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Tomasic, Diane Marie, Ed.D.

West Virginia University, 1989

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EFFECT OF INTENSIVE INSTRUCTION ON INQUIRY PATTERNS OF REGISTERED PROFESSIONAL NURSES IN MAKING CLINICAL JUDGMENTS

DISSERTATION

Submitted to the College of Human Resources and Education

of

West Virginia University

In Partial Fulfillment of the Requirements for

The Degree of Doctor of Education

by

Diane Marie Tomasic

Morgantown

West Virginia

1989

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Chapter 1

Introduction and Problem Statement

Introduction

The major objective of this study is to investigate the effects of a method to modify the inquiry pattern behaviors of registered professional nurses in data gathering for clinical judgments. An essential professional nursing responsibility is the ability to solve problems and make astute clinical judgments. Clinical judgments require the cognitive skills of inquiry, critical thinking, and decision-making. The process of making clinical judgments is referred to by various authors as problem solving, clinical inferencing, inferential judgments, diagnostic reasoning, problem identification, and nursing diagnoses (Gordon, 1982).

Astute clinical judgments are essential for the diagnostic and monitoring functions of professional nursing practice. The ability to make clinical judgments is the process of translating knowledge and observation into a plan of action focusing on the health of the patient (American Association of Colleges of Nursing, 1986). A clinical judgment is a series of decisions made by the nurse as a result of nurse-patient interactions. Decisions are typically made regarding the following: (1) what is to be observed in a patient situation, (b) evaluation and meaning of the observed data, and (c) nursing actions to be taken to benefit the patient (Tanner, 1983, 1987).

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The need to collect and process information is documented throughout nursing history. Recognition is given to the nurse's observational function and complexity of data the nurse must consider. The significance of teaching observation is traced to Florence Nightingale (1859/1946) when she writes about the importance of teaching nurses what and how to observe. The function of observation has moved from merely observing, recording, and reporting to a process which includes:

1. Observation - the recognition of signs and symptoms presented by the patient.
2. Inference - making a judgment about the state of the patient and/or the nursing needs of the patient.
3. Decision-making - determining the action which should be taken that will be of optimal benefit to the patient (Kelly, 1966, p. 24).

Tanner (1983) views the development of clinical judgment as a combination of acquiring skill in data gathering and theoretical knowledge. Basic to this process are cognitive-perceptual abilities involving collection, classification, interpretation, and analysis of data or information about the patient (Gordon, 1987b). Information collection is a combination of skills requiring a knowledge base and cue acquisition or data gathering. A knowledge base is built on nursing content and the sciences. An information collection framework guides the nurse in the collection of information. Both make the nurse sensitive to

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what information to collect and how it is categorized and/or classified.

Perception and accurate identification of information and the assignment of valid meaning to the information are basic skills required for information gathering. Two terms, cue identification and inferencing, describe the process. A cue or detail is a unit of sensory input available to an observer in any situation. A cue is a single fact or piece of information obtained through any of the senses and is given a name. Cues make up an individual's image of reality. An inference refers to the personal subjective meaning assigned to a single cue or group of cues. The ability to make an inference is the result of knowledge (Carnevali, 1983). Cues form the building blocks for further observations and subsequent inferences, decisions, and actions. Perception and interpretation of cues signals that cognitive actions should appear for questioning and further information search.

Thoroughness in data collection contributes to the accuracy of clinical judgments. The need to be sensitive to the subtleness of verbal and nonverbal cues remains important in making clinical judgments. Making a judgment based only on the most obvious or incomplete cues can result in erroneous decisions and nursing care (Ressler, 1982).

Nurses make clinical judgments in increasingly complex situations. Clinical judgments are the result of a unique process beginning with a problem or state of discrepancy

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(Jenkins, 1985). In a patient situation, the nurse is faced with a complex task or discrepant event. This task or event is probabilistic in nature because of the uncertainty of the number and types of cues in the situation. Information processing theory describes the cognitive processes used when an individual is faced with a problem solving task. Information processing refers to the way an individual handles stimuli from the environment, organizes data, identifies problems, and generates solutions to problems (Joyce and Weil, 1980). In this framework, individuals are viewed as active seekers of new information who rely on attention and memory to perceive, organize, store, and retrieve information needed for a given task or problem (Fuhrmann and Grasha, 1983). Problem solving behavior is the interaction between an information processing system or a problem solver and a task environment defined by the problem solver (Newell and Simon, 1972; Simon and Newell, 1971). Thus, an individual is an information processing system (IPS) when solving problems. When placed in a problem solving situation, adaptive or rational behaviors by the problem solver occur. These behaviors are both appropriate to the goal and demands of the situation.

A limitation of information processing is the structure of short-term memory (STM). Miller (1956) found the capacity of the STM to be seven, plus or minus two, symbols. This represents the amount of information an individual retains. Thus, in a short period of time, the

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amount of information an individual is able to receive, process, and remember is limited. To increase the capacity of the STM, information is organized into patterns or chunks which increase the amount of information an individual can handle. These patterns or chunks of information are then stored in long-term memory for future retrieval.

The task environment in information processing becomes extremely complex and results in cognitive strain (Bruner, Goodnow and Austin, 1956). To reduce cognitive strain, data is clustered into diagnostic hypotheses for testing.

Adaptive cognitive strategies are identified which involve the use of higher-thought processes (Gordon, 1987b; Elstein, Shulman, and Sprafka, 1978; Carnevali, 1983). When encountering a patient situation, the nurse narrows the search field with initial attention given to available relevant cues or cue acquisition. These cues are grouped or clustered and assigned a meaning or cue interpretation. Tentative hypotheses are generated as possible explanations for the clustered cues and the field is searched for more information to support or reject the hypotheses (information search). Hypotheses are evaluated and a decision or judgment is made. Thus, when a nurse encounters a discrepant event which produces uncertainty, the nurse must search for more information to reduce the uncertainty.

Errors in judgment occur as the result of cue acquisition problems and faulty hypothesis generation (Elstein, Shulman, and Sprafka, 1978). Tanner (1983) argues

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that information search and hypothesis generation are important prerequisites to making accurate clinical judgments. However, early hypothesis generation can close the mind to further information search. Consequently, it is important to search for competing explanations rather than just settle for the most obvious explanation.

Gordon (1987a) claims that adult logical thinking processes are used in making clinical judgments. Hale (1983) notes that most research assumes that an individual already possesses these abilities. The process of making clinical judgments requires the effective use of cognitive processes similar to those described by Piaget and measured by Piagetian tasks. Formal operational thought processes are inherent in making clinical judgments. These processes guide the search for information to support or reject hypotheses. Operations include but are not limited to:

1. Hypothetico-deductive reasoning - formulating guesses and deducing conclusions about the problem.

2. Isolation and control of variables - identifying variables and using them to solve problems.

3. Combinatorial logic - thinking in terms of combinations of variables when confronted with a problem.

4. Propositional thinking - establishing a functional relationship between variables.

5. Probabilistic reasoning - recognizing the probabilistic nature of the problem.

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The thinking characteristic of the formal operational stage is of particular importance since the practicing registered professional nurse must possess this level of cognitive functioning. Research in the cognitive processes used in clinical judgments have not addressed this variable. Evidence exists that all adults have not attained formal operational thought processes as described by Piaget (Tomlinson-Keasey, 1972; Schwebel, 1975; Hale, 1983; Sunal, 1980; Sunal and Sunal, 1985).

While course work provides a knowledge base for clinical judgments, there needs to be an emphasis on the development of the intellectual skills used in inquiry, specifically formal operational thought processes. Course work provides factual information dealing with the real, concrete world. In a nurse-patient situation, the environment is not always limited to the concrete. The environment is probabilistic and uncertain. The nurse needs to move beyond late concrete, 2B; transitional, 2B/3A; and early formal, 3A thinking; and think at the late formal operational stage, 3B. This would involve thinking in terms of new possibilities, reasoning hypothetically, formulating generalizations, and suspending judgment.

Piaget (1972) posits that a social environment and experiences provide the individual with the cognitive nourishment and intellectual stimulation necessary for the construction of formal structures. Formal operations can be encouraged and developed through providing an active

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environment (Fuhrmann and Grasha, 1983). This environment allows an individual to formulate questions, problems, and hypotheses rather than simply being a passive receptor of knowledge. One method of providing such an environment is to pose a problem representing a concrete, discrepant event which serves as the focus of inquiry. This event does not fit the present schema or structure. The event contradicts the individual's expectations about what should be happening. This generates subjective uncertainty. In order to accommodate and assimilate, the individual must gather more information to eliminate the discrepancy.

Cognitive processes related to data collection are needed for effective hypothetico-deductive reasoning. One method of developing these reasoning processes involves an intensive instruction session in cue attendance, information search, and hypotheses generation. Here, a film representing a discrepant event is shown to subjects, requiring them to identify a criterion number of details, ask questions, and generate hypotheses. Short-term training using this technique has been conducted with adolescents (Wright, 1974, 1978) and with pre-service education majors (Sunal, 1988). Long-term effects have also been significant (Wright, 1981). To date, using this training with professional registered nurses is not documented. Nevertheless, the nurses need to be able to gather sufficient information to avoid making clinical judgments based on too few cues. Therefore, there is a need to

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determine if this method can modify the inquiry behavior patterns of registered professional nurses. Information processing theory serves as the framework for analyzing the possibility of increasing the ability of the individual to gather and process information.

Statement of the Problem

The major objective of this study is to investigate the effects of a method to modify the inquiry pattern behaviors of registered professional nurses in data gathering for clinical judgments. Demographic data and the level of cognitive functioning is also collected from the registered professional nurses involved in the study.

The demographic data and level of cognitive functioning is examined to identify similarities or differences which might exist among the subjects. Demographic variables include: age, sex, basic educational preparation, current enrollment in a degree or certificate program in nursing or in a field other than nursing, education beyond basic preparation in nursing or in a field other than nursing, advanced educational preparation to assume an expanded role, certification, preferred area of clinical practice, length of time actively involved in nursing practice, length of time providing direct patient care, employment status, position, continuing education, and data gathering skills. The level of cognitive functioning is examined to determine its effect on the method used to modify inquiry patterns.

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Research Questions

In order to accomplish the purpose of this study, four research questions are examined:

1. Does intensive instruction in cue attendance, information search, and hypothesis generation affect the quantity and quality of details observed in analyzing a problem event on film--near-transfer, or in a filmed patient situation--far-transfer?

2. Does intensive instruction in cue attendance, information search, and hypothesis generation affect the quantity and quality of information search in analyzing a problem event on film--near-transfer, or in a filmed patient situation--far-transfer?

3. Does intensive instruction in cue attendance, information search, and hypothesis generation affect the quantity and quality of hypothesis generation in analyzing a problem event on film--near-transfer, or in a filmed patient situation--far-transfer?

4. Does the level of cognitive functioning affect the results of intensive instruction in the quantity and quality of cue attendance, information search, and hypothesis generation in analyzing a problem event on file--near-transfer, or in a filmed patient situation--far-transfer?

Significance of the Study

A hallmark of the nursing profession is the clinician's ability to make independent clinical judgments. Clinicians

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are expected to make accurate and logically derived clinical judgments pertinent to the care of the patient. Professional nursing practice is based on liberal and professional knowledge and clinical and cognitive skills. The application of knowledge in the clinical setting requires a high level of judgment (American Association of Colleges of Nursing, 1986).

Kemp (1985) argues that strategies that increase students' abilities to engage in critical thinking and scientific inquiry must be identified and developed by nurse educators. She notes that often concrete thinking is promoted and reinforced in nursing education because many functions of the clinician are technical procedures. The National League for Nursing, a certifying body for quality education, includes specific accreditation criteria for incorporating clinical decision making, critical thinking, and independent judgment in the curriculum (National League for Nursing, 1983). In addition, the American Association of Colleges of Nursing (1986), charged with defining education for professional nursing, stresses that graduates of professional nursing programs possess the clinical skills necessary to make clinical judgments. Therefore, it is important that curriculum and learning experiences provide and foster the cognitive skills necessary for the clinician to function as an accountable member of the profession and assume the role of the professional nurse.

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The role of the professional nurse involves a variety of behaviors requiring the use of higher-level thought processes. The National League for Nursing (1983) defines role as the attitudes, behaviors, and cognitions associated with a position. These behaviors can be viewed on a continuum progressing from simple nurturing to critical decision-making behaviors (National League for Nursing, 1982). Proper nursing roles are continuing to develop and change. As clinicians become more autonomous, competence in making clinical judgment is essential for providing quality nursing care.

In a recent Delphi survey in nursing education, strategies for teaching clinical problem solving was ranked second out of 63 research priorities (Tanner and Lindeman, 1987). Considering the emphasis for having clinicians make clinical judgments, research in the processes and the teaching of clinical judgments is new. Tanner (1986) considers the findings preliminary and identifies a critical need for research in teaching students and practitioners the process of making clinical judgments (Tanner, 1986; Padrick, Tanner, Putzer, and Westfall, 1987). Because incomplete data collection can lead to inaccurate judgments or decisions, Patrick, et al. (1987) suggest that there is a need to conduct research to determine whether efforts should be directed toward helping students and practitioners learn to gather appropriate information.

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This study describes and investigates the effects of a method to modify the inquiry pattern behaviors of registered professional nurses in data gathering for clinical judgments. Intensive instruction in cue attendance, information search, and hypothesis generation should generate uncertainty causing the individual to gather and process more information to reduce the uncertainty. The results of this study contribute to the research in clinical judgments.

Limitations

The limitations of this study must be taken into consideration in interpreting the findings. These limitations are as follows:

1. The registered professional nurses participating in this study may not be representative of the population of registered professional nurses.

2. Subjects are volunteers from an accessible population of registered professional nurses. These subjects may possess characteristics which differ from non-volunteers which affects interpretation and generalization of results.

3. While all senses are used in data collection, only the visual and hearing senses are utilized in this study.

4. While the use of a simulation provides a controlled, consistent situation for subjects, the simulated simulation may not reflect the responses in a real situation.

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Definition of Terms

Several terms in this study could have a variety of definitions. For clarity, the following terms are operationally defined.

1. Cue attendance - Refers to the process whereby a subject gathers data by noting specific details depicting a problem event on film.

2. Data gathering - Refers to the process of cue acquisition or gathering information by attending to details, asking questions, and generating hypotheses.

3. Far-transfer - Refers to measuring the effects of intensive instruction in an area of professional nursing responsibility. Far-transfer is measured by having a subject view a problem event on film depicting a nursing situation. In this study, three patient situations developed by Verhonick, Nichols, Glor and McCarthy (1968) are used. After the examiner reads the introduction to each sequence, the subject views the file as many times as needed to complete the task. Sequence B is used for the subject to record details, Sequence C is used for the subject to record questions, and Sequence D is used for the subject to generate hypotheses.

4. Hypothesis - Is defined as a testable explanation of an empirical relationship among variables in a given problem situation (Quinn and George, 1975).

5. Hypothesis generation - Refers to the process whereby subject writes hypotheses or testable explanations to explain a problem event seen on film.

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6. Information search - Refers to the process that occurs after viewing a film, when the subject is asked to gather additional information about what is seen. The subject asks the examiner questions so structured that ask for known facts, not inferences or conclusions and that can be answered with a "yes" or "no."

7. Inquiry pattern behavior - Is defined as the reorganization of knowledge by acquiring more information about an event for use in making clinical judgments.

8. Intensive instruction - Refers to an instruction session in which a subject is instructed to a high criterion in cue attendance and hypothesis generation and is instructed to ask as many questions as needed in information search. In this study, the intensive instruction consists of a subject viewing the following Inquiry Development Program in Physical Science films as many times as needed to complete the task:

a. After viewing "The Balloon in the Jar," the task is to identify 100 details for cue attendance.

b. After viewing "The Spring," the task is to ask as many questions as needed for information search.

c. After viewing "The Sailboat and the Fan," the task is to generate seven hypotheses for hypothesis generation.

9. Level of cognitive functioning - Refers to the level of reasoning processes used by the subject when processing data. Level of cognitive funcitoning is measured

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using the Piagetian Reasoning Task IV The Equilibrium In The Balance (Wylam and Shayer, 1979, 1980). The instrument yields five levels or stages: 3B = late formal operational, 3A = early formal operational, 2B/3A = transitional, 2B = late concrete operational, and 2B- = less than concrete.

10. Near-transfer - Refers to the effects of intensive instruction in an area similar to the treatment. In this study, near-transfer is measured using the Inquiry Development Program in the Physical Science film, "The Five Pendulums." The subject views the film and records details, views the film and records questions, and finally, views the film and records hypotheses.

11. Observations - Are types of details noted in a filmed patient situation by the subject. Individual observations can be signs and symptoms, patient actions, physical characteristics, psychosocial characteristics, and environmental factors. In this study, observations are classified using the method by Verhonick, et al. (1968):

a. Relevant observations - Are those explicitly depicting the patient problem presented visually in the filmed sequence;

b. Irrelevant observations - Are those not intentionally depicted but which were present in the filmed sequence, i.e., a hospital bed, or bedside stand; and

c. Inappropriate observations - Are those not present in the filmed sequence.

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12. Quality of cue attendance - Refers to the use of Suchman's categories (Suchman, 1966a) to classify the details recorded by the subject:

a. Events (e) - Are any happenings that may or may not be visible and occur within a time dimension, having a beginning, end, and duration.

b. Objects (o) - Are slightly more abstract than events. Objects represent a separate part of a whole happening. Objects are timeless and can be discussed and analyzed without any reference to time.

c. Conditions (c) - Are states of objects such as temperature, shape, position, speed, and weight. Conditions can change without the identity of the object changing. Conditions vary with time.

d. Properties (p) - Are characteristics of objects that do not change with time. Cbjects are known and identified by their properties.

13. Quality of information search - Refers to the use of Suchman's classification scheme (Suchman, 1966a) to classify questions recorded by the subject. Questions are classified as follows:

a. Verification (V) - Refers to the phrasing of questions by the subject to gather data pertinent to a single event. This includes all questions that seek to identify or verify some aspect of the given event. These questions are always factual. Questions are asked to verify objects, events, conditions, and properties.

