the classroom. In spite of the increase in use of CAI as an instructional tool, Aiken (1990) reported that over half (57%) of 158 institutions surveyed within the 15 Southern Regional Education Board (SREB) states used microcomputers less than 5% of the time for teaching the undergraduate nursing curriculum, and only one-third (34%) of these institutions used microcomputers between 5% and 25% of the time.

Learning Principles and Computers

Most of the research on learning with computers has focused on the attitudes of nurses or the effectiveness of CAI as an instructional strategy in comparison to traditional methods of instruction, such as the lecture (Oermann, 1989).

French (1986) and Vockell (1990) outline a number of learning and instructional principles to consider when integrating computers into the educational setting. One of these basic principles pertains to individual differences in learning among the student population, and the well-known fact that people learn differently. This diversity in learning, designated as

learning styles, has recently received increased attention in the literature. However, for many decades, learning styles have been studied by cognitive and educational psychologists in an attempt to understand the specific, internal processes of learning. This knowledge allows educators to create environments that optimize learning.

Learning styles is a broad term used to describe an individual's preferred way of learning in any given situation. These preferred ways of learning are individual characteristics that are as unique as one's fingerprint. In order to maximize learning, the individual will attempt to match learning style with the learning experience. However, the learning style of an individual is usually transparent to the instructor as well as the individual learner (de Tornyay & Thompson, 1987; Merritt, 1989).

In an effort to incorporate individual differences and learning styles into the teaching-learning process, a variety of instructional methods have been introduced into the nursing curriculum. CAI is considered to be one such method of individual instruction to enhance

and facilitate learning. However, the unique characteristics of learners are often overlooked when studying the effectiveness and efficiency of CAI as a method of instruction.

Purpose of the Paper

Although numerous studies have been conducted in the area of CAI, very few have focused specifically on individual learning styles as a variable in the use of this instructional technique among nurses. Furthermore, few researchers have studied the relationship of learning styles to CAI.

The purpose of this paper is to explore the relationship between learning styles and CAI within the realm of nursing education. A review of the literature will be the primary approach used in the paper with pertinent findings presented for discussion. Based on these findings, the relationship between CAI and learning styles will be identified and analyzed. It is the author's intent to present key information that will assist nurse educators in achieving optimal, individualized learning while integrating computers into the educational setting.

CHAPTER TWO

Review of the Literature: Learning Styles and Computer-Assisted Instruction

Learning: What is It?

Psychologists have long defined learning as an associative-behavioral process by studying the relationship between a stimulus and a response. B. F. Skinner is most noted in the field of behavioral psychology in studying learning based on the theory of operant conditioning. Recently, however, cognitive psychologists describe learning as a change in behavior in terms of internal, information processing mechanisms. Both of these disciplines view learning as a change in behavior, but disagree on the nature and origin of these changes; whereas, the fundamental construct of learning for behavioralists is reinforcement, cognitive psychologists associate learning to mental processes and memory storage (McKeachie, 1986).

Thus, learning can be generally defined as an active process whereby human behavior changes as a result of experience gained from specific situations

encountered in one's environment. Learning is a continuous phenomena that occurs throughout one's life span. The learner is in the best position to define learning since one's experience of learning is individual and depends on life experiences and circumstances (Gage & Berliner, 1988; Gagne, Briggs, & Wager, 1988).

The discipline of educational psychology serves as the foundation in academic settings upon which teachers attempt to understand the many factors that influence learning (Gage & Berliner, 1988). Instruction and teaching are separate and distinct entities in educational psychology. Instruction is the broad term which encompasses all sets of events that facilitate the learning process; it includes both intrinsic and extrinsic activities of the learner. Teaching is a type of instruction that is limited to events which are external to the learner and requires the presence of an individual who is the teacher or educator. For example, self-instruction is an intrinsic learning activity. An instructional tool is any device that is used to enhance the delivery of instruction in the

teaching-learning process; the computer is one such device. (Gagne, Briggs, & Wager, 1988; Lillie, Hannum, Stuck, 1989).

The changes in behavior that occur with learning transpire over time and involve some form of overt and/or covert actions in response to the environment (Gage & Berliner, 1988). These behavioral changes are in effect learner outcomes and are the basis for evaluating the process of learning. A number of authors have classified the outcomes of the behaviors within three domains of learning: cognitive, affective, and psychomotor. The cognitive domain deals with the mental process of understanding, knowledge, thought, recall, reasoning, and recognition of information. The affective domain considers attitudes, values, interest, emotions and feelings. The psychomotor domain includes simple and complex sensory, muscular or motor skills and performances. (Andrusyszyn, 1989; Boykin & Romano, 1985; Gage & Berliner, 1988). The behaviors in all three domains of learning are interrelated and should not be independently studied. This is especially true when

studying computerization as the elements of all three domains influence each other and frequently occur simultaneously. However, the major focus of this paper is concerned with aspects of learning within the cognitive domain.

Variables to Consider within the Cognitive Domain. Learning is a unique and individual process that is influenced by many factors. Five factors of learning most often appear in the literature: learner characteristics, learning process, learner outcomes, conditions of learning, and setting characteristics. Learner outcomes were briefly discussed in the previous section. Learning processes are the internal mechanisms that involve the acquisition, representation and activation of knowledge into meaningful information that is stored and retrieved for later use (Friedman, Klivington, & Peterson, 1986). Setting characteristics include the physical arrangement and management of the classroom. Conditions of learning include the materials, tools and strategies used in the instructional process. Learner characteristics include personality, intelligence, personal experience, and

learning/cognitive styles (Del Schalcck, 1972; Gagne, Briggs, & Wager, 1988). Each of these variables must be taken into account for learning to result. However, since learning is different for each individual, instructional strategies employed during the learning process must consider the various learning characteristics of the learner. Therefore, the focus of this paper is centered on the characteristics of the learner and specifically individual learning styles.

Learning Styles

As previously noted, it is a well known fact that individuals learn in different ways; the differences are a reflection of learning styles. A variety of learning style models have emerged. The models are based on observations, experiences, and research of the many pioneers who recognize individual differences in learning.

A learning style is an individual's preferred way of receiving and processing information in a learning situation. Learning styles are distinct, sometimes habitual, modes of learning. Consequently, each learner has preferred ways of perceiving, organizing,

and retaining information. These preferred ways of learning are generally consistent for an individual, but may change with experience, time and new information. Learning style is one personal characteristic that an individual brings to any new learning experience (Merritt, 1989; Schmeck, 1988). Additionally, since learning is different for each individual, instructional strategies employed during the learning process must encompass the various learning styles of the individual in order to optimize learning (Warnock-Matheron & Plummer, 1988).

Learning styles and cognitive styles are frequently used interchangeably in the literature as well as in the academic setting. However, some authors find these terms represent related yet distinct entities and describe learning styles as the broader term which includes cognitive styles (Keefe, 1979). Cognitive styles are frequently associated with internal, information processing and problem-solving abilities of an individual. Learning style is most commonly used within an educational or training environment to determine how people learn. The common

assumption underlying the use of learning styles in the teaching-learning process is that an individual's learning will improve in both quantity and quality if the information is introduced analogously to the individual's style of learning (Keefe, 1979; Merritt, 1989; Schmeck, 1988).

