

**The Decision Making Processes of Student Nurses  
in Planning Nursing Care**

by

**Sharon Elizabeth Tschikota**

**A thesis presented to the University of Manitoba  
in partial fulfillment of the requirements  
for the degree of Master of Nursing.**

**Winnipeg, Manitoba**

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**SHARON ELIZABETH TSCHIKOTA**

A thesis submitted to the Faculty of Graduate Studies of  
the University of Manitoba in partial fulfillment of the requirements  
of the degree of

**MASTER OF NURSING**

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## Abstract

This descriptive study examined the decision making processes of student nurses as they formulated a plan of care for a simulated patient using the "think aloud" verbal protocol methodology, and described the students' perceptions of specific influences on their clinical decision making. The influence of locus of control orientation upon the decision making processes used, and perceived influences on clinical decision making, was investigated. The sample consisted of 19 female second year diploma nursing students. Data were collected by means of a semi-structured interview, the administration of the Rotter Internal External Locus of Control Scale, and a researcher developed simulated patient situation. Six decision making elements and eight decision making processes were identified. The subjects used similar decision making processes in the task of planning care. Internal subjects however, interacted earlier and more thoroughly with the data, engaged in more cognitive processing prior to making decisions, and demonstrated a higher use of the more cognitively complex decision making processes, than did the external subjects. Internal and external subjects demonstrated evidence of serial processing of information, a tendency to weigh all pieces of data equally, to generate some planning decisions from unvalidated hypotheses, and to set priorities from their knowledge base of context free rules that guide nursing action. Contrary to the systematic and stepwise approach of the nursing process, subjects began to interpret data prior to complete data collection, and did not verbalize established nursing diagnoses or expected outcomes prior to making planning decisions. Subjects were also found to verbalize rationale for nursing action in a vague and non-specific manner. All subjects perceived similar categories of influences upon their clinical decision making processes, but external subjects placed a much greater emphasis on the inhibitory effect of undesirable personality characteristics and teaching techniques of the teacher than did the internal subjects. The findings of this study suggest implications for nursing education in the areas of developing internalization strategies for students in basic nursing education programs, and teaching strategies to improve logic and reasoning skills in situations of ambiguity and incomplete information, which are common in nursing. The provision of learning experiences which encourage students to verbalize scientific rationale in an accurate and concise manner are also recommended.

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## CHAPTER I

### THE PROBLEM

#### Statement of the Problem

Effective clinical decision making skill in nursing is critical to the future of professional nursing practice. The nursing profession, in concert with other professions and disciplines, is becoming increasingly aware of the effect of the knowledge explosion on the education and practice of its members. It is no longer possible to attain or maintain a body of factual information alone, which is sufficient to underlie the professional practice of nursing.

It is crucial to the advancement of nursing that its practitioners be able to make appropriate clinical decisions with a high degree of accuracy, and that teaching strategies to effect such clinical decision making skills be developed (Pardue, 1987; Prescott, Dennis, & Jacox, 1987; Tanner, 1987; Corcoran, 1986b; Westfall, Tanner, Putzier & Padrick, 1986; Jenkins, 1985; Broderick & Ammentorp, 1979). Clinical decision making as defined in this study, refers to the cognitive process(es) leading up to, and including, the conceptualization of nursing problems (nursing diagnoses) and the formulation of plans for nursing intervention (patient management). This definition of clinical decision making encompasses the terms "problem solving", "clinical judgment", "clinical reasoning process", "diagnostic reasoning" and "clinical inference" as seen in the literature.

Several nursing researchers have proposed that an understanding of the processes of clinical decision making is prerequisite to the development of suitable instructional methods for teaching this skill. In a recent Delphi survey of 121 nurse educators in the United States, Tanner & Lindeman (1987) report that the development of problem solving skills was identified as the second priority topic for research in nursing education. Despite these facts, there is a paucity of research in the nursing literature on the processes of clinical decision making. Grier (1976) studied decision making in

the planning of care using decision theory to compare nurses' choices of nursing action from a given list to a mathematical model. More recently, only two major research projects have been undertaken in this most important field. Westfall et al. (1986) and Tanner, Padrick, Westfall & Putzier (1987) investigated the diagnostic reasoning strategies of nurses and nursing students in comparison to the model of diagnostic reasoning developed by Elstein and colleagues in their work with physicians and medical students. Corcoran (1986b, 1986c) studied the decision making processes of hospice nurses, specifically, exploring the relationships among task complexity and nursing expertise, and the planning processes of generating, evaluating, and choosing alternative actions.

Both of these research studies compared strategies used by novices and experts as a basis for the discussion of findings. Although researchers have espoused the view that knowledge of the decision making processes of experts is prerequisite to understanding the novice, Tanner (1986b) cautions that "a portrayal of how competent individuals make clinical judgments does not automatically translate to a definition of the thinking processes as we should teach our students nor by what methods we should teach them" (p.4). In summary, although it is recognized that "[i]n the area of processes of clinical judgment, research is needed on virtually all components from observation to patient management, ...the goal of describing the processes...as a prerequisite to instructional design has not yet been achieved (Tanner, 1987, pp. 158, 159, 169). A major purpose of this study was to describe the clinical decision making processes of student nurses as they plan nursing care.

A search of the literature to identify factors that correlate with decision making skill was not fruitful. Considerable evidence existed, however, to suggest that factors such as educational preparation, knowledge, and experience do influence the effectiveness of making clinical decisions (Baumann & Bourbonnais, 1982; del Bueno, 1983; Pardue, 1987; Davis, 1972, 1974; Frederickson & Mayer, 1977; Verhonick, Nichols,

Glor, & McCarthy, 1968; Aspinall, 1976). Baumann & Bourbonnais (1982) investigated other influences by asking critical care nurses to rank, in order of importance, the influence of knowledge, experience, stress, role modelling, and values on their clinical decision making. Knowledge and experience were perceived as the strongest influences. An open-ended inductive approach to the identification of factors perceived by medical-surgical nurses to influence clinical decision making was employed by Prescott et al. (1987), and revealed two categories of influencing factors, namely, organizational and personal. Each category contained both facilitating and inhibiting influences. To this researcher, it seemed reasonable to suspect that student nurses would perceive different influences on their decision making processes than do practising nurses. This study identifies factors which are perceived by student nurses to influence their decision making processes.

In the investigation of a phenomenon as complex as the clinical decision making processes of student nurses, an understanding of the data is enhanced by comparing identified processes to an empirically based construct from the scientific literature. One such construct which serves this function is locus of control. Locus of control refers to an individual's beliefs about the causal source of the outcomes of events in life. When an event is perceived as the result of personal characteristics, this is termed a belief in internal control. When luck, chance, fate or powerful others, or some combination of these, is perceived as the cause of events, this is termed a belief in external control. Many studies have validated a positive relationship between internal locus of control and academic achievement (Findley & Cooper, 1983). In addition, "persons with an internal locus of control appear to be more motivated and better able to extract relevant information or situational cues and use these data in effective problem solving" (Arakelian, 1980, p. 29). Presumably, then, student nurses who have an internal locus of control, moreso than students with an external locus of control, should be more persistent, and able to process information more thoroughly and/or

efficiently in decision making tasks. The construct of locus of control has been studied extensively as an explanation for the decision making behavior of persons faced with personal health crises. Locus of control has not, as yet, found wide acceptance in the nursing literature on the processes of clinical decision making. Munley (1975) found no significant relationship between locus of control and decision making in nursing situations in senior baccalaureate nursing students. Kissinger and Munjas (1981) however, did find an internal locus of control to be associated with the decision making behavior of student nurses as measured by their ability to use the nursing process. More recently Neaves (1989) demonstrated a significant relationship between internal locus of control and independent decision making in senior nursing students in both a diploma and a baccalaureate school of nursing. Since decision making is known to be a complex psychological process, and locus of control has recently been shown to mediate cognitive processes, an exploration of the influence of locus of control upon clinical decision making processes was justified.

Nursing education places high value on the goal of achieving a body of knowledge that clearly describes the processes of clinical decision making. Some of the cognitive processes used by nurses and nursing students in the diagnostic or hypothesis generation phase of clinical decision making have been described in the nursing literature. A description of the decision making processes used by student nurses in the planning of nursing care has not been well researched. It has been the writer's experience that student nurses have more difficulty with the processes involved in planning nursing care than they have with generating hypotheses about the state of the patient. Actually, this problem is neither new, nor, it appears, unique to student nurses. In a study of the ability of registered nurses to make specific clinical decisions based on the viewing of video simulations, del Bueno (1983) noted a consistent difference in subjects between recognizing a problem (hypothesis generation) and knowing what to do about it (planning of care). Corcoran (1986b) emphasized the need



for increased knowledge about decision making during planning as a basis for strategies to improve practice or education. It is apparent, therefore, that further clarification of the processes of clinical decision making, and the identification of some of the facilitating and inhibiting influences on decision making, would be extremely useful to nurse educators in devising educational approaches to assist student nurses in the development of their decision making skills concerning patient management.

This study uses a qualitative method of inquiry which provides further descriptive information about the decision making processes of student nurses as they plan nursing care. It builds upon the work of Sheila Corcoran through the use of a different sample, and a planning task that requires independent nursing decisions. An exploration of selected relationships among locus of control orientation, decision making processes, and perceived influences on the clinical decision making of student nurses provides additional descriptive information that has not previously been collected.

The specific questions addressed in this study are:

1. What decision making processes do student nurses use when planning nursing care?
2. Is there a relationship between locus of control and clinical decision making processes used by student nurses in planning nursing care?
3. What factors do student nurses perceive to be facilitative to them in their clinical decision making processes in planning nursing care?
4. Is there a relationship between locus of control and factors which student nurses perceive to be facilitative to them in clinical decision making?
5. What factors do student nurses perceive to be inhibitive to them in their clinical decision making processes in planning nursing care?
6. Is there a relationship between locus of control and factors which student nurses perceive to be inhibitive to them in clinical decision making?

Having identified the need for, and the relevance of this research project to the nursing profession, a detailed statement of the theoretical framework which guided the design of the study is now provided. The review of relevant literature which follows, serves to orient the reader to research endeavours in nursing and related fields on the cognitive processes of decision making and on the construct of locus of control.

### Theoretical Framework

The theoretical framework of this study was derived from the perspectives of two psychological theories, social learning theory, and information processing theory. The relevance of each theory to this study is presented next.

Social learning theory, developed by Julian B. Rotter in 1954, is a theory of personality which was designed to predict the behavior of human beings in complex environments. The principles of social learning theory, (also referred to by Rotter, 1982a, as assumptions), may be found in Appendix A. Social learning theory emphasizes behavior as an interaction between person and environment in a given place and time. A person's social behavior, including choice behavior, is viewed as learned and modifiable. Learning is a maturational process, highly influenced by positive and negative life experiences. Although past experience is important in explaining present behavior, complete knowledge of previous experience is unattainable. In addition, behavior is believed to be goal-directed and influenced by associations with previous goals. The four basic concepts of social learning theory are behavior potential, expectancy, reinforcement value, and the psychological situation. All four of these factors are present in clinical decision making tasks in nursing.

Locus of control is a psychological construct that arose from social learning theory and was used in this study to provide a theoretical basis from which the clinical decision making processes of student nurses, and those factors perceived to have an influence on clinical decision making, were examined. One principle that underlies

the construct of locus of control is particularly relevant to this study. It is the principle that "the occurrence of a behavior of a person is determined not only by the nature or importance of goals or reinforcements, but also by the person's anticipation or expectancy that these goals will occur" (Rotter, 1982a, p.10). Locus of control, therefore, may be defined as individuals' beliefs about whether or not a contingency relationship exists between their behavior (actions) and their reinforcements (outcomes). As a generalized expectancy in social learning theory, locus of control is a relatively stable personality characteristic developed over time and acquired through a series of many social learning experiences. It is important to this study to note that Rotter (1982b) identified internal-external control of reinforcement as one of the generalized expectancies operative in problem solving situations.

To summarize, the focus of this study was the clinical decision making processes of student nurses. The broad principles of social learning theory and its derivative construct, locus of control, provided one basis from which the clinical decision making behavior demonstrated in this study can be understood.

While social learning theory describes the parameters of the environment in which clinical decision making takes place, information processing theory describes the manner in which human beings, as information processing systems, interact with their environment to solve problems and to make decisions. Thus, the perspectives of social learning theory and information processing theory were combined to provide a sound theoretical background for this study.

The information processing theory of human problem solving was derived from the field of cognitive psychology and specifically, from the work of Newell & Simon (1972) in artificial intelligence. Three components of information processing theory form the framework of problem solving behavior; the information processing system [the problem solver], the task environment [as described by the experimenter], and the

problem space [the problem solver's subjective view of the task environment] (Simon, 1978). Problem solving behavior is an interaction between these three components.

A major assumption of information processing theory is that there are limits to the capacity of a human being to process information. Situations that require the processing of large amounts of information place a tremendous demand on the problem solver, called "cognitive strain". In order to reduce this strain and make optimal use of memory resources, people develop strategies for selective data gathering and analysis, and simplification of problems. It has been found that information processing in decision making is highly dependent upon the demands of the task (Payne, 1982), and the problem solver's success depends upon how the person represents the critical features of the task environment in the problem space (Simon, 1978). Research that utilizes information processing theory therefore, has focused on an exploration of two aspects of decision making, first, how humans adapt their limited capacity to the complex demands of the environment, and second, the extent to which the processes used by individuals to make decisions vary across tasks (Corcoran, 1986b). This study examined the actual decision making processes used in a planning task in nursing.

The four propositions or "laws of qualitative structure" for human problem solving (Simon, 1978) are found in Appendix B. Although the origin of this theory in artificial intelligence implies a procedural, mathematical approach to problem solving and decision making, a great deal of flexibility is inherent in the beliefs posited about the characteristics of the human information processing component. Information processing theory is consistent with the beliefs of social learning theory in viewing the individual as adaptive to task requirements and capable of modifying behavior substantially over time through a learning process. Information processing theory also proposes that different information processing strategies may produce functionally equivalent behaviors (Simon, 1978). In the light of the present state of

knowledge about the processes of clinical decision making, this fact renders research on alternative strategies even more relevant.

Social learning theory and information processing theory are congruent in their comprehensive view of the behavior of individuals and their recognition of the complexity of factors influencing that behavior. In this way, both theoretical points of view allow for a flexible interpretation of the clinical decision making processes of student nurses. Rotter's concept of the psychological situation is closely aligned with the idea of representation of a problem in the problem space, as described in information processing theory. In both theories, behavior is considered to be a sampling within a specific time period, and it is recognized that any sample of behavior will only provide partial information about the cognitive processes of an individual.

Clinical decision making in nursing is an example of a complex interaction of an individual with his/her perceived environment. It is recognized that the behavior of the student nurse in clinical decision making is influenced by all of the experiences, personal characteristics, and values that are brought to the decision making situation, as well as the student's subjective interpretation of that situation. It is equally recognized that not all of these variables can be either controlled or described. However, the generalized expectancy of locus of control can be measured, and its relationship to decision making behaviors can be described. Locus of control, although fairly stable, is amenable to change through exposure to new experiences. The differences in decision making processes found between the subjects with an internal and external locus of control provide some direction for the development of teaching strategies to facilitate clinical decision making in the planning of care.

In conclusion, social learning theory provides a broad philosophical basis for this investigation, and supports the fundamental tenets of information processing theory. In turn, information processing theory describes a specific approach to human

problem solving behavior that is useful in describing the processes that student nurses use in making clinical decisions in nursing situations.

### Review of the Literature

Databases used in this study include Dissertation Abstracts Online, Psychlit, Psycalert, Medline, and Nursing and Allied Health (CINAHL). The major nursing journals *Advances in Nursing Science*, *Western Journal of Nursing Research*, *Research in Nursing and Health*, *Journal of Advanced Nursing*, and *Nursing Research* were scanned by hand to ensure that important contributions in nursing were not omitted. Moral/ethical decision making in nursing, and teaching strategies designed to improve the problem solving and decision making skills of nursing students were not addressed in this study, and are therefore not considered in the review of the literature.

From a preliminary analysis of the term "decision making" it was discovered that several professions outside of nursing have demonstrated a keen interest in the phenomenon, and have contributed a considerable body of empirically based findings that provides both depth and breadth to an understanding, not only of the processes involved in making decisions, but also the factors which influence decision making behavior. Because it is the professional disciplines which appear to have contributed most heavily to the literature on decision making and locus of control, the following professions were selected as important sources of the relevant literature for this study: Medicine, Cognitive Psychology, Business Administration, Education, and Nursing. This literature review addresses the two major concepts of interest in this study, namely, decision making processes, and locus of control. Within the concept of decision making, research on the processes or strategies of decision making is outlined first, followed by a summary of research findings on the factors influencing decision making in each professional field. These two broad categories are further subdivided as described at the beginning of each section. A summary of the research on the

concept of locus of control follows the review of the literature on decision making processes.

### Clinical Decision Making In Nursing

Interest in clinical decision making in nursing began in 1966 with a series of landmark articles by Hammond and his associates. Since then, the study of clinical decision making evolved from a statistical decision theory approach, to the study of nursing diagnosis as concept attainment, to an information processing theory perspective, to a phenomenological, inductive approach, and finally, to combinations of these approaches. Although a relationship between clinical decision making in nursing and the nursing process itself has been conjectured and even criticized, such a relationship, if it occurs, has not been formally tested.

The following literature review on clinical decision making in nursing examines the nursing process as a guide to decision making, decision making processes/strategies that nurses and nursing students have been found to use, the role of decision theory in nursing, and factors that have been found to influence decision making in nursing.

#### The Nursing Process as a Clinical Decision Making Guide

The nursing process is usually described in the nursing literature as a problem solving approach to data collection, nursing diagnosis, and the planning, implementation and evaluation of patient care. Marked by its official acceptance in 1967, it was eagerly accepted by a profession in search of a means of describing the scope of nursing function, in order to legitimize nursing practice in the interdisciplinary health care team. Since then, the nursing process has been acclaimed as the decision making tool of nursing practice. Every nursing school now teaches it, but its effectiveness as a decision making guide has not been well

researched. Popular nursing literature abounds with articles on the use of the nursing process in a variety of clinical and educational settings, but as Justus (1986) points out, there is little research to be found on teaching the nursing process, or its relationship to the decision making process. Justus discovered that virtually all 119 Associate Degree schools she surveyed in the United States taught nursing process, primarily by means of the lecture method, and evaluated it through written care plans, with the expectation of a written rationale for actions proposed. This pattern can be found in most diploma, community college, and even baccalaureate programs in the United States and Canada. Not all students, however, experience success in implementing what they have learned in the classroom about nursing process to the clinical setting. Frederickson & Mayer (1977) studied the problem solving behavior of baccalaureate degree and associate degree nursing students and discovered that both groups of students used the steps of problem solving defined as closely resembling the steps of nursing process, in random order. In addition, they did not appear to consider each step consciously, but approached the situation more in accord with their individual cognitive style. The step least frequently used by all students was that of evaluation. In a study of the problem solving ability of baccalaureate nursing students in relation to the assessment phase of nursing process, Villafuerte (1986) discovered that students provided with a structured assessment guide identified a greater percentage of relevant cues and generated a greater percentage of accurate nursing diagnoses in a simulated client care situation than other students did, who were not provided with the assessment guide. The author's concern about the low level of understanding among senior baccalaureate nursing students of the assessment phase of the nursing process, prompted her to advocate a more integrated approach to the teaching of nursing process as a problem solving process in the curriculum.

The stimulus for this study, arose in fact, from the writer's realization of the frustration experienced by student nurses as they attempted to grapple with the



apparently linear and cumbersome nature of the nursing process, when using it as a decision making tool for the design of nursing care plans. Accompanying the writer's frustration in guiding the efforts of the students, was the slowly growing conviction that the nursing process is by itself, inadequate as a model to enable students to develop their thought patterns during the process of making clinical nursing decisions.

Criticism of the nursing process began to appear in the nursing literature in 1980, and has ranged from descriptive attempts to support it as a decision making tool (McCarthy, 1981) to a questioning of its narrow scope and the apparent authoritarianism it accords to nurses (Henderson, 1982). Some authors (Gerrity, 1987; Benner, 1984; Donnelly, 1987; Young, 1987) perceive the nursing process as a linear mode of thought that is "far too limiting and rigid for use as the sole framework of practice for an evolving clinical profession" (McHugh, 1986, p.27). Four recent studies (Tanner, 1982; Westfall, Tanner, Putzier, & Padrick, 1986; Putzier, Padrick, Westfall, & Tanner, 1985; Corcoran, 1986b) suggest that neither students nor practising nurses use the linear sequence of thought described by the nursing process to analyze patient situations. As a leading researcher in the field of clinical decision making in nursing, C.A. Tanner (1986a) succinctly notes, "there is accumulating evidence in the research literature and criticism in the opinion literature that the underlying nursing process may not reflect the complexity of thinking needed for clinical judgment" (p.9), and Westfall et al. (1986) add, "although the nursing process has been used as a framework for instruction in clinical decision-making for nearly two decades, little is known about the actual thinking processes used in making patient care decisions" (p.269). Thus, it appears that the nursing process, alone, functions less than adequately as a model for the study of the thought processes involved in making clinical decisions in nursing. Clearly, processes and strategies beyond those addressed in the nursing process are operational while student nurses make clinical decisions. The literature which addresses such processes and strategies is considered next.

### Processes/Strategies of Clinical Decision Making in Nursing

Most of the literature on clinical decision making in nursing has focused on the cognitive processes that take place from the initial exposure to a patient situation, up to, and including the formulation of diagnostic hypotheses. A smaller number of studies (Baumann & Bourbonnais, 1982; Corcoran, 1983) have emphasized the generating, choosing and evaluating of nursing interventions. Because most of the nursing research relevant to this study was conducted in the framework of information processing theory, those studies are considered first, followed by an examination of inductively based studies. Research based on decision theory is then considered separately, followed by a consideration of the correlates of, and factors influencing clinical decision making in nursing.

The diagnostic reasoning strategies of practising nurses and senior and junior baccalaureate nursing students are described in a series of three articles which detail different aspects of one large research project (Tanner et al., 1987; Westfall et al., 1986; Putzier et al., 1985). This comprehensive study was designed to examine the thought processes nurses use in deriving nursing diagnoses, because, until that time, few studies had been conducted in this realm (Putzier et al., 1985). It was thought that an understanding of these processes would assist nurse educators to teach the processes of clinical decision making (Westfall et al., 1986). The diagnostic reasoning strategies of nurses (experts) and nursing students (novices) were compared to the model of diagnostic reasoning developed by Elstein and associates in their study of physicians and medical students (Elstein, Kagan, Shulman, Jason, & Loupe, 1972; Elstein, Shulman, & Sprafka, 1978). The strategy most frequently identified in all studies of diagnostic reasoning is early hypothesis generation. All three groups of nurses and nursing students in this study were found to activate diagnostic hypotheses early in the reasoning process and to use the strategies of hypothesis-driven and cue-based data acquisition more frequently than other systematic approaches, such as a review of

systems, or a random non-systematic approach (Tanner et al., 1987). Formulae and scoring procedures were developed to describe five aspects of the inference activation process, i.e., comprehensiveness, efficiency, proficiency, complexity and earliness of activation. Although registered nurses tended to score higher than nursing students on all measures, only one measure demonstrated a statistically significant difference. The more experienced nurses activated a larger number of more cognitively complex hypotheses than did the students (Westfall et al., 1986). In addition, registered nurses activated a significantly greater number of accurate diagnoses than students (Tanner et al., 1987). Thus, nurses and nursing students were found to activate hypotheses early in the situation and to use systematic information gathering to rule in or rule out the hypothesis, as do physicians and medical students.

In one aspect of the study, responses to three patient situations which differed in task complexity were analyzed. The number of hypotheses activated, earliness of activation, and accuracy of diagnosis were found to be task-specific variables, whereas data acquisition strategies were more generalizable across tasks, leading the authors to tentatively suggest that data acquisition strategies may be more related to the subjects' characteristic approach to reasoning than to the content of the task (Tanner et al., 1987). Expertise (knowledge and experience) was positively correlated with an ability to generate more accurate, complex hypotheses, but no correlation was found between expertise and the number of hypotheses activated, nor comprehensiveness, efficiency, proficiency, or earliness of hypothesis activation (Westfall et al., 1986). In a recent pilot study of the cognitive processes used by registered nurses in the practice setting, Farrell and Tamblyn (1987) identified that an hypothesis and test approach similar to that suggested by research on the clinical reasoning of physicians, occurred frequently in their data. Within this reasoning process, three alternative approaches became evident: the intuitive, that is, a knowing without the conscious use of reasoning; the scientific, in which the underlying scientific facts and principles are

articulated; and the routine, based on experience or habit, in which a semi-automatic response is evoked without much conscious thought.

The relationships among task complexity, nursing expertise, and the decision making processes of generating, evaluating, and choosing alternative nursing actions in developing plans to control patients' pain were studied by Corcoran (1983, 1986b, 1986c), with a sample of novice and expert hospice nurses. The major finding regarding decision strategies was that all subjects made intermediate decisions about alternatives (evaluated alternatives) as they were generated, rather than following the generation of all alternatives. This may be interpreted to represent a serial processing of data that is consistent with information processing theory. There was a trend for the overall approach to the planning process to vary as a function of case difficulty, i.e., an opportunistic overall approach was used in cases of greater complexity and a systematic overall approach was used for the least difficult case. In addition, a significant number of subjects evaluated a portion, rather than all alternatives generated. Evaluation of all the alternatives was negatively correlated with both the number of alternatives generated, and the difficulty of the case for decision making.

Findings regarding the influence of nursing expertise (novice-expert differences) on the decision making process are of particular interest, because the student nurses in this study are in the novice category. Experts used broad initial approaches to planning more often than did novices. No relationship existed, however, between initial approaches and task complexity. Novices used opportunistic overall approaches across all cases. In contrast, experts used opportunistic overall approaches in the more complex cases, and systematic overall approaches in the least complex case, thus varying their strategy according to task complexity. There was also no significant relationship between overall approaches and the quality of final plans. Novices developed better plans for the least complex case than they did for the more complex

cases, and experts tended to develop better final plans than novices did in the most difficult case.

Experts demonstrated greater knowledge of sources, types, and treatments of pain than did novices. They generated significantly more drug alternatives in all cases than did novices, described alternatives in greater detail, and stated intermediate decisions in more definite terms, with more rationale than did novices. The overall quality of the plans, however, did not differ significantly on the basis of nursing expertise. In those plans that were considered incomplete or erroneous, the sources of difficulty for novices were lack of knowledge and oversimplification of the planning problem. Immediately upon reading the case description, novices focused on a single problem for decision making, and treated each problem as a separate piece of information. Difficulties demonstrated by experts included dismissing a problem, or first recognizing, and then forgetting about a problem. A possible reason suggested for this forgetfulness was that the experts may have generated a number of alternative courses of action that were beyond the limits of short term memory (Corcoran, 1983).

Muzio (1985) conducted a detailed analysis of the verbal protocols of senior baccalaureate nursing students in order to identify and describe their reasoning processes while responding to a simulated clinical decision making situation. Muzio identified six reasoning process elements, and eight reasoning strategy components. From a factor analysis of the relationships between these reasoning process elements and reasoning strategy components, four major reasoning strategies and three minor strategies emerged. These reasoning strategies were named complex decision-focused reasoning, non-decision-focused internal structuring, internal support for decisions, information search, protraction of decision making, decision-chaining and extrinsic decision-support. In addition, four patterns of reasoning strategy utilization were derived. These patterns were identified as balanced reasoning, limited information

search, limited non-decision structuring, and a combination of limited non-decision structuring and limited use of factual information in decisions (Muzio, 1985).

Gordon (1980) studied master of science candidates in nursing in an attempt to identify the information seeking strategies which nurses use to select or eliminate hypotheses in the process of identifying surgical complications. Gordon's interest was in the use of predictive hypothesis testing, that is, the testing of more than one hypothesis through the use of nonvarying historical or current characteristics of the person or situation. Nurses who decreased their use of predictive hypothesis testing in the second half of the diagnostic task were more accurate in their diagnoses than were nurses who continued predictive hypothesis testing in the second half of the task. It was concluded that unlimited information conditions were associated with greater diagnostic inaccuracy. If this is true, it may indicate that a continuous search for validating information may be a subconscious strategy to avoid making a decision.

Broderick & Ammentorp (1979) studied novice associate degree nursing students and expert associate degree nurses' initial organization of information in solving a simulated patient problem of unspecified pain. Fifty-nine relevant data elements and twelve categories of information were derived from a pilot study. These categories were accepted as accurate representations of the underlying information structures in the minds of the subjects. In the experimental phase of the study, subjects' requests for data about the client were analyzed for the number of data elements sought and the relationship of these elements to the twelve categories of information. Experts and novices accessed categories of information in a similar order, but differed in the frequency of use of information. Experts were found to ask more questions in total, and for more information in all categories. They also asked for more information that was not available in the situation. Thus it was suggested that experts had more insight into what information might be applicable and what further information might be available. Experts placed greater emphasis than novices did on data about the

immediate status of the client's physiological state. The ways experts emphasized information and sampled many categories in the problem solving process would seem to be corroborated later by Corcoran's findings that experts used opportunistic overall approaches in the more complex patient situations when developing a drug administration plan for patients in pain (1983).

Matthews & Gaul (1979) examined the cognitive processes used by senior baccalaureate nursing students and graduate nursing students in deriving nursing diagnoses from case studies. None of the subjects used all available cues in determining the diagnoses, but the use of discriminating cues by each group suggested two different information processing strategies. Graduate students used negatively confirming information (cues indicating a healthy state of the patient) to derive diagnoses, whereas undergraduate students used cues indicative of a health problem. It was postulated that the difference in strategy related to the informational value of the cue to the subject rather than the number of cues utilized. The variable of nursing experience was not accounted for in this study, and therefore, no attempt was made to correlate experience with the information processing strategy used. In a more recent study that compared the clinical judgment process of experienced registered nurses with that of student nurses, Itano (1989) found that the student nurses collected fewer cues from an interview with a hospitalized patient than did the experienced nurses. The order of use of cue type for novices and experts was the same. Itano suggests that what may differ between novices and experts is how the cue is used in the judgment making process, although this was not elaborated upon.

Baumann & Bourbonnais (1982) used a semi-structured interview to study the decision making processes of critical care nurses in a case study concerning a patient with an acute myocardial infarction. The findings indicated that critical care nurses made decisions based on the problems presented, and not on medical diagnoses or a complete data base. Although the nurses varied in the prioritization of their nursing

action decisions, all nurses made the same six decisions within the specified time frame of one minute. This suggests that some flexibility needs to be allowed for individual differences in the ordering of decisions, as long as the time frame is compatible with the requirements of the patient situation.