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b. Experimentation (E) - Refers to the phrasing of questions by the subject that introduces a new condition and event in an attempt to determine the consequences of changes as in what would happen if things were done differently. This includes questions that attempt to ascertain the consequences of some change in the given experiment. These questions are always hypothetical.

c. Necessity (N) - Refers to the phrasing of questions by the subject that seek to determine whether a particular aspect of an event was necessary for the outcome.

d. Synthesis (S) - Refers to the phrasing of questions by the subject that seek to determine whether a particular idea about causation is valid. These questions are theories for which the subject is seeking approval through authority rather than attempting to verify them by gathering data.

14. Quality of hypothesis generation - Is an average point score for hypotheses generated by each subject after viewing "The Five Pendulums" and Sequence D. Each hypothesis is rated on a scale of zero to five using Quinn's Hypothesis Quality Scale (see Appendix B).

15. Quantity of cue attendance - Is the number of details recorded by the subject that are depicted in "The Five Pendulums" and Sequence B.

16. Quantity of information search - Is the number of correctly stated questions asked by the subject after viewing "The Five Pendulums" and Sequence C.

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17. <u>Quantity of hypothesis generation</u> - Is the number of hypotheses generated by the subject after viewing "The Five Pendulums" and Sequence D.

18. <u>Registered professional nurse</u> - Refers to an individual possessing a current license to practice professional nursing in a specific state.

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Chapter 2

Review of the Literature

Introduction

A primary responsibility of the nurse is the ability to make accurate clinical judgments pertinent to the care of the patient. Skill in data gathering contributes to the process of making clinical judgments. This study was done to investigate the effects of a method to modify the inquiry pattern behavior of registered professional nurses in data gathering for clinical judgments. The findings of this study contribute to the research in the area of clinical judgments.

This chapter is divided into four sections. The first and second sections are a review of the literature related to clinical judgment and observational skill to describe the skills related to making clinical judgments and to support the need for the study. The third section is a review of the literature related to the attainment of formal operational thought. The fourth section is a review of the literature related to inquiry training to support the experimental treatment.

Clinical Judgment

A major goal in nursing education is to assure that practitioners are able to make accurate clinical judgments or decisions (Jenkins, 1985; Westfall, Tanner, Putzier, and Padrick, 1986; Tanner, 1987). If nurse educators understand how clinical judgments are made and understand factors that

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influence making clinical judgments, they will be in a better position to develop appropriate instructional materials and to teach the process of making clinical judgments. The literature review on clinical judgment details the processes used in clinical judgments, teaching strategies, and correlates of clinical judgment. It should be noted that terms included under the heading of clinical judgment include clinical problem solving, clinical decision making, nursing process, and diagnostic reasoning.

Processes Used in Clinical Judgments. Although the reasoning processes used by nurses to make clinical judgments have not yet been thoroughly researched, the work of Elstein and associates has provided one theoretical perspective for research in clinical judgment. Their work in investigating the diagnostic reasoning processes used by physicians has resulted in a general model of diagnostic reasoning based on information processing theory (Elstein, Kagan, Shulman, Jason, and Loupe, 1972; Elstein, Shulman, and Sprafka, 1978). This model describes four components in the cognitive processes used by physicians to arrive at a diagnosis:

1. Cue acquisition. This involves collecting data or information about the patient by attending to the initially available cues such as signs and symptoms.

2. Hypothesis generation. Based on some, but usually not all of the cues, the clinician generates tentative diagnostic hypotheses or explanations about the possible

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cause of the problem. Hypotheses identified early in the process (a) help the clinician to overcome the limitations of short-term memory, (b) permit the use of hypothetico-deductive reasoning, and (c) guide the subsequent data collection or information search.

3. Cue interpretation. The clinician gathers more data or information about the hypotheses generated and interprets the data to accept or reject the hypotheses or suggest new ones. This process continues until a decision can be made about the problem.

4. Hypothesis evaluation. This involves making a judgment or decision about the most likely problem and formulating and stating a diagnosis.

The extent to which this model applies to the diagnostic reasoning processes used by nurses has been studied by Tanner and associates and reported in a series of articles (Putzier, Padrick, Westfall, and Tanner, 1985; Westfall, et al., 1986; Tanner, Padrick, Westfall, and Putzier, 1987; Padrick, et al., 1987). They analyzed the results of their study to (a) describe the thinking strategies used by student nurses and experienced practicing nurses and (b) to identify the differences in the strategies used by student nurses and experienced practicing nurses. Their sample of nursing students consisted of (a) 15 junior nursing students who completed only their introductory nursing course and (b) 13 senior nursing students who completed courses in medical-surgical nursing and

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maternal-child nursing. The sample of 15 practicing nurses all held a bachelor of science degree in nursing, were rated as making sound clinical judgments by their supervisors, and had at least two years of experience. Data was obtained from the verbal responses of subjects to a simulated patient situation. After hearing a change-of-shift report and viewing the videotape, subjects were instructed to ask for information from the examiner until they had sufficient information to identify the problem. These researchers found that the reasoning processes of their subjects could be described using the model developed by Elstein (1978). Diagnostic hypotheses were activated early and information search was used. There was a trend toward more systematic data acquisition and greater diagnostic accuracy with increased knowledge and experience. The data acquisition strategies most frequently used were hypothesis-driven and cue based. They concluded that most subjects were able to make correct decisions if appropriate data was obtained.

Gordon (1980) used a concept attainment model of diagnosis to study the inferential ability, hypothesis-scanning strategies, and diagnostic accuracy of 60 volunteer master of science candidates in nursing from four universities. Subjects were given patient case data for the diagnostic task and were asked to collect information and determine the state of the patient. She found that mixed hypothesis testing and single-hypothesis testing strategies were used.

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Teaching Strategies. Approaches to teaching clinical judgment using specific strategies and aides have been reported. Results have been inconclusive and further study is needed. deTorney (1968) investigated the effects of the discovery method to assist sophomore nursing students solve unfamiliar problems. The teaching strategy, consisting of a sequence of questions designed to facilitate active learning, was designed to assist students to discover concepts and generalizations. She randomly assigned 65 sophomore nursing students to three experimental groups and three control groups. Although findings failed to support the hypothesis that students would score significantly higher on a test of problem solving skills using a written patient care test, she concluded that when the discovery method was emphasized, subjects did at least as well as those not exposed to discovery on a test to measure understanding of nursing care.

Mitchell and Atwood (1975) investigated the effect of problem-oriented charting (a nurse's narrative note consisting of a problem name, subjective and objective data, and inference regarding data and plan) to teach critical thinking to beginning nursing students. No difference was found between groups in the mean number of patient problems identified in the written case study, although the experimental group identified significantly more patient problems in clinical charting. They concluded that they assumed that the case study and clinical situation were

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equivalent, that the experimental group had patients assigned who had more problems, and that the course itself had more effect on students' ability to identify problems than the charting method per se.

Aspinall (1979) investigated the effectiveness of a decision tree to improve diagnostic accuracy. Thirty triads of volunteer participants were matched on the basis of education, length of experience and previous performance in a study on identifying patient problems. All subjects were given a written case study and instructed to list possible diagnoses. One control group received only a written case study, the second control group received the case study and a list of 18 disease states, and the experimental group received the case study, the list of 18 disease states, and a decision tree. Although the experimental group performed better, she concluded that further study was needed.

Tanner (1982) used hypothesis generation as a method of instruction to teach the diagnostic process to senior nursing students. A convenience sample of 54 students was randomly assigned to one of the following six treatment groups: experimental instruction, traditional instruction, or no instruction, crossed with clinical experience and no clinical experience. Instructional materials for both consisted of a slide-and-tape presentation and workbook to teach a unit on cardiovascular nursing. The traditional groups received content organized around common medical and nursing diagnoses and discussion of related cues. The

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experimental groups received content organized around common cues with discussion of the relationship between cues and several diagnoses. The subjects were required to identify multiple hypotheses regarding each diagnosis and to test each systematically through information search. No significant results were found when compared to the traditional method although the experimental group with clinical experience generated more hypotheses.

Guyton (1984) examined the effects of teaching specific problem-solving strategies on clinical problem solving of senior baccalaureate nursing students. Competence in clinical problem solving was defined as the quality of the clinical judgment used by a clinician in the diagnostic and/or management process. Using an experimental posttest-only control group design, the control group received the traditional method of instruction consisting primarily of information giving and application of information in the clinical setting. The experimental method focused on teaching the cognitive processes of clinical problem solving through simulated practice. Subjects were given a minimal amount of patient information and were instructed to request additional information to formulate a nursing diagnosis. Subjects were taught to use the strategy of multiple hypothesis generation to direct a selective search for information. After three weeks of instruction, both groups completed a computerized version of a patient care simulation. No statistical significance was found between

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adjusted means of the groups. No statistical significant correlation was found between reasoning abilities and problem-solving skills nor between added clinical experience and problem-solving skills. She concluded the lack of positive findings may reflect inadequate teaching time or lack of sensitivity of the problem-solving instrument.

A similar method has been described by Krassirer (1983) as an approach to teach diagnostic reasoning skill to medical students, although he wrote that no attempt has been made to evaluate the approach. He referred to the approach as a hypothesis-driven iterative method. A student presents a case study and acts as the data repository by serving as the source for all the patient's clinical data. After the presenter gives the patient's age, sex, race, and reason for seeking care, the participants ask questions to produce more data. Each question must first be justified by stating the intended hypothesis, the purpose of the question, the intended outcome, and whether the expected information will have substantial diagnostic impact. After the presenter provides the information, the questioner interprets the findings and explains how the information changes or refines the earlier diagnostic hypothesis. This repetitive or iterative process of questioning, justification, and interpretation continues until all issues have been discussed or time runs out.

Thiele, Baldwin, Hyde, Sloan, and Strandquist (1986) investigated cue recognition abilities of 43 junior and 37

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senior baccalaureate nursing students. Five computer simulations were developed to teach cue recognition and subsequent linking of cues and inference development. Results showed statistical difference in pre- and post-test results on some programs, especially if the situation was unfamiliar. They concluded that cue recognition and sorting and cue grouping using computer simulation rather than relying only on experience could be taught. In addition, these effects should improve the ability to make clinical decisions.

Fredette and O'Neill (1987) hypothesized that increasing the amount of theoretical content on diagnostic process would increase skill in clinical diagnosis. The experimental group received five additional hours on the theoretical nursing diagnosis content including principles and rules of diagnosing. They developed the Diagnostic Skills Criteria for use in analyzing subjects' papers. They believed that the criteria was based on complex skills levels consistent with Piagetian Theory of Cognitive Development; no reports of validity were included. Data analysis showed that the experimental group had a higher ability to utilize diagnostic skills particularly data supporting diagnosis and clustering of data. With further analysis, Fredette (1988) found that novice diagnosticians had problems with data collection including absence of data, inaccurate data, and data which did not support the nursing diagnosis.

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Correlates of Clinical Judgment. Research has been conducted to identify clinician variables associated with performance in clinical judgment. Variables have included level of education and years of experience, measures of general problem-solving ability, personality type, type of conceptual framework in baccalaureate nursing curricula, and effects of clinical experience.

The relationship between clinical judgment and level of education and years of experience have been reported. In general, results have shown a positive relationship between performance and academic degree and a negative relationship between performance and increasing years of experience. Verhonick, et al. (1968) developed a series of five filmed patient situations to compare the types of observations made and actions taken by practicing nurses. Observations were classified as signs and symptoms, patient actions, physical characteristics, psychosocial characteristics, and environmental factors and further classified as relevant, irrelevant, and inappropriate. Professional nurses attending a nursing convention constituted the sample. Educators and practitioners with one to six years of experience recorded the largest percentage of relevant observations. Practitioners with over 30 years of experience recorded the lowest percentage. Nurses with supervisory positions recorded the lowest percentage. The number of relevant observations made by nurses increased progressively with the level of academic preparation.

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Davis (1972) used the Verhonick filmed sequences to differentiate skills possessed by the clinical nurse specialist from skills possessed by the baccalaureate nurse. Clinical specialists made significantly more relevant observations and gave more appropriate reasons for their actions than baccalaureate nurses. For both groups, negative correlations were shown between years of experience and observations made, actions taken, and reasons for actions. In a replication study, Davis (1974) reported similar findings for clinical specialists, baccalaureate nurses, and diploma nurses.

Similar findings were also reported by Aspinall (1976) who used a different simulation. Subjects were presented with a written case study and asked to list causes for the patient condition. There was a significant difference in the mean number of problems identified by baccalaureate nurses when compared to diploma and associate degree nurses. There was no difference in the mean number of problems identified by those with less than two years of experience and those with two to 10 years of experience. Both groups did significantly better than those with 10 or more years of experience.

Opposite findings were reported by del Bueno (1983). A video simulation similar to Verhonick's film was shown to subjects who were asked to identify a clinical problem and actions to correct the problem. Experience and education showed a positive correlation with the correct decision with

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the experienced baccalaureate nurse performing best. She treated experience, defined as seven months or more, as a dichotomous variable which may have accounted for the findings.

Several studies have investigated clinical judgment ability using a measure of logical reasoning ability. Matthews and Gaul (1979) sought to determine specific variables which related to the nurse's cognitive ability to process information during the diagnostic process. They found no relationship between the ability of undergraduates and graduates to formulate a nursing diagnosis and their scores on the Watson-Glaser Critical Thinking Appraisal. They concluded that the ability to formulate nursing diagnoses may be derived from cognitive abilities other than those measured by testing critical thinking skills. Gordon (1980) found no relationship between predictive hypothesis testing and scores on the Miller Analogies Test and the Graduate Record Examination Verbal Aptitude Test.

Frederickson and Mayer (1977) argued that baccalaureate nursing students possessed greater critical thinking ability in general than associate degree students but did not provide data to support. The critical thinking test used was not identified.

Koehne-Kaplan and Tildan (1976) found no significant relationship between personality type and clinical judgment. The result of a Jungian Type Survey, administered to 99 subjects, was correlated to a final examination. The

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examination was designed to require subjects to make clinical judgments based on clinical data from a written and videotaped patient situation.

Two studies examined the relationship of conceptual frameworks and clinical judgments. Conceptual frameworks or models form the basis for the nursing curriculum. DeBack (1981) investigated the relationship between curriculum models and the ability to formulate nursing diagnoses. The curriculum models of 270 baccalaureate schools were categorized into four categories. From each category, five schools were randomly selected and then each school randomly selected 10 subjects. To evaluate the diagnostic ability, a pool of 200 nursing care plans were analyzed by applying predetermined criteria derived from the definition of nursing diagnosis. No relationship was found between nursing students' ability to formulate nursing diagnoses and the type of curriculum model. She concluded that formulating a nursing diagnosis was not a competence regardless of the curriculum model used.

Beckerman (1984) used the Verhonick filmed sequences to determine if there were any differences in the identification of a patient data base by 42 senior nursing students exposed to Roy's model of adaptation and 36 senior nursing students not exposed to Roy's model. Each subject viewed five sequences once and recorded observations. No difference was found between groups in the identification of relevant, irrelevant, and inappropriate cues.

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Monahan (1986) investigated the relationship between the clinical experience of baccalaureate nursing students and both the identification of accurate clinical judgments and the development of personal identity. Clinical experience did not contribute to increased clinical judgment or foster development of personal identity.

In summary, research into the processes involved in making clinical judgments is a new field of study. Our knowledge of the processes involved in making clinical judgments and subsequent teaching strategies is limited (Tanner, 1983, 1986, 1987). Studies have been primarily descriptive in nature using verbal reports and simulations to compare the processes used by novices and experts. Currently, there is little research to support methods used to teach students and practitioners clinical judgment making. Tanner recommends that variables be identified which may impact on the process. Therefore, in the next section, the research related to observational skill is described.

Observational Skill

A primary skill that a nurse can acquire is the ability to make relevant observations (Verhonick, et al., 1968; Becknell and Smith, 1975; Tanner, et al., 1987). Accurate observations and interpretations are an essential part of the assessment and diagnostic phases of the nursing process.

The ability to notice or attend to cues is the result of theoretical and experiential knowledge and is part of the

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nurse's expertise (Carnevali, 1983). Benner and Wrubel (1982) used interview excerpts from critical incidents of expert nurses to study the acquisition of skilled clinical knowledge. "Clinical knowledge refers to that knowledge embedded in the practice of nursing" (p.11). They found expert clinicians who spent many hours observing subtle patient changes became discriminating judges, making qualitative or perceptual assessments. Global assessments were made "based on the senses of touch, smell, and sight and on the interpretation of a patient's physical, verbal, and behavioral expressions" (p. 12). Beginners dealt with each of these abilities separately. They defined experience as the exposure or encounters with clinical situations, not just the passage of time or longevity. They concluded that:

> Skilled knowledge, unlike theoretical knowledge, relies on the development of a perceptual awareness that singles out relevant information from irrelevant, grasps a situation as a whole rather than as a series of tasks, and accomplishes this rapidly and without incremental deliberative analysis of isolated facts or bits of information. This kind of perceptual awareness can only be developed in the course of exposure to many actual clinical situations (p. 13).

Inferences based on too few cues unnoticed can result in erroneous decisions and subsequent care. Pearson (1972) developed two 10-minute films with sound to teach concepts of observation to beginning baccalaureate nursing students.

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The purpose was to have students learn to discriminate between facts (objective data or cues) and inferences (judgments) based on facts. One film dealt with observation with the patient as the major focus and the other dealt with the nurse observing the patient. Subjects were randomly assigned to three groups with two groups viewing either of the films and one nonfilm control group. Subjects were required to write responses to questions asked during the films. Both films provided feedback to the questions. Using a filmed patient sequence, Pearson found that instructed students reported significantly fewer inferences as observations compared to the responses of subjects not receiving film instruction. A significant greater number of cues were reported by subjects who viewed the film with the patient as the focus compared to the other groups.