There exists a variety of models associated with learning styles that can be found throughout the literature. Merritt (1989) describes several models that are currently used in nursing research to study individual learning styles among nurses in all areas of education. These models include the Canfield Model, Hill Model, Kolb Model, Rezler Model, and Witkin Model. The most frequent model cited within the nursing literature is Kolb's experiential learning model (DeCoux, 1990). Therefore, Kolb's model will be used in this paper.

Kolb's Model on Learning Styles

Few of the models on learning styles are based on theoretical frameworks. David Kolb developed a model in 1976 which is derived from Carl Jung's theories of behavior and primarily based on the experiential

learning theory of Lewin, Dewey, Brunner, and Piaget (Holbert & Thomas, 1988; Partridge, 1983). The model is frequently used with adult learners and has been useful in nursing education and related research; whereas, most other learning style models are used with school-aged children (Laschinger, 1990).

Kolb's theory of experiential learning depicts learning as a life-long, cyclical process in which the individual acquires knowledge through interaction with one's environment by feeling, watching, thinking, and doing. Kolb's model consists of four, sequential phases of the learning cycle that begins with a concrete experience (feelings), that is followed by observation and reflection (watching), which leads to general and abstract conceptualization (thinking), and progresses to active experimentation with testing these concepts under new circumstances (doing). Each of these four phases involves four distinct modes of learning in whic the learner must demonstrate competence: 1) Concrete Experience (CE) involves the ability to become involved in new experiences; 2) Reflective Observation (RO) involves the ability to

observe and reflect upon the experiences from diverse perspectives; 3) Abstract Conceptualization (AC) involves the ability to develop concepts and logically form theories and relationships about the concepts; and 4) Active Experimentation (AE) involves the testing of these theories and relationships in an effort to solve problems and make decisions. These four modes of learning comprise two bipolar continuums in which CE is opposite AC and AE is opposite RO. An individual tends to incorporate one of the learning modes from each of the continuums during a learning experience, resulting in an individual's particular learning style (DeCoux, 1990; Highfield, 1988; Holbert & Thomas, 1988; Laschinger, 1990).

Insert Figure 1 about here

Kolb defines learning style as consistent, preferred patterns of processing information from the external world. The perpendicular intersection of the two continuums in Kolb's model delineates four distinct learning styles in each of four quadrants: diverger,

assimilator, converger, and accommodator. Each of the four types of learning styles encompass two of the four learning modes: divergers tend to prefer learning through the CE and RO modes; assimilators tend to prefer learning through the RO and AC modes skills; convergers tend to prefer learning through the AC and AE modes; and, finally, accommodators prefer learning through the AE and CE modes (Laschinger, 1990). Each of the four learning styles has particular characteristics associated with it. A summary of these characteristics is provided in Figure 2. Additionally, Kolb's research on the four learning styles suggested that these characteristics were associated with different, professional disciplines and the learning style was predictive for various academic fields. A discussion of Kolb's four learning styles is provided next.

Divergers. Divergers (CE+RO) learn best by generating numerous ideas while encompassing different viewpoints and formulating alternatives for a given situation; each situation is treated as a new and unique event and examples are preferred over theories

for learning. Divergers are capable of recognizing problems and are creative in finding solutions. These learners personalize learning experiences and are "people-oriented". Emotions and imaginations are important attributes for the diverger; practical experience is not a high priority. Feelings are emphasized in comparison to thinking skills. Divergers can usually be found among members of the arts, entertainments, and service organizations. Nurses are included among this type of learning style, as well as artists, musicians, counselors, and social workers (Arndt & Underwood; 1990; Hodges, 1988; Kolb, 1976; Kolb, 1985; Laschinger, 1990).

Assimilators. Assimilators (RO+AC) excel in the ability to reason inductively and generate theories which may consist of abstract ideas and concepts. These individuals value a wide range of facts and information that can be analyzed and organized logically into an integrated whole. Ideas are more important than people; thus assimilators tend to be introverts who prefer taking on the role of the impartial, objective observer. Thinking is emphasized

over feelings and is usually in symbolic form. Individuals with careers in science and information are thought to be assimilators. This style includes teachers, professors, financiers, and researchers. (Arndt & Underwood; 1990; Hodges, 1988; Kolb, 1976; Kolb, 1985; Laschinger, 1990).

Convergers. Convergers (AC+AE) prefer to apply and test theories and ideas in practical situations; the strengths of convergers are opposite to the strengths of divergers. This individual usually chooses to focus on narrow, specific problems which require the ability to reason in a hypothetical-deductive manner. Like the assimilator, convergers prefer structure and systematic analysis in learning situations. Things appeal to these individuals rather than ideas or people. Individuals with this learning style tend to be relatively unemotional and prefer technical tasks rather than being involved with interpersonal issues. Convergers enjoy learning situations that require diligent searching and problem solving for which there is only one correct answer. Convergers tend to find careers in technology and as

specialists. Engineers, physicians, computer programmers and computer scientists are examples of professionals found most often to exhibit this learning style (Arndt & Underwood; 1990; Hodges, 1988; Kolb, 1976; Kolb, 1985; Laschinger, 1990).

Accommodators. Accommodators (AE+CE) are risk takers and learn best through trial and error; active involvement and new experiences are well received by these "action-oriented" individuals. These learners are intuitive rather than analytical problem solvers and tend to discard theories and facts that are not suitable for the current problem. The learning strengths of these individuals are opposite those found among assimilators. Accommodators tend to rely on information from other individuals when a problem is encountered rather than analyzing the problem by oneself. People and things are valued by accommodators. Accommodators seek careers in business, promotion and organizations. Accountants, salespersons, administrators, managers, and politicians all demonstrate characteristics of the accommodator (Arndt & Underwood; 1990; Hodges, 1988; Kolb, 1976;

Kolb, 1985; Laschinger, 1990).

Insert Figure 2 about here

Learning Style Inventory (LSI). In order to classify an individual into one of the four types of learning styles, Kolb (1976) developed the Learning Style Inventory (LSI). The original instrument was a nine-item self-evaluation tool based on a semantic-differential scale; each item consisted of four adjectives representative of the four learning style modes which the individual was to rank order based on one's learning characteristics. Kolb (1985) revised the original instrument "to enhance the scientific measurement specifications and the instrument's practical use" (DeCoux, 1990, p. 203). The revised LSI consisted of twelve short sentences which the individual was to complete by rank ordering the four phrases provided for each sentence from the best to the least preferred way of learning.

Some researchers question the reliability of the instrument (DeCoux, 1990; Ferrell, 1983; Lewis &

Bolden, 1989) while others found the reliability of the LSI to be of moderate to high value within a range of .72 to .88 (Laschinger, 1990; Laschinger & Boss, 1983; Merritt, 1989: Ramprogus, 1988). The LSI was consistently found to demonstrate construct validity (Ferrell, 1983; Merritt, 1989). The results of the rank ordering are totaled and the values are plotted on a graph. The individual's learning style is determined by the quadrant in which the values fall. The LSI assists the individual in understanding one's strengths and weaknesses in a learning situation.

Although all four learning styles of Kolb's learning theory are essential for integrated learning to occur, individuals tend to exhibit a preferred style in the cycle which dominates learning in most situations encountered by the individual. This learning style correlates to different stages among the experiential learning cycle. Also, there is no best or better of the four types of learning style described by the model; each is of equitable significance with particular strengths and weaknesses associated with it.