Field (1983), who equates the nursing process to problem solving, and sees problem solving as a component of clinical decision making, found that nurses frequently collected data but failed to examine the relationships, so that often, they made poor judgments or did not arrive at appropriate conclusions.

There is a small, but growing nucleus of nurse theorists and researchers who are beginning to raise the issue of intuition as a legitimate part of the decision making process in nursing. Field (1987) believes that all factors influencing a nurse's response to a problem situation are part of the context of decision making. Donnelly (1987) states that intuition is becoming valued as a rational thinking process, and Gerrity (1987) believes that nursing is currently undergoing a synthesis of the linear and intuitive modes. Benner (1984) believes that intuition is a major determinant of the expert nurse's performance. Benner and Wrubel (1982) state that "some skilled practices, such as those involved in qualitative perceptual appraisals and global assessments, cannot be reduced to objective measurements or to context-free judgments" (p.17). In a later article, Benner and Tanner (1987) identified six key aspects of intuitive judgment; pattern recognition, similarity recognition, commonsense understanding, skilled know-how, a sense of salience, and deliberative rationality. Pyles and Stern (1983) used grounded theory methodology via in-depth interviews to collect qualitative data regarding the cognitive processes used by critical care nurses in detecting and preventing cardiogenic shock in patients with acute myocardial infarction. The process used by the nurses as a basis for their decisions was labelled Nursing Gestalt by the authors, a process that is conceptually very similar to Benner's beliefs. In Nursing Gestalt, nurses combine knowledge, past experience,



presenting patient cues and sensory clues ("gut feelings") into the strategies of categorization and differentiation to arrive at diagnoses. Nursing Gestalt is thus, both a conceptual and sensory process, a blending of knowledge, experience, skill and intuition. The authors emphasized the ability of role models to teach this process to neophyte nurses through a close preceptor-type relationship. Young (1987) tentatively states that "nursing process is a multidimensional activity that may include intuitive data and decisions that are grounded in subjectivity" (p. 52). Her belief that intuition is part of nursing practice stems from research into the phenomenon of clinical intuition via the grounded theory methodology. Her work resulted in a description of a functional and personal dimension of clinical intuition. Apart from the use of Benner's levels of competence, especially novice as compared to expert, other researchers have not yet begun to include intuition in a deliberate manner in their studies of clinical decision making. It is interesting to note, however, that intuition continues to emerge from time to time in qualitative studies of the cognitive processes of nurses, the most recent being in Farrell and Tamblyn's pilot study (1987).

### Summary

Several important facts have been learned about the cue acquisition or information seeking strategies of nurses in the diagnostic reasoning process. Both nurses and nursing students tend primarily to use hypothesis driven and cue based data acquisition strategies (Tanner et al., 1987). Experienced nurses however, tend to collect more cues than student nurses (Itano, 1989). The informational value of the cue, rather than the number of cues available, tends to affect the choice of nursing diagnosis (Matthews & Gaul, 1979). Novices tend not to recognize the probabilistic relationship between cues and states of health, and therefore believe that the mere presence of a cue indicates a 100% chance of a particular state of health (Itano, 1989). Finally,

unlimited access to information has been associated with diagnostic inaccuracy (Gordon, 1980).

Early hypothesis activation was found to be characteristic of nurses and nursing students (Tanner et al., 1987; Itano, 1989) as it is in the diagnostic reasoning of physicians and medical students. Continued hypothesis generation carried on into the latter half of the reasoning process, however, tends to lead to inaccuracies in nursing diagnoses (Gordon, 1980).

Muzio (1985) demonstrated that reasoning strategies and their patterns of use can be reliably identified from the verbal protocols of student nurses responding to a simulated clinical decision making situation.

In the planning of nursing interventions, Corcoran (1983) found that alternative nursing actions were evaluated selectively, and as they were generated by graduate nurses. Baumann and Bourbonnais (1982) found that prioritizing of nursing actions by critical care nurses was not as crucial as the time frame within which all appropriate actions were taken.

Reasoning strategies used to generate nursing diagnoses and nursing interventions seem to be related to task characteristics. Tanner et al. (1987) concluded that the number of hypotheses activated, earliness of activation, and accuracy of diagnosis are task-specific variables. Corcoran (1983) found that the overall approach to planning varied with task complexity, and that evaluation of nursing action alternatives varied with the number of alternatives generated, and with task complexity. Important task variables that affect clinical decision making are the type and amount of information available, and the difficulty of the decision making task. Having reviewed the nursing literature on clinical decision making that was based on the information processing and inductive approaches, consideration will now be given to the decision theory approach to the study of clinical decision making.

### Decision Theory and Clinical Decision Making in Nursing

Decision theory seeks to describe or prescribe how decisions should be made, by means of mathematical or statistical models. Subjects are presented with a case study and are asked to assign subjective numerical probabilities to elements of the case and to the value of each element. These subjectively assigned values are applied to the mathematical model to prescribe what the judgment should be, and the prescriptions are then compared to judgments actually made. Three types of decision theory have been used in studies of clinical decision making in nursing.

Hammond (1964) and Kelly (1964) discuss the application of Brunswik's lens model to the study of clinical inference in nursing. Retrospectively, the model appears to have been used as much for a conceptual framework, as for a methodology. Findings of these initial attempts to study clinical decision making in nursing revealed that there was no significant relationship between a single cue and a nursing action (Kelly, 1964; Hammond, Kelly, Schneider, Vancini, 1966b), nor between various configurations of cue groupings and inferences made (Hammond et al., 1966b; Kelly, 1964). In addition, nurses did not discriminate between the usefulness of various cues, nor vary their confidence in their decisions over cases (Hammond et al., 1966b). An analysis comparing nursing action decisions of nurses in clinical practice and nurses in a simulated patient situation revealed a lack of agreement between the groups as to the actions to take (Bailey, 1967). In this particular study, the actions of the nurse in practice were assumed to be the optimal actions.

Hammond and associates used Bayes' Theorem to evaluate the manner in which nurses revised their probability estimates about the state of the patient in the light of new information. Nurses were self-consistent in their intuitive manipulation of probabilities and tended to revise judgments in the direction dictated by the mathematical model. The nurses, however, tended to revise their judgments more cautiously than Bayes' Theorem prescribed. The authors stated that the model did not

adequately represent the nurses' cognitive tasks, as it was designed to deal with two mutually exclusive alternatives, and assumed that each piece of information was independent of every other piece. This does not reflect the nurses' situation with respect to data received from, or about the patient (Hammond et al., 1967).

In assessing their value, the historical context of these landmark investigations must be borne in mind, as they were undertaken prior to the development and sophistication of the nursing process and nursing diagnosis concepts that permeate contemporary nursing education and practice.

Grier (1976) and Corcoran (1983, 1986c) used the concepts of utility theory in the study of clinical decision making of nurses in different ways. Utility theory describes the selection of an action or set of actions based on a subjective assignment of value to probable outcomes of those actions, prescribing the choice that maximizes expected utility or value. Grier asked nurses to assign probabilities for the occurrence of patient care outcomes, given a specific nursing action, and to assign values to those outcomes. These values were then compared to the nurses' intuitive ranking of importance of the nursing actions. Actions ranked first by nurses were consistent with the values and probabilities they assigned to the outcomes in 58.9% of cases. Grier concluded that decision theory can improve nurses' decision making skills. Tanner (1986) criticized Grier's conclusions in that, similar to Hammond et al. (1967), the outcomes and actions were specified and limited, and decisions were not evaluated in terms of actual patient outcomes. In her study, Corcoran (1983) developed decision flow diagrams or decision trees with numerical probabilities to prescribe the correct choices for each of the case studies used. These decision trees were used as a standard against which the final choices of the subjects were compared. In this instance, the researcher and not the subjects overtly assigned subjective probabilities to actions and expected outcomes. Only seven of the thirty final plans submitted by the subjects matched the prescriptions of decision analysis. In addition, most of the plans that matched the

decision analysis were developed by experts in the case study that involved the least complex choices.

In summary, it would appear that the effective use of decision theory in nursing research on clinical decision making must await further developments in nursing science. Unlike medicine, few resources in nursing are able to provide objective probability estimates of the occurrence of nursing diagnoses and patient outcomes, given certain cues and actions. Although subjective probability in decision theory is accepted as following the same laws as objective probability, the accuracy of subjective probability estimates depends, to a great extent, on the richness and depth of a nurse's knowledge and experience. The student nurse's general lack of knowledge and experience constitutes a major reason for rejecting a decision theory approach to the study of student nurses' clinical decision making processes. Two other facts that limit the usefulness of decision theory for studying decision making in nursing are that decision theory is known to be most effective when decision conditions are controlled, and the decision alternatives are mutually exclusive. This is seldom the case in nursing. Since this study describes the thoughts that student nurses have when planning nursing interventions, it was important to the study design that their thinking be as unrestricted as possible. Consequently, a more descriptive methodology was used, which more richly describes the decision making process.

#### Factors Influencing Clinical Decision Making in Nursing

Some of the factors that have been studied as correlates of, or factors influencing clinical decision making in nursing include experience, education/knowledge, values, role modelling, stress, learning style, nursing related work experience, critical thinking ability, field dependence/field independence, and causal inference ability. Information regarding these variables has been obtained through interview, standardized tests, and existing demographic data. The Watson-Glaser Critical Thinking

Appraisal (WGCTA), which is purported to measure general problem solving ability, has been tested both as a defining characteristic of clinical decision making, and as a factor related to other measures of clinical decision making skill. Other tests that have been examined in relation to performance in clinical decision making include the Graduate Record Examination, Miller Analogies Test, Jungian personality type, Kolb's Learning Style Inventory, the Group Embedded Figures Test, and a test of causal inference.

One of the purposes of this study was to identify the perceptions that student nurses have, of factors influencing their clinical decision making. Only two studies have examined the perceptions of nurses regarding these influences. However, many attempts have been made to identify influences in a more objective manner. This portion of the literature review is organized into four sections; the nurses' perceptions of factors influencing clinical decision making, the relationship between clinical decision making and critical thinking ability, the relationship between clinical decision making and experience, knowledge, and educational level, and miscellaneous influences. This review is undertaken to summarize the established findings about influences on clinical decision making skill. This information, combined with the literature on locus of control, provides a background against which the perceptions of the student nurses who participated in this study are viewed.

#### Nurses' Perceptions of Factors Influencing Clinical Decision Making

Baumann and Bourbonnais (1982) asked their subjects to rank the various factors that influenced their decision making in a cardiac case study from a given list of five factors derived from the literature. The factors investigated were knowledge, experience, stress, role modelling, values, and combinations of these factors.

Knowledge and experience were cited by nurses as the two most influential factors.

Prescott et al. (1987) examined graduate nurses' perceptions of factors influencing clinical decision making through in-depth interviews and derived two categories of

influences, organizational and personal. Positive organizational influences on clinical decision making were the use of primary nursing, working in small units, and in ICU or specialty units. Negative influences were team or functional nursing delivery of care, working on general duty units, inadequate staffing and a large number of non-nursing responsibilities. Positive personal influences were the nurse's level of education, assertiveness and tact, and the physician's trust in the nurse. A negative influence was the devaluation of nurse decision making by physicians.

#### The Relationship Between Clinical Decision Making and Critical Thinking Ability

Tanner, in her study of nursing students (1977), found no relationship between the Watson-Glaser Critical Thinking Appraisal (WGCTA) and any of the measures of clinical judgment used in the study.

Frederickson and Mayer (1977) discovered that baccalaureate nursing students scored significantly higher than associate degree students on the WGCTA. This aptitude, however, did not appear to be used in clinical decision making, as baccalaureate students did not differ significantly from associate degree students in problem solving skills.

Matthews and Gaul (1979) found a significant difference between educational level and diagnostic ability, with graduate students identifying more diagnoses than undergraduate students. There was no difference however, between educational level and scores on the WGCTA.

Scoloveno (1981) found that baccalaureate nursing students obtained significantly higher scores on the Revised Nursing Process Utilization Inventory and the WGCTA than did associate degree or hospital-based nursing students. The author concluded that the findings of the study documented the belief that higher education contributes to the problem solving and critical thinking abilities of students.

Gunning (1981) investigated the relationship between field independence/dependence (Group Embedded Figures Test), critical thinking ability (WGCTA), and clinical problem solving (Nursing Performance Simulation Instrument) of senior baccalaureate nursing students. Data indicated a significant relationship between field independence and clinical problem solving ability and between field independence and critical thinking ability, but a non-significant relationship between critical thinking ability and clinical problem solving ability. This study provided some evidence that a student's cognitive style may be related to clinical performance.

In a study of the relationship between decision making skills and critical thinking ability, Pardue (1987) did find a significant difference in critical thinking ability as measured by the WGCTA among associate degree, diploma, baccalaureate, and masters' prepared nurses. In addition, baccalaureate and masters' degree nurses had significantly higher critical thinking scores than associate degree or diploma nurses. There was no significant difference in self-reported frequency of making decisions or self-reported difficulty in making decisions among the four groups. Pardue asked her subjects to rank the same five factors deemed to influence clinical decision making that were used by Baumann and Bourbonnais (1982) and received similar results. Experience and knowledge were ranked as the two most important influencing factors with experience being ranked over knowledge as the most important factor. This ranking is the reverse of that in Baumann and Bourbonnais's study. There were no significant differences among the four groups in perceived factors which influenced decision making.

In a study of nurse practitioners, there was no significant relationship between performance in clinical judgment and the scores on the WGCTA (Holzemer & McLaughlin, 1988).



### The Relationship Between Clinical Decision Making and Experience, Knowledge, and Educational Level

Del Bueno (1983) found a positive correlation between experience, educational preparation, and correctness of decisions in a sample of diploma, associate degree, and baccalaureate degree graduates.

Westfall et al. (1986) documented a relationship between the ability to generate complex hypotheses and level of experience, with registered nurses performing better than students. In the same sample of nurses, Tanner et al. (1987) report a positive relationship between diagnostic accuracy and experience. This appears to be related, not only to the experienced nurse's ability to process cues more efficiently, but also the development of a complex network of knowledge in long term memory. Corcoran (1983, 1986a) found that expert nurses developed better nursing action plans in complex decision making situations, and demonstrated greater knowledge than novice nurses.

### Miscellaneous Influences

Koehne-Kaplan and Tilden (1976) found no significant relationship between Jungian personality type and clinical judgment skills.

Gordon (1980) found no relationship between scores in diagnostic ability of graduate students and scores on the Graduate Record Examination or the Miller Analogies Test.

DeBack (1981) found no relationship between senior nursing students' ability to formulate nursing diagnoses and the type of curriculum model.

Jenkins (1983) developed a Clinical Decision Making in Nursing Scale (CDMNS) to test the hypothesis that differences existed among junior, sophomore, and senior students in one baccalaureate nursing program, in students' decision making scores as they progressed through the program. One significant difference between junior and

senior students was found on one subscale, Search for Alternatives or Options. Neither age nor fulltime work experience had any effect on scores. Results indicated that students perceived themselves similarly as clinical decision makers at each academic level.

McCormick (1986) discovered that a match in learning style, according to Kolb's Learning Style Inventory, between nurse educators and nursing students does not affect the student nurse's problem solving ability, as measured by Gover's Nursing Performance Simulation Instrument.

From the descriptions of differences between novice and expert clinical performance, has come the suggestion that by witnessing the clinical practice of experts, novices may begin to gain knowledge in solving practice problems (Benner & Wrubel, 1982). Dagrosa and Wood (1986) investigated the effect of a summer work study program under the guidance of an expert nurse on the problem solving skills of baccalaureate nursing students. Problem solving was measured by pre and post experience scores on the WGCTA, and a content analysis of comments related to problem solving in the students' clinical evaluations at the end of the first semester following the summer work experience. No significant differences were found between the experimental and control groups in post test scores on the WGCTA or in the number of positive comments related to problem solving on students' evaluations.

Farrell and Tamblyn (1987) derived a list of eight environmental factors that appear to affect how nurses think about their nursing care. These factors were the quality of the change of shift report(s), disruptions from other health professionals, how other nurses organize their time, the functioning of medical devices, doctors' abilities to make decisions, peer courtesy expectations, the presence of uncommon disease conditions or procedures, and the degree of mental alertness of patients.

Joseph, Matrone, and Osborne (1988) found that a nurse's attitudes about decision making, i.e. whether or not the nurse believes that decision making is an important

aspect of nursing practice, is reflected in actual decision making practices. The influence of locus of control upon the use of decision making processes as described in this study provides a possible basis for the development of such attitudes.

### Summary

Despite innovative attempts to discover variables that are consistently related to skill in clinical decision making in nursing, the only two influences that have been established as valid associations are experience and knowledge or educational level. This trend is apparent, not only between graduate nurses and students, but also among the various levels of student nurses, i.e. junior, sophomore and senior baccalaureate students, and baccalaureate students as compared to associate degree students or diploma students. Attempts to relate the WGCTA to other measures of clinical decision making have been disappointing, although the test has been positively related to education in a sample of graduate nurses (Pardue, 1987) and to field independence in senior baccalaureate nursing students (Gunning, 1981). The majority of investigations into the correlates of clinical decision making have been approached from an objective stance. This study extends the inductive approach used by Baumann & Bourbonnais (1982) and Prescott et al. (1987) to a sample of nursing students.

Since medicine and nursing are closely related professional fields, it is not surprising that clinical decision making in medical practice, particularly the aspect of diagnostic reasoning, has been studied extensively. A review of this literature is presented next.

### Clinical Decision Making in Medicine

#### Processes/Strategies of Decision Making

From the seminal work of Elstein, Shulman and Sprafka (1978), a large body of research on the clinical decision making processes of physicians and medical students,

using the information processing paradigm has been undertaken, and continues to the present time.

From their studies of physicians, Elstein et al. developed a four stage model of diagnostic reasoning which includes: (a) attending to initially available cues (e.g. signs and symptoms), (b) activating hypotheses that may explain the initial cues presented, (c) gathering data to rule in or rule out hypotheses, and (d) evaluating hypotheses, weighing the likelihood of each in light of each new cue until a diagnosis is accepted (Elstein, Shulman & Sprafka, 1978). In this literature, the model is frequently referred to as the hypothetico-deductive method.

Two important discoveries were made in these initial studies about the processing strategies of physicians. The first finding was the consistency across subjects in the use of the strategy of early hypothesis generation and data gathering to test diagnostic hypotheses. Early hypothesis generation has been corroborated in further studies of physicians and medical students (Barrows & Bennett, 1972; Barrows & Tamblyn, 1980; Beck & Bergman 1986 ; Benbassat & Bachar-Basson 1984; Kassirer & Gorry, 1978; Neufeld, Norman, Feightner, & Barrows, 1981; Norman, Tugwell, Feightner, Muzzin, & Jacoby, 1985). Early hypothesis generation has been interpreted from the perspective of information processing theory as a "chunking" mechanism which conserves space in short term memory by clustering clinical data into familiar diagnostic patterns (Elstein et al., 1978).

The second most important finding of Elstein and associates was the task specific nature of reasoning strategies, that is, that performance was not generalizable across problems. As a growing body of research failed to find consistency in performance across problems (Berner, 1984), researchers began to discover that data gathering skills transcended problem types, whereas management skills were task specific (Harasym, Baumber, Bryant, Fundytus, Preshaw, Watanabe & Wyse, 1980). Some suggestions have been offered to explain the occurrence of task specificity documented

in the literature. It is hypothesized that, because diagnostic reasoning studies have been conducted with small samples, and a small number of simulated situations, it is difficult to identify general strategies that diagnosticians may use across cases. In addition, a high degree of interaction between an individual's task-relevant knowledge, experience, and the content of the diagnostic task is assumed. Reasoning strategies may, however, be similar for expert physicians dealing with one specific problem. Kuipers, Moskowitz and Kassirer (1988) performed a protocol analysis experiment in which three expert physicians were asked to make important clinical decisions under circumstances of risk and uncertainty. The three subjects were found to share a common sequence of operations in the formulation of the decision, that did not match the prescription of decision analysis. The authors concluded that the cognitive methods for formulating a decision appeared to be incremental, breaking the overall decision into manageable pieces, which is an approach better suited to the cognitive resources of human decision makers than the decision analysis approach.

Gale and Marsden (1982) undertook to study the initial period of contact with a problem situation, i.e. prior to the generation of the first diagnostic hypothesis. A sample of final year medical students, pre-registration house officers, and post-MRCP registrars with a mean of 5.2 years of clinical practice experience was used. Although no description of the thinking processes of subjects could be drawn from this study, the major contribution was the confirmation that problem solvers do, indeed, make active interpretive, or evaluative responses to clinical information as soon as it is encountered. In terms of information processing theory, this study provides some evidence that a process is being used by the decision maker to develop a representation of the problem in the individual's problem space. Contrary to the findings of Hammond et al. (1967), Gale and Marsden's subjects were able to extrapolate from a single piece of data to form an interpretation.

Various data gathering techniques have been described in the medical literature, including hypothesis testing (Elstein et al., 1978), confirmation, elimination, discrimination and exploration strategies (Kassirer & Gorry, 1978), and a review of systems approach (Barrows & Bennett, 1972). Elstein et al. (1978) reported that, while thoroughness of cue acquisition and the accuracy of cue interpretation were uncorrelated, both were related to diagnostic accuracy.

In summary, the major findings in relation to the clinical decision making processes of physicians and medical students were the consistent use of the strategies of early hypothesis generation and testing, and the task specificity of reasoning strategies, most notably in patient management skills. Decision theory as a tool to study clinical decision making has been accorded more prominence in the medical literature than in the nursing literature. Similar conclusions, however, have been drawn as to the usefulness of the theory in describing the thinking processes involved in clinical decision making. A brief review of the use of decision theory in medicine is provided next, to corroborate the conclusions in the nursing literature.

#### Decision Theory in Medical Decision Making

Applications of decision theory to medicine have been primarily in the area of individual prescriptive decision analysis, that is, how an individual faced with alternatives should make a choice. Of interest to decision making in medicine are decisions of risk or uncertainty and decisions of ignorance. In decisions of risk or uncertainty, each alternative course of action has a well-defined set of possible outcomes, each with a probability of occurrence. In decisions of ignorance, each action results in a range of possible outcomes, but the probability of occurrence of each outcome is unknown.

Many investigations of medical decision problems have used decision theory related to risk or uncertainty, as the medical community has had a degree of confidence in the

validity of their choice of actions, range of outcomes, and estimation of the probabilities of those outcomes. The majority of work has been based on Bayes' Theorem and Utility Theory, sometimes called the "cornerstone of decision analysis" (Albert, 1978).

Bayesian inference, which involves the revision of probabilities with new information, has been used to develop automated diagnostic programs that model individual normative decision theory under risk or uncertainty. Two significant drawbacks to these programs however, include the equal ranking accorded to each diagnosis, which is not realistic, and the assumption of statistical independence of each datum, which consistently overestimates the end probability when Bayes Theorem is used. The decision analysis approach has focused on optimal strategies for determining and combining subjective probability and utility assessments in diagnosis and management decisions. A wide range of medical problems have been investigated by decision analysis (Albert, 1978). However, medicine has discovered that its problems are very complex, and that complexity and ambiguity limit the usefulness of statistical decision theory. Some of the criticisms of decision theory include:

- 1) The accuracy of probability assignments is a major problem. Much energy has been expended in the search for valid estimations. Estimates have been based on data from clinical studies, opinions of experts in the field, and the development of a method of "sensitivity analysis" which projects a range of probabilities.

- 2) For decision problems under risk, there is one accepted decision criterion - choosing the alternative that maximizes expected utility. Although this principle may be sound as a prescription, it fails to describe the broad range of both rational and irrational human decision making behavior.

- 3) The problem of what to do with counterintuitive results has not been satisfactorily solved.

4) Success in management decision analysis under risk is relatively isolated, due to the limitations of time, effort, cost, and expertise necessary to perform an analysis, that may generate little tangible benefit (Albert, 1978).

5) Studies using the decision analysis approach have revealed that, although physicians' decisions are implicitly and intuitively based on a crude assessment of probabilities, their subjective estimates of probabilities are considerably less than accurate, and neither students nor physicians use a systematic Bayesian strategy to reduce uncertainty in a maximally efficient series of steps (McGuire, 1985).

Such findings have led to the conclusion that although decision theory is not a very accurate descriptive model, it can be a valuable tool to empirically analyze medical decisions, thus offering a methodology to improve clinical judgment (Albert, 1978; McGuire, 1985). In light of these criticisms, it would appear that medical decision problems, like those in nursing, often involve decision making under conditions of ignorance, thus precluding the extensive use of quantitative analysis.

#### Factors Influencing Medical Decision Making

Research into factors influencing the clinical decision making process has revealed that education is related to the content and accuracy of diagnostic hypotheses (Neufeld et al., 1981), and that the amount of information gathered varies inversely with level of education and experience (McGuire, 1985). Experienced clinicians appear to maximize the information yield from each inquiry, that is, there is a strong link between the recognition of salient cues and extensive, well structured bodies of knowledge in long term memory (Barrows & Tamblyn, 1980; Beck & Bergman, 1986; Elstein et al., 1978; Kassirer & Gorry, 1978; McGuire, 1985). It has been suggested that the hypothetico-deductive method is the method used by novices, and that experts use a different process dependent upon a highly elaborated and structured knowledge base (Groen & Patel, 1985). Barrows and Feltovich (1987) maintain that evidence from



"thinking aloud" protocols of experts reveals that they do use hypotheses and hypothesis-oriented inquiry. The incisive accuracy of the expert, who rarely misses a subtle cue, only serves to validate, in the minds of these authors, the use of highly relevant hypotheses derived from thorough knowledge of the field. They add that many reasoning difficulties of students can be traced to inadequacies in knowledge. The relationship of knowledge and experience to clinical decision making skill in medicine closely parallels that discussed in the nursing literature.

### Criticism of Medical Decision Making

Since the study of clinical decision making in medicine is in its infancy, as it is in other health professions, the methodology and analysis procedures are of necessity, less sophisticated than in other areas of research, despite efforts to increase scientific rigor through the use of decision analysis. As a consequence, the findings of the research in clinical decision making have been the subject of much criticism and debate. Four relevant problem areas have received attention. The first problem is the perceived overemphasis by some researchers on the model of diagnostic reasoning. Some authors (Beck & Bergman, 1986; Voytovich, Rippey, & Suffredini, 1985) have raised the concern that too much efficiency in a diagnostic strategy that simplifies disease findings, may ignore important nuances in the data and lead to premature closure of diagnosis.

Groen and Patel (1985) raise a question regarding the model of diagnostic reasoning which is strikingly similar to the recent debate on the role of the nursing process in the nursing literature. They ask, "Is the hypothetico-deductive method really characteristic of experts or is it a technique for teaching novices to think systematically about their data and how to gather it "(p. 96)?

It has also been suggested that the clinical reasoning process is a matter of pattern recognition, in which the decision maker directly compares the pattern of the patient's

problem with disease patterns that it may resemble, and then selects the one that matches. This concept has been soundly criticized by Gale and Marsden (1982) and Barrows and Feltovich (1987) as a trivialization of a complex process. Barrows and Feltovich maintain that "what looks like pattern recognition ... will invariably reveal hypothetico-deductive inquiry" (p.89).

The second criticism raised by Berner (1984), in a review of the literature on medical problem solving, questions the validity of the assumption underlying the research based on information processing theory, that is, the existence of a universal problem solving process.

In her review of the literature, a third criticism is raised by McGuire (1985) concerning the problem of non-generalizable performance across tasks. She maintains that the research has taken too narrow an approach in the range of situations studied, leaving unexamined, a large portion of the cognitive process involving decisions about patient care. Barrows and Feltovich (1987) add that the reasoning involved in patient management decisions has not been as thoroughly studied as diagnostic reasoning. This observation parallels the situation in nursing and provides support for the importance of this study.

The fourth criticism involves the issues of content specificity and the influence of knowledge structure on decision making. McGuire (1985) contends it is not so much the format of a decision task that influences the reasoning process, but the cognitive task that the exercise poses to the subject. In contrast, Beck and Bergman (1986) found that a small change in the emphasis of presentation of a knowledge base to medical students, led to a major diagnostic error.

It can be seen from this brief discussion that interest in the phenomenon of clinical decision making in medicine is keen, but much research remains to be done on a broad spectrum of unresolved issues and concerns. Barrows & Feltovich (1987) offer one suggestion for the improvement of clinical decision making research in medicine

that was taken into consideration in the design of this research project. These authors criticize the previous overuse of well structured problems that have characterized decision making research, and stress the selection of ill-structured problems which are more similar to actual experience. The simulated patient situation devised for this study presents an ill-structured problem in the sense that there is an incomplete data base of clinical information from which to plan care. The situation represents a nurse/patient encounter which closely resembles actual nursing practice.

#### The Relationship Between Research in Medical Decision Making and Clinical Decision Making in Nursing

Many similarities can be drawn between the research on clinical decision making in medicine and nursing, not only in the findings regarding the cognitive processes used, but also in the factors deemed to influence decision making, and in the criticisms of, and problems encountered, in the research.

Similarities have been found in both medicine and nursing in the use of early hypothesis generation and some data gathering strategies. The performance of experts in both fields has eluded successful description, while novices have been characterized as using a systematic, stepwise problem solving approach. The suggestion that the prevailing problem solving mode in each discipline is characteristic of novices and perhaps representative of a learning process, is an assumption that is in need of further research.

Factors that most strongly influence the clinical decision making process in both disciplines are education, knowledge and experience.

Problems have been encountered in both disciplines in relation to the task specificity of reasoning processes, and both nursing and medicine have been criticized for the lack of representativeness of simulated task situations. This study did not circumvent the criticism of a small sample, or the specificity of the simulated task

situation. However, the characteristics of the assigned task were identified in such a manner that the findings may be generalized to situations, simulated or actual, of a similar structure. Thus, this study contributes to the existing knowledge base in nursing about the process of planning care.

### Decision Making in Cognitive Psychology

#### Processes/Strategies

The work of Newell and Simon (1972) in human problem solving paved the way for a new approach to the study of decision making that has led to greater understanding of the processes used in making decisions. Although a staggering volume of literature on decision making exists in the fields of psychology and business administration, much of it has been conducted within the framework of statistical decision theory. Since the focus of the investigation of decision making processes in this study was qualitative, and a statistical methodology was not used, this literature review highlights the results of research conducted in a more qualitative vein, recognizing the contribution of significant findings derived from mathematical model studies. As has been discussed in the nursing and medicine literature review, the need for a more cognitively oriented approach to decision making is also beginning to be voiced in psychology, even by investigators working with classical decision paradigms (Estes, 1980; Wallsten, 1980; Payne, 1980). Recent research in the disciplines reviewed focused attention upon accurate descriptions of how decision making is performed, with a decreased emphasis on comparing actual behavior to normative models. However, in all the studies reviewed that described how choices are made, the subject was presented with an array of predetermined alternatives. The present study differed from this a priori structure by encouraging the free flow of thoughts that led up to the choice of nursing intervention.