Jeffers and Christensen (1979) investigated the use of simulation to facilitate the acquisition of clinical observational skills. Forty senior baccalaureate nursing students were randomly assigned to three treatment groups and one control group. One group viewed a videotape of four simulated hospital settings without feedback. One group received feedback while viewing three transparencies depicting patient situations. Each transparency was viewed for 15 seconds followed by the instructor asking a question about what was seen. Feedback consisted of instructor cueing followed by a "yes" or "no" to subjects' responses. One group viewed the videotape without feedback and

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transparencies with feedback. After the exercise, all subjects were given copies of case histories represented by three mannequins. Each subject had two minutes to make observations in each situation followed by an exercise in which each subject answered the question, "Was there anything you would have questioned or changed?" (p. 31) as a method to aide in the recall of relevant information. Groups with feedback made more observations. The authors concluded that feedback was effective in developing observational skill.

In summary, the ability to attend to cues remains a primary nursing skill. Theoretical and experiential knowledge play a role in developing this ability. Methods to increase the ability to attend to cues for individuals with lack of experience and education have been described. Feedback has been shown to be effective in developing observational skill. The next section describes the research related to formal operational thought as it relates to clinical judgment.

Formal Operational Thought

Piaget describes cognitive development from birth to maturity or adulthood. This development is a continuous process of organization and reorganization of mental structures through interaction with the environment. An individual progresses through stages characterized by the achievement of major abilities. Progression is regular with mental structures developed during a particular stage

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becoming integrated in the subsequent stage (Piaget, 1973).

The fourth and final stage, formal oeprations, occurs between the ages of 12 and 15 and progresses through adulthood (Inhelder and Piaget, 1958). At the completion of this stage, an individual possesses the cognitive structures characteristic of adult thinking. Thinking is no longer limited to the real and concrete world but "proceeds from a combination of possibility, hypothesis, and deductive reasoning" (p. 16). Formal operations are characterized by abstract thought operations. Given a problem, the individual is capable of thinking of possibilities in the situation, forming propositions, testing hypotheses, and deducing conclusions. The individual is capable of solving problems involving the simultaneous manipulation of several variables and examining and manipulating several alternatives. These reasoning processes guide the search for and evaluation of evidence to support or reject hypotheses and propositions (Lawson, 1978).

There is evidence that all indiviuals do not possess formal operational thought or abstract thought as described by Piaget. Schwebel (1975) assessed the level of formal thinking of 30 male and 30 female first-year college students using Piagetian tasks. In the sample of women, 27% were concrete, 63% were lower formal, and 10% were upper formal and for men, 7% were concrete, 63% were lower formal, and 30% were upper formal. For both sexes, 17% were concrete, 63% were lower formal, and 20% were upper formal.

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There was no relationship to high school rank and SAT scores for men, but a low relationship for women. Men scored significantly higher than women.

Hale (1983) gave 12 Piagetian formal operational tasks to a volunteer sample of 49 male and 10 female, second-year medical students aged 20 to 35. For all tasks, he found that 57 were at the transitional level, while two were at the full formal level. Considering that 59 out of a class of 65 demonstrated formal thinking to a greater degree than other studies, he felt that this group was developed intellectually to meet the demands for their medical education.

Sunal and Sunal (1985) used Piagetian performance tasks to assess thinking of 330 senior level early and middle childhood education students. They found that 11% were concrete operational, 56% were transitional, and 33% were at the formal level.

Tomlinson-Keasey (1972) measured the level of cognitive development of three age groups to explore variables facilitating the acquistion of formal operations. The sample included 6th grade girls, college co-eds, and women with mean ages of 11.9, 19.7, and 54, respectively. The experimental group had a short-term training session solving Piagetian tasks. All subjects had an immediate posttest and a one-week delayed posttest designed to measure durability and generalization of the training session. The delayed posttest included a different version of one task and also

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two new tasks. Results showed that 32% of the girls, 67% of the co-eds, and 54% of the women were at the formal stage with 4% of the girls, 23% of the co-eds, and 17% of the women at stage III-B. The training session resulted in significant increases in the conceputal level for all groups. Results of the delayed posttest showed that little generalization occurred with new tasks; there was no significant difference between groups. There was a significant difference on the delayed posttest of repeated tasks between girls and coeds and the women.

In summary, not all individuals possess formal operational thought as described by Piaget. Piaget (1972) has attempted to clarify his theory. First, "in principle, all normal individuals are capable of reaching the level of formal structures on the condition provided that the social environment and acquired experience provide the subject with the cognitive nourishment and intellectual stimulation necessary for such a construction" (p. 8). Piaget emphasized active learning by having individuals formulate their own questions, problems, and hypotheses, rather than being passive receptors to knowledge. Second, all individuals would attain formal operations but they reach this stage in different areas according to their aptitudes and professional specializations. In the final section, research related to inquiry training is described as it related to the development of formal operational thought.

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Inquiry Training

Inquiry Training is a method of stimulating inquiry and critical thinking. This training increases the individual's ability to attend to cues, engage in information search behavior, and generate hypotheses. Inquiry Training (Suchman, 1964, 1966a) provides an environment that stimulates and sustains inquiry. An inquiry session begins with a discrepant or puzzling event; for example, a film or demonstration, which serves as the focus for inquiry. This event does not fit the present schema or structure. In order to be accommodated and assimilated, the individual is motivated to inquire through questioning, thus eliminating the discrepancy. Hypotheses are tested through data gathering by asking questions requiring a "yes" or "no" answer by the teacher. "The necessity of hypothesizing to obtain information means that each question must be preceded by some thought" (Suchman, 1961, p. 153). The primary learning outcomes of inquiry training are the processes of observing, collecting and organizing data, identifying and controlling variables, making and testing hypotheses, and drawing inferences (Joyce and Weil, 1980).

An important aspect of problem solving and judgment is the ability to generate subjective response uncertainty. This implies an awareness of alternative responses in a situation. Uncertainty can be relevant or irrelevant to the task at hand. Learning to solve problems involves generating responses and reducing relevant uncertainty.

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Here, the problem solver notices details and selects the most appropriate, asks questions, and generates hypotheses. Subjective response uncertainty is modifiable through training which affects future problem solving ability (Salomon and Sieber, 1970). Studies have been conducted focusing on modification of subjective response uncertainty. These have involved training in cue attendance, information search, and/or hypothesis generation.

Salomon and Sieber (1970) used structured and unstructured films to train subjects in cue attendance and hypothesis generation. In one study, 120 college freshmen were randomly assigned to one of four conditions, viewing a structured (scenes remaining sequenced as originally produced) or unstructured (randomly ordered sequence of same scenes) version of a film and recording details or viewing a structured or unstructured version of a film and generating hypotheses. In a second study, 52 student teachers were randomly assigned to the same conditions and asked to memorize as many details in their respective film as possible or generate hypotheses about what was shown. The film could be viewed as often as needed. They found that the unstructured version of the film hindered the recall of details and hypothesis generation based on factual details, while the structured version offered a meaningful basis for remembering details and generating hypotheses. For generating hypotheses not based on factual details, the

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unstructured versions were more effective. They concluded that a problem solver proceeds most insightfully with tasks arranged to elicit relevant uncertainty.

Salomon (1972, Winter) trained subjects to single out details in a film. He used zooming techniques with motion-picture films to focus in and out details. Eighth-grade subjects were trained to criterion and tested on cue attendance ability and information search ability. Subjects with low verbal reasoning and poor cue attendance ability profited by this training.

The ability to formulate a hypothesis is an important step in problem solving. Quinn (1972; Quinn and George, 1975) found that the ability to generate hypotheses could be improved and that the quality of hypotheses generated could be measured. Quinn developed the hypotheses quality scale to measure the hypotheses generated (see Appendix B). Hypotheses were scored on a scale ranging from zero to five. Sixth-grade students viewed films and were taught how to formulate good hypotheses. During the filming session, subjects were asked to generate hypotheses about what was seen. During a discussion session after the films, the investigator interacted with the subjects and showed them how to judge the hypotheses and generate better ones. They found that there was a significant difference between the quality of hypotheses generation by subjects who received instruction in this skill and by those who did not receive instruction.

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Studies have been conducted which involve working with subjects individually and training them in either cue attendance behavior or hypothesis generation, or both. This has been termed intensive instruction or intensive intervention.

Wright (1974, 1978) investigated the short-term effects of intensive instruction in cue attendance and hypothesis generation on the future exploratory behavior of 9th-graders. One hundred twenty subjects were randomly assigned to experimental groups who received intensive instruction in cue attendance or hypothesis generation and one control group. Posttesting was done using films similar to the training films. Subjects trained in cue attendance reported more details than either the subjects trained in hypothesis generation or the control group. Subjects trained in cue attendnace or hypothesis generation reported significantly more hypotheses and hypotheses of greater quality than the control group. These subjects also reported a significantly greater number and diversity of questions than the control group. Wright (1981) conducted a follow-up study 15 months later on the exploratory behavior of these subjects to determine the long-term effects of intensive instruction in solving a science problem. Only 54 subjects from the original study were available. Results were similar to the original study. Subjects trained in cue attendance described more details than either the hypothesis generation or control groups. In addition, these subjects

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asked more questions than either group and the questions asked were more diverse. Both experimental groups generated more hypotheses than the control group, although the group trained in hypothesis generation generated hypotheses of higher quality. Wright concluded that intensive instruction in cue attendance or hypotheses generation produced selective long-term effects on these subjects' ability to explore science problems.

Wright (1979) investigated the effect of intensive instruction in cue attendance on the ability of preservice elementary science methods' students to solve formal operational paper-and-pencil reasoning tasks. Thirty-four subjects were randomly assigned either to the experimental group who received intensive instruction in cue attendance or to the control group who received instruction in analyzing the reading level of science textbooks. Subjects in the experimental group were found to be more effective in solving science tests requiring formal operational skills. He concluded that there was some initial evidence that training these subjects to become more critical observers of relevant details related to developing successful strategies for solving formal thought problems presented in the posttest.

Using procedures similar to Wright, Sunal (1988) examined the short-term effects of intervention instruction in cue attendance on the ability of pre-service secondary education teachers to identify details, a test of

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near-transfer, and to analyze a lesson plan, a test of far-transfer. Subjects (N = 175) were randomly assigned to one of six groups. Three experimental groups received instruction in cue attendance; three control groups received lesson plan instruction. Instruction was done during the equivalent of a class session. A detail attendance posttest, using a film similar to the one used in the training session, was given the same day as the training session to determine near-transfer effects. Subjects trained in cue attendance reported a significantly higher number of detials about the film than the control group. On the delayed posttest, the critique of a classroom lesson plan, given one week later, subjects trained in cue attendance reported a significantly greater number of details about the lesson plan content than the control groups. In addition, the experimental groups reported a significantly greater number and type of questions and number of hypotheses on the delayed posttest. Lower cognitive level subjects as measured by a Piagetian test demonstrated a trend toward higher means in the delayed posttest.

In summary, short-term training on an individual basis in cue attendance and hypotheses generation has been effective and has resulted in more effective problem solving behaviors. However, the use of these methods using registered professional nurses has not been documented.

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Summary

Despite the importance of practitioners making accurate clinical judgments, research in this area is new. Using information processing theory as a framework, processes utilized include the ability to attend to cues and generate hypotheses. The ability to make clinical judgments requires higher level thought processes as described by Piaget. The studies related to formal operational thought have shown that all adults have not attained this level of thought. Studies related to inquiry training have shown that subjects trained in prerequisite processes related to hypothesis generation have been effective in short- and long-term effects. In light of these studies, it seems reasonable to conclude that registered professional nurses would benefit from a method to modify inquiry patterns related to data gathering in clinical judgments, specifically training in cue attendance, information search, and hypothesis generation.

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Chapter 3

Methodology

Introduction

The purpose of the study is to investigate the effects of a method to modify the inquiry pattern behaviors of registered professional nurses in data gathering for clinical judgments. This chapter provides a description of the sample, instruments, and procedures used to determine the effects of intensive instruction in cue attendance, information search, and hypothesis generation on the quantity and quality of details observed, information search, and hypothesis generation in analyzing a problem event on film--near--transfer, in a filmed patient situation--far-transfer, and also if the level of cognitive functioning affects the results of intensive instruction in cue attendance, information search, and hypothesis generation.

Sample

A convenience sample of 40 registered professional nurses at a selected college were either students currently enrolled in an upper-division baccalaureate RN completion program or graduates of the upper-dividion baccalaureate RN completion program. Subjects were asked by letter to volunteer for the study by a non-nurse faculty member in the selected school. It was felt by the investigator that this would increase the likelihood that subjects would perceive that participation or non-participation in the study would

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not affect grades or work status. From a list of 300 graduates and students, 60 individuals initially expressed interest in participating. Following contact by the investigator, 60 individuals volunteered to participate. Forty individuals were randomly selected with 20 forming Group I and 20 forming Group II. All subjects signed a written informed consent prior to participation. All subjects were offered $10.00 each for their time. Finally, all subjects completed all three sessions. Each subject attended a two-hour session, held approximately one week apart, at the convenience of the subject and investigator.

Instructional Instrumentation and Treatment

Because a genuine control group was missing, a quasi-experimental pretest-posttest design guided this study. Subjects were randomly assigned to two groups: Group I (n = 20) received the experimental treatment of intensive instruction in cue attendance, information search, and hypothesis generation; Group II (n = 20) received instruction in the principles of diagnostic reasoning.

Treatment. Each subject in Group I individually received a two-hour intensive instruction session in cue attendance, information search, and hypothesis generation. Films from Suchman's Inquiry Development Program In Physical Science (1966b) were used to present a discrepant event. These were short, silent, black and white films that presented a concrete event designed to appear discrepant to the subject. In other words, the subject saw an event that

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contradicted what the subject expected to see. Using a film as the discrepant event provided the element of research control. These films were used in previous studies and were found to be an effective stimulus (Wright, 1974, 1979, 1981; Quinn and George, 1975; Sunal, 1988). These films were not related to nursing content.

A pilot study was conducted to establish a satisfactory but realistically difficult number of details which could be described and number of hypotheses which could be generated. Three nurse educators and one clinical specialist received intensive instruction in cue attendance and hypothesis generation. The criterion number established for the cue attendance instruction film ("The Balloon in the Jar"), 100, and the hypothesis generation film ("The Sailboat and the Fan"), seven, represented the average number of cues and hypotheses found difficult to generate by the group.

The following is a description of the processes involved in intensive instruction for this study. At the beginning of the session, each subject was told that he or she was participating in a technique designed to be useful in gathering data. He or she would see a series of films and would be given instructions for each activity. The investigator had recording sheets for the subject's responses.

Cue Attendance. Intensive instruction in cue attendance consisted of viewing the film "The Balloon in the

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Jar" and having the subject report a criterion number of details (100) as established by the pilot study. The investigator instructed each individual subject as follows.

1. "This first activity is designed to help you to become a careful observer. You will learn how to detect many details in the world around you."

2. "I will show you a short film and you will be expected to memorize an acceptable number of details. After you see the film, report them to me. You have permission to see the film as many times as needed to report the acceptable number of details."

3. "You are not expected to attempt to explain what is happening in the film or to give an answer which cannot be observed directly in the film."

4. "Before the film is shown, I will show a film depicting a science problem. I will describe some details of the film as reported by a person who has been through this instruction program and detected the correct number of details."

The film "The Knife" was shown by the investigator who gave examples of acceptable details, i.e., man, tie clasp, knife, blade. Following this, the cue attendance instruction film was shown. The investigator worked with each subject individually until the criterion was met. Only details actually observed in the film were recorded and counted. Each acceptable detail was reinforced with "good" or "O.K." and recorded if it described a detail and was not

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previously reported. When the subject could not report additional details, the film was shown again. The process continued until the criterion was met. Eighteen subjects in Group I met the criterion with an average of three viewings of the film. Two subjects reported about 90 details after three viewings. Because they expressed difficulty reporting additional details, this portion was completed to avoid frustration and discouragement in the subjects.

Information Search. Intensive instruction in information search consisted of each subject viewing the film "The Spring" and reporting as many questions as possible about what was seen. Each subject was instructed as follows.

1. "You will now be asked to formulate (make up) questions about complex situations in the world around you."

2. "You will be shown a second short film. After you see the film, you will be requested to ask as many questions as you can about what you see. You have permission to see the film as many times as needed until you have exhausted your questions."

3. "The questions should be of a special kind. They must be structured so as to ask only for known facts, not inferences or conclusions and so that they can be answered by either "yes" or "no." Any other type of question will not be answered."

The film "The Knife" was shown by the investigator and examples of acceptable questions were given, i.e., "Was the

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heat necessary to make the knife bend?" After the information search film was shown, the investigator worked with each subject individually. Each question that met the criteria was reinforced with "good" or "O.K." and recorded. As indicated, each subject viewed the film as many times as needed until the number of questions to be asked was exhausted. The average number of acceptable questions for the group was 15. All subjects met the criterion.

Hypothesis Generation. Intensive instruction in hypothesis generation consisted of each subject viewing the film "The Sailboat and the Fan" and reporting a criterion number of acceptable hypotheses (seven) as determined by the pilot study. Each subject was instructed as follows.

1. "For the final activity, you will be asked to generate (make up) many explanations of why things happen in the world around you."

2. "You will see a third short film and will be expected to form an acceptable number of hypotheses (explanations) to explain what you observed. You are not expected to report or describe details of the film. You have permission to see the film as many times as needed to develop your hypotheses and until you have exhausted all that are possible."

3. "For each hypothesis I will ask you to explain how you could design an experiment to test your hypothesis."

4. "Before seeing this film, I will show a film and I will test some hypotheses which have been suggested by a

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person who generated the required number of hypotheses."

The investigator showed the film "The Knife" and gave some examples of acceptable hypotheses, i.e., "If the knife were held in the flame for a longer period of time, the degree of bending of the knife would be greater. This would be tested by varying the length of time the knife is held in the flame." After the hypothesis generation film was shown, the investigator worked with each subject individually. Each hypothesis generated by the subject was reinforced with "good" or "O.K." and recorded if it met at least one of the following criteria: (a) it made sense, (b) it was empirically based, (c) it was adequate, (d) it was precise, or (e) it stated a test (Quinn and George, 1975). The film was viewed as many times as needed to meet the criterion of seven. All subjects met the criterion of seven hypotheses with an average of two viewings.