Nursing Research Related to Learning Styles

As previously noted, the most prevalent model used in nursing research to determine individual learning styles among different nursing populations has been based on Kolb's model of learning and the use of the LSI. The most consistent finding in the studies has been the predominance of concrete learning styles, namely divergers and accommodators, among various groups of nurses. The majority of the studies were composed of samples of generic nursing students, registered nursing students, diploma nursing students, associate degree nursing students, or baccalaureate nursing students (DeCoux, 1990; Laschinger, 1990); a few studies included practicing clinical nurses or nurse educators (Hodges, 1988). It is significant to note that faculty and nurse educators were found to prefer abstract learning styles (convergers and assimilators) in comparison to students concrete learning styles (DeCoux, 1990). A literature review on Kolb's LSI by DeCoux (1990) reported distinct and diverse variables studied in relationship to learning styles and categorized the studies with respect to the

variables; the categories included differences in the educational preparation of the nurses, academic achievement, teacher/learner learning style match/mismatch, and measures of nursing process. Other variables included the relationship of learning style to theory-based nursing practice (Laschinger & Boss, 1989) and to nursing specialty (Laschinger & Boss, 1984). In contrast to the majority of research that reported most nurses as preferring concrete experience (i.e., divergers or accommodators), a few studies classified the majority of the sample nurses as assimilators (Highfield, 1988); convergers and accommodators, that is a preference for active experimentation (O'Kell, 1988); and "allrounder", a categorical mix of all four styles (Ramprogus, 1988).

Obviously, one can conclude from the current research that nurses will be represented in all four learning styles for any given population; the majority of the nursing population have demonstrated a tendency towards the concrete experience (feeling) and active experimentation (doing) on each of the respective continuums.

Computer-Assisted Learning

Computer-assisted learning (CAL) [also referred to as computer-based education (CBE)] is the term most frequently used in the literature to describe the broad use of computers in an educational setting to support and facilitate the learning process. CAL is classified as either computer-assisted instruction (CAI) or computer-managed instruction (CMI). CAI links the learner to a computer program and is directly associated with the teaching-learning process of instructional material; whereas, CMI is an administrative system concerned with the management and monitoring of student activities and related performance used to assess student needs and recommend appropriate learning resources (Hannah, 1984; Saba & McCormick, 1986; Thomas, 1988). The focus of this paper is limited to the discussion of CAI.

Types of CAI

There are four major types, or categories, of lesson formats used in CAI programs: drill and practice, tutorials, simulations, and instructional games (Hannafin & Peck, 1988). There are several other

designs defined in the literature, including problem solving (Saba & McCormick, 1986; Thomas, 1988), inquiry and discovery (Ball & Hannah, 1984), and dialogue (Ball & Hannah, 1984; Brose, 1989); however, these are usually classified under one of the previous four major types of CAI and will be minimally discussed in this paper. A new type of CAI that is quickly emerging into the classroom setting is computer-assisted video instruction (CAVI), also referred to as interactive video disc (IAVD) (Saba & McCormick, 1986). Aiken (1990) reported that the top three learning experiences provided by microcomputers in undergraduate curriculums consisted of CAI simulations, tutorials, and drill and practice. Prior to 1989, Aiken (1990) reported tutorials as the number one lesson design used in computer instruction followed by simulations and drill and practice, respectively.

Depending on the lesson design, CAI can be used to "teach, reinforce, practice, or apply information" (Hannafin & Peck, 1988, p. 137) in a number of learning situations. Furthermore, CAI provides instruction through the use of a computer to supplement or

substitute other forms of instruction. Belfry & Winne (1988) reported that CAI was most effective when used as supplementary instruction. Although not specific to CAI, Aiken (1990) reported similar results obtained in a 1989 study that found microcomputers primary purpose in the classroom to be for supplementing learning experiences, followed by enrichment and then replacement. Nonetheless, all types of CAI require active participation on the part of the learner yet vary from simple question/answer formats to more complex interactive forms of "communication". Each of the CAI types has advantages and limitations associated with it. In fact some programs, called hybrids, combine a variety of these designs in an attempt to minimize the limitations of a specific type (Hannafin & Peck, 1988). Each of the CAI types will be discussed in the next section.

Drill and practice. Drill and practice is the least complicated form of CAI and uses a question and answer format for instruction. The learner is asked a question to which a response is required; feedback is simply provided by indicating the correctness or

incorrectness of the response. Drill and practice allows the learner to repetitively review and study information and facts about previously learned material, thereby reinforcing and enhancing one's knowledge base on a particular subject or skill. The pace and duration of the session is under the control of the learner who may practice as frequently, or as seldomly, as desired or needed to acquire mastery and/or competence. This type of CAI is frequently used to supplement traditional instruction methods in the teaching-learning process and usually consists of textual materials. It is analogous to the use of worksheets and homework assignments in a typical classroom setting (de Tornyay & Thompson, 1987; Hannafin & Peck, 1988).

Drill and practice offers some advantages over traditional instruction. One of the most frequently cited advantages is that the learner receives immediate feedback regarding the accuracy of a response in a controlled, nonthreatening environment. Also drill and practice is a basic form of individualized instruction that can be adapted to a level of difficulty to meet

the needs of a specific learner. However, most available software of this type is considered dull, boring and unappealing to the learner. It is simply thought to be an electronic version of traditional question and answer methods. Most of the criticism is due to inadequate methods and designs employed in the current development of the software programs. The potential to improve drill and practice CAI is receiving increased attention by designers for future applications (Hannafin & Peck, 1988).

Tutorials. Tutorials are more complex than drill and practice and are used to introduce new information and to provide practice opportunities using the new information. Primarily used as a substitution for other forms of instruction, tutorials are analogous to traditional programmed instruction text but with increased participation on the part of the learner. This type of CAI provides a more individualized form of instruction since the learner has greater control over the level of difficulty in the selection of lesson content. Tutorials present new facts, concepts, or skills in small increments or frames in a similar

manner provided by a teacher using lectures, textbooks, videotapes or other instructional media. The learner is then required to answer questions related to the newly presented information to determine the learner's level of understanding and comprehension. Depending on the correctness or incorrectness of the learner's response to the question, tutorials provide the learner with feedback to confirm accurate responses or to provide opportunity for remedial instruction, guidance, and/or practice for incorrect responses. This is accomplished using branching techniques in the programming of tutorials. Tutorial programs range in form from very simple presentations of content to more complex programs which provide a form of discovery learning by coaching the learner to ascertain the correct answer to a question (de Tornyay & Thompson, 1987; Hannafin & Peck, 1988).

The major advantage of tutorials is the one-on-one ratio of learner to instructor to meet individual learning needs of the learner. The availability of immediate feedback and remediation of the new information is also of value to the learner. However,

the sequencing of the instruction is predetermined by the program and not under the direct control of the learner. Hence, tutorials are highly structured forms of instruction and are often viewed as duplications of traditional instructional methods and tools (Hannafin & Peck, 1988).

Simulations. Simulations provide the learner with models of real-life situations requiring judgements and decision-making strategies rather than simply a question-answer lesson. Simulations allow the learner to apply previously learned knowledge and skills to a model representing reality for which an array of consequences, both good and bad, can be generated based on the decisions of the learner. This type of CAI assists the learner in developing problem-solving skills, critical thinking, and perhaps, even creativity. The simulation usually consists of a scenario which provides a set of circumstances, for which the learner can introduce a number of different variables to determine which one will reach the best conclusion. Thus, unlike other types of CAI, simulations are primarily under the control of the

learner who is capable of manipulating the outcome of the particular scenario by modifying the selection of possible variables. Some computer simulations are programmed to allow the learner the opportunity to predict the consequences of one's decision and thereby present a method for hypothesis testing. Computer simulations usually provide concrete levels of "experience" in which the learner dynamically participates in a relatively controlled, and risk-free environment. Computer simulations are analogous to the traditional instructional method of role playing and actual "hands-on experience"; demonstrations can be considered a passive form of simulation (de Tornyay & Thompson, 1987; Hannafin & Peck, 1988).