Much attention has been paid in the psychological literature to the labelling and description of decision making processes, or strategies. Some strategies place high demands on the information processing capacity of the decision maker, and others reduce the cognitive load. Research has amply demonstrated that the decision strategy used is contingent upon task complexity (Payne, 1976, 1982; Paquette & Kida, 1988). Generally, in conditions of low task complexity, more comprehensive strategies such as compensatory processes are used, but when task complexity increases, strategies that reduce cognitive effort, such as elimination by aspects processes, are employed.

Payne (1976) examined the effects of two task variables, the number of alternatives and the number of dimensions, on the information processing strategies subjects used in reaching a preferential choice among apartments.

The most important task influence on subjects' decision making strategies was the number of alternatives available. When faced with a choice between two alternatives, subjects used strategies which involved searching the same amount of information on each alternative, consistent with a compensatory decision process. When faced with a multialternative decision task, subjects employed strategies designed to eliminate some of the available alternatives as quickly as possible and on the basis of a limited amount of information search and evaluation. This variable pattern of information search was consistent with either conjunctive or elimination by aspects decision processes, which were proposed as ways of reducing the amount of information processing involved in complex decision making. Payne proposed that these less cognitively demanding decision procedures might be used early in the decision process as a way of simplifying the task, followed by the use of the more cognitively demanding procedures such as compensatory processes, to make the final choice.

Payne's review of research (1982), which primarily refers to studies of judgment and choice among gambles, also clearly showed that information processing in decision making is highly contingent upon the demands of the task. A differentiation was made

between task effects, which are those factors associated with the structural characteristics of the decision problem, and context effects, which are those factors associated with the value of the alternatives to the decision maker.

A major task effect that determines which strategy will be used in a task is task complexity, as described above (Payne, 1976). Other task effects that may influence decision making behavior include the response mode, the order in which information is revealed to the decision maker, and agenda effects (the placing of constraints on the order of choice).

Context effects that influence information processing in decision making are the similarity of alternatives, and the quality or nature of options in a choice set. Context effects may interrelate with task effects, thus increasing the complexity of the study of decision making.

Payne concluded his extensive review with the statement that responses to decision problems would seem to involve a contingent mixture of decision processes, and that researchers should now focus upon the derivation of general principles of contingent processing.

Paquette and Kida (1988) recently studied the relationship between task complexity and the use of four different decision making strategies of 48 professionals in the business field. Of the four strategies studied, two were high processing strategies and two were reduced processing strategies. Four groups of subjects were each trained to use one of these strategies to make seven decisions in each of three levels of task complexity.

The results indicated that with greater task complexity, the reduced processing strategies required less time, with no loss of accuracy. The authors supported Payne's prior research (1976, 1982) by suggesting that reduced processing strategies may be useful in tasks involving a large number of alternatives composed of relatively few cues, but that the efficiency of these processes may diminish in tasks composed of few

alternatives with a large number of cues per choice. In these cases, full processing strategies may be necessary.

In a review of the results of decision making studies using the process tracing or verbal protocol methodology, Svenson (1979) asserted that most decision problems are solved without a complete search of information. This fact supports the view that many of the algebraic models of decision making are inadequate, because most of these models assume complete information search. An additional finding which was later verified by others (Taylor, 1984; Paquette & Kida, 1988) was that the larger the number of attributes and alternatives there are in a decision problem, the smaller the percentage of aspects that are investigated by the decision maker. These results further validated the use of strategies that reduce cognitive demand in the face of task complexity, as described by Payne (1976).

As mentioned previously, these studies of decision making processes focus on the thoughts and strategies used by subjects to make decisions between and among a given set of alternatives. This study differed in that it required the subjects to generate their own alternatives, as well as choose from among them, those alternatives they wished to implement.

### Factors Influencing Decision Making

In addition to task variables, a few personal characteristics have been studied in the psychology literature in relation to their influence on decision making. A few examples such as dogmatism, cognitive complexity, field dependence/independence, intelligence, and biased information processing have been mentioned in the literature.

Taylor (1984) reports that a dogmatic decision maker is likely to unduly curtail information input, especially in decisions which appear to threaten self-concept. The resulting reduction in information processing activities could severely hamper performance in complex decision tasks.

Two cognitive styles, cognitive complexity and field dependence/independence have revealed the strongest evidence of an impact on information processing behaviors. Abstract decision makers are able to process more information more efficiently in complex decision environments than concrete decision makers, who experience cognitive strain at lower levels of environmental complexity. Field dependent decision makers prefer information in the form of raw data and use flexible, changing strategies when making decisions. Field independent decision makers, on the other hand, use stable, fixed strategies.

More intelligent decision makers have been noted to process information more quickly and to make faster decisions.

Distortion or bias in information processing has been attributed to the unconscious application of individual knowledge structures and judgmental heuristics. Beckmann and Kuhl (1984) proposed, in contrast, that biased information processing may serve to assist individuals to make decisions in complex environments that contain large amounts of information.

Kuhl's theory of action control described two states of motivation of an individual; state orientation, in which an individual focuses on his/her past, present or future state to the exclusion of active consideration of any plan to bring about a change in the present situation, and action orientation, in which an individual seeks to implement a plan of action to bring about change. When a person intends to perform a certain action, he/she is subject to various forces which result in competing action alternatives. To ensure that the intended action occurs, it must be strengthened and protected until it is performed. Kuhl postulated several action-control processes that help the individual to shield the current intention (tentative decision).

Beckmann and Kuhl's study examined one of these processes, selective attention to information relevant to a preferred alternative. The main hypothesis was that, during the decision process, action-oriented persons increase the divergence between the



attractiveness of those alternatives they are inclined to choose, and those they do not intend to choose, and that state-oriented persons do not display this effect.

Students searching for an apartment were given a list of 16 apartments with information about each, and were asked to rate the attractiveness of each apartment twice before they were asked which apartments they would like to rent. Action-oriented subjects increased the divergence of their attractiveness ratings from the first to the second point of evaluation, whereas state-oriented subjects did not.

In a state of action orientation, alternatives available for decision making are processed in such a way as to facilitate arriving at a decision or course of action quickly without much conflict. State-oriented people seem to attempt to process the whole amount of information impartially, thereby running the risk of an unstable preference order which blocks execution of an action.

### Decision Making in Business Administration

#### Processes/Strategies

The field of management has probably been more highly involved in the use of statistical theories as tools for decision making than any of the other professional disciplines included in this literature review. Even in this stronghold, however, the value of studying the cognitive processes of decision makers has begun to infiltrate. For example, Schwenk (1988) reviewed the literature in top level managerial decision making on cognitive structures, processes, and biases as they influence decision makers with limited cognitive capacities to comprehend and solve very complex strategic problems. He urged an integration of these separate research streams in the future, in order to provide a better understanding of strategic problem solving, and to form a basis for recommendations to improve decision making.

Rodgers and Housel (1987), recognizing the shortcomings of normative decision making models, sought to analyze the cognitive processes of loan officers as they make

loan decisions, with the objective of achieving insight into the influences of the loan officers' prior experiences and native biases in making decisions. The study compared the decision making processes of graduate business students and experienced loan officers. The subjects were divided into conceptually driven and data driven perceptual types by the Myer-Briggs Type Indicator (MBTI). The assumption was made that perceptual biases would influence the judgments of decision makers and therefore, the decision outcome. The results supported this assumption. In addition, experienced loan officers did not outperform novice students on most of the loan decisions. A most important result of this study was that, while decisions among the different types of decision makers might have been the same, the cognitive processes they used to reach these decisions were significantly different.

In a sample of M.B.A. students and experienced executives, Fredrickson (1985) studied the contextual variables of decision motive (problem vs opportunity) and firms' performance level (good vs poor) on decision making. The results of the study indicated that variation in these factors affected the decision processes recommended by the M.B.A. students, but not those of the experienced executives. As in Rodgers and Housel's study, the two groups recommended very different processes for making the same strategic decisions. The executives' approaches in this study were found to be a combination of rational analysis and intuitive synthesis.

Several management and decision researchers have used the simultaneous verbal protocol as a method for tracing the problem solving and decision making processes involved in such diverse activities as job choice, strategic decision making, consumer choice, investment trust decisions, the design of management information systems, the choice of living quarters, and parole decisions (Schweiger, 1983). One of the criticisms of this methodology has been that the verbalization may interfere with problem solving and decision making performance.

Schweiger (1983) examined the impact of the simultaneous verbal protocol on problem solving and decision making performance in a complex managerial task. The results indicated, that in this context, the use of simultaneous verbal protocols did not affect performance. There were no significant differences in performance between protocol and nonprotocol subjects. Schweiger suggested that the simple instructions given, did not require subjects to attend to specific stimuli or cognitive processes that they would not otherwise use. He contended that this enabled individuals to focus most of their attention and mental effort on problem solving and decision making. He also suggested that the process of verbalization actually helped individuals articulate their ideas and offset any negative effects that might have been due to its obtrusion. Schweiger's work supports the use of verbal protocol methodology in this study.

Kayaalp (1987) described the merits and shortcomings of economic decision theory and behaviorally oriented decision theories in an attempt to encourage the integration of the two competing theories into a general theory of management decisions. This unified decision theory would combine the descriptive theory of actual decision behavior that gives due consideration to impinging psychological, social and ethical variables, with the prescriptive strength of the economic theory of choice. Such a theory has not yet been developed.

In summary, some of the findings of this research bear considerable resemblance to the literature in the fields of nursing, medicine and psychology previously reviewed. Specifically, different processes have been found to be used by novices and experts; experts appear to use a combination of rational and intuitive skills in making decisions; and even when novices and experts arrive at the same decisions, different cognitive processes are sometimes used. In addition, perceptual biases influence decisions made, both directly, in terms of assessment of stimulus information, and indirectly in the judgment process. There is an interest in the information processing approach to the study of managerial decision making using verbal protocols, with one

research report supporting the view that this methodology does not interfere with problem solving as suggested by its critics. Finally, there is some beginning evidence of an interest in combining rational and behavioral theories of decision making to take maximum advantage of the strengths of each approach, although little has yet been done in this line of research.

### Decision Making in Education

#### Processes/Strategies

Not surprisingly, the focus of problem solving research in the educational literature is on methods of teaching problem solving and decision making to students. Some attention however, has been given to the study of the process of problem solving using "think aloud" protocols. Bloom and Broder (1950), as described by Greenfield (1987) used this method to study the problem solving skills of college students. Differences between successful and unsuccessful problem solvers were noted in four areas: understanding the requirements of the problem, understanding the ideas contained in the problem, general approach to the solution of problems, and personal factors in the solution of problems, such as attitude towards reasoning, confidence in ability to solve problems, and emotional responses.

Larkin (1977), as discussed in Greenfield (1987), used thinking aloud protocols to study the differences between novices and experts in solving physics problems. The novice used a direct, systematic approach, while experts seemed to first redescribe the problem in qualitative terms before deriving quantitative equations. Differences in the storage of information in memory between novices and experts were also inferred. Novices seemed to store physical principles in memory individually, while the experts grouped interconnected principles together, and stored them as chunks. Thus, when the expert accessed one principle from memory, associated principles became available.

Evidence indicates that domain specific knowledge in the form of schemas is the primary factor distinguishing experts from novices in problem solving skill. Schemas are conceptually similar to the "chunks" of interrelated information in memory referred to in information processing theory. In a study of high school students' problem solving of Trigonometry problems, Sweller (1988) concluded that the cognitive load imposed by complex problem solving strategies leaves little processing capacity for the acquisition of schema that are important for learning. This finding, if extrapolated to nursing, has implications for the teaching of clinical decision making skills, in terms of performance expectations and teaching methods.

Woods (1987) describes the requisites for good problem solving as an organized, hierarchical knowledge structure centered around fundamental principles and abstractions, tacit knowledge or experience, and a variety of skills - the ability to identify, locate, obtain, and evaluate missing information; the ability to learn on one's own; such thinking skills as analysis, creativity, ability to generalize, and to simplify and broaden perspectives; attitudes such as motivation and perseverance, ability to cope with ambiguity, fear, anxiety, and procrastination; interpersonal and group skills; communication skills; an awareness of how one thinks; and one's personal preference or style when learning or processing information.

The term "critical thinking" as used in education, is similar to the concept of decision making described in this study. Yinger (1980) defines critical thinking as "a cognitive activity associated with the evaluation of products of thought, ... [and] is an essential element of problem solving, decision making, and creative production" (p. 14). Some strategies of information search mentioned by Yinger include hypothesis scanning and constraint seeking. In constraint seeking, the thinker asks questions to eliminate as many alternatives as possible. In this way, it is similar to the elimination by aspects strategy derived from research in psychology. Style, or personal preference for certain thinking modes and strategies influences problem solving

processes. Educators recognize the use of the heuristic principles of representativeness, availability, and adjustment and anchoring from psychology to assist in making judgments in conditions of uncertainty.

Embretson, Schneider and Roth (1986) examined the influence of processing strategies on the construct validity of a verbal reasoning test. Three strategies for solving verbal analogy items were studied: a rule oriented strategy, an association strategy, and a partial rule strategy. All three strategies were found to contribute to the solving of the verbal analogy items, but, it was also found that being able to perform a strategy correctly did not insure its use in solving an item. All three strategies contributed to individual differences in verbal reasoning and to the predictive validity of the test. The rule oriented strategy contributed strongly to the prediction of achievement in eight areas of educational achievement, the association strategy in five areas, and the partial rule strategy in one area.

A two stage theory of the processing of response alternatives is suggested by the results of this study. In a two stage theory, a global or partial rule that narrows down the correct response is used in the first stage, followed by random guessing or an evaluation process to choose the final response. This strategy is similar to that described by Payne (1976) in the field of psychology.

### Factors Influencing Problem Solving

Factors perceived by researchers in education to be important determinants of successful problem solving are similar to those previously cited in nursing, medicine, and psychology. These include a discipline-specific, complex knowledge base (Rubinstein & Firstenberg, 1987; Woods, 1987; Yinger, 1980; Sweller, 1988), experience or tacit knowledge (Woods, 1987; Yinger, 1980), personal values and biases (Rubinstein & Firstenberg, 1987; Woods, 1987; Yinger, 1980), and environmental or situational context, i.e. physical, social and intellectual forces (Yinger, 1980; Woods, 1987).

### Locus of Control in Nursing

Locus of control has been studied in relation to the use of birth control, weight loss programs, smoking behaviors, information seeking behaviors of patients, compliance with medical regimens, and venereal disease (Wallston & Wallston, 1978). Much of the recent research in health-related locus of control has been assessed by means of the Multidimensional Health Locus of Control Scale developed by Wallston, Wallston, & DeVellis in 1978. For example, between 1983 and 1987, health locus of control has been researched extensively across age groups and in many different health related conditions, such as diabetes in children and adults, hypertension, substance abuse, childbirth experiences, chemotherapy, hemodialysis, preoperative coping behavior, and weight loss. In addition, the relationship of locus of control to autonomy, satisfaction with care, anxiety, self-care, coping, and burnout has been investigated (Computer search, Nursing and Allied Health (CINAHL) 1983-1987).

The nursing literature that specifically investigates the relationship between locus of control and decision making behaviour is scant. As early as 1975, Munley recognized that insight into internal-external control aspects of personality as they influence decision making in nursing situations, had the potential to assist nursing educators to promote autonomous decision making by nursing students. Using the Rotter Internal External Locus of Control Scale, and a filmed patient care situation, Munley sought to prove that senior baccalaureate nursing students who were relatively internally controlled would make more observations and recommend more actions with greater subjective confidence after negative reinforcement, than those who were relatively externally controlled. Unfortunately, no significant differences were found (Munley, 1975).

A study by Kissinger and Munjas (1981) however, did find that a predictive relationship existed between the ability to use nursing process, as measured by two

simulated clinical problem tests, and an internal locus of control, as measured by Rotter's Internal External Locus of Control Scale.

Strauss and Hutton (1983) saw locus of control as a factor influencing students' perceptions of their capabilities in reaching certain goals, relative to the demand of the situation. Locus of control, in their view, may be related to patterns of coping in difficult clinical situations, such as those involving clinical decision making. Strauss and Hutton professed the belief that "if one views locus of control as a meaningful concept which may influence behavior, then it should have implications for nursing education. Internally controlled students should perceive themselves as important factors in the situation and act to change the demands of the situation by manipulating external variables" (p.368).

Despite these early, rather undramatic results, interest in the relationship between locus of control orientation and decision making has persisted in the minds of nurse educators. Neaves (1989) investigated the relationship between locus of control and decision making in senior diploma and baccalaureate nursing students, using the Rotter Internal External Locus of Control Scale and a "Medication Administration Questionnaire" developed by the investigator. A statistically significant relationship was found between internal locus of control and independent decision making, which in turn, was not related to the type of program in which the student was enrolled. This finding has two important implications for nursing education. The first implication is that locus of control does influence the degree of independence exercised in decision making by nursing students, both diploma and baccalaureate. Second, these results suggest that individuals with an expectancy for external control may be significantly compromised in their ability to be professional and accountable in their practice. This is particularly alarming in view of the facts that decision making is becoming increasingly important to safe and effective nursing practice, and the college population, especially female, is becoming more external (Dufault, 1985). Thus, it would



appear that knowledge of a nursing student's locus of control orientation may help to place in context, some of the characteristics of the student's decision making behavior, which was one of the purposes of this study. With an increased knowledge base regarding the influence of locus of control on decision making practices, nurse educators may better prepare their students for future practice by incorporating internality training techniques into the nursing curriculum.

One such attempt which proved successful, was made by Dufault (1985) who used the Rotter Internal External Locus of Control Scale to measure the effects of a futuristic-oriented course in nursing on the internality of registered nurse students. The results of pre and post test scores on the Rotter scale indicated a significant change towards internality in the group of students exposed to the course material, thus supporting Rotter's contention that locus of control can be influenced by new experiences and information.

In summary, locus of control has not been studied extensively in relation to the decision making abilities of nurses or nursing students. There is, however, some increasing interest being manifested in the literature about this relationship, with some research results pointing towards identifiable differences in decision making behaviours between internally and externally controlled nursing students.

#### Locus of Control in Medicine

One recent study by Diserens, Schwartz, Guenin, and Taylor (1986) specifically investigated the influence of locus of control on medical problem solving. A high internal orientation has been shown by previous research to be related to decision making, seeking relevant information, and achievement. A computer program which presented simulated patient cases, and scored participants' clinical problem solving in comparison to a group of five faculty members, was used as a measure of problem solving ability in this study. The effect of field dependence/independence as measured

by the Group Embedded Figures Test (GEFT), and locus of control as measured by Rotter's locus of control scale, on problem solving was examined. Third year medical students, residents and faculty members participated in the study, which involved three simulations of varying difficulty.

The problem solving scores were significantly different for each group only on the most difficult case, where faculty members performed better than residents, and residents better than students. Correlations between the GEFT scores and locus of control scores were small and non-significant. The low correlations of these two traits with the computer system problem solving scores were interpreted by the authors to reflect that problem solving ability might be acquired through experience rather than general traits that an individual brings to the decision making situation. It was further suggested, however, that low correlations between the problem solving scores and the GEFT and locus of control scores may alternatively, have been a function of the low reliability of the individual simulations.

#### Locus of Control in Cognitive Psychology

Research into the effect of locus of control orientation on various behaviors has been extensive (Rotter, 1975). Findings reported in Rotter's classical monograph (1966) which relate to decision making behavior, include the propensity for internally oriented persons to be attentive to those aspects of the environment which provide useful information for future behavior, to take steps to improve their environmental condition, to place greater value on skill or achievement reinforcements, to be more concerned with their ability, particularly failures, and to be resistive to subtle attempts at influence (Rotter, 1966; Rotter & Mulry, 1965).

Liverant and Scodel (1960) investigated locus of control as a determinant of decision making under conditions of risk. Results indicated that internals attempted to maintain

control by a cautious and planned selection of probabilities in a chance-determined betting situation, whereas externals decided according to "hunches" or past experience.

Davis and Phares (1967) maintained that, not only were internals more aware of available information, but they also were more active seekers of information than externals.

Although the possible influence of locus of control orientation on decision making was recognized by Hill, Bedau, Chechile, Crochetiere, Kellerman, Ounjian, Pauker, S.G., Pauker, S.P., and Rubin (1979), relatively little attention was given to this relationship in subsequent years.

Harrison, Lewis and Straka (1984) studied the interaction of locus of control and choice on satisfaction with an undesirable task. Internals were found to be more satisfied when given a choice of approaches to the task, while externals experienced greater satisfaction when not given a choice. A suggested explanation was that decision making is aversive for externals but not for internals. If, as Dufault (1985) has stated, nursing students are generally becoming more externally oriented, and if, as suggested here, externals are aversive to decision making, it would seem to be extremely valuable to know the locus of control orientation of students in a nursing program. Teaching strategies would then need to be developed, not only to emphasize clinical decision making skill, but also to alter the locus of control orientation of external students.

Minor and Roberts (1984) studied the relationship between locus of control and self-efficacy. It was predicted that congruency between locus of control and task instructions would result in higher estimates of self-efficacy and more effort expended on the task. As predicted, internal subjects who received skill instructions and external subjects who received chance instructions gave higher estimates of self-efficacy than subjects receiving instructions incongruent with their locus of control. These results, however, did not reach the level of significance. A significant interaction was found,

however, between task instructions congruent with locus of control and the amount of effort expended in solving an anagram.

Shute, Howard and Steyaert (1984) hypothesized that individuals who were able to use abstract reasoning abilities described in the Piagetian cognitive developmental framework as formal operations, would be more likely to have developed an internal locus of control. The results of this study demonstrated a significant sex difference in the relationship between cognitive developmental level and locus of control. Women with higher levels of cognitive development were more likely to be internal, but no such relationship existed for the male subjects. This study suggested that locus of control develops differently in men and women.

The characteristics of internally oriented individuals seem to indicate that they will bring better information acquisition skills, more persistence, and a more methodical approach to a planning task than externally oriented individuals.

#### Locus of Control in Business Administration

From a cursory review of the recent management literature, studies including the assessment and use of locus of control as a variable were found to be sparse, and limited to the examination of job motivation (Arnold, 1985) and individual difference effects on such topics as stress management interventions (Rose & Veiga, 1984). No studies of the influence of locus of control on managerial decision making were accessed.

#### Locus of Control in Education

The research on locus of control in education aims to discover a relationship between locus of control and academic achievement, and the effects of individual differences of internal/external students on the manner in which they perceive their own and others' behavior in the academic environment. The ultimate goal of this

research is to improve teaching practices, and various measures of locus of control are used.

In a meta-analysis of 75 studies, Findley and Cooper (1983) concluded that locus of control and academic achievement were positively related, that is, internality was related to greater achievement. The relationship seemed to be stronger for adolescents than for adults or children, and more substantial among males than females. In addition, stronger effects were associated with specific locus of control measures than with standardized achievement or intelligence tests.

Feldman, Saletsky, Sullivan and Theiss (1983) examined how locus of control related to college students' expectations about their own and their teacher's future performance. Students were divided into internal or external locus of control based on their results on the Rotter Internal External Locus of Control Scale. The students' expectations about their own performance on a multiple choice content test following a lecture, and their teacher's performance in delivering the lecture, were experimentally manipulated. The internals' performance was more congruent with the manipulation of expectations than externals. Externals not only tended to attribute less responsibility to themselves for their own outcomes, but they also attributed less responsibility to others regarding the others' behavior.

Lefcourt, Martin and Ware (1984) examined the hypothesis that certain affect clusters would characterize persons differing in locus of control. Using the Multidimensional-Multiattributonal Causality Scale for achievement, the Scale of Commonly Expressed Feelings, and Profile of Mood States, two hypotheses were confirmed. Persons who commonly express pride, confidence, competence, satisfaction and zest see themselves as responsible for achievement successes. Anger and surprise characterize persons who attribute failures to external sources. The authors concluded that internality for achievement success and externality for achievement failure were

reliably linked to affective clusters that may account for persistence in achievement pursuits.

Linder, Londoner, and Bauer (1985, 1986), using Rotter's locus of control scale, found that in a sample of 413 undergraduate education students, and a later sample expanded by 726 business students, older students were more internally oriented, and men were more internal than women. Internally oriented individuals placed greater value on self-respect, wisdom, freedom, and a sense of accomplishment. External individuals placed greater value on family security, pleasure, and a comfortable life.

Cartledge and Wells (1986), using Rotter's locus of control scale, found that graduate students, older students and full-time employed students in college had a greater degree of internal locus of control. Neither race nor gender differences were significant.

Gadzella, Williamson and Ginther (1985) found a positive relationship between self-concept, as measured by the Tennessee Self Concept Scale and internality (for both sexes) as measured by Levenson's Internality, Powerful Others, and Chance Locus of Control Scale. Grade point averages were unrelated to locus of control scale scores.

Wheless, Stewart, Kearney and Plax (1987) studied the perceptions of internal and external locus of control college students of the frequency of behavior control techniques used by classroom teachers. Levenson's locus of control scale was used to determine locus orientation. Externals reported greater frequency of the use of these techniques than internals. Differences in personal constructs, therefore, involving perceptions of how controlling others really are, were related to differential perceptions of teacher control attempts in the classroom. In the present study, it was anticipated that external student nurses would cite aspects of teacher performance as factors inhibiting their clinical decision making behavior more often than would the internal student nurses.

## CHAPTER II

### METHODOLOGY

#### Design

This descriptive study explored the cognitive processes of student nurses as they formulated a plan of care for a simulated patient, and attempted to ascertain the students' perceptions of specific influences on their clinical decision making. Relationships between and among decision processes used by students, their locus of control orientation, perceived influencing factors on the decision making process, and selected demographic information was investigated.

The research questions were:

1. What decision making processes do student nurses use in planning nursing care?
2. Is there a relationship between locus of control and clinical decision making processes used by student nurses in planning nursing care?
3. What factors do student nurses perceive to be facilitative to them in their clinical decision making processes in planning nursing care?
4. Is there a relationship between locus of control and factors which student nurses perceive to be facilitative to them in clinical decision making?
5. What factors do student nurses perceive to be inhibitive to them in their clinical decision making processes in planning nursing care?
6. Is there a relationship between locus of control and factors which student nurses perceive to be inhibitive to them in clinical decision making?

The design of this study involved the use of a researcher developed simulated patient situation, a semi-structured interview, and the administration of the Rotter Internal External Locus of Control Scale.

### Sample

The sample consisted of second year students in the diploma nursing program of the Health Sciences Centre School of Nursing. A sample of 19 females and 1 male student was obtained on a volunteer basis. Subjects met the following criteria:

1. Anticipated being able to use the "think aloud" verbal protocol technique with comfort.
2. Had a telephone.

It is assumed that students who volunteered for this study were interested in providing as thorough information as they were capable.

### Subject Recruitment

Approval of the research protocol was received from the Ethical Review Committee of the University of Manitoba School of Nursing. Permission for access to subjects was approved by the Director of Research of the Health Sciences Centre, and the Director of the Health Sciences Centre School of Nursing. The investigator met with the second year students in groups of approximately one quarter of the total class size to explain the study, and distribute printed copies of the explanation of the study (Appendix C). This explanation clearly outlined the inclusion criteria, and addressed the method of data gathering, the anticipated time to be spent with each subject, and ethical considerations. A detachable portion of the explanation form with room for the name and phone number of the student was returned to the investigator's school mailbox, or office by interested students. The investigator then telephoned the student and made an appointment for the first session of the data collection procedure. A second appointment was made at the conclusion of the first session. Data collection was completed in four months.



## Instrumentation

A semi-structured interview, the Rotter I-E Locus of Control Scale, and a simulated patient situation were used to collect data.

### Semi-Structured Interview

A semi-structured interview was conducted with each of the students to establish a rapport with them in order to decrease any apprehension they had, to elicit perceptions of influences on their decision making skill in clinical practice, and to gather some demographic information. These questions are found in Appendix D.

### The Rotter Internal External Locus of Control Scale

The Rotter Internal External Locus of Control Scale was administered (Appendix E). This scale has been used extensively in psychological research and has been validated in over 600 studies (Rotter, 1975) with internal consistency ranging from .65 to .79 and test-retest reliability coefficients from .60 to .83 (Rotter, 1966). In a more recent study, test-retest correlations over lengthy periods, for two large samples, revealed the Rotter scale to be stable (Layton, 1985). Although the validity of the construct of locus of control is accepted in the literature, the Rotter Internal External Locus of Control Scale has been criticized in recent literature for its low predictability of behavior in specific situations, and for the fact that it is used as a unidimensional measure when it is clearly a multidimensional scale. The validity of responses to the Rotter instrument does not depend on the assumption of unidimensionality, however, and the total score may adequately reflect a higher order or more general construct than scores representing the separate facets (Marsh & Richards, 1986, 1987). Rotter himself pointed out that the scale measures a broad predisposition toward certain behavior and should not be expected to predict specific responses. The purpose of using the scale in this study was to broadly categorize students' locus of control tendencies. The scores representing

students' locus of control orientation were used in a descriptive, not predictive manner, to determine if a relationship or directional tendency existed between locus of control and decision making processes used by students, and locus of control and the factors perceived by students to influence their clinical decision making.

### Simulated Patient Situation

The description of the simulated patient situation is found in Appendix F. The authenticity of the patient situation was verified by researching actual patients' charts and consulting with such experts as a surgical head nurse, surgical nursing teachers, an experienced surgical nurse, and the researcher's advisors. The case study was pilot tested with a nursing student not involved in the study. The students were asked to develop a current plan of care using the verbal protocol, or "thinking aloud" data collection technique. Prior to using it themselves, students listened to a tape recording of an example of this technique. The situation and a script of the example is found in Appendix G. The situation was concluded with a series of followup questions to monitor the students' immediate reaction to the situation and to determine how realistic it was for them. These questions are found in Appendix H.