Principles of Diagnostic Reasoning. During the second session, Group II received instruction in the principles of diagnostic reasoning in groups of one or two. This session lasted approximately the same length of time as the intensive instruction. This activity was a realistic activity related to data gathering, but it was unrelated to intensive instruction in cue attendance, information search, and hypothesis generation. After the investigator presented a brief introduction to the steps of the diagnostic process, two commercial film strips from the "Critical Thinking In Nursing" series, available from Concept Media, Irvine,

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California, were shown. The first film (17 minutes) discussed the various classifications of cues, the importance of attending to each type, and the process of cue evaluation. The second film (18 minutes) discussed the value of hypothesis generation and investigation. Following each film, subjects answered a series of study questions that accompanied the films (Freebairn and Howell, 1986). These questions were not graded or part of any data analysis, but were used to provide subject feedback.

Instruments. To determine the effects of intensive instruction in cue attendance, information search, and hypothesis generation, all subjects completed the following data collection instruments:

1. "Demographic Data" was developed for this research (see Appendix A). This questionnaire requested information on the following: (a) age, (b) sex, (c) basic educational preparation, (d) current enrollment in a degree or certificate program in nursing or in a field other than nursing, (e) education beyond basic preparation in nursing or in a field other than nursing, (f) advanced educational preparation to assume an expanded role, (g) certification, (h) preferred area of clinical practice and length of time actively involved in nursing practice, (i) length of time providing direct patient care, (j) employment status, (k) position, (l) continuing education, and (m) data gathering skills. Level of education and experience have been reported to correlate with clinical judgment. This data was

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collected on each subject during the first session in order to determine pre-existing differences between Groups I and II.

2. "Piagetian Reasoning Task IV Equilibrium In The Balance" developed by Wylam and Shayer (1979, 1980) (see Appendix A) was used to measure the level of cognitive functioning of each subject to determine if the level of cognitive functioning affected the results of intensive instruction. This task is one of a series of tasks developed by the Centre for Science and Mathematics Education in London and is directly available for purchase from Shayer and Adey. This task is based on Chapter 11 of Inhelder and Piaget's The Growth of Logical Thinking From Childhood to Adolescence. The task can be used for older students and adults. The task, which comes with a set of instructions and materials, dealt with inverse proportions in a balance problem and investigated the ability of a subject to recognize and use inverse proportions. Late formal thinkers can understand the task in terms of the work principle introduced near the end of the task. Task IV is a demonstration task which takes about 35 minutes to administer. Here, the administrator performs the experiments and asks questions while proceeding. Each subject has a response sheet to record answers to the problems. Task IV contains 13 scored items with three items scored at stage 2B (late concrete operational), seven items scored at stage 3A (early formal operational), and three

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items scored at stage 3B (late formal operational).

Reliability and validity of task IV have been reported by the authors and are based upon studies conducted with British children ages 9 to 16. Recorded reliabilities of task IV include an internal consistency of .84 measured by the Kuder-Richardson coefficient, a test-retest correlation of .78, and a task-interview correlation of .55 (Shayer and Adey, 1981).

As of yet, reliability and validity studies on adults have not been conducted due to the difficulty of getting a representative sample of individuals after the age of 16 (P. L. Adey, personal communication, March 6, 1989). Dr. Adey notes that although there is no confirming data the task is adequately valid in an older group. The tasks have been used with student teachers with results showing a low level of thinking in these samples. Thus, the results of using the task with this sample contributes to additional data on the reliability and validity of the task.

For this study, the investigator demonstrated the task to small groups of subjects during the first session. Response sheets were coded with the subject's number. The information at the top of the response sheet to elicit information about the subject was not utilized (see Appendix A). Response sheets were scored according to the authors' guidelines. A correct answer was scored "1" and an incorrect "0". Interrater reliability was also evaluated by having the investigator and a physics teacher score each

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sheet independently. The phi coefficient for discrete nominal data was .74. There was 73% scoring agreement. Scoring disagreements were discussed and consensus reached for all discrepancies. Responses were tallied according to guidelines and a level of cognitive functioning was given to each subject. For data analysis, the levels were coded 2B- = 1 to 3B = 5 as described by the authors (see Appendix B).

3. "The Five Pendulums" from Suchman's Inquiry Development Program In Physical Science (1966b) was used as a discrepant event to determine the effects of intensive instruction in cue attendance, information search, and hypothesis generation in similar effects, near-transfer effects. This film was similar to the films used in the experimental treatment. The subject viewed the film during the third session, approximately one week after session two. Details, questions, and hypotheses were recorded on data collection sheets for the third session (see Appendix A). After the directions were read by the investigator, the subject viewed the film and then recorded the details observed. The subject viewed the film as many times as needed to record the details. During the viewing of the film, the data collection sheet was not available. The same procedure was followed for recording questions and hypotheses. When more than one subject was present in the session, the film was physically placed so it could only be seen by the subject viewing it.

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The data from the sheets was scored using procedures described by Wright (1974), Suchman (1966a), and Quinn and George (1975). Suchman (1966a) describes a procedure for classifying details and questions. For each subject, the quantity of details was obtained by counting the number of details recorded that were present in the film. Details recorded that were not present were counted separately. The quality of details recorded were classified as: (1) event (e)--any happening, apart from any analysis of it; (2) an object (o)--a separate part of a whole happening; (3) a condition (c)--state of an object; or (4) a property (p)--characteristic of an object that does not change with time (Suchman, 1966a). Thus, for each subject the total number and type of details recorded were obtained. Interrater reliability was obtained as follows: The investigator and a nursing faculty member scored each sheet independently. The average Pearson Product-Moment Correlation Coefficient for the types of details was .96. Disagreements were discussed and consensus reached for all discrepancies.

The quantity of information search for each subject was obtained by counting the number of questions that were stated so as to ask only for known facts that could be answered either "yes" or "no." Questions that did not meet this criteria were counted separately. The quality of the questions was measured using the classification scheme for information search questions described by Suchman (1966a,

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p. 57) (see Appendix B). In analyzing each acceptable question, 16 combinations of types of questions and types of data used were possible:

1. Verification (V). These questions seek to identify or verify some aspect of what was observed. This involves the process of data gathering.

2. Experimentation (E). These questions attempt to determine the consequence of some change.

3. Necessity (N). These questions seek to determine if some aspect was necessary for the outcome.

4. Synthesis (S). These questions are asked to determine if an idea regarding the cause is valid.

For each subject, the number and type of acceptable questions were calculated. The number of questions that did not ask for known facts were calculated separately. Interrater reliability was determined as described for details. Since, as Suchman (1966a) noted, a question may be placed in several categories with justification, rater disagreements were anticipated. The average Pearson Product-Moment Correlation Coefficient for types of questions was .83. Disagreements were discussed and consensus reached for all discrepancies.

Quinn's Hypothesis Quality Scale was used to evaluate the quality of hypotheses generated by the subjects (Quinn and George, 1975). Generated hypotheses were evaluated on a scale from zero to five according to criteria (see Appendix B). Reliability of the scale has been reported using three

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science teacher educators to evaluate 50 hypotheses. This produced a coefficient of .94, thus establishing the reliability of the scale (p. 290).

All hypotheses were evaluated. The number of hypotheses stated as hypotheses and the number not stated as hypotheses were calculated. For each subject an average was calculated for the quality of the hypotheses stated as hypotheses. Interrater reliability of scoring was done as previously described. The Pearson Product-Moment Correlation Coefficients for the number and quality of hypotheses generated were .89 and .94. Disagreements were discussed and consensus reached for all discrepancies.

4. Filmed patient sequences developed by Verhonick, et al. (1968) were used as the discrepant event to determine the effects of intensive instruction in cue attendance, information search, and hypothesis generation for far-transfer treatment effects in a professional area of nursing. This film was developed by the Walter Reed Institute of Research. It consists of five silent color patient sequences, each lasting one to two minutes and each preceded by a 25 to 50 word introduction. In this study, the first four sequences were used and identified as Sequences A, B, C, and D. Appendix B contains each sequence with introductory statements and relevant details underlined. The film was obtained in VCR format for ease in presenting. The reliability and validity of the film was established by the Verhonick, et al. study (1968). To

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establish the accuracy of the intended observations, a panel of 10 nurse specialists viewed each filmed sequence three consecutive times and were instructed to record their relevant observations and actions. Two coders classified the observations in five categories: (a) signs and symptoms, (b) patient actions, (c) physical characteristics, (d) psychosocial characteristics, and (e) environmental factors. Observations were further classified as relevant, irrelevant, and inappropriate. The panelists recorded 87% of all relevant observations depicted in the filmed sequences (p. 39), thus establishing that the film portrayed a valid situation to serve as a reliable stimuli (p. 40).

Using a film provided the element of research control. For this study, Sequence A was used as a pretreatment measure to determine pre-existing differences between Groups I and II. The introductory statement was read by the investigator and the film shown once. The subject had five minutes to record observations from memory (see Appendix A, Details - First Session). The same procedure was followed for questioning and hypothesis generation (see Appendix A).

Sequence B was used to determine the effects of intensive instruction in cue attendance in far-transfer, Sequence C was used to determine the effects of intensive instruction in information search in far-transfer, and Sequence D was used to determine the effects of intensive instruction in hypothesis generation in far-transfer. The sequences were used in the order of appearance on the film.

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The procedure followed was the same as described for the film "The Five Pendulums," except that the introductory statement for each sequence was read each time by the investigator.

Data collection sheets were scored as previously described for details questions and hypotheses. Physiological and psychological signs and symptoms depicted by the patient in the filmed patient sequences were categorized as conditions. In addition, details were scored as described by Verhonick, et al. (1968): (a) relevant, those explicitly depicting the patient problem presented visually in the sequence; (b) irrelevant, those not intentionally depicted but which were present, for example, a hospital bed; and (c) inappropriate, observations not present in the sequence. This was done to determine the effects of intensive instruction in cue attendance on the quality of details observed. The quantity of relevant, irrelevant, and inappropriate observations were calculated for each subject. It was possible to have differences in the total number of details described using Verhonick's method as compared to the method of scoring described by Wright (1974). With the filmed patient sequences, several details were counted as one observation (see Appendix B). When using Wright's method, these were counted individually. Interrater reliability was conducted as previously described. The Pearson Product-Moment Correlation Coefficient for Sequence A types of observations

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was .91 and .93 for types of details. Coefficients for types of observations for Sequence B were .99 and .88 for types of details. The average Pearson Product-Moment Correlation Coefficient for Sequence A questions was .86 and .92 for Sequence C questions. Pearson Product-Moment Correlation Coefficients for the quantity and quality of hypotheses generation for Sequence A were .99 and .993 and .72 and .81 for Sequence D. Scoring disagreements were discussed and consensus reached for all discrepancies.

Procedures

Following is a listing of the procedures that were necessary for the completion of this research project:

1. Approval for the implementation of this project at the selected college was obtained. (See Appendix C for the letter of agreement.)

2. Approval for implementation of this project from the Institutional Review Board for the Protection of Human Subjects was obtained. (See Appendix C.)

3. A list of students and graduates was obtained by the investigator. The list of names and addresses was given to a non-Department of Nursing faculty member who contacted subjects by mail asking for volunteers. If interested, subjects returned a 3 x 5 card to the investigator. (See Appendix C.)

4. The investigator contacted the subjects to explain the study and answer questions.

5. Subjects volunteered to participate in the study.

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Names of 60 subjects were placed in a hat. The first name drawn was placed in Group I and the next name drawn was placed in Group II. This process continued until a sample of 20 subjects was in each group. Subjects not chosen were thanked for their willingness to participate.

6. All subjects involved in the project signed a written informed consent. (See Appendix C.) Confidentiality of information and anonymity of subjects was explained to the participants. All data collection sheets included only a code number. To minimize the Hawthorne effect, subjects were not told into which group they were placed.

7. Each subject met with the investigator for three sessions held approximately one week apart. Because of class schedules and work schedules, sessions were conducted in groups of one to two at the convenience of the investigator and subjects. Because of the size of the groups, the investigator conducted all sessions. A script was used by the investigator to ensure that all subjects received the same information and instructions. Subjects were asked not to discuss the project with others in the project.

8. The first session lasted approximately one hour to one hour and 30 minutes. Data collection sheets and pencils were provided. Each subject completed the demographic information sheet and took the Piagentian Reasoning Task IV. Each subject viewed the filmed patient sequence A and

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was instructed to record details, questions, and hypotheses.

9. The second session was held about one week later and lasted approximately one hour and 30 minutes to two hours. Each subject in Group I was individually instructed in intensive instruction in cue attendance, information search, and hypothesis generation. Subjects in Group II received instruction in the principles of diagnostic reasoning in groups of one to two.

10. The third session was held about one week later and lasted approximately one hour to one hour and 30 minutes. Each subject viewed the filmed patient sequences B, C, and D, and was instructed to record details, questions, and hypotheses, respectively. Each subject then viewed the film "The Five Pendulums" and was instructed to record details, questions, and hypotheses.

11. At the completion of the third session, subjects were thanked for their participation and any questions about the study were answered.

Research Design

The design of this study was a quasi-experimental pretest--posttest control group (see Table 1). Three questions were investigated to determine the effects of intensive instruction in cue attendance, information search, and hypothesis generation on (a) the quantity and quality of details observed in analyzing a problem event on film--near-transfer, and in a filmed patient situation--far-transfer; (b) the quantity and quality of

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information search in analyzing a problem event on film--near-transfer, and in a filmed patient situation--far-transfer; and (c) the quantity and quality of hypothesis generation in analyzing a problem event on film--near-transfer, and in a filmed patient situation--far-transfer. The fourth question investigated was to determine if the level of cognitive functioning affected the results of intensive instruction in quality and quantity of details observed, information search, and hypothesis generation. A convenience sample of 40 subjects was randomly assigned as Group I (n = 20) and Group II (n = 20). To demonstrate group homogeneity, pre-treatment measures of both groups

Table 1

Research Design

GROUP	PRE-INSTRUCTION	TREATMENT	POST-INSTRUCTION
I (n = 20)	X	Intensive Instruction*	X
II (n = 20)	X	Principles of Diagnostic Reasoning	X

MEASURES	MEASURES
Demographic Data	Near-transfer - "The Five Pendulums" film for 1. Cue attendance 2. Information search 3. Hypothesis generation
Piagetian Reasoning Task IV for level of cognitive functioning	
Sequence A film for 1. Cue attendance 2. Information search 3. Hypothesis generation	Far-transfer 1. Cue attendance Sequence B film 2. Information search Sequence C film 3. Hypothesis generation Sequence D film

* Experimental treatment

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included demographic data, level of cognitive functioning, and the ability to note details, ask questions, and formulate hypotheses in a filmed patient situation. Approximately one week later, subjects in Group I received the experimental treatment of a two-hour intensive instruction session in cue attendance, information search, and hypothesis generation; subjects in Group II received instruction in the principles of diagnostic reasoning. Post-treatment measures included the quantity and quality of detail attendance, information search, and hypothesis generation in a problem event on film--near-transfer, and in a filmed patient situation--far-transfer.

Treatment of the Data

1. "Demographic Data," "Piagetian Reasoning Task IV," and filmed patient sequence A are discussed to determine if the groups of subjects are similar. If the groups are non-equivalent, any post-treatment differences are due to initial differences rather than effect of the treatment.

2. Research Questions 1, 2, and 3 would be statistically supported or rejected using a one-way analysis of variance with a significance level of .10 to examine group means on cue attendance ability (question 1), information search ability (question 2), and hypothesis generation ability (question 3).

3. Research Question 4 would be statistically supported or rejected using a one-way analysis of variance with a significance of .10 to examine Group I means on the

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level of cognitive functioning and its effect on the results of intensive instruction in cue attendance, information search, and hypothesis generation. Because the one-way analysis of variance does not indicate which set of more than two means are significantly different from each other, multiple comparisons using Tukey's Test and t-tests would be used to provide information about the differences among the means.

The level of significance for determining the effect of the treatment was set at .10 level. This level of significance was significantly stringent for an exploratory study such as this one. With replication, two successive findings at the .10 level would be roughly equivalent to a single finding at the .01 level (Isaac and Michael, 1981).

The one-way analysis of variance was selected for this study because it was the most powerful statistical test available to examine the two groups for difference. Requirements for using the one-way analysis of variance were met: data on an interval scale and variances sufficiently similar for groups to be considered homogeneous.

Two-tailed t-tests were used to determine group homogeneity in relation to interval data obtained from the demographic data and level of cognitive functioning. Chi-square tests were conducted to compare groups in relation to demographic data measured on a nominal scale.

The treatment used in this study has been effectively used with adolescents and pre-service education majors. Its

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use with registered professional nurses had not been documented. Therefore, the research questions had no directional prediction.

Summary

Forty registered professional nurses who were either students currently enrolled in or graduates of an upper-division baccalaureate RN completion program volunteered to participate in the study. Twenty subjects were randomly assigned to Group I and received the experimental treatment of intensive instruction in cue attendance, information search, and hypothesis generation; 20 subjects were randomly assigned to Group II and received instruction in the principles of diagnostic reasoning. All subjects completed all three sessions. Pre-instruction measures included demographic data, level of cognitive functioning, and inquiry behavior patterns in cue attendance, information search and hypothesis generation. A two-tailed t-test and Chi-square test were used to compare groups in relation to demographic characteristics and level of cognitive functioning. A one-way analysis of variance with a level of significance set at .10 was used to test the research questions. Each research question was supported if the F-value equaled or exceeded the critical F-value for the .10 level of significance. Implementation of methodology permitted the exploration of the effects of intensive instruction in cue attendance, information search, and hypothesis generation on the quantity and quality of details

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observed, information search, and hypothesis generation in analyzing a problem event on film, or near-transfer, and in a filmed patient situation, or far-transfer, and also the affect of the level of cognitive functioning on the results of intensive instruction.

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Chapter 4

Analysis of the Data

Introduction

The purpose of this chapter is to present an analysis and discussion of the data collected. It is divided into five sections. Section one is a description of Groups I and II prior to instruction. It includes data related to demographic characteristics, level of cognitive functioning, and pre-instruction inquiry behavior patterns. Sections two to five are examinations of the data related to the research questions.