The CAI types of problem-solving, inquiry, discovery, and dialogue are usually considered as subcategories of simulations since the lesson design of each resembles that of simulations (de Tornyay & Thompson, 1987). In fact, many authors use inquiry, discovery, and problem-solving interchangeably when referring to simulations that simply present problems rather than situations or scenarios (Ball & Hannah,

1984; de Tornyay & Thompson, 1987; Thomas, 1988). Dialogue is the most complex of the CAI categories because the student is actually engaged in a "conversation" with the computer program in natural language; the same procedure is followed as with other types of simulations, but with greater learner-computer interaction and flexibility (de Tornyay & Thompson, 1987). For the purposes of this paper, these types of CAI will be considered as types of simulations.

The advantages of simulations are gaining the attention of educators and are considered to be very useful in nursing education (de Tornyay & Thompson, 1987). Many learners can be exposed to a single real-life situation by introducing a hypothetical patient/situation in order to prepare the nurse for clinical decision making without the fear of making a mistake or bringing harm to the patient. Simulations also provide for learning experiences which are performed infrequently or randomly, as in the case of specific nursing procedures and skills. The major limitation of simulations is in the narrow scope of software design as well as the time and expertise

needed to develop the programs (Hannafin & Peck, 1988). However, the availability of this type of CAI is increasing and becoming more common in academic settings.

Instructional games. Games provide a means of motivating the learner to develop, reinforce, and refine previously learned information. The instruction occurs by instilling a sense of competition into the teaching-learning process which acts as the major source of motivation. The learner and the opponent(s) (one which may be the computer) are given a situation or problem for which strategies must be developed to achieve a specific goal. Like simulations, the strategies (or decisions) are evaluated and the learner receives feedback on the appropriateness of the strategy for the particular situation. Additionally, variables may be introduced into the game which may alter the course of events that can effect the outcome and success of the game. Gaming programs usually incorporate the computer features of graphics, sound, animation, and motion into the software; however, many instructional games consist of textual material.

Essentially, games allow the learner to apply concepts, skills, and knowledge in a competitive environment, thereby increasing one's attention and motivation which are known to enhance learning (de Tornyay & Thompson, 1987; Hannafin & Peck, 1988).

The advantages of instructional games are not new in the learning environment. The learner is provided with the opportunity to compete and win, although one does so in a nonthreatening atmosphere. Games capture the interest and enthusiasm of the learner(s) and provide the motivation that may be lacking with other types of CAI. Instructional games are the only type of CAI that allow for more than one learner to participate at the same time in solving a single situation/problem. For the most part, instructional games do not mimic traditional instructional methods and represent a new, unique, and creative tool in the teaching-learning process (Hannafin & Peck, 1988). The limitations of games lies in the design of the programs as well as the fact that not many CAI programs available use gaming techniques for instructional purposes. The latter is particularly true in the nursing educational arena (de

Tornyay & Thompson, 1987). Thus, with improvements in the development of software, this type of CAI holds potential in the future for being a very effective instructional method.

Computer-assisted interactive video (CAIV). CAIV is a branch of CAI that is gaining popularity in the educational setting. CAIV combines the interactive technologies of computers with videotapes or videodisc instructional media. This combination produces a broad range of possibilities for enhancing learning by incorporating a number of sensory stimuli into the teaching-learning process; CAIV programs can include visual (textual and graphic displays) and/or audio (sound) combinations. The potential of CAIV technology offers the most promising means of all types of CAI by appending both efficiency and effectiveness to instruction (de Tornyay & Thompson, 1987; Hannafin & Peck, 1988).

CAIV has many advantages over conventional CAI by overcoming the limitations of the other computerized methodologies. One of the major advantages is the ability of CAIV to "adapt to the individualized

differences of the learner through varied instructional pathways, lesson pacing, and individualized feedback" (Dalton, 1990, p. 8). Other advantages are produced by the integration of the verbal content of video components and the visual concepts of the computer to provide a more meaningful learning experience. Hannafin & Peck (1988) outline the major limitations of CAIV: 1) increased cost; 2) additional time, skill, and manpower to develop and design software; 3) increased instructional time for the learner; and 4) limited portability of the system. Other authors describe limitations including the unavailability of hardware systems, lack of social interaction with teachers and peers, and overstimulation of the learner with distracting visual and auditory stimuli (Battista-Calderone, 1989).

Related Research on CAI in Nursing Education

Despite the limited use in some areas of education, the nursing profession has been actively researching and authoring CAI for over a decade (Hmelo, 1990). The research varies with respect to the CAI types, content, and variables studied. Many of the

studies specified one of three major types of CAI: drill and practice (Merrill & Salisbury, 1984; Reynolds & Pontious, 1986); tutorial (Gaston, 1988; Holzemer, Slaughter, Chambers, & Dulock, 1989; Kirchhoff & Holzemer, 1979; Thiele, 1986; Yoder & Heilman, 1985); and simulations (Dooling, 1987; Droste-Bielak, 1986; Howard, 1987; Huckabay, Anderson, Holm, & Lee, 1979; Lowdermilk & Fishel, 1991). No nursing study was found using instructional games. The content area for the studies include communication, pharmacology, clinical specialty areas, nursing diagnosis, patient management, and nursing research. Most of the research studied one of two variables: attitudes or achievement/acquisition of knowledge, or a combination of these two variables. Also, a number of the studies compared CAI to traditional instructional methods such as lectures, discussions, and role playing.

Few studies have attempted to study the relationship of learning styles to CAI. Even fewer studies have incorporated Kolb's LSI as a measurement to determine the learning style of the sample population. Paulanka (1986) studied the learning

characteristics of nursing students with regard to CAI, but did not determine the sample's learning styles. Three studies could be found that did use Kolb's LSI as a measurement of learning style (Brudenell & Carpenter, 1990; Kirchhoff & Holzemer, 1979; Lowdermilk & Fishel, 1991). However, none of these studies researched learning styles in comparison to the major types of CAI discussed in this paper. Therefore, the author will present a hypothesized correlation between the four learning styles and the type(s) of CAI preferred in a learning environment.

Summary

Learning is an active process in which behavior changes. Individuality in learning is not a new concept and has been studied for several decades. The differences in individual learning is thought to be due to the differences in learning styles. Learning styles are preferred ways of acquiring knowledge in the teaching-learning process.

Many theorists have developed models based on learning style. Kolb's Model of Experiential Learning is most frequently used within the nursing field. Kolb

identifies four learning styles: diverger, assimilator, converger, and accommodator. Each learning style has specific characteristics associated with it and were discussed in great detail.

Computer-assisted instruction (CAI) is an instructional method used in the educational setting. There are five common types of CAI most often identified in the literature: drill and practice, tutorials, simulations, games, and the newly emerging computer-assisted video instruction (CAIV). The functional design of each type was presented which included the advantages and disadvantages discussed.

In the next chapter, the author will propose a theoretical paradigm to integrate Kolb's learning styles with the five types of CAI. This paradigm can assist the nursing information systems specialist or the nurse educator to effectively and efficiently adapt the specific type of CAI to the individual learner.