Prior to a discussion of the procedure for data collection, it is necessary to explain the use of the verbal protocol and simulation techniques used in this study. The verbal protocol approach to studying clinical decision making is derived from the field of cognitive psychology and specifically, from information processing theory. It requires that the subjects think aloud as they solve problems. The verbal protocol approach produces data rich in detail, preserves the sequence of processes used by the subjects, and can reveal the generation and evaluation of alternative actions by decision makers (Corcoran, 1983). However, since the method relies on the verbal reports of subjects, the extent to which actual mental processes are reflected in verbalization, has been questioned. Payne (1980) says, "the research results seem to

indicate that the verbal protocol procedure slows down the process slightly, but does not change it fundamentally" (p. 111). The contention of Ericsson and Simon (1980) that verbalization affects cognitive processes only if the instructions require verbalization of information that would not otherwise be attended to, was substantiated in a more recent study by Schweiger (1983).

As recently as 1988, three well known researchers in the field of medical decision making endorsed verbatim protocol collection techniques as the best suited to the study of knowledge representation and problem solving strategies (Kuipers, Moskowitz & Kassirer, 1988). Further support for this methodology was provided by a study of the clinical decision making processes of 60 pediatric nurses on a computer-assisted clinical simulation, which suggested that there was no apparent effect of verbalization of cognitive processes on performance (Henry, LeBreck, Holzemer, 1989).

The instructions for the simulated nursing situation in this study asked the students to verbalize the reasons behind their choices of planning decisions as part of the "thinking aloud" process. Since a consideration of the rationale for nursing intervention is an integral part of planning nursing care, it is, therefore, information that is usually attended to quite specifically by student nurses. Thus, it is assumed that this instruction did not interfere with the verbalization of decision making processes.

The use of simulation to study clinical decision making processes has been criticized, because simulations necessarily delimit and control variables which may have an influence on the decision making process (Tanner, 1986b). Lacking more sophisticated methodology, however, it is premature to abandon simulations, as they offer the advantage of presenting life-like scenarios, and the objectivity of examining the performance of several subjects on a fixed task (Holzemer, 1986; Tanner, 1987). Many of the research studies that have used simulation, have focused on attributes of the outcomes of decision making processes, and not on the processes themselves. In addition, the pattern of responses in these studies has been directed by a branched

programming format, thus, implicitly if not explicitly, interfering with the subjects' unique patterns of thought. The simulation used in this study differed in that it placed no restrictions on the direction or pattern of thought processes, once the initial situation was presented. As well, it was the processes of decision making, and not the outcomes, that were the prime focus of this investigation.

The limitations of verbal protocol methodology and the use of simulation are recognized in this study. Given the present state of knowledge of clinical decision making processes of student nurses, however, the advantages of obtaining a rich fund of descriptive data under conditions that, apart from distractions and time pressure, closely approximate a natural nurse/patient encounter, outweigh the disadvantages, in the opinion of this researcher. Increased knowledge in nursing regarding the crucial process of clinical decision making must spring from a substantial body of description that corroborates previous research and/or extends prior findings. Only then, can the higher levels of predictive and prescriptive theory building be undertaken. The intent of this study was to contribute to that basic body of knowledge.

The characteristic features of the simulated nursing situation used in this study are as follows:

- a). The situation is realistic, in that the student is asked to plan nursing interventions for the care of a patient under conditions of ambiguity and incomplete information.
- b). The content of the situation was selected so that it would be readily understood by student nurses, and not require a highly specialized or complex knowledge base in order to respond appropriately. A deliberate attempt was made, not only to limit knowledge-based error, but also to diminish the possibility of arousing anxiety in the students that might influence their thinking, if they perceived the situation to be a test. It was thus made clear to the subjects that the correctness or quality of the planned interventions is not of major concern to this study.
- c). The focus of the situation is on the planning aspect of nursing care.

d). The emphasis of the planning task is on independent nursing functions and not on those requiring a definitive medical opinion prior to taking action.

e). The simulation represents a non-emergency situation of medium complexity.

This aspect of the study design is consistent with social learning theory underlying the construct of locus of control. Rotter (1966) states that locus of control is more likely to be operative in situations that are novel or ambiguous, rather than routine. The simulated situation in this study is ambiguous, and is one in which student nurses have had limited experience, i.e. a range from no experience to a maximum of 2 or 3 patients who have had this type of surgery and developed a wound infection. The simulated situation is also consistent with information processing theory through the use of a verbal protocol approach, in which students are free to explore planning decisions without the interference of a rigidly structured data collection instrument.

#### Procedure For Data Collection

Data collection involved two sessions that varied from one half hour to one and a half hours each, with each subject. The data collection took place in a mutually convenient location at a mutually convenient time. In the first session, the explanation of the study was reviewed and questions were answered. The consent form (Appendix I) was then explained and signed. The subject was given a copy of the consent form at the second session. The subject was then interviewed using the semi-structured questionnaire in Appendix D, and the Rotter Internal External Locus of Control Scale (Appendix E) was administered. The interview segment of this session was tape recorded. In the second session, the subject listened to a taped verbal protocol of a common, non-nursing planning problem to demonstrate the "think aloud" process, following which he/she was free to ask questions. The subject then proceeded to process the simulated patient situation and write the plan, while thinking out loud.

This was tape recorded. No time limit was imposed, and the subject was allowed to write notes at will, on the case description. The followup questions were then asked.

### Ethical Considerations

The study proposal was approved by the Ethical Review Committee, School of Nursing, University of Manitoba, and the Director of Research of the Health Sciences Centre. A letter requesting access to the student sample was then sent to the Director of the Health Sciences Centre School of Nursing (Appendix J). The request for access to subjects was approved.

Confidentiality of subjects was maintained by having interested students return the detachable part of the explanation form to the investigator, being identified by name and telephone number. Since the investigator was unknown to this particular group of students, and as First Year Coordinator, had no influence upon, or jurisdiction over, their progress in the second year of the program, it is believed that this assured students of the freedom to choose whether or not they would participate. The names of subjects were not released to the teachers. The investigator was the only person knowing the identity of the subjects, unless the subjects chose to reveal this information themselves. Tapes, transcriptions, simulated patient situations, and nursing care plans were identified by a code number. Information matching the subject's identity with the code was kept under lock and key and was available only to the researcher. Coded data was available to the investigator's advisors during the course of the study. Following the completion of the study, tapes were erased. Segments of transcribed data formed part of the data analysis and findings of the completed thesis.

Subjects were informed that there would be no direct benefits to them for participating in the study, other than the recognition that they were contributing to the generation of information that may prove to be of benefit to nursing students in

the future, and to the expansion of the knowledge base of clinical decision making processes in nursing. Subjects were advised of their right to withdraw from the study at any point, without penalty of any kind, although none chose to do so.

### Plan For Data Analysis

#### Semi-Structured Interview

Data given by subjects were analyzed for categories of facilitating and inhibiting influences on clinical decision making when planning nursing care. The responses of students that fell into the derived categories were described initially according to the students' locus of control orientation as measured by the Rotter Internal External Locus of Control Scale, to determine whether or not the influences mentioned by internally and externally oriented students differed. A comparative summary of this data was then written.

#### Rotter Internal External Locus of Control Scale

The Rotter scale yields a range of scores between zero and 23. The higher the score, the more externally oriented the subject is said to be. Division of subjects into internal or external categories has traditionally been at the median score for any particular group. Those subjects scoring above the median are considered to be external, and those scoring below the median are considered to be internal. Since the sample in this study was small, norms identified for a large sample of female college students were used to determine internal or external orientation (Cellini & Kantorowski, 1982).

#### Simulated Patient Situation

Data to be analyzed consisted of the typed transcriptions of tape recordings. Since the focus of this study was to ascertain the decision making processes that student nurses use when planning care and not the content of their plans, no attempt was made

to evaluate the accuracy or sophistication of the planning decisions formulated by the subjects. The analysis therefore, examined the structure of thought processes revealed by the verbal data.

The subjects of this study were divided into two groups according to their locus of control orientation, as determined by their score on the Rotter I-E Locus of Control Scale. The data from the simulated patient situation was then analyzed by group, in terms of internal and external locus of control. The plan for the analysis of data from the simulated nursing situation included the identification of decision making elements, the coding of transcripts in terms of these elements, the determination of thought segments contained in the transcripts, and the description of combinations of decision making elements found within each thought segment. Each of these phases of analysis are now presented.

#### The Identification of Decision Making Elements

From a careful and indepth examination of the transcribed verbal protocols of the subjects in this study, a set of concepts emerged that were labelled by the researcher as decision making elements. These elements, their abbreviations, their descriptions, and an example from the transcripts, are as follows:

Cue (C) - a piece of information given in the typed simulated nursing situation. e.g. "She looks flushed."

Hypothesis (H) - a projected or proposed possibility. An hypothesis may concern what is wrong with the patient, what the nurse/doctor/patient might do, think, or feel, or what possible doctor's orders or hospital policies might be used. An hypothesis is often introduced by subjects with such words as, probably, might, if, could be, maybe, perhaps, sounds like, or looks like. e.g. "She probably has a temp."

Planning Decision (PD) - any proposed nursing action. Based on the education of this sample of subjects, planning decisions in this study are deemed to include nursing interventions in the categories of assessment, physical care activities, patient



teaching, therapeutic communication (communication with the patient), and collaboration with, or referral to, other personnel (communication with support systems). e.g. "speed up the IV a little bit" (physical care)

Knowledge Base (KN) - information, correct or incorrect, that is used as rationale or support for any statements made by the subject. e.g. "because nausea is a side effect of Demerol"

Search (S) - indication of a desire for additional or supplementary information about the patient situation. Search is often introduced by such phrases as "it doesn't say anything about...", "I don't know if...", or "I was wondering if ...". At times, a question by the subject indicates search, for example, "She doesn't have a Foley, does she?"

Assumption (A) - a conclusion verbalized by the subject for which there is insufficient information given in the simulated patient situation. e.g. "her urine output is fine" (No information is given about urine output)

### The Coding of Transcripts

The definitions of the decision making elements served as a guideline to the researcher for the coding of the transcripts. Each transcript was coded twice, (on two separate occasions), in order to increase the validity of the coding. Each element was coded according to the meaning conveyed by the particular usage of the words. Although this involved a subjective judgment, these judgments were made on the basis of the researcher's extensive experience in nursing education, and were consistent throughout the coding of all transcripts. Once coded, each decision making element was individually reviewed across all transcripts to check for consistency. Three of the coded transcripts were reviewed by the thesis advisor, who is also an experienced nurse educator.

The transcribed verbal protocols of each subject were divided into three sections; the Reading Aloud section, the Thinking Aloud section, and the Thinking Aloud and Writing section, to correspond with the activities of the subjects while working with

the simulated patient situation. The frequency of occurrence of the individual decision making elements in each of the three sections was obtained. Characteristics of the use of the decision making elements in each section were described, and the findings for the internal subjects were compared to the findings for the external subjects.

#### Determination of Thought Segments

Each transcript was broken down into thought segments by listening to the tape recordings while simultaneously reading the typed transcripts. Thought segments included all verbalization that occurred between pauses, or a verbalized hiatus in thinking, for example, when the subject said, "Now what?". Subjectivity in the determination of thought segments was a risk, but was balanced by the crucial importance of knowing which thoughts occurred together. Avoidance of this step of the analysis could have led to the derivation of artificially induced decision making processes.

#### Combinations of Decision Making Elements

Once the transcripts were coded, and thought segments identified, each thought segment was examined for the combinations of decision making elements it contained. Combinations of decision making elements were identified as single decision elements, two element, three element, four element, and five element combinations. The composition of those combinations of decision making elements that occurred in the data, and the frequency of their occurrence in each of the three sections of the protocols, were recorded. The characteristics of these decision making combinations were then described, and the findings for the internal subjects were compared to the findings for the external subjects. Only one male subject volunteered for the study. This subject scored as having an internal locus of control on the Rotter I-E Locus of Control Scale. Since it has been suggested that locus of control develops differently in men than in women (Shute, Howard, & Steyaert, 1984), and if so, is likely to affect

cognitive processes in decision making, the data from the male subject was not included in the analysis.

The decision making processes that emerged from the data were then defined, and the use of these processes by internally and externally oriented subjects was compared.

The responses to the followup questions were summarized, drawing a comparison between the responses of internal and external subjects, and a qualitative description of each subject group's evaluation of the simulated patient situation was written.

## CHAPTER III

### FINDINGS

The subjects of this study were divided into two groups, those subjects with an internal locus of control orientation, and those subjects with an external locus of control orientation, according to their scores on the Rotter I-E Locus of Control Scale.

Following a description of the characteristics of the sample, the findings of this study that were derived from the simulated patient situation are presented for the group of subjects with an internal locus of control, followed by the group of subjects with an external locus of control. This is followed by a comparison of these findings for the internal subjects with those of the external subjects. The decision making processes that emerged from the analysis of data are then defined, and the decision making processes used by the internal subjects are compared to the processes used by the external subjects. A summary of the responses to the questions asked of subjects immediately following the planning task is then presented, as well as a comparison of responses between the internal and external subjects. The perceived facilitative and inhibitory influences on clinical decision making that were verbalized by the subjects are then summarized and the internal and external groups are compared. Serendipitous findings are briefly outlined, and a summary of major findings concludes the chapter.

#### Characteristics of the Sample

The locus of control scores for the sample of 19 female subjects yielded a mean score of 12, a median score of 12, and a standard deviation of 4.04. Compared to the normative

data compiled by Cellini and Kantorowski (1982) on a sample of 183 female college students in 1980, this sample is approximately the same.

Table 1

Measures of Centrality and Variability on I-E Scale

Measure	1989 Sample	1980 Sample
Mean	12.0	11.70
Median	12.0	11.88
Standard Deviation	4.04	3.71

Subjects with a locus of control score of 11 or less were considered to have an internal locus of control, and are referred to as "internals". Subjects with a score of 12 or more were considered to have an external locus of control, and are referred to as "externals". There were nine internal subjects, and ten external subjects in the sample.

A background questionnaire (Appendix D, Part A) was used to gather demographic data and personal information on age, prior education, and work experience. These data are summarized in Table 2.

Table 2  
Selected Demographic Data

Demographic	Locus of Control	
	Internal n - 9	External n - 10
<u>Age</u>		
< 20	--	2
20-25	4	5
26-30	2	1
31-35	--	1
36-40	2	1
>41	1	--
<u>Education</u>		
< Grade 12	--	1
Grade 12	9	9
Some university credit	3	5
University degree	3	--
Diploma/Certificate	2	3
<u>Nursing Related</u>		
<u>Work Experience</u>		
Unit Assistant	1	2
Operating Room Technician	1	1
Other	2	2
<u>Present Employment</u>		
Unit Assistant	4	2
Operating Room Technician	1	1

Note. A dash indicates that no subject fell into the designated category.

The internal subjects were a slightly older group with 55.6% of them over 25 years of age, whereas only 30% of the external subjects were over 25 years of age. All subjects except one had a complete grade twelve education. The one subject who had grade eleven education had also taken a university credit course and a post-secondary technical course. Three of the internal subjects held a university degree (33.3%) and three had some university credit courses. Thus, 66.6% of the internal subjects had taken university courses.

Four of the internal subjects (44.4%) had some experience in nursing related work prior to entering the school of nursing. This included such positions as unit assistant, operating room technician, volunteer labor coach, and work with the handicapped. Five of the external subjects (50%) had prior experience in such nursing related work as unit assistant, operating room technician, medical receptionist and health record technician.

Five of the internal subjects were presently employed as unit assistants or an operating room technician outside of school hours, and three of the external subjects were presently employed as unit assistants or an operating room technician outside of school hours.

Data that was collected regarding ethnic/cultural background, languages spoken other than English, marital status, dependents, and present clinical experience area were deleted following the analysis of data. These attributes did not form clusters in either the internal or the external group of subjects, and were therefore not perceived to be major influences on the subjects' decision making processes.

## Simulated Patient Situation

### Subjects With an Internal Locus of Control

The frequency of occurrence of each of the individual decision making elements, and the composition and frequency of occurrence of the combinations of decision making elements in the protocols of subjects with an internal locus of control are examined and described, section by section, beginning with the Reading Aloud section, followed by the Thinking Aloud section, and concluding with the Thinking Aloud and Writing section. Examples are included throughout the analysis, and are numbered in sequence after each example for ease of future reference. The decision making elements identified in this study are referenced by the following abbreviations:

C = Cue

H = Hypothesis

KN = Knowledge Base

PD = Planning Decision

S = Search

A = Assumption



The Reading Aloud Section

Individual Decision Making Elements

Table 3

Reading Aloud Section: Frequency of Decision Making Elements (Internals)

Subj.	Cue		Hypothesis		Planning decision		Knowledge base		Search		Assumption	
	T	N	T	N	T	N	T	N	T	N	T	N
1	2	2	2	2	--	--	--	--	5	5	1	1
3	8	8	2	2	1	1	3	3	1	1	--	--
4	--	--	--	--	--	--	--	--	--	--	--	--
6	47	36	24	20	30	25	23	22	2	2	2	1
9	15	14	9	8	9	9	10	7	1	1	1	1
10	3	3	--	--	--	--	2	2	--	--	--	--
11	22	21	1	1	--	--	--	--	2	2	--	--
12	24	23	4	4	1	1	16	16	1	1	1	1
17	5	5	--	--	--	--	3	3	--	--	--	--
Total	126	112	42	37	41	36	57	53	12	12	5	4

Note. A dash indicates no occurrence of the item. Subj. = Subject; T = Total; N = New.

Table 3 indicates the total number of decision making elements verbalized in this section for each subject, (identified by code number), as well as the number of elements verbalized for the first time, which are designated in the table as "new" elements. The differentiation between total numbers and numbers of elements mentioned for the first time was deemed helpful, since the same decision making element was often articulated more than once.

#### Cue.

As might be expected when reading aloud, cues were verbalized more than any other decision making element, ranging from zero to 47 per subject. This represents the number of times cues from the situation were commented upon by the subjects. Only one subject made no comment while reading the situation out loud. Repeated mention of the same cue occurred quite infrequently, with the exception of subject 6.

#### Hypothesis.

Early hypothesis generation, i.e. hypotheses generated in this first section of the protocols, occurred in six of the nine internal subjects' protocols, the number of hypotheses over all nine subjects, ranging from zero to 24. Few hypotheses were repeated. There were more broadly stated hypotheses than specific ones.

#### Planning Decision.

Planning decisions were not a prominent feature in the Reading Aloud section. Five subjects did not make planning decisions at all in this initial section. Of the four subjects who did make decisions, the number of decisions ranged from one to 30. Repeated mention of planning decisions in this section was made only by subject 6, who generated the 30 planning decisions. As can be seen in Table 4, the majority of planning decisions were in the assessment and physical care categories. Two subjects included decisions to teach the patient, and one subject made a decision to consult with the physician at this point.

### Knowledge Base.

The use of facts, theory, or rationale in this section ranged from zero to 23 incidents. Repeated mention of the same knowledge base occurred infrequently, as might be expected, since each decision making element is likely to be supported by a slightly different theoretical point. Much of the rationale verbalized was vague and non-specific, and paraphrased general surgical nursing knowledge.

### Search.

The internal subjects did not seek much information beyond the given situation. This was influenced, no doubt, by the instructions to subjects that the information given in the simulated patient situation was the only information available to them.

### Assumption.

Subjects made very few assumptions in the Reading Aloud section.

### Summary.

In the Reading Aloud section, cues were verbalized most frequently, followed by knowledge base, hypotheses, planning decisions, search and assumptions, in descending order.

Table 4  
Frequency of Use of Categories of Planning Decisions (Internals)

Category of decision	Frequency by subject								
	1	3	4	6	9	10	11	12	17
<b>Reading aloud section</b>									
Assessment	--	1	--	14	3	--	--	--	--
Physical care	--	--	--	5	4	--	--	1	--
Teaching	--	--	--	3	2	--	--	--	--
Communication (patient)	--	--	--	--	--	--	--	--	--
Communication (support systems)	--	--	--	3	--	--	--	--	--
<b>Thinking aloud section</b>									
Assessment	4	--	5	2	2	5	5	2	11
Physical care	7	4	9	4	9	14	2	5	5
Teaching	1	--	--	--	3	1	--	1	1
Communication (patient)	1	1	--	2	1	4	1	3	2
Communication (support systems)	1	2	2	2	2	2	1	1	1
<b>Thinking aloud and writing section</b>									
Assessment	7	11	4	3	3	8	5	4	2
Physical care	3	1	1	4	3	6	3	7	3
Teaching	1	--	3	--	1	--	--	--	--
Communication (patient)	5	2	5	8	1	3	1	2	--
Communication (support systems)	4	2	5	8	1	3	1	2	--

Note. Numbers represent new decisions made within each section. A dash indicates no occurrence of the item.

### Combinations of Decision Making Elements

The frequency of occurrence and the composition of each of the combinations of decision making elements in the Reading Aloud section are found in Tables 5, 6, 7, and 8.

#### Single Decision Elements

Table 5

#### Reading Aloud Section: Single Decision Elements (Internals)

Element	Frequency by subject								
	1	3	4	6	9	10	11	12	17
Cue	--	--	--	--	--	--	13	--	--
Hypothesis	--	--	--	--	--	--	--	--	--
Planning decision	--	--	--	--	--	--	--	--	--
Knowledge base	--	--	--	--	--	--	--	--	--
Search	--	--	--	--	--	--	--	--	--
Assumption	--	--	--	--	--	--	--	--	--

Note. A dash indicates no occurrence of an element.

Only one subject made use of single decision elements in the Reading Aloud section. Subject 11 verbalized 13 cues but made no further comment upon them. Three subjects verbalized personal reactions to cues. For example, after reading that the patient does not participate in regular exercise, the subject queried, "Who does?" These reactions, although interesting, were not included in the decision making combinations.

Two Element Combinations.

Table 6

Reading Aloud Section: Two Element Combinations (Internals)

Combination	Frequency by subject								
	1	3	4	6	9	10	11	12	17
C/H	--	2	--	7	3	--	1	3	--
C/KN	--	2	--	4	4	2	--	15	3
C/PD	--	1	--	4	--	--	--	1	--
C/S	1	1	--	--	--	--	2	1	--
C/A	--	--	--	--	--	--	--	1	--

Note. A dash indicates no occurrence of a combination. C = cue; H = hypothesis; PD = planning decision; KN = knowledge base; S = search; A = assumption.

The cue/hypothesis and cue/knowledge combinations were the most frequently used two element combinations in the Reading Aloud section, occurring 16 and 31 times respectively.

Cue/Hypothesis.

This combination involved the direct stimulation of hypotheses from cues. Some hypotheses were quite specific, for example:

- C: "She looks flushed,  
H: so she probably has a temp." [1]

Others, however, were quite broad, for example:

- C: "the doctor admitted her for surgery.  
H: Ok, so she's had problems with her gallbladder." [2]

Cue/Knowledge.

This combination consisted of the evaluation of cues accessed from the situation against five categories of knowledge. These five categories and an example of each are now presented.

a) Evaluation of cue against knowledge of general surgical routines and risk factors.

- C: "she does not participate in regular exercise  
KN: which also increases her risk." [3]

- C: "Beginning to take clear fluids...  
KN: so her bowel sounds came back." [4]

- C: "Moderate amount of drainage...  
KN: by then it should have been less than that." [5]

b) Evaluation of cues against norms and policies.

C: "5 feet, 4 inches, 110 lbs.

KN: Ok, so she's average height, average weight." [6]

C: "BP 132/86, TPR 37-72-20...

KN: so that's within normal ranges." [7]

C: "Demerol 100 mg. q3-4h prn.

KN: Well, that should have been standing order." [8]

c) Evaluation of cues against experience.

C: "had a cholecystectomy and exploration of the common bile duct.

KN: So that, she's probably in the O.R. for a while...common bile duct is...takes a little bit of extra time." (This subject was an operating room technician prior to entering nursing). [9]

d) Evaluation of cues against specific knowledge of disease condition and surgery.

C: "Cholecystectomy...

KN: very painful." [10]

e) Vague, non-specific evaluation of cues.

C: "light smoker...

KN: that's bad." [11]



### Cue/Planning Decision.

This combination involved the direct stimulation of planning decisions from cues, and occurred a total of six times, four of these in the protocol of subject 6. The generation of planning decisions from cues was, therefore, relatively infrequent in this stage. The planning decisions made were primarily in the assessment category.

C: "T-tube to straight drain,

PD: watch for any kinks in the T-tube,

PD: how she's positioned." [12]

### Cue/Search.

This combination occurred a total of five times, and represented a search for further information stimulated by a cue.

C: "Demerol...

S: "Ok, but when did she have it?" [13]

The information sought was specific to physical status, except for one general query about what might be bothering the patient.

### Cue/Assumption.

This combination occurred once. It was similar to the cue/hypothesis combination with the distinction that assumptions generated from a cue represented unwarranted conclusions, i.e. judging with insufficient data.

C: "preferring to control her weight through dieting..."

A: "well, that's probably why she's in this trouble." [14]

Three Element Combinations.

Table 7

Reading Aloud Section: Three Element Combinations (Internals)

Combination	Frequency by subject								
	1	3	4	6	9	10	11	12	17
C/H/KN	--	--	--	3	--	--	--	1	--
C/H/PD	--	--	--	2	1	--	--	--	--
C/H/S	1	--	--	--	--	--	--	--	--
C/H/A	--	--	--	1	--	--	--	--	--
C/PD/KN	--	--	--	3	1	--	--	--	--
C/KN/S	--	--	--	1	--	--	--	--	--
C/PD/A	--	--	--	--	1	--	--	--	--
KN/PD/S	--	--	--	1	--	--	--	--	--
H/S/A	1	--	--	--	--	--	--	--	--

Note. A dash indicates no occurrence of a combination. C = cue; H = hypothesis; PD = planning decision; KN = knowledge base; S = search; A = assumption.

Five subjects did not use three element combinations in this section. A total of seventeen 3-element combinations was used by the remaining four internal subjects, 11 of these by subject 6. The most frequently used combinations were cue/hypothesis/knowledge, cue/hypothesis/planning decision, and cue/planning decision/knowledge.

Cue/Hypothesis/Knowledge.

This combination was used four times. Cues from the situation stimulated hypothesis generation from memory or experience, and the hypotheses were then supported from the subject's knowledge base.

C: "she is having a lot of pain in her abdomen,

C: and looks flushed and uncomfortable.

H: Hmm. Obviously there's something going on inside, possibly a subphrenic abscess or something,...

KN: on the third day, she shouldn't be in this much pain." [15]

Cues and knowledge also combined to stimulate hypotheses, and knowledge was used to evaluate a cue, to provide rationale for a cue, or to provide rationale for an hypothesis. The following example illustrates all of these processes in one thought segment.

C: "Her nasogastric tube has been removed

C: and she is beginning to take clear fluids.

KN: Ok, that's good,

C: just IV still running at 50 cc.

KN: Basically, that's just a maintenance, and

KN: just to see how she tolerates her clear fluids.

H: She probably has minimal bowel sounds as yet.

KN: They're not going to stop the IV until she's got good bowel sounds and has a good input and output." [16]

Cue/Hypothesis/Planning Decision.

This combination was used three times. In this combination, planning decisions arose directly from cues and the hypothesis provided rationale for the planning decision.

C: "large abdominal dressing.

PD: Got to watch for drainage from that and

PD: explain to her...the reasons for the abdominal pressure dressing...

H: She might be alarmed by the large abdominal dressing." [17]

Cue/Planning Decision/Knowledge.

In this combination, cues and knowledge combined to generate planning decisions. Knowledge also served to provide rationale for the planning decisions made.

C: "more encouragement during the evening to get out of bed

C: and was reluctant to do her deep breathing and coughing exercises.

KN: Ok, that would seem quite normal,

PD: but she does need the encouragement to do it.

PD: I would check to see...how often she's getting her pain medication

PD: ...and whether she's taking it on a regular basis,

PD: and if this is why she doesn't want to move, or deep breathe and cough,

PD: and explain to her the importance of both

KN: especially her deep breathing and coughing with her smoking and her moving, would increase her healing time and also help her chest. [18]

Cues also stimulated planning decisions directly, which were then supported by knowledge.

C: "a penrose drain was inserted through a separate stab wound

C: and she had a subcostal incision.

PD: Ok, you have to watch for drainage from the penrose.

KN: It's not near the wound site, which is good." [19]

Other three element combinations occurred once each and did not add to the knowledge of decision making in this section.

Four Element Combinations.

Table 8

Reading Aloud Section: Four Element Combinations (Internals)

Combination	Frequency by subject								
	1	3	4	6	9	10	11	12	17
C/H/PD/KN	--	--	--	4	2	--	--	--	--
C/H/KN/S	--	--	--	--	1	--	--	--	--
C/H/KN/A	--	--	--	1	--	--	--	--	--

Note. A dash indicates no occurrence of a combination. C = cue; H = hypothesis; PD = planning decision; KN = knowledge base; S = search; A = assumption.

Only two of the internal subjects used four element combinations in the Reading Aloud section. Subject 6 used them five times and subject 9 used them three times.

Cue/Hypothesis/Planning Decision/Knowledge.

This combination was the most frequently occurring four element combination. Cues, knowledge, and hypotheses in various combinations often preceded planning decisions, and built up support for the planning decision.

C: "she's got a subcostal,  
 KN: that's a high incision  
 H: so she's not going to want to breathe very well,  
 H: she'll certainly have a lot of pain  
 PD: so we'll have to watch her pain management." [20]

A cue and hypothesis together prompted a planning decision, supported by rationale.

C: "moist looking  
 H: ...if anything looks suspicious  
 PD: I'd probably take a C&S  
 KN: just to make sure." [21]

Cues and knowledge together would stimulate planning decisions that were supported by knowledge, and on occasion, by an hypothesis.

C: "slightly swollen  
 C: and moist looking,  
 KN: shouldn't be moist looking yet  
 PD: so I'd probably take a C&S  
 KN: and see what's going on  
 PD: and check her temp too,  
 KN: see if she has an elevated temp  
 H: and possibly an infection." [22]

Two 4-element combinations were used which did not include a planning decision. A cue/hypothesis/knowledge/assumption combination was used to formulate a patient

problem. A cue/hypothesis/knowledge/search combination was used to generate and support hypotheses.

Summary of the Combinations of Decision Making Elements

Table 9

Frequency of Use of Combinations of Decision Making Elements (Internals)

Combination of Elements	Frequency by subject									Total
	1	3	4	6	9	10	11	12	17	
	Reading aloud section									
Single	--	--	--	--	--	--	13	--	--	13
Two	1	7	--	15	7	2	3	21	3	59
Three	2	--	--	11	3	--	--	1	--	17
Four	--	--	--	5	3	--	--	--	--	8
Five	--	--	--	--	--	--	--	--	--	--
	Thinking aloud section									
Single	1	1	1	1	1	3	2	1	--	11
Two	3	1	1	--	3	6	2	3	3	22
Three	1	1	3	1	2	7	2	6	5	28
Four	1	--	3	3	1	1	1	--	3	13
Five	--	--	--	--	--	--	--	--	--	--
	Thinking aloud and writing section									
Single	2	2	1	2	2	2	2	1	1	15
Two	6	4	4	5	2	7	5	5	3	41
Three	--	4	4	5	8	4	3	2	--	30
Four	5	3	1	--	3	1	2	1	--	16
Five	2	--	--	1	--	--	--	--	--	3

Note. A dash indicates no occurrence of the combination.