Pre-instruction Data

Forty subjects volunteered to participate in the study. Subjects were randomly assigned to Group I (n = 20) and Group II (n = 20). All subjects completed all three sessions. Group I received the experimental treatment of intensive instruction in cue attendance, information search, and hypothesis generation. Group II received instruction in the principles of diagnostic reasoning.

Demographic Data. The data from the demographic data questionnaire was examined to determine if there were any pre-existing differences between groups. These results are displayed in Tables 1, 2, 3, 4, 5, 6, and 7.

Overall, subjects in Group I were younger. The ages for Groups I and II ranged from 25 to 46 and 28 to 55 years of age, respectively. There was a significant difference in group means related to age ($t = -2.77$, $p = .008$). Group II

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was significantly older. Thirty-eight (95%) subjects were female and two (5%) were male. Table 2 displays demographic data related to the individual.

Table 2
Data Related to the Individual

Group	Age Mean/(SD)	Sex Female Frequency (%)	Sex Male Frequency (%)
I (n = 20)	33.65 (5.8)	18 (90%)	2 (10%)
II (n = 20)	39.55* (7.50)	20 (100%)	0 (0%)

* Significantly different from Group II at $p < .1$ using a two-tailed t-test.

Table 3 displays demographic data related to the basic educational preparation of the sample. Both groups were similar in their educational preparation to obtain licensure as registered professional nurses. Twenty-five subjects received their initial education in a hospital-based diploma nursing program (DIP) and 15 in an associate degree program (AD). Length of time since initial preparation ranged from 4 to 22 years for Group I and 7 to 35 years for Group II. There was a significant difference between group means ($t = -3.16$, $p = .003$). This finding was anticipated considering the difference in age groups.

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Table 3
Basic Educational Preparation

Variable	Group I (n = 20) Frequency (%)		Group II (n = 20) Frequency (%)	
Basic educational preparation	DIP 11 (55%)	AD 9 (45%)	DIP 14 (70%)	AD 6 (30%)
	Mean (SD)		Mean (SD)	
Time since initial preparation	11.3 (4.64)		17.5* (7.85)	

* Significantly different from Group I at $p < .1$ using a two-tailed t-test.

Table 4 displays demographic data related to educational preparation beyond the basic preparation. An equal distribution was noted for subjects currently enrolled in a degree or certificate program in nursing. Eleven subjects were currently enrolled in an upper-division RN completion program. Seven subjects were currently enrolled in a degree or certificate program in a field other than nursing.

Groups were similar in the area of educational preparation beyond their initial educational preparation. Over 70% ($N = 29$) of the total sample had received their BSN degree. The remainder were currently enrolled in the upper-division RN completion program. Six subjects in the total sample had master's level preparation in nursing. The length of time for subjects in Group II with master's preparation was significantly different when compared to Group I ($t = -10.3$, $p = .0005$). Seven subjects (17.5%) in

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the sample indicated advanced educational preparation in a field other than nursing.

Table 4
Educational Preparation Beyond Basic Preparation

Variable	Group I (n = 20) Frequency (%)		Group II (n = 20) Frequency (%)	
	YES	NO	YES	NO
Current enrollment in nursing program	7 (35%)	13 (65%)	7 (35%)	13 (65%)
BSN	6	-	5	-
MSN	0	-	1	-
DNS/PhD	0	-	1	-
MSN/MBA	1	-	0	-
Current enrollment in a non-nursing program	2 (10%)	18 (90%	5 (25%)	15 (75%)
Advanded educational preparation in nursing	14 (70%)	6 (30%)	15 (75%)	5 (25%)
BSN	14	6	15	5
MSN	4	16	2	18
Non-nursing	2 (10%)	18 (90%)	5 (25%)	15 (75%)
Expanded role	2 (10%)	18 (90%)	2 (10%)	18 (90%)
Practice in role	1	1	2	0
Certification	6 (30%)	14 (70%)	10 (50%)	10 (50%)
	Mean	(SD)	Mean	(SD)
Time since initial preparation	11.3	(4.64)	17.5	(7.85)
Time since BSN preparation	3.35	(3.15)	4.4	(3.24)
Time since MSN preparation	1.5	(0.57)	6.0*	(0.00)
Length of time of certification	0.6	(1.50)	1.45	(2.52)

* Significantly different from Group I at $p < .1$ using a two-tailed t-test.

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Four subjects in the sample indicated preparation to assume an expanded role. This preparation was through certification and not an advanced degree. None of the subjects indicated preparation as a clinical specialist, nurse practitioner, nurse anesthetist, or related role. Groups were similar in terms of being certified in a specialized area of nursing practice. Eleven different areas of certification were identified.

Table 5 displays demographic data related to clinical practice. There were no significant differences noted for the preferred areas of clinical practice.

Table 5
Clinical Practice

Variable	Group I (n = 20) Frequency		Group II (n = 20) Frequency	
Preferred area				
Medical-surgical	3		6	
Psychiatry	2		1	
Surgery	1		2	
Critical care	6		2	
Emergency room	1		2	
Infection control	3		0	
Administration	2		1	
	Mean	(SD)	Mean	(SD)
Years in practice	11.0	(4.72)	16.25*	(8.10)
Years providing direct patient care	9.0	(4.19)	12.10	(7.58)

* Significantly different from Group I at $p < .1$ using a two-tailed t-test.

However, there was a significant difference in group means related to the number of years actively involved in

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nursing practice (t = -2.5, p = .01). The number of years in practice ranged from four to 21 years for Group I and four to 35 years for Group II. Groups were similar in the number of years of providing direct patient.

Table 6 displays demographic data related to employment. The groups were similar with respect to employment status. Overall, 23 employing institutions were identified by the subjects. Three subjects were previously employed in nursing, but currently were in positions outside of nursing for approximately two months. One subject did not specify the length of time not employed in nursing.

Table 6
Employment in Nursing

Variable	Group I (n = 20) Frequency (%)		Group II (n = 20) Frequency (%)	
Work status				
Full-time	14	(70%)	15	(75%)
Part-time	5	(25%)	3	(15%)
Not employed in nursing	1	(5%)	2	(10%)
Position				
Clinician	5	(26.32%)	7	(35%)
Administration	8	(42.11%)	9	(45%)
Education	3	(15.79%)	2	(10%)
	Mean	(SD)	Mean	(SD)
Length of time in position (months)	49.6	(46.99)	44.46	(53.05)

Groups were similar with respect to current positions held and major functions in the role. One subject did not respond. Groups were similar with respect to the length of time employed in the identified position. The range for Group I was 0 to 11 years and for Group II it was 0 to 14

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years. All subjects attended continuing education programs relating to their area of practice.

Table 7 displays data related to data gathering. All but six subjects had taken a class dealing with the topic of nursing diagnosis. There was a significant difference between groups (t = 1.7, p = .08) when asked to rate their overall data gathering ability. Eighteen (90%) subjects in Group I rated themselves as 5 or better compared to 15 (75%) in Group II.

Table 7
Data Gathering Skills

Variable	Group I (n = 20)		Group II (n = 20)	
	YES (%)	NO (%)	YES (%)	NO (%)
Nursing Diagnosis	16 (80%)	4 (20%)	18 (85%)	2 (15%)
	Mean	(SD)	Mean	(SD)
Skill	5.8*	(0.95)	5.25	(1.15)

* Significantly different from Group II at p < .1 using a two-tailed t-test.

In summary, Groups I and II were similar with the exception of the variables identified: age, length of time since initial education, length of time since MSN preparation, years of active clinical practice, and data gathering ability. Because these findings could have implications for the study, further analysis was done. (See Pre-instruction Inquiry Behavior Patterns).

Level of Cognitive Functioning. Table 8 displays a summary of the results of the Piagetian Reasoning Task used to measure level of cognitive functioning. There was no

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significant difference between group means (t = .84, p = .4). However, a Chi-square of value of 8.5 (p = .037) indicated that there were significant differences in the overall pattern of the data for observed frequencies between groups for the stages of cognitive functioning. For both groups, at least 70% were at the formal operational level. Only Group I had four subjects at the late formal operational stage. In both groups, 15% scored below the late concrete stage. (These results are further discussed with research question 4).

Table 8
<u>Level of Cognitive Functioning</u>

Variable	Group I (n = 20) Mean/SD		Group II (n = 20) Mean/SD	t/(p)
Piagetian Reasoning Task	3.6 (1.27)		3.25 (1.33)	.84 (.4)
STAGE*	Frequency	%	Frequency	%
2B-	3	15	5	15
2B	0	0	0	0
2B/3A	3	15	0	0
3A	10	50	15	75
3B	4	20	0	0

* 2B- = less than concrete, 2B = late concrete, 2B/3A = transitional, 3A = early formal operational, 3B = late formal operational.

<u>Pre-instruction Inquiry Behavior Patterns</u>. Inquiry behavior patterns for cue attendance, information search, and hypothesis generation are displayed in Tables 9, 10, and 11.

A summary report of pre-instruction cue attendance behavior when analyzing a problem event in filmed patient

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situation (Sequence A) is displayed in Table 9. Details were categorized first using Verhonick's method. Sequence A

Table 9
Pre-instruction Cue Attendance Behavior

Variable	Group I (n = 20) Mean/SD	Group II (n = 20) Mean/SD	F/p
Observations			
Relevant	4.45 (1.23)	4.55 (1.39)	0.06 (.81)
Irrelevant	5.7 (5.27)	4.25 (2.53)	1.23 (.27)
Total	10.15 (5.73)	8.8 (2.85)	0.98 (.32)
Inappropriate observations	0.2 (0.41)	0.05 (1.57)	2.06 (.21)
Details describing			
Events	4.9 (1.71)	5.5 (1.57)	1.56 (.21)
Objects	5.3 (3.34)	5.0 (4.0)	0.07 (.79)
Total	10.2 (3.74)	10.5 (4.45)	0.07 (.78)
Details stated as inferences	0.65 (1.04)	0.6 (0.82)	0.03 (.86)

contained 10 possible relevant observations (explicitly depicting the patient problem). Group I recorded 89 (22.2%) and Group II recorded 91 (22.7%) of the total number of possible relevant observations. A total of 379 relevant and irrelevant (depicted but not related to the patient problem) observations depicted in the film were recorded. The average total number was 10.15 for Group I and 8.8 for Group II. There was no significant difference between group means at the .10 level.

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When details were categorized using Suchman's classification, a total of 415 details identifying events and objects in the film were recorded whereas using Verhonick's categories yielded fewer details. There were no significant differences between group means for the combined number of details at the .10 level. As there were no significant differences at the .10 level in any of the measurements, it was concluded that the groups were similar in the types of observations made.

Table 10 displays a summary of pre-instruction information search behavior after analyzing a problem event in a filmed patient situation (Sequence A). The total number of acceptable questions (questions that asked only

Table 10
Pre-instruction Information Search Behavior

Variable	Group I (n = 20) Mean/SD	Group II (n = 20) Mean/SD	F/p
Number of acceptable questions asked	12.65 (5.48)	10.8 (5.11)	1.22 (.17)
Types of questions			
Verification of objects	0.55 (2.03)	0.5 (0.22)	1.99 (.28)
Verification of events	11.1 (5.22)	8.8 (5.05)	2.0 (.16)
Verification of conditions	1.00 (1.41)	1.95 (1.39)	4.58* (.03)
Statements given which were not questions	0.05 (2.25)	0.35 (2.0)	1.95 (.17)

* Significantly different from Group I at $p < .1$ using one-way analysis of variance with 1,38 degrees of freedom.

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for known facts) asked by both groups was 469. There was no significant difference between group means.

When the questions were categorized according to type of questions, only Group II's ability to ask questions verifying conditions (n = 39) was significantly different from Group I (n = 20) at the .10 level. Eighteen subjects in Group II asked this type of question as compared to 10 subjects from Group I. Because this finding could have implications for the study, this result was compared with the significant demographic data. Although a Pearson Product-Moment Correlation of r = .09 indicated a positive relationship between the number of questions asked to verify a condition and the number of years since obtaining a master's degree in nursing for those subjects in Group I, but no correlation (r = 0) for Group II (the group with the higher mean), it was concluded that this finding was due to chance. There was little if any correlation for the other variables: age, length of time since initial preparation, years of active clinical practice, and skill. With the exception of the single significant difference in asking verification of condition questions, both groups were similar.

Table 11 displays a summary of pre-instruction hypothesis generation behavior after analyzing a problem event in a filmed patient situation (Sequence A). A total of 90 acceptable hypotheses (hypotheses that met the criteria) were generated by the subjects.

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Table 11
Pre-treatment Hypothesis Generation Behavior

Variable	Group I (n = 20) Mean/SD	Group II (n = 20) Mean/SD	F/p
Number of hypotheses given to explain what was observed on film	2.05 (1.82)	2.45 (1.79)	0.49 (.48)
Hypothesis quality	1.85 (1.17)	2.2 (1.09)	0.98 (.32)
Number of statements given which were not hypotheses	1.55 (2.37)	0.8 (0.95)	1.72 (.19)

At the onset of this study, there was no significant difference between groups at the .10 level in their ability to generate hypotheses after analyzing a problem event in a filmed patient situation (see Table 11).

In summary, both groups were essentially homogeneous with respect to demographic data with the exceptions identified. More important, the level of cognitive functioning was similar for both groups. Only in the single information search behavior relating to the verification of conditions was there any significant difference. After examination of the significant demographic data with verification questions, the investigator felt comfortable in declaring that the two groups in the study were equal in abilities prior to intensive instruction.

Research Question 1

The first research question was as follows: Does intensive instruction in cue attendance, information search, and hypothesis generation affect the quantity and quality of

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details observed in analyzing a problem event on film--near-transfer, or in a filmed patient situation--far-transfer? Table 12 displays a summary report of details observed when analyzing a problem event on film--near-transfer ("The Five Pendulums"). A total of 531 acceptable details (details depicted in the film) were recorded by the subjects. There was a significant difference between group means at the .10 level for the average number of details recorded.

Table 12
Near-transfer Effect of Intensive Instruction on Cue Attendance Behavior

Variable	Group I (n = 20) Mean/SD	Group II (n = 20) Mean/SD	F/p
Number of acceptable details described	16.5 (4.18)	10.05 (1.96)	39.94* (<.01)
Details describing			
Events	5.55 (2.14)	4.15 (1.35)	6.13* (.017)
Objects	10.35 (2.81)	5.50 (1.91)	50.34* (<.01)
Conditions	0.60 (1.39)	0.40 (0.50)	0.37 (.54)
Details recorded but not depicted	1.95 (2.11)	0.9 (1.96)	4.16* (.04)

* Significantly different from Group II at $p < .1$ using one-way analysis of variance with 1,38 degrees of freedom.

Details were further categorized by types of details. A significantly greater number of details describing events or objects were recorded by Group I when compared to Group II. Group I also recorded a significantly greater number of

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details not depicted in the film (n = 39) as compared to Group II (n = 18). Near-transfer effects of intensive instruction when analyzing a problem event on film were statistically evident at the the .10 level.

Table 13 displays a summary report of the types of details recorded in analyzing a problem event in a filmed patient situation--far-transfer (Sequence B). Details were categorized first using Verhonick's method.

Table 13
Far-transfer Effect of Intensive Instruction on Cue Attendance Behavior

Variable	Group I (n = 20) Mean/SD	Group II (n = 20) Mean/SD	F/p
Observations			
Relevant	6.2 (1.39)	5.25 (1.83)	3.40* (.07)
Irrelevant	14.1 (9.08)	4.50 (3.47)	19.49* (<.01)
Total	20.3 (9.59)	9.25 (3.80)	20.90* (<.01)
Inappropriate observations	0.25 (0.44)	0.10 (0.30)	1.54 (.22)
Details describing			
Events	8.30 (3.61)	5.20 (2.06)	11.09* (.001)
Objects	12.10 (7.51)	4.61 (3.95)	15.60* (<.01)
Conditions	2.25 (0.85)	1.45 (0.60)	11.75* (.001)
Total	22.65 (10.36)	11.25 (4.59)	20.20* (<.01)
Details stated as inferences	0.80 (1.19)	0.55 (0.68)	0.66 (.42)

* Significantly different from Group II at $p < .1$ using one-way analysis of variance with 1,38 degrees of freedom.

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A total of 601 relevant (explicitly depicitng the patient problem) (n = 229) and irrelevant (depicted but not related to the problem) (n = 372) observations were recorded by both groups. Group I recorded a significantly greater mean number of both relevant and irrelevant observations, ($F = 20.90$, $df = 1, 38$, $p = .0001$), than Group II who did not receive intensive instruction. Of the total possible observations in Sequence B, Groups I and II recorded 28% and 23%, respectively. Significant differences were also obtained when details were categorized using Suchman's classification. A total of 678 details describing events, objects, and conditions depicted in the film were recorded. After instruction, there was a significant difference. Group I averaged more details describing events, objects, and conditions ($F = 20.20$, $df = 1, 38$, $p = .0001$) when compared to Group II. Thus, far-transfer effects of intensive instruction when analyzing a problem event in a filmed patient situation were statistically evident.

<u>Research Question 2</u>

The second research question was as follows: Does intensive instruction in cue attendance, information search, and hypothesis generation affect the quantity and quality of <u>information search</u> in analyzing a problem event on film--near-transfer, or in a filmed patient situation--far-transfer? Table 14 displays a summary report of near-transfer effects of intensive instruction on information search behavior when analyzing a problem event

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on film ("The Five Pendulums"). A total of 340 acceptable questions (questions that asked only for known facts) were asked by subjects about what was seen on film. Group I asked 58% (n = 198) of the questions and Group II asked 42% (n = 142) of the questions. The average number of questions asked by Group I was significantly greater when compared to Group II at the .10 level. Questions were further classified according to categories of questions. The average number of questions asked by Group I to verify a condition or event was significantly greater when compared to Group II at the .10 level. Four additional types of questions were asked by three subjects. One subject from Group II asked a question scored as an experimentation of a

Table 14
Near-transfer Effect of Intensive Instruction on Information Search Behavior

Variable	Group I (n = 20) Mean/SD	Group II (n = 20) Mean/SD	F/p
Number of questions asked	9.9 (4.56)	7.1 (3.35)	4.89* (.03)
Types of questions			
Verification of objects	3.0 (2.77)	2.75 (2.71)	.08 (.77)
Verification of events	2.3 (1.97)	1.15 (0.74)	5.93* (.019)
Verification of conditions	4.3 (2.0)	3.05 (1.73)	4.46* (.04)
Statements given which were not questions	0.6 (2.25)	0.4 (.99)	0.13 (.71)

* Significantly different from Group II at $p < .1$ using one-way analysis of variance with 1,38 degrees of freedom.