CHAPTER THREE

Practical Application: The Theoretical Paradigm

Methods of Instruction

Instruction is the manner in which information is presented to an individual in a particular learning situation. Instruction is often referred to as teaching methods in the literature (Oermann, 1990); however, the term instruction is preferred by the author as teaching infers the presence of a person other than the learner, namely a teacher.

Instructional strategies consist of a set of organized procedures which are usually external to the learner, but may be internal as in self-instruction methods (Gagne, Briggs, & Wager, 1988). Instructional strategies enhance learning and allow the learner to achieve particular learning outcomes within the cognitive, affective, or psychomotor domains of learning.

Traditional methods of instruction in nursing education include the lecture, group discussion, and seminar (de Tornyay & Thompson, 1987; Oermann, 1990). Nontraditional instructional methods include

experiential learning (eg. simulations, games, and role playing), discovery learning, self-directed or individualized learning (eg. CAI, independent study, self-paced modules, and programmed modules), and problem solving (eg. case studies). CAI is frequently compared to other instructional methods, primarily the lecture, and is found to be equivalent or superior to the compared method in terms of effectiveness and achievement (Belfry & Winne, 1988). One can see that instructional methods fall within a spectrum ranging from those which are entirely teacher-centered (external) to those that are entirely learner-centered (internal).

Instruction is delivered through different printed and nonprinted media techniques which "communicate" information to the learner. The selected media stimulate the senses of sight (visual/graphic), hearing (auditory) and/or touch (tactile/kinesthetic) independently or in combination (i.e. multimedia instruction). Common types of media include the instructor, text, overhead projector, video cassette, slide/tape, and computer (Gagne, Briggs, & Wager,

1988).

As previously noted, CAI is most often used to supplement, rather than substitute, traditional instruction while enhancing learning. The five CAI types, or categories, presented in the paper are drill and practice, tutorials, simulations, games, and computer-assisted video instruction (CAVI). Each of these types represents a specific method of instruction based on the instructional design of the CAI program. Since CAI is a form of individualized instruction and individuals have specific learning styles as outlined in the previous chapter, the author next proposes a paradigm to illustrate the learner preference(s) for specific types of CAI based on the learning styles of Kolb.

Paradigm

The individual characteristics for each of Kolb's four learning styles (refer to figure 2) form the basis for determining the type of CAI instructional method preferred by a particular learner. A discussion and rationale is provided for each style.

The following matrix summaries the correlation

among the variables in the paradigm:

Insert Figure 3 about here

Divergers. Divergers are "creative learners". This type of learner perceives information concretely and processes it reflectively in order to activate past and present knowledge. The greatest asset of the diverger is the ability to be imaginative and creative while integrating personal experience into an unstructured learning environment. Divergers learn best when involved with other people. Group interactions with the sharing of feelings are important to divergers. Therefore, the most appropriate type of CAI for divergers would be simulations, games, or CAVI. Drill & practice and tutorials would be less effective in enhancing learning for the diverger since both would prove to be tedious and mundane due to the structured format of the material presented. Also, of all four learning styles, divergers are the most people-oriented and would probably be most resistent to learning with a computer through individualized instruction.

Assimilators. Assimilators are "analytic learners" and engage in learning for the purpose of gaining new knowledge. Information is perceived abstractly and processed reflectively. Factual information presented in a logical and sequential manner is the ultimate goal in the learning process for the assimilator. Expert knowledge and precise details are valued by assimilators. Analyzing information and thinking through ideas allows the assimilator to generate theories and identify problems. For these reasons, assimilators enjoy the traditional, structured methods of instruction, mainly learning from lectures, seminars or textbooks. Therefore, assimilators would choose between drill & practice or tutorials as the most preferred type of CAI. Assimilators may also prefer CAVI, if available, since it combines the other types of CAI with increased sensory stimulation and accentuates individualized instruction. These types of CAI would also be appropriate since assimilators learn best alone and need time to reflect on ideas and concepts.

Convergers. Convergers are "pragmatic learners"

and perceive information abstractly while actively processing it. Convergers learn best by using practical knowledge to test theories and acquire skills through practice. Being avid problem-solvers and decision-makers, convergers prefer to find the correct answer to problems rather than be given the solution, and apply common sense to the problem at hand. Since convergers enjoy technical tasks, computers would appeal to this type of learner. Thus, all five types of CAI would be of interest to convergers especially since these individuals prefer thinking about ideas/concepts for which a solution must be ascertained. Although convergers would use all five types of CAI, tutorials and drill & practice would be preferred since there is usually only one correct answer for the existing problem.

Accommodators. Accommodators are "dynamic learners"; information is perceived concretely and processed actively. Personal experience is integrated with application, and learning is chiefly accomplished through intuitive trial and error. Being risk-takers, learning is best achieved in an unstructured

environment in which experimentation and discovery is encouraged. Exploring the hidden possibilities intrigues the accommodator. Hence, accommodators would prefer simulations, games, and CAVI over tutorials and drill and practice since these types of CAI would allow the most flexibility in learning.

Summary

A wide variety of instructional methods are available to the instructor and/or learner in a learning situation. Traditional methods are most often utilized in nursing education; however, nontraditional methods, such as CAI, are gaining in popularity.

A theoretical paradigm is proposed by the author to demonstrate the preference for certain types of CAI based on the profiles of Kolb's four learning styles. Since no similar paradigm can be found in the literature, the author invites researchers to study and test the validity of the paradigm postulated in this paper.

CHAPTER FOUR

Conclusions, Implications, and Recommendations

Concluding Remarks

With the advent and proliferation of computers in the academic arena, technology has the potential to enhance learning through instructional effectiveness. However, lack of computer literacy continues to plague the nursing profession, and the universal adoption of computer technology in nursing education continues to be a slow and sporadic process. Nursing educators and nursing information systems (NIS) specialists must take advantage of this technology and integrate learning "about" computers to learning "with" computers.

One of the major advantages of the computer in education is the ability to individualize instruction to meet the needs of a variety of learners. Individualized instruction asserts that everyone learns differently and there is no one right way of learning. One of the best means of individualizing instruction is by incorporating computer-assisted instruction (CAI) into the academic environment. Furthermore, there are various characteristics of the learner which can

positively or negatively influence the process of learning. One particular learner characteristic which has received increased attention within the recent past is the concept of learning styles.

Kolb's model on experiential learning identifies four learning styles, and provides a useful framework to integrate learning styles with specific instructional methods such as CAI types. Since each learner demonstrates a dominant learning style, knowledge of the learner's preferred methods of instruction should be of importance to nurse educators and NIS specialists. Each type of CAI can be thought to portray a particular learning style with similar characteristics to that of the learner. Fostering an awareness of the relationship between learning styles and CAI will empower both the learner and the instructor by helping to maximize each learning opportunity and tailoring the instruction to match the learner.

All learners have strengths, but these strengths vary with preferred learning style. By capitalizing on these individual strengths and matching learning style

to a specific type of CAI, barriers to learning can be reduced or eliminated. Not only would learning be enhanced, but other benefits may simultaneously occur; for example, higher academic achievement, greater retention, and/or improved transfer of learning may result. A potential source of conflict in a learning situation is the mismatching of learning style to instructional method. This mismatching of learning style to CAI type would not necessarily prevent learning from occurring, but might make learning less effective and efficient. Diversification of instructional methods is an obvious strategy in preventing or limiting a conflict between the learning style and preference for particular types of CAI.