In the Reading Aloud section, two and three element combinations were used most frequently. Only one subject used single decision elements, and none used five element combinations. Those combinations of decision making elements, whether they were two, three, or four element complexes, that did not include planning decisions, seemed to be used for purposes related to the development of a representation in the problem space. The approaches used included hypothesis generation and rationale, information search, and the evaluation of cues and hypotheses against the subjects' knowledge base.

#### Overall Approaches Used in the Reading Aloud Section

The most common overall approach by the internal subjects was to compare selected cues with knowledge base, with a minimal amount of hypothesizing and generating of planning decisions. This approach was used by five of the subjects.

One subject, whose Reading Aloud section was very short, seemed to be primarily seeking information.

One subject repeated cues she had just read with no further comment, as if she were rehearsing the information.

One subject spent a great deal of time in this section, reading the situation sentence by sentence, and pausing after each to hypothesize, evaluate information, or make planning decisions.

One subject made no comment in the Reading Aloud section.

It must be noted that subject 6 was an outlier in this group of internal subjects. Her approach was very systematic and comprehensive. She acquired more cues, hypothesized more, made more planning decisions, and used her knowledge base significantly more than any of the other internal subjects.



The Thinking Aloud Section

Individual Decision Making Elements

Table 10

Thinking Aloud Section: Frequency of Decision Making Elements (Internals)

Subj.	Cue		Hypothesis		Planning decision		Knowledge base		Search		Assumption	
	T	N	T	N	T	N	T	N	T	N	T	N
1	5	4	6	4	16	14	4	3	2	2	--	--
3	2	2	2	1	7	7	1	1	--	--	--	--
4	4	4	9	8	18	16	13	13	--	--	--	--
6	6	1	4	3	17	10	8	5	--	--	--	--
9	6	5	8	7	24	15	6	6	--	--	3	3
10	24	13	17	11	33	26	5	5	--	--	2	2
11	8	6	6	5	9	9	3	3	1	1	--	--
12	6	3	6	6	13	12	7	7	1	1	--	--
17	22	15	14	7	26	20	9	7	1	1	1	1
Total	83	53	72	52	163	129	56	50	5	5	6	6

Note. A dash indicates no occurrence of the element. Subj. = subject; T = total; N = new.

Table 10 indicates the total number of decision making elements verbalized in this section for each subject (identified by code number), as well as the number of elements verbalized for the first time, designated in the table as "new" elements.

#### Cue.

The number of cues mentioned by an individual subject in this section ranged from two to 24. One subject mentioned 24 cues and one mentioned 22. The majority of subjects mentioned between four and six cues. Seven subjects repeated some cues from the Reading Aloud section and two subjects did not repeat cues. Subject 6 repeated five cues from the Reading Aloud section. This subject generated a total of 47 cues in the Reading Aloud section, so five repeats is quite a small number in comparison. Overall, fewer cues were mentioned in the Thinking Aloud protocols than in the Reading Aloud section.

#### Hypothesis.

The total number of hypotheses generated in the Thinking Aloud protocols is significantly greater than in the Reading Aloud section. This was to be expected, as hypotheses are more likely to be formulated while thinking about the task of planning care than they are while simply reading the simulated situation.

Subject 6 decreased the number of hypotheses mentioned quite drastically from the Reading Aloud section. This subject however, generated by far the largest number of hypotheses in the Reading Aloud section. The reduction of hypotheses in the Thinking Aloud section may represent the refinement of hypotheses at this early stage in the planning process.

Hypotheses in the Thinking Aloud section were a mixture of specific and very broad statements, as they were in the Reading Aloud section, although more of the hypotheses were specific, identifiable problems than in the previous section. This may be due, perhaps, to sheer numbers, but perhaps also, to a refinement of the patient's problems in the minds of the subjects. The broader hypotheses seemed to be mentioned in

relation to the patient's psychosocial status, response to the pain, and to pain management, whereas the specific hypotheses dealt with the condition of the wound, the elevation of temperature, and the patient's respiratory status.

#### Planning Decision.

Planning decisions were the most frequently used decision making element in the Thinking Aloud protocols, as a total of 163 planning decisions were made. Subjects 9, 10, and 17 were the most prolific planners, but all subjects, with the exception of subject 6, increased the number of decisions made from the previous section. Subject 6 decreased the number of decisions from the Reading Aloud section.

As can be seen in Table 4, most of the planning decisions were physical care or assessment decisions. Most planning decisions that were mentioned more than once were also physical care or assessment decisions. Communication with the patient and communication with support systems (almost exclusively physicians), were fairly well represented at 15 occurrences each. The least frequent planning decisions were in the category of teaching the patient. Five subjects failed to generate any teaching decisions in this section.

Subject 17 generated 11 assessment decisions and only five physical care decisions. This subject experienced considerable frustration with the ambiguity of the situation, which may account for the small number of action oriented decisions.

#### Knowledge Base.

Evidence of the use of knowledge to support decision making in the Thinking Aloud section occurs with approximately the same frequency and specificity as in the Reading Aloud section. Subjects often do not verbalize their knowledge base in detail, although it cannot be assumed from this, that they do not possess the knowledge.

#### Search.

Seeking for information beyond that given in the situation occurred only five times across four subjects. This is somewhat less than in the Reading Aloud section.

Most of the information sought in this section was specific, for example, whether or not the patient had a foley catheter, what the intake and output values were, and the patient's current temperature. Two pieces of information sought were a little vague, for example, whether or not the patient had been assessed in the evening.

#### Assumption.

Assumptions were made by three subjects for a total of six. Subjects 9 and 10 made three and two assumptions respectively. Assumptions were used as a rationale or basis for making planning decisions. The assumptions made, however, could not be validated by the information given in the situation. The danger in making assumptions is that incorrect planning decisions may be made, based on false assumptions. Since it was not the purpose of this study to evaluate the accuracy or quality of planning decisions made by the subjects, no conclusions can be drawn from these results.

#### Summary.

In the Thinking Aloud section, planning decisions were the most frequently mentioned decision making element, followed by cues, hypotheses (equal to cues), knowledge base, assumptions, and search (equal to assumptions), in descending order.

#### Combinations of Decision Making Elements

The frequency of occurrence and the composition of each of the combinations of decision making elements in the Thinking Aloud section are found in Tables 11, 12, 13, and 14.

Single Decision Elements

Table 11

Thinking Aloud Section: Single Decision Elements (Internals)

Element	Frequency by subject								
	1	3	4	6	9	10	11	12	17
Cue	--	--	--	--	--	--	--	--	--
Hypothesis	--	--	--	--	--	--	--	--	--
Planning decision	1	1	1	1	1	3	2	1	--
Knowledge base	--	--	--	--	--	--	--	--	--
Search	--	--	--	--	--	--	--	--	--
Assumption	--	--	--	--	--	--	--	--	--

Note. A dash indicates no occurrence of an element.

All internal subjects except one, formulated planning decisions that appeared as independent elements, that is, they were verbally unsupported by other decision making elements. These single element processes occurred in groups varying from two to six elements in number. Three subjects used them at the beginning of the Thinking Aloud protocol, two subjects used them halfway through, and three subjects used them at the end. One subject generated lists of planning decisions at the beginning, midpoint, and end of the Thinking Aloud section. At times, these lists of planning decisions were composed of decisions generated for the first time, and at

other times, they seemed to summarize or review what had been mentioned previously. A new planning decision was occasionally added to a list that reviewed previous decisions. An example of a list of planning decisions generated for the first time occurred at the beginning of the Thinking Aloud section of subject 1, as follows:

PD: "I would take her temperature at this point.

PD: I'd try and reassure her, um, by responding to, identifying and responding to her feelings and, um,

PD: I would also try, ... find out when she had her last analgesic.

PD: And give her an analgesic if it was due, um, there was something else I was thinking of, um, about, oh yeah, her, um,

PD: I would check her input and output." [23]

Two Element Combinations.

Table 12

Thinking Aloud Section: Two Element Combinations (Internals)

Combination	Frequency by subject								
	1	3	4	6	9	10	11	12	17
C/H	1	--	--	--	--	1	--	--	1
C/KN	--	--	--	--	--	--	--	--	2
C/PD	--	1	--	--	1	3	1	--	--
H/PD	--	--	--	--	1	2	1	1	--
PD/A	--	--	--	--	1	--	--	--	--
PD/KN	2	--	1	--	--	--	2	--	--

Note. A dash indicates no occurrence of a combination. C = cue; H = hypothesis; PD = planning decision; KN = knowledge base; S = search; A = assumption.

The cue/planning decision, hypothesis/planning decision, and knowledge/planning decision combinations were the most frequently used two element combinations in the Thinking Aloud section, occurring six, five, and five times each, respectively. This was followed by the cue/hypothesis combination, which occurred three times.

### Cue/Planning Decision.

In the cue/planning decision combinations, cues stimulated planning decisions directly, or they provided rationale for a planning decision already made. An example in which both of these functions occurred is as follows:

PD: "record what she's been saying like about pain in her abdomen,

C: she just doesn't feel very well,

C: she looks flushed and uncomfortable,

PD: just report that to the service." [24]

The two cues in this example provided a reason for the first planning decision and also triggered a new, but related planning decision. The types of planning decisions that occurred in this two element combination included all categories of planning decisions except teaching.

### Hypothesis/Planning Decision.

In this combination, hypotheses that are mentioned prior to the planning decision served the function of stimulating, or triggering that decision.

H: "if a swab was sent

PD: check for any results before calling him." [25]

Hypotheses mentioned after the formulation of a planning decision served as rationale for that decision.

PD: "check her intake and output for the last 24 hours

PD: and [check] what she's drank since midnight.

H: I'm just thinking ... maybe she should have an increase in fluids.

H: ...I guess I'm thinking more of a respiratory infection." [26]

The planning decisions made in this two element combination included all categories except teaching.



### Knowledge/Planning Decision.

In all of the examples of the knowledge/planning decision combination, the planning decision was mentioned first, and the knowledge element provided a reason or rationale for the decision. All planning decisions in this combination were assessment decisions.

PD: "I'm going to take a look at her incision

KN: and see ... if it was changed at all from the last look at it.

KN: Um, because then I can determine if it's infected or not

KN: and, uh, just to see how it looks." [27]

Subject 1 used this combination of decision making elements to test, that is, to rule in or out, three previously identified hypotheses. The subject hypothesized wound infection, respiratory problems, and urinary tract infection. She then went on to say,

PD: "I would also take a swab ... of any drainage and the incision site

KN: ... and send it for testing.

PD: If there's any sputum, I would send that in ...

KN: for microbiological testing

PD: and I would probably take an MSU as well

KN: just to be on the safe side." [28]

### Cue/Hypothesis.

Cues served to trigger hypotheses in this combination, or to provide support or evidence for the hypothesis.

C: "there was a moderate amount of serosanguinous drainage

C: ... and the incision itself looked swollen and moist, and slightly reddened,

H: so, looks like a wound infection." [29]

H: "she's very, very, upset

C: it could be the pain." [30]

#### Cue/Knowledge.

One cue/knowledge combination was used by one subject in the same manner as this combination was used in the Reading Aloud section, that is, a cue was compared to the subject's knowledge of normal progress following surgery.

#### Planning Decision/Assumption.

In this combination, used by one subject, the assumptions served as conditions under which the planning decision would be carried out.

#### Three Element Combinations.

Table 13

#### Thinking Aloud Section: Three Element Combinations (Internals)

Combination	Frequency by subject								
	1	3	4	6	9	10	11	12	17
C/H/PD	1	--	--	--	--	1	--	1	--
C/H/KN	--	--	--	--	1	2	1	1	2
C/PD/KN	--	--	1	1	--	--	--	1	--
C/PD/S	--	--	--	--	--	--	--	1	--
C/PD/A	--	--	--	--	--	2	--	--	--
H/PD/KN	--	1	2	--	--	2	1	2	2
PD/KN/A	--	--	--	--	1	--	--	--	--

**Note.** A dash indicates no occurrence of a combination. C - cue; H - hypothesis; PD - planning decision; KN - knowledge base; S - search; A - assumption.

All subjects used at least one 3-element combination in this section, with a total of 28 combinations in all. The hypothesis/planning decision/knowledge combination was the most frequently used three element combination in this section. This was followed by the cue/hypothesis/knowledge combination, cue/hypothesis/planning decision combination, and cue/planning decision/knowledge combination.

#### Hypothesis/Planning Decision/Knowledge

Four different patterns emerged in this section in the use of this combination of decision making elements.

1. A planning decision with its associated rationale combined to provide evidence or support for an hypothesis.

PD: "I'd take her temperature

KN: to see if it was elevated

H: ...an increase in temperature would indicate um, an infection." [31]

2. Hypotheses also stimulated planning decisions directly, which were then supported by a reason.

H: "if it was still swollen and reddened,

H: and if her temperature was elevated,

PD: I would also notify the doctor

KN: so something could be done, and she could be getting some antibiotic or something

KN: um, so it wouldn't be getting worse." [32]

3. An hypothesis stimulated a planning decision directly, and was then further supported by a combination of knowledge and another related hypothesis.

H: "if she's not drinking,

PD: I think I might speed up the IV a little bit

KN: ...'cause she's not feeling well,

H: she might not drink very much." [33]

In one example, this approach was extended, that is, a series of planning decisions were made on the basis of an hypothesis, with some support from knowledge base.

PD: "further assess her pulmonary status

H: ...and if she is ... coughing up anything

PD: get C&S, uh, a sample of the sputum,

PD: reinforce the importance of deep breathing and coughing ... do it with her  
and encourage her every two hours.

PD: Walk her every two hours,

PD: give her fluids, uh, two and a half to three liters a day

KN: just to clear up any secretions that's there,

H: if she does have any. [secretions]

PD: By then I would have listened to her chest sounds." [34]

4. Knowledge base and hypotheses were often combined to serve as rationale for planning decisions. This function occurred six times.

PD: "check her bowel sounds

KN: see what's happening there

H: as there might be some blockage ... um, paralytic ileum

KN: ...her bowels maybe weren't ready to have the fluid come down, and so  
that's their response, to shut down." [35]

#### Cue/Hypothesis/Knowledge.

Three patterns of this combination were identified in this section.

1. Cues stimulated hypotheses which were compared to, or evaluated from, knowledge base.

C: "my first levels from looking at the incision

C: and report [from the night nurse]

H: push towards wound [infection]

KN: although it's kind of early." [36]

2. Cues and knowledge together were used to support or validate hypotheses. In this example, the cue, and knowledge of post operative progress, served to validate the hypothesis of wound infection.

H: "she might probably have an infection

C: ... it is her third day post op

KN: which is common for infection to set in then." [37]

3. Some examples of this combination, although they included the three decision making elements, were, in fact, a series of two element combinations intermingled.

In this example, the first two cues are compared to the subject's knowledge base regarding surgical complications. The next two cues stimulate an hypothesis, which is then supported by three more cues. Basically, the subject seems to be reviewing cues and comparing them to her knowledge base.

C: "she's laying [sic] on her back with her knees drawn up,

C: so she's having pain,

KN: which is common if there's an infection in the wound site.

C: And she says she's having a lot of pain,

C: and she looks flushed and uncomfortable

H: so she probably has a fever.

C: Her skin feels warm,

C: and she says she feels funny,

C: and not very well." [38]

In another example, the first cue is compared to the subject's knowledge about post operative progress. The next two cues stimulate an hypothesis. The last cue relates to the hypothesis and repeats a cue mentioned prior to the hypothesis.

- C: "she's draining some amount, moderate amount of serosang drainage  
 KN: ... that's kind of, that's still a lot on the third day, a moderate amount.  
 C: ...and she's getting only 50 cc. an hour on the intravenous  
 C: and she's trying to control her weight through dieting.  
 H: so she's probably not eating, or not drinking that much in the hospital, as  
 she should after the post-op day,  
 C: um, her intravenous is still running." [39]

Cue/Hypothesis/Planning Decision.

Four different configurations of this combination occurred in this section as follows:

1. Two planning decisions were made. A cue and two hypotheses provided rationale for the importance of the planning decisions.

PD: "encourage her to get out of bed and walk, to be active

PD: ... explain to her why this is important for her respiration and circulation

C: even though she's reluctant

H: especially if she's running a temperature

H: and she's probably feeling very weak." [40]

2. An hypothesis and a cue were used together to stimulate a planning decision.

H: "If the wound is draining something,

C: it says serosanguinous,

PD: I'd probably still take a swab and send it." [41]

3. A cue stimulated a non-specific planning decision which was followed by a short section in which the subject tried to determine how to carry out the planning decision, but did not come to a conclusion.

C: "so she's in pain.

PD: I'll probably want to give her something for pain.

C: Third day post-op.

H: the Demerol is probably off, 48 hours, yeah

H: so probably the Demerol might have to be re-ordered." [42]

4. A cue stimulated an hypothesis, followed by the formulation of three more hypotheses. The cue and all four hypotheses together led to the development of a broad planning decision.

C: "she's flushed

H: so maybe she probably has a temp right now.

H: Um, and there is some evidence of wound infection,

H: and it could also be her pulmonary status

H: or urinary status being affected.

PD: Uh, so with that, I would further assess her." [43]

#### Cue/ Planning Decision/Knowledge.

Three instances of this combination occurred. In all three examples, cues stimulated planning decisions that were supported by rationale.

#### Cue/Planning Decision/Assumption.

This combination occurred twice in the protocol of subject 10. In both cases, a combination of cue and assumption occurred between planning decisions. The cue and assumption acted together to provide rationale for the planning decisions that they follow. The final planning decisions in both examples seemed only vaguely related to the first decisions, but occurred in the same thought segment.

PD: "I'd still get her to drink more.

C: She's third day post-op,

A: her urine output is fine.

PD: ...And explain to her what might be going on." [44]

PD: "give her something for pain, the Demerol,

PD: give her some Phenergan also.

C: she's not feeling very well,

C: she feels funny,

C: and she's crying,

A: so she's feeling nausea along with the funniness

PD: and I'd give her some Phenergan too.

PD: and find out what her allergies are,

PD: and maybe make a note to the doctor, about what's going on

PD: ... or have service come up and assess for themselves." [45]

#### Cue/Planning Decision/Search.

This occurred once in the protocol of subject 12. A search for information stimulated review of given cues, which then stimulated two planning decisions.

#### Planning Decision/Knowledge/Assumption.

This occurred once in the protocol of subject 9. Based on an assumption about previous methods used to manage the patient's pain, the subject generated two planning decisions regarding pain management with rationale for the decisions.



Four Element Combinations.

Table 14

Thinking Aloud Section: Four Element Combinations (Internals)

Combination	Frequency by subject								
	1	3	4	6	9	10	11	12	17
C/H/PD/KN	--	--	3	3	1	1	--	--	1
C/H/PD/S	1	--	--	--	--	--	--	--	1
C/H/KN/S	--	--	--	--	--	--	1	--	--
C/H/KN/A	--	--	--	--	--	--	--	--	1

Note. A dash indicates no occurrence of a combination. C = cue; H = hypothesis; PD = planning decision; KN = knowledge base; S = search; A = assumption.

A total of 13 four element combinations were evidenced in the Thinking Aloud section. Nine of these were cue/hypothesis/planning decision/knowledge combinations, two were cue/hypothesis/planning decision/search examples, one was a cue/hypothesis/knowledge/assumption combination, and one was a cue/hypothesis/knowledge/search combination. Two subjects did not use four element combinations at all in the Thinking Aloud section.

Cue/Hypothesis/Planning Decision/Knowledge.

There were six ways in which combinations of these four elements were used.

1. Cues stimulated planning decisions, which were then supported by knowledge and hypotheses.

2. Cues and hypotheses combined to stimulate planning decisions, which were supported by knowledge.

3. In one example, a cue provided rationale for a planning decision, and then the cue and an hypothesis together triggered four planning decisions and another hypothesis.

4. Cues, knowledge, and hypotheses were also used individually, to provide rationale for planning decisions. One instance of this was similar to a review or summary of planning decisions with associated rationale, although the rationale was vague and scanty.

PD: "check the drainages.

C: She's still got her penrose in there,

PD: check that

KN: to see if there's anything coming from that.

PD: Check the wound again

KN: to see if it's increased in redness or swelling or discharge

PD: ... take a C&S

KN: to find out an exact, exactly what it's growing, if it is.

PD: I'd take a C&S ... from the penrose

H: if there's any discharge from there

PD: and [take a C&S] from the wound

KN: to see if it's on the inside or not." [46]

5. Two of these combinations contained examples of the generation of hypotheses that stimulated planning decisions, with occasional support from knowledge base.

C: "she feels funny,

KN: that concerns me because, she might, well, she's lost a moderate amount of drainage.

H: Perhaps she's bleeding more so now,

KN: which would make me think that something has opened up.

PD: so I would check that,

H: and if that's the case, [that she's opened up]

PD: I'd get her to lie down right away, and uh,

PD: get a, just a sterile moist dressing on, like,

PD: try and keep her calm,

PD: and I'd get some help in there right away

KN: to assess the situation and get it fixed.

H: and she'd be NPO because if that's the case, [that she opened up]

H: she might have to go back to the O.R." [47]

6. In one of these four element combinations, the subject hypothesized wound infection and instituted a number of planning decisions to validate that hypothesis.

H: "if it was the wound infection,

PD: I would check the dressing,

PD: um, what kind it's draining, an excess

PD: or [check] if it's purulent drainage there

PD: ... swab it for C&S

PD: ... and report any abnormalities to the doctor.

C: ... um, this little swollen and moist looking,

C: ... and the skin edges slightly reddened,

KN: it sounds, it's like a normal response, on the third day." [48]

Cue/Hypothesis/Planning Decision/Search.

In the two examples of this four element combination, planning decisions are developed to rule in or out three different hypotheses being considered simultaneously.

S: "it doesn't really have any information about it [intake and output]

C: ... she's still on an IV

C: and she still has drainage

PD: so that's something I'd like to check as a matter of course. [intake and output]

H: ... she might also have a UTI,

S: it doesn't have anything about that.

H: She's got an infection, probably in her wound

C: and she's a fresh post-op

PD: so she should have her respirations checked.

H: ... the other area of infection she'd be prone to is um, urinary tract,

PD: so I'd like to check that out." [49]

Summary of Combinations of Decision Making Elements in the Thinking Aloud Section (Internals)

In the Thinking Aloud section, two and three element combinations were the most frequently used combinations of decision making elements. The use of single decision elements and four element combinations was approximately equal, and no five element combinations were used.

Overall Approach in Thinking Aloud Protocols (Internals)

Four patterns of approach to planning the care of the patient in this simulated situation emerged in this section. These patterns were alternating hypotheses and planning decisions, or vice versa, formulating hypotheses and testing them, that is,

attempting to rule them in or out, formulating hypotheses and developing treatment decisions directly, and a balanced approach that utilized more equal numbers of cues, hypotheses and theoretical knowledge to derive planning decisions.

Subjects 10 and 17 may be characterized as "active processors" in this stage, in that they worked extremely hard at attempting to utilize a large body of information. These two subjects used significantly more cues, and formulated more hypotheses and planning decisions than the remainder of the internal subjects. It is important to note that in the initial Reading Aloud section, these two subjects used the smallest number of cues, and formulated no hypotheses or planning decisions. In contrast, subject 6 was the most "active processor" in the Reading Aloud section, and was the only subject to decrease the number of hypotheses and planning decisions in the Thinking Aloud section. In addition, a prominent feature of the Thinking Aloud protocol of subject 17 was the processing of cues, hypotheses, and theoretical facts together, without developing a planning decision at that point in time.

#### Comparison of Reading Aloud and Thinking Aloud Protocols of Subjects With an Internal Locus of Control

##### Frequency of use of individual decision making elements.

The frequency of use of individual decision making elements in the Reading Aloud section and the Thinking Aloud section is found in Tables 3 and 9. A difference between these two sections was evidenced by the frequency of use of three of the elements. In the Reading Aloud section, the majority of subjects accessed a large number of cues, but did not formulate hypotheses or planning decisions extensively. In the Thinking Aloud section, the majority of subjects mentioned fewer cues, but increased the formulation of hypotheses and planning decisions. The proportion of planning decisions made in each of the five categories of nursing intervention were similar in both sections, that is, the majority of planning decisions were in the

assessment and physical care categories. Evidence of the use of knowledge base was surprisingly low in both sections of the protocol. In addition, instances of a search for information not given in the situation were infrequent, and the number of assumptions made, was minimal.

#### Frequency of use of combinations of decision making elements.

A comparison of the number of occurrences of each combination of decision making elements in the three sections is found in Table 9. The number of single decision elements used was similar in both sections. Although the Reading Aloud and Thinking Aloud sections were alike in that the two and three element combinations of decision making elements were the most frequently occurring, the number of three element combinations was greater than the number of two element combinations in the Thinking Aloud section. The reverse was true in the Reading Aloud section, that is, two element combinations were more frequent than three element combinations. The number of four element combinations increased from eight in the Reading Aloud section to 13 in the Thinking Aloud section.

#### Function of individual decision making elements within combinations.

##### Cue.

Cues appeared to stimulate hypotheses, planning decisions, search, or assumptions directly, that is, without the presence of another decision making element. Cues alone, also provided a reason for a planning decision or an hypothesis. Cues were also found to combine with knowledge to stimulate hypotheses, and to combine with knowledge or hypotheses to stimulate planning decisions. Cues combined with knowledge to provide rationale for hypotheses, and cues combined with hypotheses or assumptions to provide rationale for planning decisions.

### Hypothesis.

Hypotheses were found to stimulate planning decisions directly, or to provide rationale for a planning decision. Hypotheses also combined with knowledge to either stimulate, or provide rationale for, a planning decision.

### Planning Decision.

Planning decisions were occasionally combined with knowledge to provide support for the formulation of an hypothesis.

### Knowledge Base.

Knowledge as an individual decision making element, provided theoretical support or rationale for cues, hypotheses, and planning decisions. Knowledge base, understandably, was not used to support search or assumptions.

### Search.

Search was used infrequently, and resulted in a review of available information, as no new information was provided by the investigator.

### Assumption.

Assumptions were rarely used, but when they occurred, they stimulated, or provided a reason for, a planning decision.

The Thinking Aloud and Writing Section

Individual Decision Making Elements

Table 15

Thinking Aloud and Writing Section: Frequency of Decision Making Elements

(Internals)

Subj.	Cue		Hypothesis		Planning decision		Knowledge base		Search		Assumption	
	T	N	T	N	T	N	T	N	T	N	T	N
1	13	7	15	8	41	20	12	11	4	1	1	1
3	12	6	16	9	23	16	6	6	1	1	2	2
4	3	3	7	5	33	14	14	9	--	--	--	--
6	8	1	5	3	39	19	16	14	1	1	--	--
9	7	4	9	2	49	9	20	20	1	1	4	4
10	8	1	17	11	52	21	4	4	--	--	2	1
11	15	1	14	11	22	12	4	4	3	3	--	--
12	2	1	4	3	23	16	12	12	--	--	--	--
17	1	--	2	2	10	6	2	1	--	--	--	--
Total	69	24	89	54	292	133	90	81	10	7	9	8

Note. A dash indicates no occurrence of the element. Subj. = subject; T = total; N = new.



Table 15 indicates the total number of decision making elements verbalized in this section for each subject (identified by code number), as well as the number of elements verbalized for the first time, designated in the table as "new" elements.

#### Cue.

The number of cues mentioned by an individual subject in this section ranged from one to 15. The majority of subjects mentioned less than eight cues. Fewer cues were mentioned in this section than the previous two sections.

#### Hypothesis.

The total number of hypotheses generated in the Thinking Aloud and Writing section was equal to that of the Thinking Aloud section. The hypotheses in the Thinking Aloud and Writing section began to show a general increase in specificity. The range of hypotheses projected was very wide, from nursing diagnoses accepted in the profession, to some that would have been identified in the past as patient problems, to single signs or symptoms, to the projected results of medical treatment or nursing care, and finally, to possible psychosocial responses of the patient.

#### Planning decision.

In the Thinking Aloud and Writing section, planning decisions were the most frequently mentioned decision making element. A total of 292 planning decisions were made, and 133 of these were new decisions not mentioned in previous sections. All subjects increased the total number of planning decisions in this section, but many of these decisions were repeated from previous sections, and/or within this last section itself. As seen in Table 4, the majority of planning decisions in the Thinking Aloud and Writing section were again in the assessment and physical care categories. Communication with the patient, and communication with support systems increased in this last section. Teaching is still the least frequently mentioned decision, with six subjects failing to include any teaching decisions in this section. Five subjects made more new assessment decisions in this section than physical care decisions.

### Knowledge base.

Evidence of the use of knowledge base to support decision making in the Thinking Aloud and Writing section increased over the previous two sections. The specificity and detail of knowledge statements however, remains rather broad in scope.

### Search.

Seeking information beyond that given in the situation occurred a total of 10 times across five subjects. Most of the information sought in this section was specific and the majority of it related to the patient's physical status, e.g. intake/output measures, temperature, fluids, etc.

### Assumption.

Nine assumptions were made among four subjects in this section. Five of these assumptions related to behaviour of the patient, e.g. voiding, toleration of fluids, smoking while in hospital; one assumption related to the patient's physical status, e.g. secretions in the lungs; and three referred to the patient's knowledge, e.g. that the patient knows something is wrong, but is not sure what, and that the patient doesn't realize the importance of deep breathing and coughing and ambulation.

### Summary.

In the Thinking Aloud and Writing section, planning decisions were the most frequently mentioned decision making element, followed by knowledge base, hypotheses, cues, search, and assumptions in descending order.

### Combinations of Decision Making Elements

The frequency of occurrence and the composition of each of the decision making elements in the Thinking Aloud and Writing section are found in Tables 16, 17, 18, 19, and 20.

Single decision elements.

Table 16

Thinking Aloud and Writing Section: Single Decision Elements (Internals)

Element	Frequency by subject								
	1	3	4	6	9	10	11	12	17
Cue	--	1	--	--	--	--	--	--	--
Hypothesis	--	--	--	1	--	1	--	--	--
Planning decision	2	1	1	1	2	1	2	--	1
Knowledge base	--	--	--	--	--	--	--	1	--
Search	--	--	--	--	--	--	--	--	--
Assumption	--	--	--	--	--	--	--	--	--

Note. A dash indicates no occurrence of an element.