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condition. One subject from Group I asked a question to determine the necessity of a condition. One subject from Group I asked one question classified as experimentation of an object and one classified as synthesis of an event. There was no significant difference between groups for statements which were not questions ($p > .10$). Thus, near-transfer effects of intensive instruction when analyzing a problem event on film were statistically evident.

Table 15 displays far-transfer effects of intensive instruction on information search behavior when analyzing a problem event in a filmed patient situation (Sequence C). A total of 583 acceptable questions were asked by subjects

Table 15
Far-transfer Effect of Intensive Instruction on Information Search Behavior

Variable	Group I (n = 20) Mean/SD	Group II (n = 20) Mean/SD	F/p
Number of questions asked	17.6 (2.44)	11.55 (6.59)	5.88* (.02)
Types of questions			
Verification of objects	1.2 (2.44)	0.355 (0.48)	2.33 (.13)
Verification of events	11.5 (5.59)	8.65 (5.76)	1.94 (.17)
Verification of conditions	5.25 (4.49)	2.55 (1.82)	6.20* (.01)
Statements given which were not questions	1.3 (2.25)	0.65 (2.0)	0.93 (.34)

* Significantly different from Group II at $p < .1$ using one-way analysis of variance with 1,38 degrees of freedom.

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with Group I asking 60% (n = 352) of the questions and Group II asking 40% (n = 231) of the questions. Group I means were higher than Group II in all areas. The Group I mean for total number of questions was significantly greater when compared to Group II at the .10 level. Of the specific types of questions asked, Group I asked a significantly greater number of questions to verify a condition when compared to Group II who did not receive intensive instruction. One subject in Group II asked 32 questions with the remainder of the group asking between 4 to 21 questions. Thus, far-transfer effects of intensive instruction when analyzing a problem event in a patient situation was statistically evident.

<u>Research Question 3</u>

The third research question was as follows: Does intensive instruction in cue attendance, information search, and hypothesis generation affect the quantity and quality of <u>hypothesis generation</u> in analyzing a problem event on film--near-transfer, or in a filmed patient situation--far-transfer? Near-transfer effects of intensive instruction when analyzing a problem event on film ("The Five Pendulums") are displayed in Table 16. A total of 72 acceptable hypotheses (hypotheses that met the criteria) were generated by the subjects to explain what was observed in the film. Five (25%) subjects in Group I could not generate any acceptable hypotheses as compared to seven (35%) in Group II. Although the group means for the

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quantity (number) and quality of hypotheses generated for Group I were slightly higher than for Group II, there were no significant differences between groups at the .10 level for near-transfer effects of intensive instruction when analyzing a problem event on film.

Table 16
Near-transfer Effect of Intensive Instruction on Hypothesis Generation Behavior

Variable	Group I (n = 20) Mean/SD	Group II (n = 20) Mean/SD	F/p
Number of hypotheses given to explain what was observed on film	2.0 (1.75)	1.6 (1.79)	.51 (.48)
Hypothesis quality	1.78 (1.13)	1.56 (1.28)	.32 (.57)
Number of statements given which were not hypotheses	0.95 (1.36)	0.9 (1.25)	.01 (.90)

Far-transfer effects of intensive instruction when analyzing a problem event in a filmed patient situation (Sequence D) are displayed in Table 17. A total of 108 acceptable hypotheses were generated by the subjects. After instruction, Group I reported a slightly higher mean number of hypotheses than Group II, but these hypotheses were of a lower quality. Group I also had a higher mean for unacceptable hypotheses. Five (25%) subjects in Group I could not generate any acceptable hypotheses as compared to two (10%) subjects in Group II. Two subjects in each group had this same difficulty on near-transfer. Far-transfer effects of intensive instruction when analyzing a problem

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event in a filmed patient situation were not statistically evident at the .10 level.

Table 17
Far-transfer Effect of Intensive Instruction on Hypothesis Generation Behavior

Variable	Group I (n = 20) Mean/SD	Group II (n = 20) Mean/SD	F/p
Number of hypotheses given to explain what was observed on film	2.9 (2.57)	2.5 (1.88)	.32 (.57)
Hypothesis quality	1.77 (1.15)	2.15 (0.91)	1.41 (.24)
Number of statements given which were not hypotheses	1.45 (2.87)	0.55 (0.83)	1.83 (.18)

Research Question 4

The fourth research question was as follows: Does the level of cognitive functioning affect the results of intensive instruction in the quantity and quality of cue attendance, information search, and hypothesis generation in analyzing a problem event on film--near-transfer, or in a filmed patient situation--far-transfer. Only the results for the subjects who received intensive instruction in cue attendance, information search, and hypothesis generation were used in the analysis. Results of the Piagetian Reasoning Task IV from Group I were subjected to a one-way analysis of variance at the .10 level of significance to determine the effect of the level of cognitive functioning on the results of intensive instruction. T-tests and Tukey tests were used post hoc to compare differencs in group

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means at the .10 level. These results are discussed with the following considerations. Four (20%) subjects in Group I were at the 3B stage, or late formal operational, with 10 (50%) at the 3A stage, or early formal operational; 3 (15%) at the 2B/3A stage or transitional; and 3 (15%) at the 2B- stage, or less than concrete. No subject was scored as 2B or late concrete.

Cue Attendance. Tables 18, 19, and 20 display summaries of the mean results of the effect of the level of cognitive functioning on cue attendance behavior for Group I who received intensive instruction. Prior to instruction there were no significant differences at the .10 level between groups using a one-way analysis of variance with 3 and 16 degrees of freedom. (See Table 18.) However, there was a significant difference in the mean relevant observations recorded between four subjects at the late formal operational stage (3B) and the 10 subjects at the early formal operational stage (3A) ($t = 2.11$, $df = 12$, $p = .05$). There were significant differences in group means between subjects at the early formal operational stage and the three subjects at the less than concrete stage (2B-) ($t = 2.09$, $df = 11$, $p = .05$) and between the three subjects at the transitional stage (2A/3B) ($t = 1.91$, $df = 11$, $p = .07$) for recording details describing objects. Also, there was a significant difference between group means for subjects at the early formal operatinal stage and subjects at the

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transitional stage for recording details as events (t = 2.09, df = 11, p = .05).

Table 18
Level of Cognitive Functioning and Group I Mean Scores for Pre-instruction Cue Attendance Behavior

Variable	3B (n=4) M/SD	3A (n=10) M/SD	2B/3A (n=3) M/SD	2B (n=0) M/SD	2B- (n=3) M/SD	F/p
Observations						
Relevant	5.75	4.2	4.0	-	4.0	2.25
	(1.5)	(1.14)	(0.0)	-	(1.0)	(.12)
	+					
Irrelevant	4.5	5.4	10.33	-	3.67	1.0
	(2.38)	(2.88)	(12.74)	-	(3.79)	(.58)
Total	10.25	9.6	14.33	-	7.67	0.83
	(2.75)	(3.31)	(12.74)	-	(3.79)	(.50)
Details describing						
Events	6.25	4.1	6.07	-	4.67	2.43
	(2.06)	(1.45)	(1.0)	-	(1.53)	(.102)
		+				
Objects	6.0	6.5	3.0	-	2.67	1.77
	(4.9)	(3.03)	(1.0)	-	(1.15)	(.19)
		+				
			+			
Conditions	-	-	-	-	-	-
Total	12.25	10.6	9.0	-	7.33	1.16
	(4.5)	(4.01)	(0.0)	-	(2.52)	(.35)

+p < .10, t-tests (between group comparisons).

There were no significant differences between group means at the .10 level using one-way analysis of variance with 3 and 15 degrees of freedom for near-transfer effects (see Table 19). The only between group difference was for the total number of details recorded with subjects at the early formal operational stage having a higher mean than

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those subjects at the late formal operational stage ($t = 1.99$, df = 12, $p = .06$).

Table 19
Level of Cognitive Functioning and Group I Mean Scores for Near-transfer Cue Attendance Behavior

Variable	Stage 3B (n=4) M/SD	3A (n=10) M/SD	2B/3A (n=3) M/SD	2B (n=0) M/SD	2B- (n=3) M/SD	F/p
Details describing Event	4.25 (2.22)	6.2 (2.15)	5.67 (2.89)	- -	5.0 (1.0)	.84 (.51)
Objects	8.75 (2.5)	10.9 (3.07)	12.0 (2.65)	- -	9.0 (1.73)	1.16 (.35)
Conditions	0.25 (0.5)	0.9 (1.91)	0.0 (0.0)	- -	0.67 (0.58)	0.38 (.76)
Total	13.25 (1.71)	18.0 (4.55)	17.67 (5.03)	- -	14.67 (2.08)	1.65 (.21)
	|——+——	——|				

+$p < .10$, t-tests (between group comparisons).

For far-transfer effects, there were significant differences between groups for the mean number of relevant observations recorded and the mean number of details describing events at the .10 level. Tukey tests revealed that the three subjects at the transitional stage (2B/3A) has significantly higher means than the 10 subjects at the early formal operational stage (3A) ($q = 3.55$, df = 4, 16) and the three subjects at the late formal operational stage (3B) ($q = 4.20$, df = 4, 16) for recording relevant observations. In addition, the three subjects at the late formal operational stage (3A) had significantly lower means

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Table 20
Level of Cognitive Functioning and Group I Mean Scores for Far-transfer Cue Attendance Behavior

	Stage					
Variable	3B (n=4) M/SD	3A (n=10) M/SD	2B/3A (n=3) M/SD	2B (n=0) M/SD	2B- (n=3) M/SD	F/p
Observations						
Relevant	5.25 (0.96)	6.0 (1.15)	8.0 (1.73)	- -	6.33 (1.15)	3.14* (.05)
	3B–3A ++; 3B–2B/3A ++					
Irrelevant	8.0 (7.75)	15.6 (9.4)	19.67 (4.51)	- -	11.67 (11.59)	1.17 (.35)
Total	13.25 (6.95)	21.6 (9.9)	27.67 (4.93)	- -	18.0 (11.79)	1.55 (.23)
Details describing						
Events	4.25 (1.71)	8.6 (3.31)	12.0 (1.73)	- -	9.0 (3.61)	4.18* (.02)
	3B–2B/3A ++; 3B–3A ++					
Objects	7.75 (8.66)	13.2 (6.75)	17.0 (2.65)	- -	9.33 (11.02)	1.1 (.38)
Conditions	1.75 (0.5)	2.3 (0.82)	3.0 (1.0)	- -	2.0 (1.0)	1.42 (.27)
Total	13.75 (7.63)	24.1 (9.17)	32.0 (2.65)	- -	20.33 (15.5)	2.3 (.11)

* Statistically significant at $p < .10$ using one-way analysis of variance with 3,16 degrees of freedom.
++$p < .10$, Tukey test (between group comparisons).

when compared to the 10 subjects at the early formal operational stage (3A) ($Q = 3.52$, $df = 4, 16$) and when compared to the three subjects at the transitional stage ($Q = 4.86$, $df = 4, 16$) for recording details describing events. In all cases, the means for subjects at the transitional stage were highest and the means for subjects

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at the late formal operational stage were the lowest.

Information Search. Tables 21, 22, and 23 display summaries of the mean results of the effect of the level of cognitive functioning on information search behavior for Group I who received intensive instruction. Prior to instruction, there were significant differences at the .10 level using one-way analysis of variance with 3 and 16 degrees of freedom between groups for the average number of questions asked and the average number of questions asked to verify events. (See Table 21.) Tukey tests revealed that for the average number of questions asked, the subjects at

Table 21

Level of Cognitive Functioning and Group I Mean Scores for Pre-instruction Information Search Behavior

Variable	Stage 3B (n=4) M/SD	3A (n=10) M/SD	2B/3A (n=3) M/SD	2B (n=0) M/SD	2B- (n=3) M/SD	F/p
Total questions asked	7.5 (3.42)	14.9 (5.22)	16.33 (1.53)	- -	8.33 (4.16)	4.29* (.02)
	++ (3B vs. 3A); ++ (3B vs. 2B/3A)					
Types of questions						
Verification of Events	5.0 (1.83)	13.7 (4.9)	13.67 (0.58)	- -	8.0 (3.61)	5.59* (<.01)
	++ (3B vs. 3A); ++ (3B vs. 2B/3A)					
Objects	2.25 (4.5)	0.0 (0.0)	0.67 (1.15)	- -	0.0 (0.0)	1.3 (.30)
Conditions	0.25 (0.5)	1.2 (1.55)	2.0 (2.0)	- -	0.33 (0.58)	1.2 (.34)

* Statistically significant at p < .10 using one-way analysis of variance.

++p < .10, Tukey test (between group comparisons).

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the late formal operational stage (3B) (n = 4) differed significantly from the subjects at the transitional (2B/3A) stage (n = 3) (q = 3.66, df = 4, 16) and differed significantly from subjects at the early formal stage (3A) (n = 10) (q = 3.96, df = 4, 16) at the .10 level. Tukey tests revealed that for questions asked to verify events, the subjects at the late formal operational stage (3B) (n = 4) differed significantly from the subjects at the transitional (2B/3A) stage (n = 3) (q = 4.03, df = 4, 16) and differed significantly from subjects at the early formal stage (3A) (n = 10) (q = 5.23, df = 4, 16) at the .10 level.

There were no statistical significant differences between group means at the .10 level of significance using one-way analysis of variance with 3 and 16 degrees of freedom for near- and far-transfer effects. (See Tables 22 and 23.) But, for both near- and far-transfer, there were group mean differences. For near-transfer, subjects at the late formal operational stage (n = 4) differed from subjects at the transitional stage (n = 3) (t = 4.91, df = 5, p = <.01) and differed from subjects at the early formal stage (3A) (n = 10) (t = 2.34, df = 12, p = .03) for asking questions to verify events. (See Table 22.) For far-transfer effects, subjects at the early formal operational stage differed from subjects at the transitional stage when asking questions to verify events (t = 2.23, df = 11, p = .04).

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Table 22

Level of Cognitive Functioning and Group I Mean Scores for Near-transfer Information Search Behavior

Variable	Stage 3B (n=4) M/SD	3A (n=10) M/SD	2B/3A (n=3) M/SD	2B (n=0) M/SD	2B- (n=3) M/SD	F/p
Total questions asked	7.5 (1.0)	10.8 (4.54)	12.00 (6.08)	- -	8.0 (6.24)	.86 (.51)
Types of questions						
Verification of Events	0.5 (0.58)	2.9 (1.97)	2.67 (0.58)	- -	2.33 (3.21)	.16 (.23)
		+				
	+					
Objects	3.25 (1.71)	3.0 (3.09)	4.0 (4.58)	- -	1.67 (0.58)	.33 (.80)
Conditions	3.75 (2.36)	4.6 (1.43)	5.33 (1.53)	- -	3.0 (3.61)	.84 (.50)

+p < .10, t-tests (between group comparisons).

Table 23

Level of Cognitive Functioning and Group I Mean Scores for Far-transfer Information Search Behavior

Variable	Stage 3B (n=4) M/SD	3A (n=10) M/SD	2B/3A (n=3) M/SD	2B (n=0) M/SD	2B- (n=3) M/SD	F/p
Total questions asked	14.25 (4.99)	18.0 (8.65)	25.33 (11.02)	- -	13.0 (11.36)	1.2 (.32)
Types of questions						
Verification of Events	9.25 (2.63)	10.1 (4.25)	17.0 (6.24)	- -	11.33 (10.12)	1.5 (.26)
		+				
Objects	0.25 (0.5)	1.0 (0.94)	4.0 (6.08)	- -	0.33 (0.58)	1.9 (.16)
Conditions	4.75 (3.77)	6.9 (5.34)	4.33 (1.53)	- -	1.33 (1.15)	1.3 (.29)

+p < .10, t-tests (between group comparisons).

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Hypothesis generation. Table 24 displays the summary of the mean results of the effect of the level of cognitive functioning on hypothesis generation behavior for Group I who received intensive instruction. There were no significant differences between group means at the .10 level of significance using one-way analysis of variance with three and 16 degrees of freedom. Subjects at the late formal operational stage (3B) (n = 4) had higher means for the number of acceptable hypotheses on pre-instruction and

Table 24
Level of Cognitive Functioning and Group I Mean Scores for Hypothesis Generation Behavior

Variable	3B (n=4) M/SD	3A (n=10) M/SD	2B/3A (n=3) M/SD	2B (n=0) M/SD	2B- (n=3) M/SD	F/p
Pre-instruction						
Number	3.25	2.3	0.67	-	1.0	1.7
	(1.89)	(1.95)	(0.58)	-	(1.0)	(.20)
	|	+	|			
Quality	2.75	1.69	1.67	-	1.33	1.18
	(0.5)	(1.23)	(1.53)	-	(1.15)	(.38)
Near-transfer						
Number	2.50	1.70	2.66	-	1.60	.35
	(1.92)	(1.42)	(2.88)	-	(2.08)	(.79)
Quality	1.50	1.77	2.33	-	1.58	.32
	(1.0)	(1.29)	(0.58)	-	(1.42)	(.81)
Far-transfer						
Number	3.7	2.8	3.33	-	1.6	.37
	(0.5)	(2.25)	(5.77)	-	(1.5)	(.78)
	|		+		|	
Quality	2.54	1.88	0.76	-	1.33	1.7
	(0.42)	(1.16)	(1.32)	-	(1.15)	(.20)
	|	+	|			

+$p < .10$, t-tests (between group comparisons).