The paradigm proposed in this paper is an initial, innovative undertaking to illustrate the relationship between learning styles and different types of CAI. The matrix could serve as a useful tool in matching learning style to the corresponding type(s) of CAI appropriate for a specific learner. The nurse educator or NIS specialist can administer Kolb's Learning Style Inventory (LSI) to determine the learning style of the

learner and select the appropriate type of CAI, if available. This would be extremely valuable for the educator who lacks knowledge and experience with respect to CAI design. Of course, the tool will need to be validated and tested for reliability.

Some general conclusions can be made from the postulated matrix (figure 3) and current literature on learning styles and CAI. One obvious conclusion is the fact that the flexible design of CAVI makes it the most versatile type of CAI for all four learning styles. In addition, most studies have found that the majority of nurses fall into the categories of diverger and/or accommodator. Based on this data, the availability of CAI simulations and games that are adaptable to nursing education should be increased. This is especially true in light of the fact that the most accessible types of CAI in nursing education may be tutorials or drill & practice. Ideally, all five types of CAI should be available to allow for the matching of learning style and preferred instructional method; although this is not always economically feasible. Neither learning style nor CAI alone can be a panacea for ineffective

learning situations; however, the synergistic effect of combining the two concepts may prove more beneficial than dealing with either in isolation.

Implications for Nursing

The integration of learning styles and instructional methods in nursing education has important implications for nurses at all levels within the profession. Leaders in nursing education and nursing information technology must realize the immediate need of implementing CAI into all academic settings to include undergraduate and graduate curricula as well as continuing educational programs. The nursing profession, as a whole, has lagged behind other professions in adopting CAI as an equal partner with other instructional methods. Since learning involves a change in behavior, the nurse educator or NIS specialist takes on the role of change agent in the learning process and adopts new ways of learning.

CAI can be used to ease the transition of technology into the nursing profession. CAI has proven to be an effective method of instruction for some nurses. Therefore, by integrating CAI into nursing

education, educators will increase computer literacy among nurses practicing currently and in the future. Also, nurses will have a better understanding of the capabilities and applications of computers as adjunct tools in the academic and clinical settings. Nurse educators must acknowledge and honor the diversity among individual learners and adapt instruction to the characteristics of the learner. Educators must not assume that all learners prefer the traditional, structured approach to learning. It is also vital for educators to recognize that any group of learners will include a certain percentage of all four of Kolb's learning styles. Over-generalization of a particular group may also be a dangerous practice. The educator must adapt instructional methods to include all types of learners or the learning experience will not be maximized. Furthermore, educators must be careful not to stereotype a particular individual or group because learners may be improperly categorized. A sole method of instruction based on incorrect assumptions may prove ineffective and a waste of time. Educators must also understand that there is no one best or better learning

style.

It is important to note that one's preference for a particular instructional method may not be related to a particular learning style, but rather to the acceptance or resistance of computerization by the individual. Certain learners may be better candidates for CAI than other instructional methods simply due to their attitude regarding computers. In addition, instructors may teach according to their own preference for particular instructional methods, which may not include CAI. This reluctance to use CAI is most likely due to a lack of personal knowledge and/or comfort with computerization. Therefore, instructors need to be educated on CAI and be aware of both the learner's and one's own preference for learning.

The process of integrating learning styles with CAI types in nursing education can best be summarized by following the steps of the nursing process: 1) assessment of learning style; 2) planning/ diagnosing the type of CAI to be used; 3) implementation of the appropriate CAI; and 4) evaluation of the effectiveness of the learning strategy. If learning is enhanced by

providing a means of matching learning style and type of CAI, the nurse will be able to transfer this learning to the clinical setting and ultimately improve the quality of patient care. Furthermore, knowledge of the relationship between learning styles and types of CAI can be useful not only in nursing education but also in other areas of application such as patient education.

Nurse educators need to continually search for new and more effective methods of disseminating information in order to facilitate and enhance learning. One of the key issues to ensure the integration of learning styles and CAI is the availability of a variety of software programs and instructional design. Nurses can influence the design, development, and implementation of CAI and other educational software into academic curricula and various educational settings. Furthermore, critical evaluation of available CAI for nursing is necessary to ensure the inclusion of learning style theory and identification of type of CAI. Although nurse educators have experience evaluating traditional instructional material,

additional expertise is needed to evaluate CAI. The NIS specialist can be a valuable resource to accomplish this task. Also, nurses need to become more involved with authoring CAI to ensure the needs of the learner are being met and matched with learning styles.

Recommendations

The challenges facing nursing education in the future are of paramount importance today. No longer can nurses wait for things to happen within the profession; nurses must be in the forefront to make things happen for the good of the profession. Clearly, the future of the nursing profession begins within the educational arena.

There exists limited research comparing the effectiveness of traditional instructional methods with contemporary methods in nursing education. Thus, additional research is needed in the area of computerization and learning. Specifically, further investigation is warranted in the areas of learning styles, matching learning styles to instructional methods, and the role of computers in nursing education. Replication of previous research on

learning styles and instructional methods needs to be accomplished with results reevaluated and published in the nursing literature. This research may provide new knowledge and insight about learning styles while effectively and efficiently promoting the use of CAI in the classroom. Some of the questions that need to be further explored and answered are:

1. Is the proposed paradigm valid? reliable?
2. Which learning model is most appropriate for determining the preferred type of CAI?
3. How can learning styles be integrated into the design and development of CAI?
4. What is the current level of application of learning styles in nursing education?
5. What other factors influence a learner's preference for particular type of CAI?
6. What are the advantages/disadvantages of matching learning style to specific types of CAI?

Answers to these questions could be useful in understanding and applying learning styles to different types of CAI.

In addition to increasing nursing research, a

number of other recommendations are proposed:

* Nurse educators need to become computer literate to reduce the learning curve with respect to the applications of CAI.
* Nurse educators must become familiar with the concept of learning styles and also inform learners of the concepts.
* Nurse educators need to become involved in the process of evaluating CAI.
* Incentives should be developed to encourage nurses to author new CAI suitable for nursing education.
* Nurse educators should elicit the support and collaboration of colleagues and professional organizations in developing and designing CAI.
* Employ the expertise of the NIS specialist in the design, implementation and evaluation of CAI.
* The concepts of learning styles and CAI should be applied to patient education in the clinical setting.
* CAI should present the same information in various forms designed to capitalize on the different characteristics of each learning style.
* All types of CAI software should be capable of

assessing the learning style of the learner and adapt the lesson to the individual user.

* The use of CAVI needs to be explored and integrated into nursing education as it appears to accommodate most learning styles.