The majority of single decision elements in this section were planning decisions. The planning decisions were evident in the protocols of all subjects except one. The phenomenon occurred at the beginning, halfway mark, or at the end of the section. The purpose seemed to be the same as in the Thinking Aloud section, that is, to summarize or review and, on occasion, add a new decision to the list. In the Thinking Aloud and Writing section, one subject used a list of cues as a single decision element. This represented a review of cues from the situation. Two subjects mentioned hypotheses without the support of other decision making elements, and one subject made a statement of fact without relationship to any other contiguous decision making element.

Two element combinations.

Table 17

Thinking Aloud and Writing Section: Two Element Combinations (Internals)

Combination	Frequency by subject								
	1	3	4	6	9	10	11	12	17
C/H	--	--	--	--	--	--	1	--	--
C/PD	3	3	--	--	--	2	--	--	1
C/S	--	--	--	--	--	--	1	--	--
H/PD	--	--	--	--	--	3	2	1	1
H/KN	1	--	--	--	--	--	--	--	--
PD/KN	2	1	4	5	1	2	1	4	1
PD/A	--	--	--	--	1	--	--	--	--

Note. A dash indicates no occurrence of a combination. C = cue; H = hypothesis; PD = planning decision; KN = knowledge base; S = search; A = assumption.

The planning decision/knowledge combination was the most common two element combination in this section, used by all subjects. This combination was simply the statement of planning decisions supported by rationale, and occurred for all categories of planning decisions. In many cases of this combination, the main purpose served was to summarize, review, or formulate a series of planning decisions, only some of which, were supported by rationale. Therefore, although it is a two element combination, the knowledge base used was secondary to the purpose. As was true throughout the

protocols of all subjects, the evidence of knowledge base that was verbalized was non-specific and incomplete.

Cue/planning decision.

This combination occurred nine times. Cues were found to stimulate planning decisions directly, to provide a reason for a planning decision already made, or to serve both functions at the same time when sandwiched between planning decisions. Since all of these combinations were used in the same manner in the Thinking Aloud section, examples have been omitted from this summary.

Hypothesis/planning decision.

In this combination, hypotheses stimulated the formulation of planning decisions directly, or provided a reason for designing a particular planning decision. Thus, hypotheses, when combined with planning decisions, acted in the same manner as did cues combined with planning decisions. Since all of these combinations were used in the same manner in the Thinking Aloud section, examples have been omitted from this summary.

Cue/search.

Only one subject used a cue/search combination in this section. This consisted of a review of cues and a request for further information.

Hypothesis/knowledge.

One subject used an hypothesis/knowledge combination, the only combination of this type in the protocols of the internal subjects. In this example, an hypothesis was proposed, followed by an indicator of its existence, then a second hypothesis and an

indicator were mentioned. The indicators represented recall of knowledge regarding the hypotheses.

H: "if she had a wound infection

KN: she'd have an increase in drainage,

H: and if she has an um, urinary tract infection,

KN: her output might be decreased." [50]

#### Planning decision/assumption.

There was one example of a planning decision/assumption combination in which the assumption, sandwiched between two planning decisions, formed the basis for each planning decision.

PD: "go over more teaching with her about the importance [of DB&C]

A: because I don't think she realizes what, how important it really is.

PD: ...tell her that we will keep her medicated so it won't be so uncomfortable, you know, for her to do these things." [51]

Three element combinations.

Table 18

Thinking Aloud and Writing Section: Three Element Combinations (Internals)

Combination	Frequency by subject								
	1	3	4	6	9	10	11	12	17
C/H/PD	--	1	--	--	--	2	1	--	--
C/H/KN	--	--	--	1	--	--	--	--	--
C/H/S	--	--	--	--	--	--	1	--	--
C/PD/KN	--	--	1	2	2	--	--	1	--
H/PD/KN	--	3	3	2	5	1	1	1	--
H/KN/S	--	--	--	--	1	--	--	--	--
PD/KN/A	--	--	--	--	--	1	--	--	--

Note. A dash indicates no occurrence of a combination. C = cue; H = hypothesis; PD = planning decision; KN = knowledge base; S = search; A = assumption.

A total of 30 three element combinations were used by the subjects in this section. The three most frequently occurring combinations were hypothesis/planning decision/knowledge, cue/planning decision/knowledge and cue/hypothesis/planning decision combinations.

Hypothesis/planning decision/knowledge.

In addition to the four patterns of this combination discussed in the Thinking Aloud section, two new configurations of these elements occurred in the Thinking Aloud and Writing section.

1. An approach was used in which a section of hypothesizing and comparing to knowledge base preceded the generation of a planning decision to rule in/out different sources of infection.

H: "if she's got an infection

KN: ... like the most possible site that she'd have infection would be from her incision, but

H: ... if she's got a lot of drainage coming from her T-tube,

H: ... maybe it's an infection, not just from the top, but like from underneath.

H: ... maybe like a break in sterile technique in the O.R. or

H: maybe there was something else that was missed.

KN: and now it's starting to fester inside, so

PD: ... check all possible, like where um, [she] possibly can have an infection."

[52]

The second pattern was a mixed use of two and/or three element combinations. In the following example, two 2-element combinations are used sequentially. The subject made a planning decision and gave a reason for it. She then expanded on that decision and supported it with an hypothesis.

PD: "respond to her feelings.

KN: I think she's in a need for venting them, and maybe for some reassurance.

PD: So I'd respond to her feelings

PD: ... explore her concerns

H: ... maybe there's other things bothering her that has caused her to cry."

[53]



In an example of a two and three element combination, the subject made a planning decision and supported it with rationale. She then made a new, but related planning decision, supported by a combination of an hypothesis and knowledge base.

PD: "assess her chest.

KN: ... I want to make sure that there aren't any crackles in her

PD: ... elevate her bed too, the head of the bed.

H: ... if she's in fluid overload

KN: ... to make sure ... that she's draining Ok." [54]

#### Cue/planning decision/knowledge.

There were six occurrences of this combination and five of them were the same as in the Thinking Aloud section, i.e., cues stimulated planning decisions which were supported by knowledge. In one instance, a combination of cue and knowledge provided support for three planning decisions.

#### Cue/hypothesis/planning decision.

In addition to the cue and hypothesis elements combining to provide rationale for planning decisions or to stimulate planning decisions as in the Thinking Aloud section, there were two examples of the occurrence of one, two, and three element complexes in the same thought segment, in which the connections between complexes were not readily apparent. In the following example, a cue stimulated three hypotheses. The planning decision that follows seemed to stand alone. The third hypothesis then stimulated three more related hypotheses. The last three hypotheses may support the planning decision, but that is impossible to ascertain from the typed transcript or the tape recording itself.

C: "I'm also thinking ... it's third day post-op.

H: Maybe she just could very well be constipated

H: and have abdominal distention

H: but uh, peritonitis ...

PD: I think her output again, also, [check] her urine output.

H: There'd be a lot of third space shifting,

H: and her abdomen would probably be distended and very uncomfortable,

H: ... her blood pressure would probably have dropped." [55]

In the following example, a cue and hypothesis combined to stimulate a planning decision. In the same thought segment, another cue stimulated another planning decision. This represents a three and two element combination.

C: "The NG tube is discontinued,

H: but if it [the NG tube] was there,

PD: you'd check that,

C: the IV's running still,

PD: so, you're going to be checking the bag, making sure the right solution's up and that it's even running and all the basic stuff." [56]

Four element combinations.

Table 19

Thinking Aloud and Writing Section: Four Element Combinations (Internals)

Combination	Frequency by subject								
	1	3	4	6	9	10	11	12	17
C/H/PD/KN	2	1	1	--	1	--	2	1	--
C/H/PD/S	--	1	--	--	--	--	--	--	--
C/H/PD/A	1	1	--	--	--	1	--	--	--
C/H/KN/A	--	--	--	--	1	--	--	--	--
C/PD/KN/S	1	--	--	--	--	--	--	--	--
C/PD/KN/A	--	--	--	--	1	--	--	--	--
H/PD/KN/S	1	--	--	--	--	--	--	--	--

Note. A dash indicates no occurrence of a combination. C = cue; H = hypothesis; PD = planning decision; KN = knowledge base; S = search; A = assumption.

There were 16 four element combinations used in this section, eight of these being the cue/hypothesis/planning decision/knowledge combination. There were four patterns within this combination as follows:

1. Cues and hypotheses combined to stimulate planning decisions which were supported by knowledge, as discussed in the Thinking Aloud section.
2. Knowledge and a cue combined to stimulate hypotheses which in turn, stimulated a planning decision with rationale.

3. Cues and an hypothesis provided rationale for a planning decision. The hypothesis stimulated a second planning decision, closely related to the first one, which was supported by rationale.

PD: "ask her if she has nausea

C: ... she's feeling funny,

C: not very well.

H: She might be experiencing a little bit of nausea.

PD: Give her the Phenergan

KN: because nausea is a side effect of Demerol." [57]

4. A mixture of two, three, and four element combinations occurred sequentially, in which one combination stimulated the next decision making complex.

a) A lengthy section of hypothesis/knowledge/cue combination provided rationale for the first planning decision. This four element complex stimulated a three element complex consisting of two more planning decisions supported by an hypothesis and knowledge base.

PD: "auscultate [sic] the chest,

H: she might be developing a wound infection

KN: ... her risk for it would increase

C: because she is a smoker,

H: so she'd be having secretions,

C: and she hasn't been doing her deep breathing and coughing

C: and she hasn't been getting out of bed.

H: ... so ... there'll be an accumulation of secretions,

KN: and you want to, you know, see if they're present and remove them.

PD: ... encourage ambulation

PD: ... encourage DB&C

H: although I might have to give her about 20 minutes or so if she's in a lot of pain

KN: for the analgesic to take effect." [58]

b) A three element combination in which a cue and knowledge provided rationale for a planning decision was followed by an hypothesis that stimulated another planning decision (two element combination).

c) There were two instances in which a four element complex consisting of a cue/hypothesis/planning decision/knowledge combination stimulated a two element combination in which hypotheses triggered the formulation of other planning decisions.

Cue/hypothesis/planning decision/assumption.

There were three instances of this combination.

1. In one example, a combination of assumption, cue and knowledge provided rationale for a planning decision.

2. In the second example, the combination of assumption, cue, and knowledge stimulated planning decisions which triggered two more hypotheses.

3. In the third example, an hypothesis stimulated a planning decision which was supported by a cue/assumption combination. This cue/assumption combination stimulated two planning decisions very similar to the first planning decision.

Two subjects did not use four element combinations at all in the Thinking Aloud and Writing section.

Five element combinations.

Table 20

Thinking Aloud and Writing Section: Five Element Combinations (Internals)

Combination	Frequency by subject								
	1	3	4	6	9	10	11	12	17
C/H/PD/KN/S	2	--	--	1	--	--	--	--	--

Note. A dash indicates no occurrence of a combination. C = cue; H = hypothesis; PD = planning decision; KN = knowledge base; S = search.

Three 5-element combinations occurred in the Thinking Aloud and Writing section. These were all cue/hypothesis/planning decision/knowledge/search combinations. In one instance, the subject started with a planning decision that caused her to think about the patient's intake. She then combined what she did not know, with what she did know, and what she hypothesized to be true, to generate three more planning decisions.

PD: "get an order for them to increase her IV

KN: um, because she does have a temp.

S: It doesn't say anything about her intake.

C: She is on clear fluids,

C: but with not feeling great, you know,

C: having pain

- C: and being flushed and uncomfortable,  
 H: she's probably not, doesn't have a great input,  
 PD: so I would probably get her IV speed up  
 PD: and possibly try to encourage her to drink more.  
 PD: Check her output,  
 KN: see what's happening there as well." [59]

### Summary of Combinations of Decision Making Elements in the Thinking Aloud and Writing Section (Internals)

In the Thinking Aloud and Writing section, two and three element combinations were the most frequently occurring combinations of decision making elements. The use of single decision elements and four element combinations was approximately equal, and three 5-element combinations occurred.

### Overall Approach in Thinking Aloud and Writing Protocols

One subject used cues, knowledge base and hypotheses in fairly equal numbers to stimulate or provide rationale for planning decisions.

Two subjects used fairly equal numbers of cues and hypotheses to stimulate or provide rationale for planning decisions, but used very minimal support from their knowledge base.

Four subjects concentrated on generating planning decisions with support from their knowledge base. Not many cues or hypotheses were referred to in this section.

One subject generated a number of hypotheses and developed many planning decisions to cover these possibilities. In addition, she formulated lists of planning decisions unsupported by knowledge or cues.

One subject simply listed planning decisions which were mostly unsupported in this section. For this subject, the Thinking Aloud and Writing section was very short, as was

the Reading Aloud section. The subject virtually made all the planning decisions in the Thinking Aloud section.

Of the total number of combinations of decision making elements in this section, only seven failed to include a planning decision.

#### Comparison of Reading Aloud, Thinking Aloud, and Thinking Aloud and Writing Protocols (Internals)

##### Frequency of use of individual decision making elements. (Tables 3, 10, 15)

The total number of cues mentioned by the subjects decreased from the Reading Aloud to the Thinking Aloud to the Thinking Aloud and Writing section.

The total number of hypotheses and the number of new hypotheses mentioned, increased from the Reading Aloud to the Thinking Aloud section, and then remained approximately the same in the Thinking Aloud and Writing section.

The total number of facts or rationale mentioned, planning decisions made, and assumptions made, increased from the Reading Aloud to the Thinking Aloud to the Thinking Aloud and Writing section. The most significant increase was evident in the number of planning decisions made between the Reading Aloud and Thinking Aloud sections.

The search for information not provided was highest in the Reading Aloud section, dropped considerably in the Thinking Aloud section, and increased again in the Thinking Aloud and Writing section.

Cues, hypotheses and planning decisions were the elements most frequently repeated, with the number of repetitions increasing from the Reading Aloud to the Thinking Aloud and to the Thinking Aloud and Writing section.

The number of new hypotheses and planning decisions increased in the Thinking Aloud section from the Reading Aloud section, but remained approximately the same in number in the Thinking Aloud and Writing section.



Of the five categories of planning decisions, assessment and physical care decisions remained the most frequently mentioned decisions in all three sections. Although the total number of planning decisions increased from section to section, the number of new assessment decisions increased from the Thinking Aloud to the Thinking Aloud and Writing section, and the number of new physical care decisions decreased from the Thinking Aloud to the Thinking Aloud and Writing section. Teaching decisions were the lowest in frequency in both the Thinking Aloud and Thinking Aloud and Writing sections, whereas communication with the patient and communication with support systems decisions increased in frequency from the Thinking Aloud to the Thinking Aloud and Writing section.

#### Frequency of use of decision making combinations. (Table 9)

The number of single decision elements mentioned by subjects remained fairly stable across all three sections of the protocols. The two and three element combinations were the most frequently used in all three sections. The number of four element combinations increased from the Reading Aloud to the Thinking Aloud to the Thinking Aloud and Writing section, and five element combinations were evident only in the Thinking Aloud and Writing section.

#### Function of individual decision making elements.

The functions served by each of the decision making elements in the Thinking Aloud and Writing section remained similar to those in the Reading Aloud and Thinking Aloud sections.

#### Use of Qualifiers and Organizers (Internals)

Two techniques which the internal locus of control subjects seemed to find useful in their decision making were the use of qualifiers and organizers.

Qualifiers are defined as techniques the subjects used to determine what, when, or if, planning decisions might be implemented. The three types of qualifiers identified, are termed Time Sequencing, Priority Setting, and Contingency.

1. Time sequencing.

In time sequencing, planning decisions were made in "before" and "after" terms.

e.g. "about 20 minutes after I give her the Demerol."

"after all that's done ..."

"after I check the dressing out..."

"if it was three hours or later ..."

"before all this, I would probably try to calm her down."

2. Priority setting.

In priority setting, the subject verbalized the relative urgency or importance of planning decisions by prioritizing them.

e.g. "temperature would be a priority ..."

"first of all, I'd take her temp."

"first thing I would do is probably assess her pain ... second, I'd take her vital signs."

"I would get a swab for C&S first and then I would do a dressing change."

"to me, getting her up and deep breathing and coughing is more of a priority."

3. Contingency.

In contingency, the subject considered the impact of decisions made by other health professionals or departments, or other factors, which she deemed as important influences upon her own planning decisions.

e.g. "just when some decision's been made, according to these guys [physicians], then implement from there."

"would have brought ... some dressings to change it, if it needed to be changed."

"I'd have to wait for the report of the C&S."

"So it would depend whether I could actually see the wound myself or not."

"if she hasn't had one for a while, I'd give her an analgesic right away. Um, Ok, and that's providing her vital signs would be fine."

"Depending on how bad I think she is, you know, I might phone the service to come up and see her ..."

Organizers are defined as comments made by the subjects to themselves, which seemed to be aimed towards organizing their thoughts and the direction they wish to take in decision making.

e.g. "Um, let's see now, what else could I possibly do for her?"

"What am I going to do?"

"Um, where am I at now?"

"I wonder if I'm missing something?"

#### Simulated Patient Situation

#### Subjects With an External Locus of Control

The frequency of occurrence of each of the individual decision making elements, and the composition and frequency of occurrence of the combinations of decision making elements in the protocols of subjects with an external locus of control are examined and described, section by section, beginning with the Reading Aloud section, followed by the Thinking Aloud section, and concluding with the Thinking Aloud and Writing section. Examples are included throughout the analysis, and are numbered in sequence after each example for ease of future reference.

The Reading Aloud Section

Individual Decision Making Elements

Table 21

Reading Aloud Section: Frequency of Decision Making Elements (Externals)

Subj.	Cue		Hypothesis		Planning decision		Knowledge base		Search		Assumption	
	T	N	T	N	T	N	T	N	T	N	T	N
2	8	8	2	2	--	--	2	2	--	--	--	--
5	--	--	--	--	--	--	--	--	--	--	--	--
7	14	14	3	3	--	--	10	10	2	1	--	--
8	19	18	6	6	5	5	5	5	2	2	--	--
13	--	--	--	--	--	--	--	--	--	--	--	--
14	--	--	--	--	--	--	--	--	--	--	--	--
15	10	10	--	--	--	--	3	3	--	--	--	--
16	10	10	2	2	--	--	3	3	--	--	--	--
18	10	10	4	4	--	--	5	5	--	--	--	--
19	--	--	--	--	--	--	--	--	--	--	--	--
Total	71	70	17	17	5	5	28	28	4	3	--	--

Note. A dash indicates no occurrence of the element. Subj. = subject; T = total; N = new.

Table 21 indicates the total number of decision making elements verbalized in this section for each subject, identified by code number, as well as the number of elements

verbalized for the first time, which are designated in the table as "new" elements. The differentiation between total numbers and numbers of elements mentioned for the first time was deemed helpful, since the same decision making element was often articulated more than once.

#### Cue.

Cues were verbalized more than any other decision making element in this section, ranging from zero to 19 per subject. Repeated mention of the same cue occurred once. Four subjects made no comment while reading the situation out loud.

#### Hypothesis.

A total of 17 hypotheses were made by the external subjects in this section, ranging from zero to six per subject. None were repeated.

#### Planning decision.

Only one subject formulated planning decisions in the Reading Aloud section. Three of these were physical care interventions, and two were assessment decisions. (See Table 22).

#### Knowledge base.

The use of facts, theory or rationale in this section occurred 28 times across all subjects. None of these statements were repeated. Most of the rationale verbalized was very global.

#### Search.

Only two subjects sought information beyond the given situation.

#### Assumption.

No assumptions were made by the external subjects in the Reading Aloud section.

#### Summary.

In the Reading Aloud section, cues were verbalized most frequently, followed by knowledge base, hypotheses, planning decisions, search and assumptions in descending order.

Table 22

Frequency of Use of Categories of Planning Decisions (Externals)

Category of Decision	Frequency by subject									
	2	5	7	8	13	14	15	16	18	19
Reading aloud section										
Assessment	--	--	--	2	--	--	--	--	--	--
Physical care	--	--	--	3	--	--	--	--	--	--
Teaching	--	--	--	--	--	--	--	--	--	--
Communication (patient)	--	--	--	--	--	--	--	--	--	--
Communication (support systems)	--	--	--	--	--	--	--	--	--	--
Thinking aloud section										
Assessment	2	2	1	1	--	7	8	5	1	6
Physical care	5	5	2	14	--	7	1	5	7	6
Teaching	--	1	--	--	--	2	--	--	3	--
Communication (patient)	1	1	1	--	1	--	4	4	5	2
Communication (support systems)	1	1	1	2	--	1	1	5	4	2
Thinking aloud and writing section										
Assessment	3	1	3	4	12	4	4	--	--	5
Physical care	3	5	12	2	8	6	--	--	3	6
Teaching	--	2	1	10	2	--	--	3	--	--
Communication (patient)	2	3	2	4	2	--	1	1	--	--
Communication (support systems)	4	1	3	3	3	2	2	2	3	3

Note. Numbers represent new decisions made within each section. A dash indicates no occurrence of the item.

Combinations of Decision Making Elements

The frequency of occurrence and the composition of each of the combinations of decision making elements in the Reading Aloud section are found in Tables 23, 24, and 25.

Single decision elements.

Table 23

Reading Aloud Section: Single Decision Elements (Externals)

Element	Frequency by subject									
	2	5	7	8	13	14	15	16	18	19
Cue	2	--	--	--	--	--	--	--	1	--
Hypothesis	--	--	--	--	--	--	--	--	--	--
Planning										
decision	--	--	--	--	--	--	--	--	--	--
Knowledge										
base	--	--	--	--	--	--	--	--	--	--
Search	--	--	--	--	--	--	--	--	--	--
Assumption	--	--	--	--	--	--	--	--	--	--

Note. A dash indicates no occurrence of an element.

Two subjects verbalized cues in the Reading Aloud section with no further comment. Three subjects verbalized personal reactions to cues. These reactions tended

to represent subjective opinions about the information being read. For example, after reading the patient's history and the fact that the doctor admitted her for surgery, one subject said, "That makes a lot of sense. The poor lady's been through a lot, might as well get it over with." These reactions were not included in the decision making combinations.

Two element combinations.

Table 24

Reading Aloud Section: Two Element Combinations (Externals)

Combination	Frequency by subject									
	2	5	7	8	13	14	15	16	18	19
C/H	2	--	2	3	--	--	--	2	--	--
C/PD	--	--	--	2	--	--	--	--	--	--
C/KN	2	--	8	2	--	--	3	3	--	--
C/S	--	--	1	2	--	--	--	--	--	--

Note. A dash indicates no occurrence of a combination. C = cue; H = hypothesis; PD = planning decision; KN = knowledge base; S = search.

Five subjects used two element combinations in the Reading Aloud section. The cue/hypothesis and cue/knowledge combinations were the most frequently used, occurring nine and 18 times, respectively. This was followed by three occurrences of



the cue/search combination, and two occurrences of the cue/planning decision combination.

Cue/hypothesis.

In the cue/hypothesis combination, cues stimulated hypotheses directly. The hypotheses varied from such specific ones as "pain" and "infection" to more ambiguous statements, such as "she's going to have a few drains."

Cue/knowledge.

The cue/knowledge combination for external subjects consisted of the evaluation of cues against the five categories of knowledge that were presented in the discussion of this combination for internal subjects. The two categories of knowledge that the external subjects used the most to evaluate cues, were the categories of established norms, and vague, non-specific evaluation of cues.

Cue/search.

This combination represented a search for further information stimulated by a cue. The information sought was both specific and general.

Cue/planning decision.

The generation of planning decisions from cues was done by one subject. The planning decisions formulated were both assessment and physical care decisions.

Three element combinations.

Table 25

Reading Aloud Section: Three Element Combinations (Externals)

Combination	Frequency by subject									
	2	5	7	8	13	14	15	16	18	19
C/H/PD	--	--	--	1	--	--	--	--	--	--
C/H/KN	--	--	1	1	--	--	--	--	1	--
C/PD/KN	--	--	--	1	--	--	--	--	--	--

Note. A dash indicates no occurrence of a combination. C = cue; H = hypothesis; PD = planning decision; KN = knowledge base.

A total of five 3-element combinations were used by three subjects in this section. The cue/hypothesis/knowledge combination occurred three times, cue/hypothesis/planning decision once, and cue/planning decision/knowledge once.

Cue/hypothesis/knowledge.

In this combination, a cue stimulated an hypothesis which was supported by knowledge, or cues were evaluated against the knowledge base and together, the cue and knowledge stimulated hypotheses. In the following example, the subject is trying to assess the patient's risk for respiratory complications.

C: "right subcostal incision.

KN: ... she's so light and small,

H: probably won't be any trouble turning her, or anything.

C: and smoking ... light smoker,

KN: may or may not have a bearing on her lungs afterwards." [60]

Cue/hypothesis/planning decision.

In the following example of this combination, the hypothesis and second cue together provide rationale for the first cue, and then the two cues and hypothesis together stimulate a planning decision.

C: "reluctant to do her DB&C exercises

H: she's probably not getting her analgesia as frequently

C: since it's her third day.

PD: So try and plan to make sure she gets it before I expect her to get up or to do deep breathing and coughing." [61]

Cue/planning decision/knowledge.

In this combination, a cue stimulated a planning decision that was supported by knowledge.

There were no four or five element combinations of decision making elements in the Reading Aloud protocols of the external subjects.

Overall Approaches Used in the Reading Aloud Section

Of the six subjects who made comments in the Reading Aloud section, the most common approach was to compare or evaluate selected cues against the subjects' knowledge base. Very little hypothesizing occurred, and only one subject generated a few planning decisions. The knowledge base verbalized was very vague.

Summary of the Combinations of Decision Making Elements

Table 26

Frequency of Use of Combinations of Decision Making Elements (Externals)

Combination	Frequency by subject										Total
	2	5	7	8	13	14	15	16	18	19	
	Reading aloud section										
Single	2	--	--	--	--	--	--	--	1	--	3
Two	4	--	11	9	--	--	3	5	--	--	32
Three	--	--	1	3	--	--	--	--	1	--	5
Four	--	--	--	--	--	--	--	--	--	--	--
Five	--	--	--	--	--	--	--	--	--	--	--
	Thinking aloud section										
Single	--	--	--	5	--	--	2	2	2	2	13
Two	--	6	1	2	1	7	3	3	4	2	29
Three	2	1	3	3	2	7	2	2	5	3	30
Four	1	1	--	--	--	3	1	2	1	--	9
Five	--	--	--	--	--	--	--	--	--	--	--
	Thinking aloud and writing section										
Single	2	--	3	5	3	4	--	--	--	4	21
Two	5	6	3	8	11	7	2	1	3	4	50
Three	2	2	6	9	5	1	2	1	3	5	36
Four	1	--	1	1	4	1	--	--	--	2	10
Five	1	--	--	--	1	--	--	--	--	--	2

Note. A dash indicates no occurrence of the combination.

In the Reading Aloud section two element combinations were the most frequently used by the external subjects. Thus, the main purpose of the scant information

processing that occurred in this section, was to hypothesize and evaluate cues against the subjects' knowledge base.

### The Thinking Aloud Section

#### Individual Decision Making Elements

Table 27

#### Thinking Aloud Section: Frequency of Decision Making Elements (Externals)

Subj.	Cue		Hypothesis		Planning decision		Knowledge base		Search		Assumption	
	T	N	T	N	T	N	T	N	T	N	T	N
2	4	4	5	3	9	9	3	3	--	--	--	--
5	9	9	5	5	10	10	5	4	2	2	--	--
7	1	1	4	3	7	5	4	4	1	1	--	--
8	1	1	2	1	23	17	7	7	--	--	--	--
13	8	8	3	3	1	1	1	1	--	--	--	--
14	57	26	2	2	36	17	10	10	7	7	--	--
15	6	4	5	5	23	14	2	2	2	2	--	--
16	6	5	6	6	27	19	3	3	2	2	--	--
18	13	8	10	6	24	20	6	6	--	--	--	--
19	2	2	4	4	17	16	3	3	1	1	--	--
Total	107	68	46	38	177	128	44	43	15	15	--	--

Note. A dash indicates no occurrence of the element. Subj. = subject; T = total; N = new.

Table 27 indicates the total number of decision making elements verbalized in this section for each subject, identified by code number, as well as the number of elements verbalized for the first time, designated in the table as "new" elements.

#### Cue.

The number of cues mentioned by an individual subject in this section ranged from one to 57. The majority of subjects mentioned between four and 13 cues. In total, more cues were mentioned in the Thinking Aloud section than the Reading Aloud section for the external subjects.

#### Hypothesis.

The total number of hypotheses generated in the Thinking Aloud protocols of the external subjects was greater than in the Reading Aloud section.

#### Planning decision.

Planning decisions were the most frequently used decision making element in the Thinking Aloud protocols, as a total of 177 planning decisions were made. The planning decisions made by individual subjects ranged from one to 36, but considering the fact that only one subject made any planning decisions in the Reading Aloud section, this represents a significant increase. Most planning decisions were in the physical care and assessment categories (see Table 22). Communication with the patient and communication with support systems was also fairly well represented. The least frequent planning decisions were in the category of teaching the patient. Seven subjects failed to generate any teaching decisions in this section.

#### Knowledge base.

The use of knowledge to support decision making in the Thinking Aloud section was approximately twice that of the Reading Aloud section.

### Search.

Search for information beyond that given in the situation occurred 15 times across six subjects, which is a higher frequency than in the Reading Aloud section.

Information being sought was specific to the patient's physical condition.

### Assumption.

No assumptions were made by the external subjects in the Thinking Aloud section.

### Summary.

In the Thinking Aloud section, planning decisions were the most frequently mentioned decision making element, followed by cues, hypotheses, knowledge base, search and assumptions in descending order.

### Combinations of Decision Making Elements

The frequency of occurrence and the composition of each of the combinations of decision making elements in the Thinking Aloud section are found in Tables 28, 29, 30, and 31.

Single decision elements.

Table 28

Thinking Aloud Section: Single Decision Elements (Externals)

Element	Frequency by subject									
	2	5	7	8	13	14	15	16	18	19
Cue	--	--	--	--	--	--	--	--	--	--
Hypothesis	--	--	--	--	--	--	1	--	--	--
Planning decision	--	--	--	5	--	--	1	2	2	2
Knowledge base	--	--	--	--	--	--	--	--	--	--
Search	--	--	--	--	--	--	--	--	--	--
Assumption	--	--	--	--	--	--	--	--	--	--

Note. A dash indicates no occurrence of an element.

Six external subjects verbalized planning decisions that appeared as independent elements. These elements appeared at the beginning of the Thinking Aloud section, and/or halfway through, and/or at the end, in no apparent pattern.