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for near- and far-transfer effects. In addition, this group had higher means for the quality of hypotheses generated prior to instruction and for far-transfer. Post hoc comparisons of between group means revealed that the four subjects at the late formal operational stage had significantly higher means than the three subjects at the transitional stage for the number of hypotheses generated prior to instruction ($t = 2.23$, $df = 5$, $p = .07$). For far-transfer effects, subjects at the late formal stage differed significantly from the subjects at the less than concrete stage (2B-) ($n = 3$) for the number of hypotheses generated ($t = 2.62$, $df = 5$, $p = .04$) and differed significantly from subjects at the transitional stage (2B/3A) ($n = 3$) for the quality of hypotheses generated ($t = 2.58$, $df = 5$, $p = .04$).

In summary, because of the number of subjects per group, it was difficult to draw conclusions. For cue attendance behavior, subjects at the early formal stage, 3A, tended to have higher means for near-transfer while subjects at the transitional stage, 2B/3A, tended to have higher means for far-transfer. Also, subjects at the transitional stage tended to have higher means for both near- and far-transfer information search behavior. Subjects at the late formal stage tended to have higher means for hypothesis generation behavior.

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Summary

Four research questions were investigated. Question 1 determined the effect of intensive instruction in cue attendance, information search, and hypothesis generation on the quantity and quality of details observed in analyzing a problem event on film--near-transfer, or in a filmed patient situation--far-transfer. There were significantly higher means in the quantity and quality of details observed in both near- and far-transfer effects supporting the effect of intensive instruction in a positive direction. Question 2 determined the effect of intensive instruction in cue attendance, information search, and hypothesis generation on the quantity and quality of information search in analyzing a problem event on film--near-transfer, or in a filmed patient situation--far-transfer. There were significantly higher means in the quantity and quality of questions for near- and far-transfer-effect giving support of intensive instruction. Question 3 examined the effect of intensive instruction in cue attendance, information search, and hypothesis generation on the quantity and quality of hypothesis generation in analyzing a problem event on film--near-transfer, or in a filmed patient situation--far-transfer. There was no evidence to support any effect of the intensive instruction. Question 4 examined the relationship between the level of cognitive functioning and the results of intensive instruction. There was insufficient evidence to support any effect of the level

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of cognitive functioning and accomplishments of the subjects as the results of intensive instruction.

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Chapter 5

Conclusion and Recommendation

Introduction

The major objective of this study is to investigate the effects of a method to modify the inquiry pattern behaviors of registered professional nurses in data gathering for clinical judgments. The design of the study was quasi-experimental. Forty registered professional nurses volunteered and were randomly assigned to two groups of 20. Group I received the experimental treatment of a two-hour session of intensive instruction in cue attendance, information search, and hypothesis generation while Group II received instruction in the principles of diagnostic reasoning. Intensive instruction consisted of having a subject view films which presented discrepant events that contradicted what the subject expected to see and then working with each subject individually by having the subject report a criterion number of details (100) depicted in the film for cue attendance, ask as many questions as possible that asked for facts about what was seen, and, finally, generate a criterion number of hypotheses (seven) to explain what was seen on film. A pilot study was conducted to determine an acceptable, but difficult, criterion for cue attendance and hypothesis generation. All subjects completed all sessions. In addition to data collected to answer the research questions, pre-instruction data collected included demographic data, level of cognitive

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functioning, and pre-instruction inquiry behavior patterns. Subjects' response sheets from the Piagetian Reasoning Task, cue attendance, information search, and hypothesis generation were scored independently by the investigator and another individual to obtain interrater reliability. The purpose of this chapter is to draw conclusions and formulate recommendations based on the data collected.

To provide a logical organization, this chapter is divided into seven sections. In the first section, data collected prior to instruction are examined and conclusions are drawn from that data. In the second, third, fourth, and fifth sections, data collected for each research question are examined and conclusions are drawn. In the next section, implications for nursing education are discussed. In the final section, recommendations are made for additional research.

Pre-instruction Data - Conclusions

Data collected prior to instruction included demographic data, level of cognitive functioning, and pre-instruction inquiry behavior patterns. With a few exceptions, both groups were similar on the variables examined prior to instruction.

Both groups were basically similar with respect to demographic characteristics. The sample was primarily female with only two males, both of whom were in the treatment group. Group II was a significantly older group and had been in practice longer than the members in Group I.

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Both groups had one or two individuals who were at the extremes which affected group means for the number of years since their initial educational preparation and subsequent number of years in practice. There were no significant differences at the .10 level in the educational background of both groups with the exception of four individuals in Group I and two in Group II with master's level preparation in nursing. As a whole, the sample was diverse with respect to places of employment, preferred areas of clinical practice, and current positions. Group I rated themselves significantly higher at the .10 level than Group II in the area of data gathering ability.

Both groups were similar with respect to their average level of cognitive functioning based on the results of the "Science Reasoning Task IV Equilibrium In The Balance." In Group I, four subjects scored at the late formal operational stage, 3B; 10 subjects scored at the early formal operational stage, 3A; three subjects scored at the transitional stage; and three subjects scored at the less than concrete stage, 2B-. No subject scored at the early concrete stage, 2B. In Group II, 15 subjects scored at the early formal operational stage and five subjects scored at the less than concrete stage, 2B-. No subject scored at the early formal, transitional, or late concrete stages. At least 72.5% of the total sample (N = 40) were at the early or late formal operational stage with 27.5% below the formal operational stage. Considering the sample size and the use

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of a single instrument to measure the level, the number of subjects at the formal operational stage is higher than findings reported by Schwebel (1975), Hale (1983), Sunal and Sunal (1985), and Tomlinson-Keasey (1972).

All subjects viewed a filmed patient situation (Sequence A) to obtain a measure of pre-instruction inquiry behavior patterns for cue attendance, information search, and hypothesis generation to determine any pre-existing differences between the groups when analyzing a problem event on film. No significant differences were found between the groups' behavior to observe details in a filmed patient situation at the .10 level. Both groups were similar in their ability to ask questions that asked for known facts about what was seen on film with the only exception of the number of questions categorized as verification of conditions. Group II was significantly different from Group I at the .10 level. Because this finding could have implications for the rest of the study, further examination was conducted using measures that were found significant in the demographic data. There were no significant differences between groups. Both groups were similar in their hypothesis generation behavior after seeing a filmed patient situation.

In summary, it is concluded that the sample of registered professional nurses in this study were homogeneous prior to instruction. The level of cognitive functioning and pre-instruction inquiry pattern behaviors of

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this sample cannot be generalized beyond this sample to other experienced registered professional nurses nor to students enrolled in a nursing program leading to licensure.

Research Question 1 - Conclusions

The first question was as follows: Does intensive instruction in cue attendance, information search, and hypothesis generation affect the quantity and quality of details observed in analyzing a problem event on film--near-transfer, or in a filmed patient situation--far-transfer? For near-transfer, all subjects viewed the film "The Five Pendulums" and were instructed to record all details observed from memory. This film was similar to the intensive instruction films. The subject could view the film as many times as needed to report the details. For far-transfer, all subjects viewed the filmed patient Sequence B using the same procedure as for near-transfer. Findings supported the effectiveness of intensive instruction for near- and far-transfer effects. For near-transfer, Group I treatment means for details and observations were significantly different from Group II means in most areas at levels of significance much greater than the .10 level set for this study. (See Tables 12 and 13.)

In terms of far-transfer effect, there were significant differences between groups in their ability to make observations. Group I's performance was significantly greater at the .10 level when compared to Group II.

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Although pre-instruction cue attendance behavior was not compared statistically with post-instruction behavior because of different stimuli being used, there were differences between the groups in their ability to make observations after intensive instruction. Prior to instruction, Group I had a higher mean for observations (10.15) when compared to Group II mean (8.8) but had a lower mean for details (10.2) when compared to Group II (10.5). But after intensive instruction, Group I had a significantly higher means for observations (20.3) and details (22.65) when compared to Group II means for observations (9.25) and for details (11.25). In fact, the mean for Group I was about twice the mean for Group II on both scoring methods. When details were categorized as events, objects, and conditions, Group I had significantly higher means in all areas at levels of significance much greater than .10 level when compared to Group II. There were also significant differences at the .10 level between groups when observations were categorized as relevant and irrelevant. Prior to instruction, Group I made an average of 4.45 relevant observations and Group II made 4.55, slightly higher than Group I. But after instruction, the opposite occurred. The average number of relevant observations made by Group I was 6.2 and 5.25 for Group II, significantly different at the .10 level. Group I also had a significantly higher mean for irrelevant observations (14.1) when compared to Group II (4.50) ($p < .01$). Irrelevant

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observations were observations depicted in the patient situation, but not related to the patient's problem. Although subjects were instructed to record details, a higher number of irrelevant observations compared to relevant observations were made by Group I. This finding suggests that the training increased the ability to observe cues and the need for further investigation to examine the effect of intensive instruction in cue attendance on the ability to make a clinical judgment based on training for relevant details.

In summary, it is concluded that the two-hour session of intensive instruction in cue attendance was effective for near-transfer and far-transfer effects. This finding supported similar significant findings in past research (Wright, 1974, 1981; Sunal, 1988). In addition to statistical significance, there is practical significance supporting intensive instruction in cue attendance. The difference between groups in their ability to make observations after treatment are large enough to be worth the time and effort to train subjects in this behavior. In addition, further study is needed to determine the effect of intensive instruction by training for relevant details.

Research Question 2 - Conclusions

The second question was as follows: Does intensive instruction in cue attendance, information search, and hypothesis generation affect the quantity and quality of information search in analyzing a problem event on

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film--near-transfer, or in a filmed patient situation--far-transfer? All subjects viewed the film "The Five Pendulums" to obtain a measure of near-transfer and viewed filmed patient Sequence C to obtain a measure of far-transfer. Subjects were instructed to ask questions that asked for known facts about what was seen on film. Both films could be viewed as often as needed to complete the task. The quantity and the quality of the questions asked by Group I was significantly better than Group II for near-transfer at the .10 level. Group I asked an average of 9.9 questions that asked for known facts while Group II asked 7.1. Specifically, the average number of questions asked by Group I to verify events (2.3) and conditions (4.3) were significantly greater when compared to Group II who asked an average of 1.15 questions to verify events and 3.05 questions to verify conditions. "The Five Pendulums" was the same film used to measure near-transfer cue attendance behavior. Of interest is the significant detail attendance for objects compared to their use in terms of questions about what was seen. Group I reported an average of 10.35 details describing objects compared to Group II who reported an average of 5.5 details describing objects in the film, a much greater level of significance ($p < .01$). But, the average number of questions asked by Group I to verify objects (3.0) as compared to Group II (2.75) was nonsignificant ($p = .08$).

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For far-transfer, Group I had higher means in all areas. The means for total questions asked and questions to verify conditions were significantly different at the .10 level. Group I asked an average of 17.6 questions compared to 11.55 questions asked by Group II (p = .02). The average number of questions asked by Group I to verify conditions was 5.25 and 2.55 for Group II (= .01). Prior to instruction, Group II had a significantly greater average number of questions to verify conditions (1.95) compared to Group I (1.00). After instruction, not only did Group I ask more questions, their information search behavior improved over Group II.

In summary, the effect of intensive instruction is supported for both near- and far-transfer effects. The information search behavior for Group I changed significantly when compared to Group II, who did not receive intensive instruction.

Research Question 3 - Conclusions

The third question was as follows: Does intensive instruction in cue attendance, information search, and hypothesis generation affect the quantity and quality of hypothesis generation in analyzing a problem event on film--near-transfer, or in a filmed patient situation--far-transfer? Subjects viewed "The Five Pendulums" to obtain a measure of near-transfer and viewed filmed patient Sequence D to obtain a measure of far-transfer. Subjects were instructed to generate

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hypotheses (explanations) about what was seen on film. The films could be viewed as many times as needed to complete the task. Near-transfer effects and far-transfer effects of intensive instruction were not statistically evident at the .10 level, although Group I had higher means for the number of acceptable hypotheses. For near-transfer effect, Group I averaged 2.0 acceptable hypotheses with an average quality of 1.78 compared to 1.6 hypotheses generated with an average quality of 1.56 for Group II. For far-transfer, Group I averaged 2.9 acceptable hypotheses with a quality of 1.77 compared to 2.5 acceptable hypotheses with a quality of 2.15 generated by Group II.

In this study, the effect of intensive instruction on hypothesis generation behavior was not stastically evident. Although all subjects in Group I met the criterion of seven acceptable hypotheses without difficulty during the intensive instruction, hypothesis generation was the last activity of the two-hour instruction session. Fatigue may have played a role in the lower scores. Perhaps this activity requires a longer session, even a session by itself, to develop improved skills in hypothesis generation. Both hypothesis generation and information search are important prerequisites to making accurate clinical judgments. The ability to search for competing explanations to explain problems is needed by nurses to avoid making judgments based on insufficient data.

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Research Question 4 - Conclusions

The fourth question was as follows: Does the level of cognitive functioning affect the results of intensive instruction in the quantity and quality of cue attendance, information search, and hypothesis generation in analyzing a problem event on film--near-transfer or in a filmed patient situation--far-transfer? Only the results for the subjects who received intensive instruction were used in the analysis. For this group, four subjects were scored at the late formal operational stage, with 10 at the early formal operational stage, three at the transitional stage, and three at the less than concrete stage. No subject in this group was scored as late concrete. Considering the small number of subjects at the various stages, there was insufficient evidence to conclude that there was any effect.

Three subjects at the transitional stage benefited most often by intensive instruction. This was especially noted for far-transfer cue attendance behavior and subsequent near- and far-transfer information search behavior. For cue attendance behavior, the three subjects at the transitional stage had the highest means for making total observations for filmed Sequence A and especially for making irrelevant observations. This same finding was noted on far-transfer. Although the mean number of total observations for the transitional subjects (27.67) compared to the three subjects at the late formal operational stage (13.25) was double, this was not statistically significant at the .10 level.

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But, on far-transfer, the mean number of relevant observations (8.0) for the transitional subjects was significant at the .10 level compared to the late formal operational subjects (5.25). Similarly, subjects at the transitional stage had higher means for information search pre-instruction and increased this ability on near- and far-transfer. With regards to hypothesis generation behavior, the three subjects at the late formal operational stage had the higher means prior to instruction and on far-transfer. Transitional subjects showed improvement in their ability to generate hypotheses after instruction.

These findings related to cue attendance, information search, and hypothesis generation behaviors are consistent with previous research (Sunal, 1988; Salomon, 1972). Late formal operational thinkers already possessed the ability to think abstractly, as in generating hypotheses. Cue attendance and information search behaviors, both easier to do and prerequisite to hypothesis generation, may have been avoided by these subjects. On the other hand, transitional subjects already possessed the more concrete abilities of cue attendance and information search. They may have preferred to think more concretely, thus benefiting more from the intensive instruction in cue attendance and information search.

Further investigation is needed in several areas. Perhaps, the Piagetian Reasoning Task did not provide an accurate assessment of the level of cognitive functioning.

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This task only measured one segment of formal thinking. The use of several tasks or the use of a series of tasks developed by Lawson (1978) may provide a better estimate of the level of cognitive functioning. The two-hour session of intensive instruction appeared adequate to develop the lower level skills of cue attendance and information search for subjects not at the formal stage. The results of a more concentrated session in hypothesis generation over a longer period of time may benefit subjects at a lower level of cognitive functioning. Instruction in generating hypotheses by using their skill in cue attendance and information search merits further investigation.

Implications for Nursing Education

Conclusions drawn from this study have implications for nursing education. Although the characteristics of this sample of experienced registered professional nurses in the study cannot be generalized to other experienced registered professional nurses nor to students enrolled in nursing programs preparing them for licensure, the use of intensive instruction in cue attendance, information search, and hypothesis generation with a nursing population has not previously been documented. These findings provide an optimistic beginning for further research with this population.

The registered professional nurses in this sample did increase their abilities in a number of important skills needed for clinical observations. The ability to make

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accurate clinical judgments is an essential nursing skill. Continued research is needed in the process of making clinical judgments and methods to modify inquiry patterns related to data collection. Incorrect judgments result from faulty data collection. The cue attendance, information search, and hypothesis generation behaviors associated with intensive instruction are components of clinical judgments. These abilities are not just limited to nursing education, but are abilities that need development across the curriculum. While the end results differ among disciplines, the means to that end are similar. This study adds to the positive evidence of the techniques of intensive instruction by showing its significant effects on a heretofore untested sample.

The findings in this study of the number of subjects in the total sample at the early (4) and full operational stage (25) of cognitive functioning merits continued assessment of the level of cognitive functioning in this population to get better understanding of the abilities of a population at the early and full operational stages. Educators need to identify those individuals at a lower level and develop and use instructional methods to move them to a higher level of thinking. This is important especially since higher thought processes are used in making clinical judgments and because higher thought processes preclude the ability to perform lower level skills such as cue attendance and information search at a consistently high rate.

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Recommendations

This study has been conducted to investigate the effects of a method to modify the inquiry pattern behaviors of registered professional nurses in data gathering for clinical judgments. It has also provided the groundwork for further research. From the results of this study, the following recommendations for research are made:

1. The use of intensive instruction in cue attendance, information search, and hypothesis generation with a nursing population needs to be continued. A research study using a sample of beginning nursing students would possibly control for the effects of nursing knowledge and experience.

2. A longer intensive instruction merits investigation, especially a more concentrated session in hypothesis generation.

3. Measurements of the level of cognitive functioning need to be continued to get a better understanding of the cognitive function of experienced registered professional nurses and beginning students.

4. A measure of the level of cognitive functioning before and after intensive instruction should be made to determine if the level of cognitive functioning changed as the result of the intensive instruction.

5. Ways of measuring the effects of intensive instruction in actual patient situations over a period of time merits consideration. The abilities of subjects in a controlled situation may differ in a real situation.

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Summary

Intensive instruction in cue attendance, information search, and hypothesis generation was found to be effective in modifying inquiry pattern behaviors related to cue attendance and information search in the statistical and practical sense. Intensive instruction was not found to be statistically effective in modifying inquiry pattern behaviors related to hypothesis generation. There was insufficient evidence to support any effect of the level of cognitive functioning and accomplishments of the subjects as the result of intensive instruction, although the three subjects at the transitional stage of cognitive functioning tended to improve in their cue attendance, information search, and hypothesis generation behaviors. Further research in the use of intensive instruction in cue attendance, information search, and hypothesis generation is recommended.