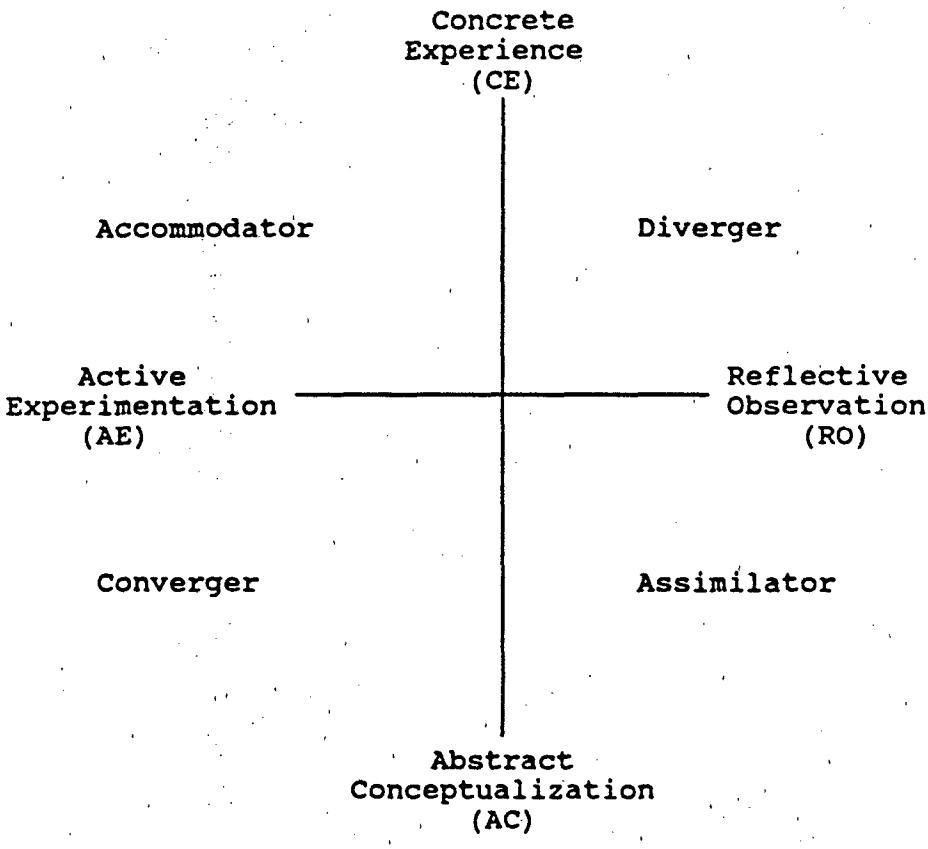
* Computer technology needs to be integrated into nursing education, research and practice.

* An evaluation tool needs to be developed to determine the applicability of the various types of CAI to specific learning styles.

* The feasibility of using expert systems, and specifically intelligent CAI, should be explored.

Use of computers in nursing education is in its infancy. Nurse administrators, educators, researchers, clinicians and specialists must accept the future challenges to meet the needs of all learners within the profession. Nurses must move forward and not remain stagnant in an ever-changing world. Those individuals who can envision the future and see the full potential of the computer in education will enhance learning for everyone in this decade and beyond into the 21st century.

Figure 1: Kolb's Four Learning Styles



Adapted from Kolb (1985)

Figure 2: Kolb's Learning Styles and Characteristics

Diverger:
- focuses on being involved
- emphasizes feeling as opposed to thinking
- intuitive and artistic
- values people and being involved
- open-minded and imaginative
- good at brainstorming and seeking meaning
- places value on understanding as opposed to practical application of information
- patient and impartial

Assimilator:
- focuses on ideas and abstract concepts
- logical in thinking
- scientific as opposed to artistic
- ability to create theoretical models
- emphasizes thinking rather than feeling
- good at systematic planning
- values precision, rigor, and analysis
- passive rather than action-oriented
- emphasis on understanding rather than pragmatic

Converger:
- focuses on logic, ideas, and concepts
- preference for technical tasks and problems
- pragmatic in actions and thoughts
- doing as opposed to observing
- results oriented
- problem-solver, decision-maker
- emphasizes thinking rather than feeling

Accommodator:
- intuitive and artistic
- open-minded, adaptable, flexible
- emphasizes feeling as opposed to thinking
- good at carrying out plans and tasks
- values people and being involved
- risk-taker, action-oriented, opportunity seeker
- problems solved by intuitive trial and error
- relies on others for information rather than analyze

(Adapted from Arndt & Underwood, 1990)

Figure 3: Matrix of Kolb's Learning Styles and preferred types of CAI

	Diverger	Assimilator	Converger	Accommodator
Drill & Practice		X	X	
Tutorial		X	X	
Simulation	X		X	X
Games	X		X	X
CAVI*	X	X	X	X

* Computer-assisted video instruction

References

Aiken, E. (1990). Continuing nursing education in computer technology: A regional experience. Atlanta, GA: Southern Regional Education Board.

Armstrong, M. L. (1989). Computer competence for nurse educators. In V. K. Saba, K. A. Reider, & D. B. Pocklington (Eds.), Nursing and computers: An anthology (pp.336-348). New York: Springer-Verlag.

Andrusyszyn, M. A. (1989). Clinical evaluation of the affective domain. Nurse Educator Today, 9, 75-81.

Arndt, M. J., & Underwood, B. (1990). Learning style theory and patient education. The Journal of Continuing Education, 21(1), 28-31.

Arnold, J. M., & Bauer, C. A. (1988). Meeting the needs of the computer age in continuing education. Computers in Nursing, 6(2), 66-69.

Ball, M. J., & Hannah, K. J. (1984). Using computers in nursing. Norwalk, CT: Appleton-Century-Crofts.

Battista-Calderone, A. (1989). Designing interactive video instruction: An educator's perspective. Nursing & Health Care, 10(9), 505-510.

Belfry, M. J., & Winne, P. H. (1988). A review of the

effectiveness of computer assisted instruction in nursing education. Computers in Nursing, 6(2), 77-85.

Boykin, P., & Romano, C. (1985). A decade of decisions: Education. Computers in Nursing, 3(2), 70-73.

Brose, C. H. (1989). Computer technology in nursing: Revolution or renaissance? In V. K. Saba, K. A. Reider, & D. B. Pocklington (Eds.), Nursing and computers: An anthology (pp.359-365). New York: Springer-Verlag.

Brudenell, I., & Carpenter, C. S. (1990). Adult learning styles and attitudes towards computer assisted instruction. Journal of Nursing Education, 29(2), 79-83.

Dalton, D. W. (1990). The effects of cooperative learning strategies on achievement and attitudes during interactive video. Journal of Computer-Based Instruction, 17(1), 8-16.

DeCoux, V. M. (1990). Kolb's learning style inventory: A review of its applications in nursing research. Journal of Nursing Education, 29(5), 202-207.

Del Schalock, H. (1972). Learner outcomes, learning

processes and the conditions of learning. In J. V. Edling (Ed), The cognitive domain (pp. 37-85). Washington, DC: Gryphon House.

de Tornyay, R., & Thompson, M. (1987). Strategies for teaching nursing (3rd ed.). New York: Wiley Medical.

Dooling, S. L. (1987). Designing computer simulations. Computers in Nursing, 5(6), 219-224.

Droste-Bielak, E. M. (1986). Two techniques for teaching interviewing: A comparative study. Computers in Nursing, 4(4), 152-157.

Ferrell, B. G. (1983). A factor analytic comparison of four-learning styles instruments. Journal of Educational Psychology, 75(1), 33-39.

French, D. (1986). Using learning theory to design and evaluate computer-assisted instruction software. Nurse Educator, 11(5), 33-37.

Friedman, S. L., Klivington, K. A., & Peterson, R. W. (1986). The brain, cognition, and education. New York: Academic Press.

Gage, N. L., & Berliner, D. C. (1988). Educational psychology (4th ed.). Boston: Houghton Mifflin.

Gagne, R. M., Briggs, L. J., & Wagner, W. W. (1988).

Principles of instructional design (3rd ed.). Fort Worth, TX: Holt, Rinehart & Winston.