One subject hypothesized halfway through this section, but this was in response to a prompt by the investigator.

One subject reviewed cues out loud at the beginning of the section.

Independent elements appearing in lists served to summarize or review previously mentioned data, or available information.



Two element combinations.

Table 29

Thinking Aloud Section: Two Element Combinations (Externals)

Combination	Frequency by subject									
	2	5	7	8	13	14	15	16	18	19
C/H	--	2	--	--	1	--	--	--	--	--
C/PD	--	2	--	--	--	6	1	--	1	--
C/KN	--	--	--	--	--	--	--	--	1	--
C/S	--	--	--	--	--	1	--	--	--	--
H/PD	--	--	--	--	--	--	2	2	2	1
PD/KN	--	2	--	2	--	--	--	1	--	--
PD/S	--	--	1	--	--	--	--	--	--	1

Note. A dash indicates no occurrence of the combination. C = cue; H = hypothesis; PD = planning decision; KN = knowledge base; S = search.

In total, seven 2-element combinations were used by the external subjects. The most frequently used were the cue/planning decision combination, which occurred 10 times, the hypothesis/planning decision combination, which occurred seven times, and the planning decision/knowledge combination, which occurred five times.

#### Cue/planning decision.

In this combination, cues stimulated planning decisions directly, or they provided rationale for the planning decisions made. The types of planning decisions that occurred in this two element combination included all categories of planning decisions except communication with support systems.

#### Hypothesis/planning decision.

In this combination, hypotheses stimulated planning decisions directly, provided a reason for a planning decision, or both. Hypotheses therefore, when combined with planning decisions, acted in a manner similar to that of cues in the cue/planning decision combination. The planning decisions made in this combination included physical care, communication with the patient, and communication with support systems.

#### Planning decision/knowledge.

In all of the examples of the planning decision/knowledge combination in this section, the planning decision was mentioned first, and the knowledge element provided a reason or rationale for the decision. The planning decisions in this combination included physical care, communication with the patient, and communication with support system decisions.

#### Cue/hypothesis.

There were three examples of the cue/hypothesis combination. In this combination, a single cue stimulated an hypothesis or several cues combined to trigger an hypothesis.

Cue/knowledge.

This combination was used by one subject. The cues in this combination were compared to the subject's knowledge of normal progress following surgery.

Planning decision/search.

This combination occurred once and represented the formulation of planning decisions to encompass a lack of information.

Cue/search.

This combination was used once. A search for a broad category of information led the subject to review a series of available cues.

Three element combinations.

Table 30

Thinking Aloud Section: Three Element Combinations (Externals)

Combination	Frequency by subject									
	2	5	7	8	13	14	15	16	18	19
C/H/PD	--	--	--	--	1	1	1	1	2	1
C/H/KN	--	--	--	--	1	--	--	--	--	--
C/PD/KN	--	1	1	1	--	4	--	--	1	1
C/PD/S	--	--	--	--	--	1	--	1	--	--
C/KN/S	--	--	--	--	--	--	1	--	--	--
H/PD/KN	2	--	2	2	--	--	--	--	2	1
PD/KN/S	--	--	--	--	--	1	--	--	--	--

Note. A dash indicates no occurrence of a combination. C = cue; H = hypothesis; PD = planning decision; KN = knowledge base; S = search.

All subjects used two or more three element combinations in the Thinking Aloud section, with a total of 30 combinations. The two most frequently used combinations were the hypothesis/planning decision/knowledge and cue/planning decision/knowledge combinations, followed by the cue/hypothesis/planning decision combination.

Hypothesis/planning decision/knowledge.

Three patterns of this combination appeared in the protocols of the Thinking Aloud section. The most common use of these three elements was to support, or provide a rationale for a planning decision by means of a combination of knowledge base and hypothesis. This was also the most common pattern of these three elements used by the internal subjects in the Thinking Aloud section.

Another pattern that was evident in the Thinking Aloud section of the internal subjects, and was used once in the Thinking Aloud section of the external subjects, was the stimulation of a planning decision from an hypothesis. The planning decision was then supported by rationale.

A different arrangement of these three elements occurred twice in the Thinking Aloud section of the external subjects. In this arrangement, combinations of knowledge and hypotheses served as both a stimulus and rationale for a planning decision.

H: "If her blood pressure and pulse are up,

KN: that could just be a sign of pain.

PD: And so we can check that

H: and make sure she's not going shocky or anything

KN: 'cause of the infection." [62]

Cue/planning decision/knowledge.

This three element combination was used in three different ways.

1. A cue stimulated a planning decision, which was then supported by knowledge.

This relationship among the three elements was common and has been previously described.

2. Cues and knowledge were combined to stimulate a planning decision. This occurred twice in this section.

C: "Ok, she had a right subcostal incision, Ok.

KN: ... her incision's really high, right subcostal incision is right below the ribs,

PD: ... I'd want to do the deep breathing and coughing and get her walking."

[63]

3. Cues and knowledge were also combined to provide rationale for a planning decision. This occurred three times in this section. In the following example, the description of the wound drainage (cue) and the subject's reason for wanting to compare the cue with current data, together provided rationale for all of the planning decisions.

PD: "I'd want to have a look at her dressing too,

KN: to see what it was like right now.

C: Like, last night it was serosanguinous drainage.

PD: I'd want to have a look at her dressing.

PD: And have a look at the wound." [64]

#### Cue/hypothesis/planning decision.

The following arrangements of these three elements were noted in this section:

1. A cue and hypothesis combined to stimulate a planning decision.
2. A cue and hypothesis combined to provide rationale for a planning decision.
3. A cue stimulated a planning decision which was supported by an hypothesis.
4. A cue stimulated an hypothesis, which stimulated a planning decision.
5. A cue stimulated a planning decision, which stimulated an hypothesis.

Cue/hypothesis/knowledge.

One example of this combination occurred in the Thinking Aloud section. In this example, a cue was compared to the subject's knowledge of normal post-op progress, which then stimulated an hypothesis.

C: "... third day post-op.

KN: Normally wound infection doesn't develop until at least the fourth day.

H: ... So, I would question whether or not she had had a systemic infection to begin with." [65]

Cue/planning decision/search.

There were two examples of this combination in this section. In both cases, search stimulated a planning decision which was supported by a cue.

Planning decision/knowledge/search.

In this combination, the planning decision stimulated search for further information, and knowledge supported the planning decision.

Cue/knowledge/search.

This combination was an attempt to combine known and unknown information regarding the patient's pain, which ended in an admitted knowledge deficit on the subject's part.

Four element combinations.

Table 31

Thinking Aloud Section: Four Element Combinations (Externals)

Combination	Frequency by subject									
	2	5	7	8	13	14	15	16	18	19
C/H/PD/KN	1	--	--	--	--	--	1	1	1	--
C/H/PD/S	--	1	--	--	--	--	--	--	--	--
C/H/KN/S	--	--	--	--	--	--	--	1	--	--
C/PD/KN/S	--	--	--	--	--	2	--	--	--	--
H/PD/KN/S	--	--	--	--	--	1	--	--	--	--

Note. A dash indicates no occurrence of the combination. C = cue; H = hypothesis; PD = planning decision; KN = knowledge base; S = search.

There were nine 4-element combinations in the Thinking Aloud section of the protocols of the external subjects. The most common of these were the cue/hypothesis/planning decision/knowledge and cue/planning decision/knowledge/search combinations.

Cue/hypothesis/planning decision/knowledge.

In two of these combinations, the cue, hypothesis, and knowledge base were used together to provide rationale for the planning decisions made.



In another example of this combination, one decision making element, or a combination of decision making elements, stimulated further thoughts in a sequential or cascading manner. That is, a cue stimulated an hypothesis, which triggered two planning decisions, supported by rationale and a cue/knowledge/hypothesis combination respectively.

C: "She's in a lot of pain

H: ... the increase in intensity of pain is probably due to the infection.

PD: Um, I would like her to, her pain to be controlled,

KN: because I would like to get her out of bed,

PD: and I would like to get her to do deep breathing and coughing

KN: because she's at risk for respiratory problems,

C: because she's a smoker,

C: and if she hasn't been moving around a whole lot,

H: she could get pneumonia." [66]

Cue/planning decision/knowledge/search.

Two examples of this combination occurred, in which cues were combined with search for further information, or with search and knowledge base to stimulate planning decisions.

Hypothesis/planning decision/knowledge/search.

One example of this combination occurred and represented an attempt on the subject's part, to find support for giving Demerol, which was the decision she wished to make.

Cue/hypothesis/knowledge/search.

In this combination, the subject compared known and unknown information to knowledge base to develop an hypothesis.

Cue/hypothesis/planning decision/search.

One example of this combination occurred in the protocol of subject 5. Two hypotheses, in combination with a cue and search for information not given, led to a planning decision.

Five element combinations.

There were no five element combinations in the Thinking Aloud section of the protocols of the external subjects.

Summary of Combinations of Decision Making Elements in the Thinking Aloud Section (Externals)

In the Thinking Aloud section, two and three element combinations were the most frequently used combinations of decision making elements. The use of single decision elements occurred slightly more often than four element combinations, and no five element combinations were used.

Overall Approach in Thinking Aloud Protocols (Externals)

The external subjects, as a group, processed very little information verbally in the Thinking Aloud section. The typed transcripts of this section ranged from one third of a page to two and one half pages in length. Five of the ten subjects verbalized less than one typed page in this section.

The number of hypotheses generated in this section was low, as was the use of knowledge base. Although the numbers of cues, hypotheses and planning decisions

varied across the subjects, the approaches used by most subjects included the stimulation of planning decisions directly from cues or hypotheses, and the support of planning decisions by cues and/or hypotheses. There were also many instances of the generation of lists of planning decisions that were either unsupported by any other decision making element, or weakly supported by the occasional cue or hypothesis, rather than theoretical knowledge. Subject 13 used this very short section mainly to review cues.

There were very few examples of the more complex decision making processes in this section. Even the four element combinations that were used, represented primarily a serial processing of information.

#### Comparison of Reading Aloud and Thinking Aloud Protocols (Externals)

##### Frequency of use of individual decision making elements (Tables 21 and 27).

The use of all decision making elements increased significantly in the Thinking Aloud section, except assumptions, which remained absent from the protocols. As seen in Table 21, each of the five categories of nursing intervention were represented in the Thinking Aloud section, whereas only physical care and assessment decisions were mentioned in the Reading Aloud section. Physical care and assessment decisions remain the most frequently used categories, however.

##### Frequency of use of decision making combinations (Table 26).

The number of single decision elements used increased in the Thinking Aloud section, as did the number of three and four element combinations. Two element combinations remained similar in both sections.

##### Function of decision making elements.

The function of the individual decision making elements in the Reading Aloud and Thinking Aloud sections was similar to that previously described for the internal subjects.

The Thinking Aloud and Writing Section

Table 32

Thinking Aloud and Writing Section: Frequency of Decision Making Elements  
(Externals)

Subj.	Cue		Hypothesis		Planning decision		Knowledge base		Search		Assumption	
	T	N	T	N	T	N	T	N	T	N	T	N
2	5	3	6	5	19	12	13	12	2	2	1	1
5	2	2	3	2	23	12	7	5	--	--	--	--
7	5	3	10	6	32	21	12	12	1	--	--	--
8	11	7	14	9	52	23	19	16	3	2	--	--
13	23	6	13	8	51	27	21	17	16	14	--	--
14	5	1	2	2	43	12	14	14	--	--	--	--
15	3	2	3	2	18	7	4	4	--	--	--	--
16	1	--	5	4	10	6	--	--	--	--	--	--
18	--	--	5	--	19	6	10	9	1	1	--	--
19	5	5	13	10	35	14	10	10	1	1	--	--
Total	60	29	73	48	302	140	110	98	25	20	1	1

Note. A dash indicates no occurrence of the element. Subj. = subject; T = total; N = new.

### Individual Decision Making Elements

Table 32 indicates the total number of decision making elements verbalized in this section for each subject, identified by code number, as well as the number of elements verbalized for the first time, designated in the table as "new" elements.

#### Cue.

The number of cues mentioned by an individual subject in this section ranged from one to 23. Seven subjects mentioned between one and five cues. Fewer cues were mentioned in this section than in either of the preceding sections.

#### Hypothesis.

The total number of hypotheses generated in the Thinking Aloud and Writing section was greater than in the Reading Aloud or Thinking Aloud sections. The range of hypotheses projected in this section was very wide and paralleled that of the internal subjects.

#### Planning decision.

In the Thinking Aloud and Writing section, planning decisions were the most frequently mentioned decision making element. A total of 302 planning decisions were made, and 140 of these were new decisions not mentioned in previous sections.

All subjects except 15, 16, and 18 increased the total number of planning decisions in this section from previous ones, although many decisions were repeated. Subjects 15, 16, and 18 did most of their verbalizing of planning decisions in the Thinking Aloud section and less in the Thinking Aloud and Writing section.

In the Thinking Aloud and Writing section, the majority of planning decisions were again in the assessment and physical care categories (Table 22). Teaching and communication with support systems increased in this section, while communication with the patient remained approximately equal to the Thinking Aloud section. Although decisions to teach the patient increased in total, five subjects failed to include any teaching decisions in this section.

Three subjects made more new assessment decisions in this section than physical care decisions.

#### Knowledge base.

Evidence of the use of knowledge base to support decision making in the Thinking Aloud and Writing section increased dramatically over the previous two sections. One subject, however, made no supporting theory statements in this section. As was the case with the internal subjects, the specificity and detail of the knowledge statements verbalized, remained broad in scope.

#### Search.

Seeking information beyond that given in the situation increased in this section, primarily as a result of subject 13, who sought information that was not available, a total of 16 times. This subject processed most of the information in the Thinking Aloud and Writing section, with very scant verbalization in the Reading Aloud and Thinking Aloud sections.

#### Assumption.

Only one assumption was made in this section by the external subjects. This assumption related to the pain management of the patient prior to the time period in which the subjects were to plan the care of the patient.

#### Summary.

In the Thinking Aloud and Writing section, planning decisions were the most frequently mentioned decision making element, followed by knowledge base, hypotheses, cues, search, and assumptions in descending order.

#### Combinations of Decision Making Elements

The frequency of occurrence and the composition of each of the decision making combinations in the Thinking Aloud and Writing section are found in Tables 33, 34, 35, 36, and 37.

Single decision elements.

Table 33

Thinking Aloud and Writing Section: Single Decision Elements (Externals)

Element	Frequency by subject									
	2	5	7	8	13	14	15	16	18	19
Cue	--	--	--	--	2	--	--	--	--	--
Hypothesis	--	--	--	1	--	--	--	--	--	--
Planning decision	2	--	3	4	1	4	--	--	--	4
Knowledge base	--	--	--	--	--	--	--	--	--	--
Search	--	--	--	--	--	--	--	--	--	--
Assumption	--	--	--	--	--	--	--	--	--	--

Note. A dash indicates no occurrence of an element.

The majority of single decision elements in this section were planning decisions. However, four subjects did not make use of any single decision elements. One subject verbalized cues and one subject verbalized an hypothesis unsupported by other decision making elements.

Two element combinations

Table 34

Thinking Aloud and Writing Section: Two Element Combinations (Externals)

Combination	Frequency by subject									
	2	5	7	8	13	14	15	16	18	19
C/H	--	--	--	--	--	--	--	--	--	1
C/PD	--	1	1	3	2	1	--	--	--	--
C/KN	--	--	--	--	--	1	--	--	--	--
H/PD	--	--	2	1	3	1	1	1	--	2
H/KN	--	--	--	--	1	--	--	--	--	--
PD/KN	5	4	--	4	2	4	1	--	2	1
PD/S	--	--	--	--	2	--	--	--	1	--
PD/A	--	5	--	--	--	--	--	--	--	--
KN/S	--	--	--	--	1	--	--	--	--	--

Note. A dash indicates no occurrence of a combination. C = cue; H = hypothesis; PD = planning decision; KN = knowledge base; S = search; A = assumption.

The planning decision/knowledge combination was the most common two element combination in this section and was used by eight out of 10 subjects. The purpose of this combination and the quality of knowledge base verbalized was the same as



documented for the internal subjects. An example of this combination illustrated a review of previous decisions, occasionally supported by knowledge.

PD: "check the dressing for drainage

PD: and send a swab for C&S,

PD: check the incision

KN: to see if it's still swollen, reddened and approximated.

PD: Ok, then start taking the temp, probably q2-3,

KN: see what's going on there,

PD: and call the doctor about drainage." [67]

The hypothesis/planning decision combination occurred 11 times. As with the internal subjects, this combination consisted of hypotheses serving as rationale for planning decisions or as stimuli to planning decisions.

The third most frequent two element combination was the cue/planning decision combination which occurred eight times. In this combination, a cue or cues stimulated planning decisions directly or served to support planning decisions. Occasionally, cues placed between two planning decisions served to provide rationale for the first planning decision while simultaneously stimulating the second planning decision.

There were three planning decision/search combinations, and one planning decision/assumption combination. In these examples, search and assumption either stimulated a planning decision or supported a planning decision in some manner.

There were four combinations occurring once each, that did not include a planning decision. These were cue/hypothesis, cue/knowledge, hypothesis/knowledge, and knowledge/search combinations. All of these combinations represented attempts to make sense of known or unknown information, or to compare information to knowledge base.

Three element combinations.

Table 35

Thinking Aloud and Writing Section: Three Element Combinations (Externals)

Combination	Frequency by subject									
	2	5	7	8	13	14	15	16	18	19
C/H/PD	1	--	--	1	1	--	1	1	--	--
C/H/KN	--	--	--	--	1	--	--	--	--	--
C/PD/KN	1	--	1	1	1	1	1	--	--	2
C/PD/S	--	--	--	1	1	--	--	--	--	--
H/PD/KN	--	2	5	5	--	--	--	--	3	3
PD/KN/S	--	--	--	1	1	--	--	--	--	--

Note. A dash indicates no occurrence of a combination. C = cue; H = hypothesis; PD = planning decision; KN = knowledge base; S = search; A = assumption.

A total of 36 three element combinations were used by the subjects in this section. Planning decisions were present in 35 of these combinations. The three most frequently occurring combinations were hypothesis/planning decision/knowledge, cue/planning decision/knowledge, and cue/hypothesis/planning decision.

Hypothesis/planning decision/knowledge.

In one of these combinations, the subject started by suggesting two planning decisions that involved communicating with the patient. This stimulated two alternative hypotheses. The first hypothesis, pain, stimulated two treatment decisions, i.e., what the nurse will say to the patient. The second hypothesis, "not pain", led to planning decisions aimed at discovering what is wrong.

PD: "respond to feelings, like 'You look upset.'

PD: Find out what's really bugging her,

H: ... if it is actually the pain,

PD: you can say that the Demerol should be starting to work in not too long, and then that will go away

PD: and then just as soon as she feels pain she should be asking for it.

H: ... it might not even be the thing that's bugging her.

KN: It could be something else and this is just setting it off.

PD: ... find out what is upsetting her to begin with,

PD: and sort of, exploring that." [68]

In three of these combinations, either knowledge or hypotheses provided rationale for planning decisions made.

In nine of these combinations, hypotheses and knowledge combined to provide rationale for a planning decision.

Three combinations were those in which hypotheses stimulated planning decisions, which were then supported by knowledge.

One combination exemplified the sequential phenomenon described previously in the Thinking Aloud and Writing section of the internal subjects, in which one decision making element or a combination of decision making elements stimulated further related thoughts in a sequence or chain.

Cue/planning decision/knowledge.

Three variations of this combination occurred which have previously been described in the Thinking Aloud section of the external subjects. These variations were:

1. A cue stimulated a planning decision which was then supported by rationale.
2. A cue and knowledge combined to stimulate a planning decision.
3. A cue and knowledge combined to provide support or rationale for a planning decision.

There were two instances in which the overall intent of the thought segment was simply to list or summarize planning decisions, which were supported either by knowledge base alone, or a combination of cue and knowledge base.

Cue/hypothesis/planning decision.

In this section, the following arrangements of these three elements occurred:

1. A cue and hypothesis combined to stimulate a planning decision.
2. A cue and hypothesis combination occurring between two sets of planning decisions served to provide rationale for one set of planning decisions, while simultaneously stimulating the second set of planning decisions.
3. Collections of one, two or three element complexes appeared within a thought segment in which the connecting links were not apparent.
4. A planning decision stimulated two alternative hypotheses. The second hypothesis was pursued and supported by a cue/hypothesis combination which then resulted in a list of treatment decisions.

Planning decision/knowledge/search.

In one example of this combination, the subject weighed her knowledge base against lack of information, in an attempt to validate the planning decision.

In the other example, the subject, faced with a lack of information, made a planning decision anyway, and gave a reason for it.

Cue/planning decision/search.

In these two examples, the subjects compared information that was available to information that was not available, and formulated a planning decision.

Cue/hypothesis/knowledge.

In this combination, the subject attempted to validate an hypothesis by comparing cues to knowledge base.

H: "she might have had a systemic infection ... to start with,

C: she's warm,

C: she feels warm and clammy to the touch,

KN: but that could also be as a result of the pain.

C: and so could the flush..

KN: [be a result of the pain]." [69]

Four element combinations.

Table 36

Thinking Aloud and Writing Section: Four Element Combinations (Externals)

Combination	Frequency by subject									
	2	5	7	8	13	14	15	16	18	19
C/H/PD/KN	--	--	1	1	2	1	--	--	--	1
C/H/KN/S	1	--	--	--	--	--	--	--	--	1
C/PD/KN/S	--	--	--	--	2	--	--	--	--	--

Note. A dash indicates no occurrence of a combination. C = cue; H = hypothesis; PD = planning decision; KN = knowledge base; S = search.

Cue/hypothesis/planning decision/knowledge.

The following arrangements of this combination occurred in this section:

1. A cue and hypothesis combined to stimulate a planning decision, which was then supported by knowledge.
2. Planning decisions were supported by a cue and hypothesis combination or by knowledge base alone.
3. A three element combination of cue/planning decision/knowledge stimulated another planning decision which stimulated an hypothesis.
4. An hypothesis was made and planning decisions to validate it were formulated.
5. A single element followed by a four element combination occurred in one thought segment.

Cue/planning decision/knowledge/search.

In this combination, cues combined with search and a knowledge/search combination to stimulate a planning decision.

Cue/hypothesis/knowledge/search.

Both examples of this combination represented thinking about available and unavailable information, hypotheses, and facts from the subjects' knowledge base.

Five element combinations.

Table 37

Thinking Aloud and Writing Section: Five Element Combinations (Externals)

Combination	Frequency by subject									
	2	5	7	8	13	14	15	16	18	19
C/H/PD/KN/S	1	--	--	--	1	--	--	--	--	--

Note. A dash indicates no occurrence of the combination. C = cue; H = hypothesis; PD = planning decision; KN = knowledge base; S = search.

Two 5-element combinations occurred in the Thinking Aloud and Writing section, both of which were cue/hypothesis/planning decision/knowledge/search combinations. One example was a four element combination followed by a three element combination, dealing with two separate topics. In the other example, one element or group of elements stimulated the next in a chain.

Summary of Combinations of Decision Making Elements in the Thinking Aloud and Writing Section (Externals) (Table 26)

In the Thinking Aloud and Writing section, two and three element combinations were the most frequently occurring combinations of decision making elements. There were more single decision elements used than four element combinations, and only two 5-element combinations occurred.

Overall Approach in the Thinking Aloud and Writing Section (Externals)

Two subjects used cues, hypotheses, and knowledge base in fairly equal numbers to stimulate or provide rationale for planning decisions. This represented a balanced use of decision making elements.

Two subjects used hypotheses to stimulate or support planning decisions, and knowledge to support planning decisions in fairly equal numbers, but did not use many cues.

The major approach of four of the subjects was to generate planning decisions and support them with knowledge base. Few cues and hypotheses were used.

Two subjects generated planning decisions that were unsupported by any other decision making elements, or rarely supported by knowledge, cues, or hypotheses.

Of the 119 combinations of decision making elements in this section, only 10 did not include a planning decision.

Comparison of Reading Aloud, Thinking Aloud, and Thinking Aloud and Writing Sections (Externals)

Frequency of use of individual decision making elements (Tables 21, 27, 32)

The total number of cues mentioned by the subjects increased from the Reading Aloud to Thinking Aloud sections, and then decreased from the Thinking Aloud to the



Planning decisions were the elements most frequently repeated, with the number of repetitions increasing from section to section. Cues were the next most frequently repeated elements, followed by hypotheses. The repetitions of cues and hypotheses, however, were much fewer in number than were the repetitions of planning decisions.

The number of new planning decisions and hypotheses increased slightly from the Reading Aloud to the Thinking Aloud to the Thinking Aloud and Writing section.

Of the five categories of planning decisions, assessment and physical care decisions remained the most frequently mentioned decisions in all three sections. Although the total number of planning decisions increased from section to section, new assessment decisions increased slightly from the Thinking Aloud to the Thinking Aloud and Writing section. Teaching decisions were the lowest in frequency in the Reading Aloud and Thinking Aloud sections, but increased in the Thinking Aloud and Writing section to approximately the same numbers as communication with the patient. The largest number of decisions to communicate with the patient occurred in the Thinking Aloud section, and dropped slightly in the Thinking Aloud and Writing section. Communication with support systems decisions increased from the Thinking Aloud to the Thinking Aloud and Writing section.

#### Frequency of use of decision making combinations (Table 26).

The number of single decision elements mentioned by subjects increased from the Reading Aloud to the Thinking Aloud to the Thinking Aloud and Writing section.

The two and three element combinations were the most frequently used in all three sections. The number of four element combinations remained equal between the Thinking Aloud and the Thinking Aloud and Writing sections, and five element combinations were evident only in the Thinking Aloud and Writing section.

#### Function of individual decision making elements.

The functions served by each of the decision making elements in the Thinking Aloud and Writing section remained similar to those previously discussed.

Thinking Aloud and Writing section. However, in the Thinking Aloud section, subject 14 mentioned 57 cues out of the group total of 107 cues. If this subject is disregarded for these totals, the number of cues mentioned by the group decreased from the Reading Aloud to Thinking Aloud section and increased slightly from the Thinking Aloud to the Thinking Aloud and Writing section. In addition, the increase in cues in the Thinking Aloud and Writing section was due primarily to subject 13 who mentioned 23 of the group total of 60 cues. If this subject is disregarded for the totals in the Thinking Aloud and Writing section, the number of cues mentioned by the group decreased from the Reading Aloud to the Thinking Aloud to the Thinking Aloud and Writing section, as was true for the internal subjects.

The total number of hypotheses and the number of new hypotheses mentioned increased from the Reading Aloud to the Thinking Aloud to the Thinking Aloud and Writing section.

The total number of facts or rationale mentioned and planning decisions made, increased from the Reading Aloud to the Thinking Aloud to the Thinking Aloud and Writing section. Significant increases were especially evident in the number of planning decisions made from the Reading Aloud to the Thinking Aloud to the Thinking Aloud and Writing section.

The search for information not provided was lowest in the Reading Aloud section, highest in the Thinking Aloud and Writing section.

Only one assumption was made, and this occurred in the Thinking Aloud and Writing section.

In summary, the use of all the decision making elements except one increased from section to section, as the subjects worked through the simulated situation. For seven of the external subjects, this fact coincided with an increase in the amount of processing done in each section, as measured by the length of the typed transcripts of each section.

### Use of Qualifiers and Organizers

The external subjects used qualifiers and organizers in the same way as the internal subjects did, to assist in the formulation of planning decisions. Some examples of each technique as used by the external subjects, are now presented.

#### Qualifiers.

##### Time sequencing.

- e.g. "before I ran around doing all those things ... I would ..."  
 "I would clean it [wound] because by this time, there would be an order."  
 "about an hour after giving her the Demerol"

##### Priority Setting.

- e.g. "Maybe I should worry about this first and try to keep her more comfortable, and then check the dressing, the wound, and then continue on with my assessment."  
 "The first thing I would do, would be, I'd give her Demerol 100 mg."  
 "first thing, do TPR and BP and swab the wound, check the dressing, and get all that charted and sent off to the lab, and after that, second thing would be to..."

##### Contingency.

- e.g. "I think giving the bath would depend on how comfortable she was."  
 "once you get her pain under control, you can try again."  
 "after the doctor's taken care of it ... whatever plan he tells me to do, I'd follow from there."  
 "give her the Demerol ... depending on when she last had it."  
 "depending on her, how much she's ready to take in"

Organizers.

- e.g. "her nasogastric tube has been removed, so I won't worry about that anymore"
- "I'm trying to think..."
- "Ok, what am I doing here?"
- "Mmm, let's see"
- "Oh, wait a minute"
- "have to read over this a little bit again. Try to put everything together."
- "um, just trying to run through in my head too, the other things that could be causing this."
- "I feel like I'm overlooking something that I should be considering here."

### Comparison of Internal and External Subjects

The internal and external subjects' performance is now compared, section by section, in terms of the overall amount of verbalization, the use of the individual decision making elements and combinations of elements, the overall approach to the planning task, and the use of the decision making processes identified in this study.

### The Reading Aloud Section

In total, there was less verbalization by the external subjects than the internal subjects in this section. Four external subjects made no comments while reading aloud, whereas only one internal subject failed to comment.

### Individual Decision Making Elements

The internal subjects verbalized all decision making elements in significantly greater numbers than the external subjects. The order of frequency of each decision making element however, was the same for both groups. The internal subjects included a few teaching decisions among the planning decisions made, as well as communication with support systems, whereas the planning decisions made by the one external subject included assessment and physical care only. Neither internal nor external subjects made any decisions to communicate with the patient in the Reading Aloud section.

### Combinations of Decision Making Elements

The external subjects used fewer single, two element and three element combinations than the internal subjects. The external subjects did not use four element combinations at all, whereas two of the internal subjects did. Only four combinations of decision making elements in the Reading Aloud section of the protocols of the external subjects contained planning decisions, whereas 21 combinations in the Reading Aloud section of the protocols of the internal subjects included planning decisions.

### The Thinking Aloud Section

The internal and external subjects verbalized approximately the same amount in the Thinking Aloud section, in terms of the length of the typed transcripts.

### Individual Decision Making Elements

The external subjects verbalized more cues and searched for more information outside the available data in this section than the internal subjects. The internal subjects formulated more hypotheses, and made more assumptions, than the external

subjects. The number of planning decisions made, and the number of incidents of the use of facts or rationale, i.e. knowledge base, were not significantly different between the two groups. The order of frequency of each decision making element was the same for both groups, with the exception of search and assumption, as mentioned above. The internal and external subjects made planning decisions in each of the five categories of nursing management in the same proportion and order of frequency. The most frequently mentioned planning decisions for both groups fell into the physical care category, followed by assessment decisions. Communication with the patient and communication with support systems occurred with approximately the same frequency within each group, and teaching decisions comprised the least frequently mentioned category.