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Appendix A

1. Demographic Data
2. Details - First Session
3. Questioning - First Session
4. Hypothesis Generation - First Session
5. Details - Third Session
6. Questioning - Third Session
7. Hypothesis Generation - Third Session
8. Piagetian Reasoning Task IV Equilibrium In The Balance

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CODE NUMBER _____

Demographic Data

DIRECTIONS: Please provide the following information about yourself by circling the appropriate response and/or filling in the blank provided. If a question makes you uncomfortable to answer, you may omit the answer.

1. What is your age? (Fill in) _____

2. Sex: (Circle one)
   a. Male
   b. Female

3. Basic educational program which prepared you to take the registered nurse licensing examination. (Circle one and fill in date of graduation.)
   a. Diploma - Year _____
   b. Associate degree - Year _____
   c. Baccalaureate degree - Year _____
   d. Generic Masters degree - Year _____
   e. Generic Doctorate degree - Year _____

4. Are you currently enrolled in a degree or certificate program in nursing? (Circle one)
   a. No
   b. Yes

   If yes, specify the type of degree or certificate you are seeking and your major.

   ____

5. Are you currently enrolled in a degree or certificate program in a field other than nursing? (Circle one)
   a. No
   b. Yes

   If yes, specify the type of degree or certificate you are seeking and your major.

   ____

6. Do you have a degree or degrees in nursing beyond your basic educational preparation? (Circle one)
   a. No
   b. Yes

   If yes, list degree(s) you have, your major, and date of graduation.

   ____

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7. Do you have a degree or degrees in a field other than nursing beyond your basic educational preparation? (Circle one)
   a. No
   b. Yes

   If yes, list degree(s) you have, your major, and date of graduation.

   ____

8. Do you have advanced educational preparation to assume an expanded role in nursing, for example, clinical specialist, nurse practitioner, nurse anesthetist, or other role? (Circle one)
   a. No
   b. Yes

   If yes, list the role and indicate if you currently practice in that role.

   ____

9. Are you currently certified in a specialized area of nursing practice? (Circle one)
   a. No
   b. Yes

   If yes, specify your area and year obtained.

   ____

10. What is your preferred area of clinical practice? (Circle one)
    a. Medical-surgical
    b. Pediatrics
    c. Mental health/Psychiatry
    d. Surgery - Operating room
    e. Maternity
    f. Critical care
    g. Other (Specify) ____________________________

11. How many years have you been actively involved in nursing practice? (Fill in)

    ____

12. How many years of clinical nursing experience providing direct patient care do you have? (Fill in)

    ____

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13. Circle one of the following regarding your employment status in nursing.
    a. Employed full-time
    b. Employed part-time
    c. Previously employed but currently unemployed
    d. Never employed in nursing

    If you circled choice c, how long have you been unemployed? ____________________

    If you circled choice d, go to question #15.

14. If you are currently employed or previously employed, complete the following.

    Employing institution ____________________________

    Position you hold or held and length of time in that position ____

    Which of the following describes your major function/role in the above question? (Circle one)
    a. Clinician
    b. Management/Supervision/Administration
    c. Educator
    d. Researcher
    e. Other (Specify) ________________________________

15. Do you attend continuing education programs in nursing? (Circle one)
    a. No
    b. Yes

    If yes, specify how often and type of programs _______
    ____

16. Have you ever attended a continuing education program or had a class in nursing diagnosis? (Circle one)
    a. No
    b. Yes

17. Rate your overall data gathering skills in a patient situation by placing a check in the appropriate space on the scale.

    Very Poor |__|__|__|__|__|__|__| Excellent
    1 2 3 4 5 6 7

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CODE NUMBER _____

Details - First Session

DIRECTIONS: After seeing this film only once, record all details you observed from memory. Your response may be a short answer or narrative. Do not attempt to explain what is happening in the film.

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CODE NUMBER _____

Questioning - First Session

DIRECTIONS: After seeing this film only once, from memory write as many questions as you can about what you saw that you would like answered. State the questions so as to ask for known facts, not inferences or conclusions, and so they can be answered either "yes" or "no."

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CODE NUMBER _____

Hypothesis Generation - First Session

DIRECTIONS: After seeing this film only once, from memory write as many hypotheses (explanations) as you can to explain what you saw. Test one hypothesis by identifying additional information that you would need to support or reject your hypothesis.

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CODE NUMBER _____

Details - Third Session

DIRECTIONS: After seeing this film, record all details you observed from memory. Your response may be a short answer or narrative. Do not attempt to explain what is happening in the film. You are permitted to see the film as many times as you need.

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CODE NUMBER _____

Questioning - Third Session

DIRECTIONS: After seeing this film from memory write as many questions as you can about what you saw that you would like answered. State the questions so as to ask for known facts, not inferences or conclusions, and so they can be answered either "yes" or "no." You are permitted to see the film as many times as you need.

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CODE NUMBER _____

Hypothesis Generation - Third Session

DIRECTIONS: After seeing this film, from memory write as many hypotheses (explanations) as you can to explain what you saw. Test one hypothesis by identifying additional information that you would need to support or reject your hypothesis. You are permitted to see the film as many times as you need.

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These consist of pages:

138-140, TASK IV Science Reasoning Tasks

U·M·I

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Appendix B

1. Piagetian Reasoning Task IV Equilibrium In The Balance - Scoring and Coding
2. Classification Scheme For Information Search Questions
3. Hypothesis Quality Scale
4. Verhonick Filmed Patient Sequences

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Piagetian Reasoning Task IV Equilibrium In The Balance

Scoring and Coding

	Level	Code
TWO or more 3B items right	3B	5
FOUR or more 3A or 3B items right	3A	4
THREE 3A or higher items plus ONE or more 2B items	2B/3A	3
TWO 3A or higher items right plus TWO or more 2B items	2B/3A	3
TWO 2B or higher items right	2B	2
Less than the above	2B-	1

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Classification Scheme For Information Search Questions

	Events	Objects	Conditions	Properties
Verification	V_e	V_o	V_c	V_p
Experimentation	E_e	E_o	E_c	E_p
Necessity	N_e	N_o	N_c	N_p
Synthesis	S_e	S_o	S_c	S_p

NOTE: The capital letter indicates the type of question and the subscript indicates the type of information or data.

Note. From Developing Inquiry: Inquiry Development Program (p. 57) by J. R. Suchman, 1966a, Chicago: Science Research Associates.

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Hypothesis Quality Scale

Points given	
0	No explanation, such as, a nonsense statement, a question, an observation, a single inference about a single concrete object.
1	Non-scientific explanation, such as, "...because it's magic" or "...because the man pushed a button."
2	Partial scientific explanation, such as, incomplete reference to variables, a negative explanation or an analogy.
3	Scientific explanation relating at least two variables in general or non-specific terms.
4	Precise scientific explanation, a qualification and/or quantification of the variables.
5	Explicit statement of a test of an hypothesis...

Note. From "Teaching Hypothesis Formation" by M. E. Quinn and K. D. George, 1975, July-September, Science Education, 59(3), p. 290.

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These consist of pages:

145–146, Verhonick Filmed Patient Sequences

UMI

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Appendix C

1. Letter of Agreement with Selected College
2. Approval from the Institutional Review Board for the Protection of Human Subjects
3. Consent Forms
4. Letter to Subjects Requesting Participation
5. 3 x 5 Card

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WEST LIBERTY STATE COLLEGE

PROTECTION OF HUMAN SUBJECTS COMMITTEE

NOTICE TO THE INVESTIGATOR

Date 10/21/88

TO: Ms. Diane Tomasic

PROJECT TITLE: Effect of Intensive Instructionon Inquiry Patterns of Registered Professional Nurses in Making Clinical Judgments

SPONSORING AGENCY: West Virginia University

The Protection of Human Subjects Committee of West Liberty State College has approved the project described above. Approval is based on the descriptive material and procedures submitted for review.

This approval is limited to insuring that proper standards are met and that the procedures do not infringe upon the safety, health, and welfare of the human subjects at risk. This approval does not extend to the experimental design, the validity of the concept, nor any other technical aspects of the experiment. Such professional judgments are left to the experimenter and the project advisor.

Should any changes be made in the protocol, or if one would encounter any new risks, reactions, injuries, or deaths of persons as subjects, you **must** notify the Committee immediately.

A consent form is XX is not ___ required of each subject.

Chairman, Protection of Human Subjects Committee
West Liberty State College

rtf
31 March 1986

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The Institutional Review Board for the Protection of Human Subjects

West Virginia University

Date: 12-13-88

NOTICE OF APPROVAL FOR PROTOCOL # 11659

TO: Diane Tomasic

PROJECT TITLE: "Effect of Intensive Instruction on Inquiry Patterns of Registered Nurses in Making Clinical Judgments"

SPONSORING AGENCY: N/A

The Institutional Review Board for the Protection of Human Subjects has approved the project described above. Approval was based on the descriptive material and procedures you submitted for review. Should any changes be made in your procedures, or if you should encounter any new risks, reactions, injuries, or deaths of persons as subjects, you should notify the Board.

A consent form [XX] is required of each subject.
[ ] is not

An assent form [ ] is required of each subject.
[XX] is not

This protocol was first approved on 12-13-88.
This research will be reviewed every 6 months.

Marian J. Turner
IRB/ACUC Administrator

MJT/maa

304 293-7073 □ Glennlock Hall □ Morgantown, WV 26506

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The Institutional Review Board for
the Protection of Human Subjects
304 293-7073

Morgantown, West Virginia
26506

West Virginia
University

Date: 2-23-89

NOTICE OF APPROVAL FOR PROTOCOL # 11659
#1 Addendum

TO: Diane Tomasic

PROJECT TITLE: "Effect of Intensive Instruction on Inquiry Patterns of Registered Nurses in Making Clinical Judgments"

SPONSORING AGENCY: N/A

The Institutional Review Board for the Protection of Human Subjects has approved the project described above. Approval was based on the descriptive material and procedures you submitted for review. Should any changes be made in your procedures, or if you should encounter any new risks, reactions, injuries, or deaths of persons as subjects, you should notify the Board.

A consent form [XX] is required of each subject.
[ ] is not

An assent form [ ] is required of each subject.
[XX] is not

This protocol was first approved on 12-13-88.
This research will be reviewed every 6 months.

Marian J. Turner
IRB/ACUC Administrator

MJT/maa

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Division of Education
West Virginia University
College of Human Resources and Education

CONSENT TO ACT AS A SUBJECT IN A RESEARCH PROJECT

EFFECT OF INTENSIVE INSTRUCTION ON INQUIRY PATTERNS OF REGISTERED PROFESSIONAL NURSES IN MAKING CLINICAL JUDGMENTS

By signing my name below I am voluntarily agreeing to participate in a research study to investigate the effect of intensive instruction on inquiry patterns of registered professional nurses in making clinical judgments. This study is being conducted by Diane M. Tomasic. R.N.. M.N.. a graduate student at West Virginia University. This study is to be used for her doctoral dissertation and group results will be published as such.

I understand my duration of involvement will include attending three sessions at West Liberty State College at mine and her convenience. I will be involved in a technique useful in gathering data. completing data about myself. completing a task to determine my level of thinking. and answering questions about what I see on film. I understand that no risks are involved.

I understand that my refusal to participate involves no penalty or loss of benefits to which I am entitled or that it affects my grades. class standing or job standing. I may decide at any time during the study to drop out without notification, explanation. or penalty.

I understand that there will be no cost to me for participating in the study and that no monetary rewards will be given. If I wish the principal investigator will provide me with a letter for my files documenting my participation in this study. I understand that the benefits of this study may not necessarily affect me right now but may benefit registered professional nurses in the future.

I understand that it is not the Policy of the West Liberty State College and the Department of Health and Human Services. other Federal Agencies. State Institutions and Agencies which are funding the research project in which you are participating to compensate or provide treatment in the event the research results in injury.

I understand that any information about me obtained as a result of my participation in this research will be kept strictly confidential. I do understand that my research records, just like hospital records. may be supoenaed by court order or may be inspected by federal regulatory authorities.

I have been given the opportunity to ask questions related to my participation in this study. Should I have further questions. I may contact the principal investigator listed below.

I have been given a copy of this signed consent form.

West Virginia University
Institutional Review Board
for The Protection of Human Subjects

Particpant's signature	Principal Investigator Diane M. Tomasic, R.N..M.N.	Phone
Witness	Date	

DEC 13 19[illegible]

APPROVED

Marvin J. Turner

304 293-3441/3442 □ 602-604 Allen Hall □ P.O. Box 6122 □ Morgantown, WV 26506-6122

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Division of Education
West Virginia University
College of Human Resources and Education

West Virginia University
Institutional Review Board
for The Protection Of Human Subjects
FEB 23 1989
APPROVED

CONSENT TO ACT AS A SUBJECT IN A RESEARCH PROJECT

EFFECT OF INTENSIVE INSTRUCTION ON INQUIRY PATTERNS OF REGISTERED PROFESSIONAL NURSES IN MAKING CLINICAL JUDGMENTS

By signing my name below I am voluntarily agreeing to participate in a research study to investigate the effect of intensive instruction on inquiry patterns of registered professional nurses in making clinical judgments. This study is being conducted by Diane M. Tomasic, R.N., M.N., a graduate student at West Virginia University. This study is to be used for her doctoral dissertation and group results will be published as such.

I understand my duration of involvement will include attending three sessions at West Liberty State College at mine and her convenience. I will be involved in a technique useful in gathering data, completing data about myself, completing a task to determine my level of thinking, and answering questions about what I see on film. I understand that no risks are involved.

I understand that my refusal to participate involves no penalty or loss of benefits to which I am entitled or that it affects my grades, class standing or job standing. I may decide at any time during the study to drop out without notification, explanation, or penalty.

I understand that there will be no cost to me for participating in the study and that I will be compensated $10.00 for my time. If I wish the principal investigator will provide me with a letter for my files documenting my participation in this study. I understand that the benefits of this study may not necessarily affect me right now but may benefit registered professional nurses in the future.

I understand that it is not the Policy of the West Liberty State College and the Department of Health and Human Services, other Federal Agencies, State Institutions and Agencies which are funding the research project in which you are participating to compensate or provide treatment in the event the research results in injury.

I understand that any information about me obtained as a result of my participation in this research will be kept strictly confidential. I do understand that my research records, just like hospital records, may be supoenaed by court order or may be inspected by federal regulatory authorities.

I have been given the opportunity to ask questions related to my participation in this study. Should I have further questions, I may contact the principal investigator listed below.

I have been given a copy of this signed consent form.

Particpant's signature	Principal Investigator Diane M. Tomasic, R.N.,M.N.	Phone
Witness	Date	

304 293-3441/3442 □ 602-604 Allen Hall □ P.O. Box 6122 □ Morgantown, WV 26506-6122

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Letter to Subjects Requesting Participation

Dear________________________,

Diane M. Tomasic, R.N., M.N., a graduate student at West Virginia University, is conducting a research study for her doctoral dissertation. She is investigating the effect of intensive instruction on inquiry patterns of registered professional nurses in making clinical judgments. She has asked me to contact students currently enrolled in the Upper-Division RN Completion Program at West Liberty State College and graduates of the program to see if they would be interested in volunteering to be a participant.

This will involve coming to the West Liberty State College for three sessions totalling about 4-5 hours of your time. During these sessions, you will be involved in a technique useful in gathering data, completing data about yourself, completing a task to determine your level of thinking, and answering questions about what you see on film. It is hoped that these findings will benefit registered professional nurses in the future.

If you would like to participate, complete the enclosed card and mail it to the address on the envelope. When she receives your card, she will contact you to verify your interest in participating, answer any questions, and set up a time at your and her convenience to come to campus. The study will begin about January 10, 1989. If you want further information about the study, you may call her at this number __________ before deciding to return your card. Of course, no one must participate if he or she does not wish to do so.

Sincerely,

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3 x 5 Card

PLEASE COMPLETE THE FOLLOWING SO THAT
DIANE M. TOMASIC MAY CONTACT YOU.

NAME:
ADDRESS:

PHONE:

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Abstract

The purpose of this study is to investigate the effects of a method to modify the inquiry pattern behaviors of registered professional nurses in data gathering for clinical judgments.

Forty registered professional nurses who were either students currently enrolled in an upper-division baccalaureate RN completion program or graduates of the program participated in the study. Twenty subjects were randomly assigned to Group I and received the experimental treatment, intensive instruction in cue attendance, information search, and hypothesis generation. Twenty additional subjects were assigned to Group II and received instruction in the principles of diagnostic reasoning. Measures of demographic data, level of cognitive functioning, and pre-instruction inquiry pattern behaviors were obtained prior to instruction.

Analysis of variance were used to determine the effectiveness of intensive instruction. Significant near- and far-transfer effects for cue attendance and information search behaviors were demonstrated. Significant effects for hypothesis generation behaviors were not demonstrated. There was insufficient evidence to support any effect of the level of cognitive functioning and accomplishments of the subjects as the result of intensive instruction.

It was concluded that intensive instruction was effective for cue attendance and information search

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behaviors but not for hypothesis generation behaviors. Further research in the use of intensive instruction was recommended.

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Curriculum Vita

Name. Diane Marie Tomasic

Education

Braddock General Hospital School of Nursing	Diploma	1967
Point Park College Pittsburgh, Pennsylvania	B.S.	1971
Duquesne University Pittsburgh, Pennsylvania	M.S.Ed.	1974
University of Pittsburgh Pittsburgh, Pennsylvania	M.N.	1980
West Virginia University Morgantown, West Virginia	Candidate, Ed.D.	1988

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APPROVAL OF EXAMINING COMMITTEE

Mary Frances Borgman, Ed.D

W. Scott Bower, Ph.D.

Roy A. Moxley, Ph.D.

Curtis J. Bonk, Ph.D.

10-10-89
Date

Mary E. Haas, Ed.D., Chair

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