Gaston, S. (1988). Knowledge, retention, and attitude effects of computer-assisted instruction. Journal of Nursing Education, 27(1), 30-34.

Hamby, C. S. (1986). A study of the effects of computer assisted instruction on the attitude and achievement of vocational nursing students. Computers in Nursing, 4(3), 109-113.

Hannafin, M. J., & Peck, K. L. (1988). The design, development, and evaluation of instructional software. New York: Macmillan.

Hannah, K. J. (1988). Using computers to educate nurses. In M. J. Ball, K. J. Hannah, U. Gerdin Jelger, & H. Peterson (Eds.), Nursing informatics: Where caring and technology meet (pp. 289-300). New York: Springer-Verlag.

Hebda, T. (1988). A profile of the use of computer assisted instruction within baccalaureate nursing education. Computers in Nursing, 6(1), 22-29.

Heller, B. R., & Romano, C. A. (1988). Nursing informatics: The pathway to knowledge. Nursing and

Health Care, 9(9), 483-484.

Heller, B., Romano, C., Damrosch, S., & Parks, P. (1985). Computer applications in nursing: Implications for the curriculum. Computers in Nursing, 3(1), 14-21.

Highfield, M. E. (1988). Learning styles. Nurse Educator, 13(6), 30-33.

Hmelo, C. E. (1990). Computer-assisted instruction in health professions education: A review of the published literature. Journal of Educational Technology Systems, 18(2), 83-101.

Hodges, S. A. (1988). Individual learning styles of student nurses, their teachers and ward sisters. Journal of Advanced Nursing, 13, 341-344.

Holbert, C. M., & Thomas, K. J. (1988). Toward whole-brain education in nursing. Nurse Educator, 13(1), 30-34.

Holzemer, W., Slaughter, R., Chambers, D., & Dulock, H. (1989). The development of a computer-based tutorial for an introductory course on nursing research. Computers in Nursing, 7(6), 258-265.

Howard, S. A. (1987). Use of a computer simulation for

the continuing education of registered nurses. Computers in Nursing, 5(6), 208-213.

Huckabay, L., Anderson, N., Holm, D., & Lee, J. (1979). Cognitive, affective, and transfer of learning consequences of computer-assisted instruction. Nursing Research, 28(4), 228-233.

Keefe, J. W. (1979). Learning styles: An overview. In Student learning styles (pp. 1-17). Reston, VA: The National Association of Secondary School Principals.

Kirchhoff, K. T., & Holzemer, W. L. (1979). Student learning and a computer-assisted instructional program, Journal of Nursing Education, 18(3), 22-30.

Kolb, D. A. (1976). The learning style inventory: A technical manual. Boston: McBer.

Kolb, D. A. (1985). The learning style inventory: A technical manual. Boston: McBer.

Laschinger, H. K. (1990). Review of experiential learning theory research in the nursing profession. Journal of Advanced Nursing, 15, 985-993.

Laschinger, H. K., & Boss, M. W. (1984). Learning styles of nursing students and career choices. Journal of Advanced Nursing, 9, 375-380.

Laschinger, H. K., & Boss, M. K. (1989). Learning styles of baccalaureate nursing students and attitudes towards theory-based nursing. Journal of Professional Nursing, 5(4), 215-223.

Lewis, A. P., & Bolden, K. J. (1989). General practitioners and their learning styles. Journal of the Royal College of General Practitioners, 39, 187-189.

Lillie, D., Hannum, W., & Stuck, G. (1989). Computers and effective instruction. White Plains, NY: Longman.

Lowdermilk, D. L., & Fishel, A. H. (1991). Computer simulations as a measure of nursing students' decision-making skills. Journal of Nursing Education, 30(1), 34-39.

McKeachie, W. J. (1986). Teaching tips: A guidebook for the beginning college teacher (8th ed.). Lexington, MA: Heath.

Merrill, P. F., & Salisbury, D. (1984). Research on drill and practice strategies. Journal of Computer-Based Instruction, 11(1), 19-21.

Merritt, S. L. (1989). Learning styles: Theory and use

as a basis for instruction. In W. L. Holzemer (Ed.), Review of research in nursing education: Volume II (pp. 1-31). Thorofare, NJ: Slack.

Newbern, V. B. (1985). Computer literacy in nursing education: An overview. Nursing Clinics of North America, 20(3), 549-583.

Oermann, M. H. (1990). Research on teaching methods. In G. M. Clayton & P. A. Baj (Eds.), Review of research in nursing education: Volume III (pp. 1-31). Thorofare, NJ: Slack.

O'Kell, S. P. (1988). A study of the relationships between learning style, readiness for self-directed learning and teaching preference of learner nurses in one health district. Nurse Education Today, 8, 197-204.

Partridge, R. (1983). Learning styles: A review of selected models. Journal of Nursing Education, 22, 243-248.

Paulanka, B. J. (1986). The learning characteristics of nursing students and computer assisted instruction: An exploratory study. Computers in Nursing, 4(6), 246-253.

Ramprogus, V. K. (1988). Learning how to learn nursing. Nurse Educator Today, 8, 59-67.

Reynolds, A., & Ferrell, M. (1989). Computer literacy: A mission for continuing education for professional nurses. The Journal of Continuing Education in Nursing, 20(3), 132-135.

Reynolds, A., & Pontious, S. (1986). CAI enhances the medication dosage calculation competency of nursing students. Computers in Nursing, 4(4), 158-165.

Saba, V., & McCormick, K. (1986). Essentials of computers for nurses. Philadelphia: J. B. Lippincott.

Schmeck, R. R. (1988). An introduction to strategies and styles of learning. In R. R. Schmeck (Ed.), Learning strategies and learning styles (pp. 3-19). New York: Plenum.

Sparks, S. M. (1989). Computer-based education in nursing (Lister Hill monograph; LHNCBC 89.3). Bethesda, MD: National Library of Medicine.

Thiele, J. (1986). The development of computer-assisted instruction for drug dosage calculations: A group endeavor. Computers in Nursing, 4(3), 114-118.

Thomas, B. S. (1985). A survey study of computers in nursing education. Computers in Nursing, 3(4), 173-179.

Thomas, B. S. (1986). Instructional computing in American nursing programs. International Journal of Nursing Studies, 23(3), 221-229.

Thomas, B. S. (1988). Educational software. In M. J. Ball, K. J. Hannah, U. Gerdin Jelger, & H. Peterson (Eds.), Nursing informatics: Where caring and technology meet (pp. 301-311). New York: Springer-Verlag.

Vockell, E. L. (1990). Instructional principles behind computer use. The Computing Teacher, Aug/Sept, 10-13.

Walker, M. B. (1986). Nursing education: Challenges of the computerized environment. Computers in Nursing, 4(4), 166-171.

Warnock-Matheron, A., & Plummer, C. (1988). Introducing nursing information systems in the clinical setting. In M. J. Ball, K. J. Hannah, U. Gerdin Jelger, & H. Peterson (Eds.), Nursing informatics: Where caring and technology meet (pp. 115-127). New York:

Springer-Verlag.

White-Delaney, C. (1989). Nurse educators' acceptance of the computer in baccalaureate nursing programs. Computers in Nursing, 7(3), 129-136.

Yoder, M. E., & Heilman, T. (1985). The use of computer assisted instruction to teach nursing diagnosis. Computers in Nursing, 3(6), 262-265.

END

FILMED

DATE: 1-92

DTIC