#### Combinations of Decision Making Elements

The internal and external subjects used approximately the same number of single, three element, and five element combinations in this section. The external subjects used a few more two element combinations, and the internal subjects used more four element combinations. The external subjects used a total of 72 combinations of decision making elements which included planning decisions in this section, whereas the internal subjects used a total of 60 combinations which included planning decisions.

#### The Thinking Aloud and Writing Section

The internal and external subjects verbalized approximately the same amount in the Thinking Aloud and Writing section, in terms of the length of typed transcripts.

### Individual Decision Making Elements

The external subjects verbalized more knowledge base, and searched for more information not available in the situation in this section than the internal subjects. The internal subjects formulated more hypotheses and made more assumptions than the external subjects. The number of planning decisions made and the number of cues verbalized were not significantly different between the two groups. In addition, the order of frequency of each decision making element was the same for both groups. The internal and external subjects made planning decisions in each of the five categories of nursing management, but the order of frequency differed in this section. Internal subjects made more assessment than physical care planning decisions, and more decisions to communicate with the patient than to teach the patient. External subjects made more physical care than assessment decisions, and more teaching decisions than communicating with the patient. Repeated mention of decision making elements between and among the three sections occurred frequently, but did not differ significantly between internal and external subjects.

### Combinations of Decision Making Elements

The internal and external subjects used approximately the same number of five element combinations in this section. The external subjects used more single, two element and three element combinations and the internal subjects used more four element combinations. The external subjects used a total of 109 combinations of decision making elements which included planning decisions in this section, whereas the internal subjects used a total of 95 combinations which included planning decisions.

### Comparison of Overall Approach to Planning Task

In the Reading Aloud section, four external subjects made no comments whereas only one internal subject failed to verbalize. The approach used by the majority of the internal subjects and all of the external subjects in this section was to compare cues to their knowledge base to evaluate the information. There was minimal use of hypotheses or formulation of planning decisions, except for subject 6. Subject 6, an internal subject, used complex reasoning in this section, processing sentence by sentence. She was the only subject to do this. One internal subject used an information seeking approach, and another used rehearsal or repetition of cues with no further comment.

The approaches used by the internal subjects in the Thinking Aloud section differed considerably from those of the external subjects. The internal subjects alternated an episode of hypothesizing with an episode of formulating planning decisions, or vice versa, they formed hypotheses and made planning decisions designed to either test the hypothesis, or treat the hypothesis without validation, and used a balanced proportion of cues, hypotheses and knowledge base to derive planning decisions. The externals, on the other hand derived planning decisions directly from cues or hypotheses, or used cues and hypotheses rather than knowledge base to support the planning decisions made. The external subjects also used lists of planning decisions unsupported by knowledge base in this section.

In the Thinking Aloud and Writing section, the majority of both internal and external subjects verbalized planning decisions supported by knowledge base as their general approach to the final phase of planning. The emphasis on these two elements revealed in this approach may have been influenced by the instructions to the subjects to continue to verbalize their reasons for their planning decisions as they wrote them down. Other approaches demonstrated by both internal and external subjects in this



section included a well balanced use of decision making elements, and the generation of lists of planning decisions unsupported by other decision making elements.

### Decision Making Processes Identified

Eight identifiable decision making processes used by the subjects of this study emerged from the analysis of combinations of decision making elements. These processes are not inclusive of all of the complex decision making that was evident in the subjects' verbal protocols, but they do provide some interesting information about how student nurses think while they are making planning decisions on behalf of their patients. These processes and their definitions are now provided.

Stimulus-Response - the stimulation of planning decisions directly from cues, hypotheses, search, assumptions, or any combination of these elements without verbalized support or rationale. One illustration of this process is found in example 12.

Listing - a series of cues, hypotheses, or planning decisions that are generated for the first time in the planning process. Other decision making elements may be found in association with the list, but these elements, although present, do not add depth or meaning to the process. One illustration of this process is found in example 23.

Review/Summarizing - a series of cues, hypotheses, or planning decisions that repeat previously verbalized information. At times, a new planning decision is appended to the end of the series. Other decision making elements may be found in association with the series, but these elements, although present, do not add depth or meaning to the process. One illustration of this process is found in example 67.

Non-Decision Structuring - any combination of two or more decision making elements in which the subject organizes, relates, or attempts to synthesize data, without formulating a planning decision. A similar strategy was identified by Muzio (1985), which she called "non-decision-focused internal structuring." Illustration of this process is found in examples three to 11 and example 15.

Hypothesize and Test - a series of planning decisions made on the basis of an hypothesis, explicit or implicit (i.e. previously mentioned), which attempts to validate that hypothesis. One illustration of this process is found in example 48.

Hypothesize and Treat - a series of planning decisions made on the basis of an hypothesis, explicit or implicit (i.e. previously mentioned), in which little or no attempt is made to validate the hypothesis before instituting nursing care measures. One illustration of this process is found in example 47.

Cascading - a series of two, three, four, or five element combinations occurring in any order within a thought segment, in which each combination stimulates the formulation of the next combination, resembling a cascade effect. It is not essential that every combination in the series contains a planning decision. Illustrations of this process are found in examples 58 and 59.

Sequential Combination - a series of two, three, four, or five element combinations occurring in any order within a thought segment, which are not overtly connected to, or dependent upon, each other. It is essential that every combination in the series contains a planning decision. One illustration of this process is found in example 56.

## Decision Making Processes Used By Internal and External Subjects

Table 38

Comparison of Decision Making Processes Used By Subjects

Process	Locus of Control					
	Internal			External		
	RA	TA	TA&W	RA	TA	TA&W
Stimulus-Response	9	4	5	2	12	13
Listing	--	10	4	1	11	11
Review/Summarizing	--	7	32	2	9	27
Non-decision Structuring	60	13	6	40	7	7
Hypothesize and Treat	--	3	6	1	2	1
Hypothesize and Test	--	5	2	--	--	2
Cascading	2	4	9	--	3	6
Sequential Combination	--	2	8	--	3	5

Note. A dash indicates no occurrence of the decision making process. RA - reading aloud section; TA - thinking aloud section; TA&W - thinking aloud and writing section.

Use of Individual Decision Making Processes

The internal subjects used more non-decision structuring, hypothesize and test, hypothesize and treat, and cascading processes than did the external subjects. The external subjects used more stimulus-response and listing processes than did the internal subjects. The use of review/summarizing and sequential combination processes was approximately the same for both groups. The internal subjects used more decision making processes in the Reading Aloud section than did the external subjects, but the total number of decision making processes used in the Thinking Aloud and the Thinking Aloud and Writing sections were approximately equal.

### Trends in the Use of Decision Making Processes

#### Internals.

The use of stimulus-response, listing, and non-decision structuring processes decreased as the internal subjects progressed from the Reading Aloud to the Thinking Aloud to the Thinking Aloud and Writing section, whereas the review/summarizing process increased in frequency as the subjects advanced through the planning phases. The hypothesize and test process was used more in the Thinking Aloud section, and the hypothesize and treat process was used more in the Thinking Aloud and Writing section. The cascading and sequential combination processes increased in number from section to section.

#### Externals.

Like the internal subjects, the external subjects decreased the use of the non-decision structuring process from the Reading Aloud to the Thinking Aloud and Thinking Aloud and Writing sections. It is important to remember, however, that the external subjects used this process significantly fewer times than the internal subjects. Also like the internal subjects, the review/summarizing process increased from the first section to the last section, and the number of cascading and sequential combination processes used, increased from the Thinking Aloud to the Thinking Aloud and Writing section. The external subjects differed from the internal subjects in that the use of stimulus-response and listing processes increased from the Reading Aloud to the Thinking Aloud and Thinking Aloud and Writing sections. The hypothesize and test, and hypothesize and treat processes were used much less often by the external subjects, and there was no evidence of a trend in their use.

In summary, the internal subjects used more of the non-decision structuring, hypothesize and test, hypothesize and treat, and cascading processes than the external subjects. The external subjects, on the other hand, used more stimulus-response and listing processes.

## Responses to the Followup Questions

Each of the followup questions are discussed individually for the internal, and subsequently, for the external subjects. This is followed by a comparison between the two groups. Responses to questions 1, 2, 3, and 5 are found in Table 39.

### Internal Subjects

1. How many patients have you cared for with a cholecystectomy?

Three subjects had cared for two or three patients with this surgery, and two subjects had cared for 4-5 and 6-7 patients respectively.

2. Did the patient(s) have, or develop, a wound infection?

One of these patients had an infection present at the time the subject cared for the patient.

3. Was the description of the situation realistic?

All of the internal subjects except one, stated that the description of the situation given to them was realistic. One subject questioned the probability of the development of a wound infection on the third post-operative day.

4. What information would you like to have had, that was not given?

The internal subjects would like to have had more specific information in five broad categories, i.e. psychosocial information, medical history, physical status, the status of equipment, and information about the other nurses' activities with the patient.

The majority of data desired was in the category of physical status. Common requests were for current vital signs and details of pain management, for example, the time the last analgesic was given, and how the patient was tolerating the drug. Details regarding the amount and characteristics of the wound drainage were also considered necessary by the subjects. Respiratory status was requested by some students, as well as information relating to the functioning of the gastrointestinal and urinary systems, such as intake and output measures, presence of bowel sounds, and toleration of fluids.

Also sought, was information regarding the patient's usual patterns, for example, how she slept, what her activity level was, and a description of her usual emotional status.

These subjects showed some concern about equipment attached to the patient, and would like to have had a description of the drainage that was coming from the T-tube, the penrose drain, and the nasogastric tube.

One subject felt that it would have been helpful to know whether or not the previous nurses had cultured the wound drainage, and contacted the physicians prior to the morning for which they were to plan care.

5. How would you rate this situation in terms of difficulty for making decisions about what nursing interventions to plan? Choose a number between 1 (very easy) and 9 (very difficult).

The intent of the researcher when developing the simulated patient situation, was to design a problem which would be perceived as of medium complexity. This intent, for the most part, was achieved, as seven of the subjects estimated the difficulty of the situation as equal to, or less than 5, on a scale from 1 to 9. Two subjects rated it as greater than 5, indicating that they perceived the decision making situation as fairly difficult.

6. Did you have a general approach to the task of developing a plan of care? If so, what was it?

Two subjects verbalized the intermediate step of identifying a nursing diagnosis between symptoms, or first level assessment data, and the planning of nursing intervention.

Three subjects stated that they made planning decisions based on the patient's presenting symptoms. For example, one subject said, "it's individualized, so like, whatever symptoms the patient was showing, that's what I would act on first."

The four remaining subjects perceived that their approach to planning care was to carry out a "focused head to toe assessment" and deal with priorities. For example, "Do a

head to toe and deal with the thing that's the most threat to life first," and "you do the first thing you do first, like, priority action ... and then you just add on everything that goes along with it."

7. Did you find some information more helpful than others for your decision making? If so, what was more helpful?

Although there was a wide variety of single pieces of information the individual subjects found helpful, the night nurse's report and the description of the patient as the nurse entered the room was considered to be most helpful by the majority of subjects. The operative report was also mentioned as being helpful.

8. How did you feel while doing this exercise?

Even though the researcher assured the subjects repeatedly that there were no right or wrong answers, these subjects verbalized their concern that they would say or do the right thing. Five of the subjects stated that they felt a little nervous or uncomfortable at first, but as they began to work through the situation, these feelings subsided. Some comments to this effect were:

a) "I guess I was a little bit nervous, trying to make sure I made the right decisions, but I think just with the information I got ... I didn't feel too badly about it."

b) "Well, it feels like a test ... I don't do well with tests, but once I felt I was starting to talk about it, it was getting better ... and I felt more comfortable with it."

Four subjects did not verbalize any anxiety in the situation.

#### External Subjects

1. How many patients have you cared for with a cholecystectomy?

Two subjects had never cared for a patient with a cholecystectomy. Six of the subjects had cared for only one patient with this surgery, and one subject had cared for three of these patients.

2. Did the patient(s) have, or develop, a wound infection?

None of the patients these students cared for had, or developed, a wound infection during the time they were in contact.

3. Was the description of the situation realistic?

All of the subjects stated that, in their estimation, the description of the simulated patient situation was realistic.

4. What information would you like to have had, that was not given?

The external subjects desired more information in the same categories as the internal subjects, with the exception of the status of equipment, about which they did not seem concerned.

Information about the physical status of the patient was the most frequently requested, once again, in the areas of vital signs, pain management, wound management, and the status of the gastrointestinal and urinary systems.

One subject felt it would have been helpful to know if the previous nurses had reported anything to the physician.

5. How would you rate this situation in terms of difficulty for making decisions about what nursing interventions to plan? Choose a number between 1 (very easy), and 9 (very difficult).

Six of the subjects estimated the difficulty of the situation as equal to, or less than 5. Three subjects rated the difficulty quite high, two as 7, and one as 8-9.

6. Did you have a general approach to the task of developing a plan of care? If so, what was it?

The subjects did not articulate a clear awareness of a planning approach. The majority of them made planning decisions based on symptoms and other available information. For example, a common theme was, "I was looking at the data and thinking what I could do about each thing." One subject stated "just sort of what we've been taught. Sort of, if you're ever in doubt, take vital signs."



Two subjects mentioned setting priorities and dealing with those first. One subject seemed to be using a diagnostic approach, as she described her planning as, "trying to do interventions that are going to rule things out as well as confirm things."

7. Did you find some information more helpful than others for your decision making? If so, what was more helpful?

The external subjects found the night nurse's report, and the description of the patient as the nurse entered the room as the most helpful information given. The operative report was also mentioned by one subject. It was interesting to note that three of the subjects specifically stated that the background information was not particularly helpful. Some of these comments were:

a) "nice to know, but you don't have to"

b) "The stuff before [the operative report] is good to know, and important in planning teaching and all that, but just deciding your actions, that would have been enough."

8. How did you feel while doing this exercise?

Two subjects stated that they were not nervous at all. One said, "No, I was working, it didn't make me feel anxious. Like, I find this is the type of problem that helps you learn." Three subjects felt a bit nervous at the beginning, but it subsided as they worked through the situation. Three subjects verbalized uncertainty and awkwardness that might or might not be indicative of anxiety.

One subject felt anxiety that was sustained throughout the exercise, related to a felt pressure to "do the right thing." She felt that verbalization did interfere with her thought processes because she had to consciously remind herself to say everything out loud. She also stated, "I feel a lot of decision making comes intuitively, just from being right in the situation."

One subject found the ambiguity and lack of information very frustrating, as she stated, "it was frustrating. I didn't have enough information to go on."

Table 39  
Followup Questions

Locus of Control	Question			
	Patients cared for	Infection present	Situation realistic	Estimation of difficulty
<b>Internal Subjects</b>				
1	--	--	yes	1
3	4-5	1	yes	4-5
4	2	--	yes	2-3
6	6-7	--	yes	2-3
9	3	--	yes	4
10	2	--	yes	2-3
11	3	--	no	7
12	--	--	yes	6
17	--	--	yes	4-5
<b>External Subjects</b>				
2	1	--	yes	3-4
5	1	--	yes	8-9
7	1	--	yes	2
8	--	--	yes	6
13	1	--	yes	5
14	1	--	yes	5
15	--	--	yes	7
16	1	--	yes	3
18	2	--	yes	7
19	3	--	yes	3

Note. A dash indicates no occurrence of the item.

### Comparison of Responses to Followup Questions: Internal and External Subjects

As anticipated, most students had cared for less than three patients who had a cholecystectomy in their two year program, with one quarter of the sample having never cared for such a patient. Thus, the situation was relatively novel to most subjects. The complication of wound infection with this surgery had been seen by only one subject.

All of the subjects except one, felt that the description of the situation was realistic.

More than half of the subjects in each group rated the difficulty of the situation at, or less than, the midpoint of the scale (4.6).

Information that was not provided, but which the subjects felt would have been helpful to know, was very similar between groups. The external subjects did not mention the need for information regarding bowel sounds and did not verbalize concern about equipment, as did the internal subjects.

The internal subjects were able to verbalize their perceptions of how they approached the care planning process more definitively than did the external subjects. Most of the subjects, both internal and external, however, stated that they used a symptomatic approach to planning care, along with an awareness of priorities. Two internal subjects and one external subject verbalized the usefulness of making a diagnosis to guide the selection of planning decisions.

Both internal and external subjects found the night nurse's report, the description of the patient as the nurse entered the room, and the operative report, the most helpful information given. Three external subjects specifically mentioned that the history or background information given, had not been particularly helpful to their decision making. This was not verbalized by the internal subjects.

On the whole, both internal and external subjects seemed to feel some apprehension at the beginning of the planning exercise. This apprehension related more to a fear of

saying the wrong things, than to nervousness precipitated by the presence of the researcher or the process of tape recording. For the majority of subjects, this nervousness dissipated as they became engrossed in the thinking process. Indeed, some subjects denied nervousness at any point. Only one of the subjects felt that the verbalization process interfered with her thinking. The remainder of subjects felt that verbalization did not change the planning decisions they would have made under normal circumstances.

In conclusion, the differences between internal and external subjects in their responses to the followup questions were slight. The internal subjects mentioned a larger number of specific pieces of information they would like to have known in relation to the patient situation, they articulated their awareness of their approach to planning more clearly, and they found the patient history information more helpful to decision making, than did the external subjects.

#### Perceived Influences on Clinical Decision Making

A very wide range of factors were perceived by the subjects to facilitate or inhibit their decision making in the actual clinical setting. The subjects seemed to enjoy this aspect of the research study. They were relaxed, and responded with voluminous information to the broadly stated interview questions. The influences verbalized by the subjects were organized into six broad categories, namely, personal qualities, teachers, other health team members, circumstances/events, inanimate resources, and the institutional environment. Influences in each of these categories are now presented, beginning with those factors perceived to facilitate clinical decision making, and followed by those factors perceived to inhibit clinical decision making. The influences verbalized by the internal and external subjects are considered

simultaneously, in order to elucidate similarities and differences as they appear in each category.

### Facilitative Influences

#### Personal Qualities

In this category, the subject's knowledge was a very important factor. Prior to caring for a patient, knowledge of the patient's disease process, medical history, problems other than medical problems, and present physical status were perceived by both internal and external subjects to be crucial to effective decision making. The ability to gather adequate assessment data was also considered important by both groups. The internal subjects mentioned learning to set priorities as helpful to decision making. The external subjects felt that the ability to gather pertinent data from the chart assisted in decision making.

The ability to establish good relationships and communicate effectively with patient, teacher, and other staff was perceived as a factor helpful to decision making. Although this was mentioned by both groups, a larger number of examples were verbalized by the internal subjects than the external subjects. These examples included developing a trust relationship with the patient, learning how to ask for help, recognizing when assistance is needed, seeking advice and guidance from the teacher when unsure, and discussing the patient with the teacher prior to the implementation of care. It was mentioned by one of the external subjects that "knowing what the teacher wants" was helpful. Another external subject stated that "a clear idea of what you can and cannot do" is important. Assertiveness was verbalized by one subject in each group as an important factor in facilitating clinical decision making. The external subject discussed assertiveness with reference to the teacher, while the internal subject referred to assertiveness with the ward staff.

Experiential knowledge was mentioned by both groups as facilitative to clinical decision making. Familiarity, or past experience with the same, or similar situations

was a frequently occurring response from the external subjects. The internal subjects mentioned more distantly related experiences such as working in a nursing home, or life experience in general, as a facilitating influence.

Both internal and external subjects mentioned intuitive knowledge or "gut instincts" that assist in making the right "on the spot" decisions. When talking about nursing diagnoses, one subject said "you can almost pick it out without actually doing it in your conscious awareness."

Self confidence was a personal attribute considered important by both groups. Being comfortable with your level of skill, being able to approach doctors and other staff with questions or concerns, feeling that you are part of the team, and believing in yourself, were all mentioned as helpful in making decisions on wards.

#### The Teacher

Teaching behaviors that were perceived to facilitate clinical decision making were similar in both groups. Most important was the ability to instill self confidence in the student, and encourage independent functioning. In addition, the teacher who acts as a resource, sounding board, or collaborator, who demonstrates respect for the student, who asks questions in a positive manner, and is supportive, is perceived as being extremely helpful to students in making appropriate planning decisions for patient care.

#### Other Health Team Members

Good communication within the health team, a willingness on the part of others to use information provided by students, and positive reinforcement of students by other health team members were seen as facilitating influences by both groups.

The assistance of the staff nurse, through demonstrating and helping students to perform nursing activities, was very highly rated by both internal and external subjects. Staff nurses were perceived to have "a lot of common sense", and if they were

approachable, supportive of the student, and trusting of the student's decisions, they were valued as helpful adjuncts to the student's ability to make planning decisions.

Doctors were perceived to be helpful by both groups when they demonstrated respect for the student, and were willing to listen, and explain to them at a level they could understand.

Patients were seen as excellent sources of information helpful to decision making if they were interested in their own care and willing to share pertinent data with students.

Families and/or significant others could also be helpful sources of information for students, although the students did not have much contact with families as a result of their scheduled clinical hours.

Sharing experiences and problems with other students was also seen as a way of improving the student's clinical decision making for both groups.

A variety of other health team members were mentioned as helpful resources for students. Among these was the head nurse who encouraged and supported students in making decisions. As one student commented, "the attitude of the head nurse dictates the ward attitude."

#### Events/Circumstances

The external subjects did not verbalize peripheral events or circumstances that were helpful for decision making. The internal subjects felt that having only one patient, and having sufficient time to carry out their planned interventions, was helpful.

#### Inanimate Resources

The external subjects made extensive reference to inanimate resources for decision making, including textbooks, modules, seminars, procedure and policy manuals, lectures/discussions about decision making, clinical post conferences, and standard care plan manuals. Two of the external subjects were the only ones to mention nursing

diagnoses and the nursing process as helpful guides to clinical decision making. Examples of these comments included, "nursing diagnosis helps you focus what you're going to do and why", "you do, after a while, know what those priority interventions are for each diagnosis, and each need area, and you quickly put them together." The internal subjects mentioned only books as helpful inanimate resources.

### Institutional Environment

Neither internal nor external subjects mentioned environmental influences that helped them make clinical decisions.

## Inhibitory Influences

### Personal Qualities

Lack of adequate theoretical preparation for ward experience (i.e. research from the chart, Kardex, and patient interview), lack of experience with new skills, lack of knowledge of a wide variety of details such as ward routines, what the patient normally looks like, resources available to help patients, and a general feeling of not knowing what is happening, were cited by both internal and external subjects as influences that hinder clinical decision making. Both groups of students mentioned personal prejudices as interfering with their ability to make decisions in the best interests of the patient.

Stresses in their personal lives were verbalized by both internal and external subjects as factors that interfere with clinical decision making. Other stresses such as lack of sleep the night before clinical practice and illness were commonly mentioned also. Fear of teachers, especially their perceived power, was mentioned by the external subjects, and not by the internal subjects. As one subject so clearly stated, "they can pretty well get me out of the program." The external subjects also discussed fear of approaching doctors, and anxiety regarding clinical practice demands, such as having



to make "on the spot" decisions, not knowing how to organize a heavy workload, and not having a good care plan, as detrimental to decision making.

Lack of self confidence, nervousness, and fear of doing something wrong were cited by both internal and external subjects as powerful inhibitors of clinical decision making. More of these comments, however, were made by the external subjects than the internal subjects. A fear of making decisions, in case they are wrong, not being sure enough of self to act independently, an inability to ask for help, and continual checking and re-checking of information were characteristic responses of the external subjects. A classic example of lack of self confidence leading to poor self esteem was evident in the transcript of one subject as she talked about her difficulty in approaching medical staff, "It's just more me, sort of feeling very overpowered with them, and just, it's me, this little, stupid student nurse."

#### The Teacher

Issues surrounding the teaching activity of asking questions of students in the clinical setting, or "quizzing" as the students termed it, were mentioned by both internal and external subjects as prime inhibitors of, or interferences with, clinical decision making. Of particular importance to the student was the inappropriate timing of these "quiz" sessions. First thing in the morning, while students are trying to organize care, and prior to, or during, the performance of skills, were seen as difficult times. The reason they felt these times were inappropriate was because they are concentrating on what they are doing, and being asked to change their thoughts to something else, was perceived as disruptive, and not indicative of their true knowledge base. In addition to timing, the place in which questioning occurred was important. A public place, such as the nursing station, was considered inappropriate and potentially embarrassing, as there are so many other people watching and listening. Excessive or "third degree" quizzing on the ward was felt by students to be unnecessary and

potentially detrimental to decision making for that particular clinical day, depending on the perceived outcome of the questioning.

Both groups of subjects mentioned that lack of availability of the teacher could interfere with decision making, although this was not a major concern for either group.

Expectations for student behavior that are perceived to differ from teacher to teacher, are unknown to the student, or are perceived as too high by the student, were another major concern, especially for the external subjects. Although the internal subjects mentioned that all teachers had a different method of doing a "time plan" or work schedule, and wanted students to do it their way, the external subjects felt that teachers expected students to do everything the way the teacher wanted it. One student summed up the influence this had by saying, "You're thinking so much about how the teacher is going to react to what you do, that it gets in the way of your actual thinking process."

While the internal subjects admitted some nervousness with teachers, their anxiety was more with respect to the content of the teacher's questions, than the manner of questioning. The external subjects, however, placed major importance upon the inhibitory influence of the teacher's personal attributes and specific teaching behaviors on the clinical decision making ability of students. Personal qualities that subjects found detrimental to decision making were disparaging non-verbal behavior ("the look"), an aggressive manner of questioning, intimidation, lack of positive reinforcement, petty criticism, and a condescending manner. Supervising students too closely, documenting negative performance behaviors and not positive ones, and not speaking to students about problems before documenting them, were all seen by the external subjects as constraining behaviors on their decision making ability.

### Other Health Team Members

Both internal and external subjects stated that, when faced with information or direction from staff nurses that conflicted with what they had been taught, they were uncertain of what decision to make. For example, "You've been taught one way in the school, and they come out and do it a different way. And they say, 'we don't do it this way. This is the way we do it, so you do it this way.' And that makes it hard too, because you want to do it the way you're told to do it, but yet you also don't want them to think that you're just some student nurse, you know, who just fell off the truck!" Staff nurses who make such unhelpful comments as, "You have a teacher, that's what she's for!", and who are unapproachable or indifferent, also make it difficult for students to function freely and use their decision making abilities.

Doctors who demonstrate lack of respect for students, fail to take their comments seriously, who are unapproachable, or do not listen to students, were also cited by internal and external subjects as inhibitory influences on their clinical decision making.

The uncooperative or noncompliant patient who does not want to follow the nurse's plan were cited by both internal and external subjects as influencing the students' clinical decision making in a negative way. The internal subjects also mentioned the difficulty to clinical decision making imposed by a very complex patient assignment and the situation that occurs when a patient's perception of his/her problems differs from the nurse's perception. The external subjects mentioned that when the patient did not like the student, or the patient was unable to communicate clearly, the clinical decision making of the student was inhibited.

Few comments were made about the inhibitory influence of families on the ability of students to make clinical decisions. One internal subject verbalized the frustration that results when families are unwilling "to be educated about changing the way they do things." One of the external subjects stated that the presence of a large number of

family members in the patient's room, as well as interference by significant others in the care of the patient, inhibits clinical decision making.

Neither the internal nor the external subjects made any reference to their peers as being inhibitory influences on clinical decision making.

#### Events/Circumstances

Both internal and external subjects mentioned a wide variety of uncontrollable events as having deleterious effects on their clinical decision making. Both groups found unexpected happenings, time pressures, the characteristics of the patient assignment, and discontinuities in clinical experiences, to interfere with clinical decision making.

Unanticipated events included such examples as having to cope with unfamiliar psychomotor skills that come up "on the spot", sudden changes in doctors' orders, sudden and unexpected change in patient status, particularly a rapid increase in patient acuity, and new situations that the subject has not encountered before, such as the death of a patient. Any circumstances that interfere with the implementation of a subject's plan of care in terms of timing, were perceived as negative influences on decision making. Examples of these circumstances that were mentioned are, when the operating room attendant arrives on the ward early for a patient, when the patient is off the ward for two or three hours or involved with the doctors for a long period of time, when the subject is not able to see the patient's chart, especially on "prep" day, when times of scheduled diagnostic tests are changed, and when subjects feel that there is not enough time to prepare for wards, or to complete the assigned care.

Characteristics of the patient assignment that were perceived to inhibit clinical decision making were the performance of nursing skills for the first time, the assignment of an acutely ill, unstable patient, and the number of patients assigned.

Discontinuities in clinical experience, such as absence from clinical practice over Christmas and summer breaks, and short postings to clinical areas of only four or five

weeks, were perceived as factors that inhibited the growth of the students' clinical decision making skill. The subjects felt that their decision making skills regressed after these break periods, until further practice occurred.

Other negative events that the internal subjects mentioned as interfering with clinical decision making included confusion at the nursing station, not only in terms of noise level, but also the large numbers of personnel that congregate in this area, poor communication among health team members, the difference that sometimes occurs between the student's perception of the patient as conveyed by the chart, and the perception of the patient when seen by the student, and the frequent inability of the student to meet the patient's significant others.

The external subjects mentioned such factors as the first clinical day of the week, the imminence of exams, and when "the day starts off bad", as being negative influences on clinical decision making.

#### Inanimate Resources

Instances in which the chart or Kardex were not updated or contained non-specific information were the only items mentioned by the internal and external subjects as negative influences of inanimate resources on clinical decision making.

#### Institutional Environment

Only one internal subject made reference to the negative effect of having to provide nursing care in the hallway while the floors were being washed in the patient's room. The external subjects mentioned that unfamiliarity with the physical layout of a unit, a busy, noisy ward, and expectations by the unit that baths and beds will be done in the morning regardless of the workload or priorities of the student, could have disastrous effects on planned nursing care decisions.

#### Summary

In summary, the influences on clinical decision making that were verbalized by the internal and external subjects were more similar than they were different.

External subjects differed from the internal subjects in very subtle ways. The major difference in facilitative influences was that the external subjects mentioned inanimate resources as helpful adjuncts to clinical decision making much more often than did the internal subjects.

The differences in inhibitory influences were more pronounced than for the facilitative influences. The external subjects verbalized more fear of authority figures and a lower self esteem than did the internal subjects. The external subjects were also more fearful of teacher expectations, and placed a much greater emphasis on the effect of negative personality characteristics and teaching techniques of the teacher, than did the internal subjects. In addition, the external subjects referred more to fate or chance influences such as "having a bad day" than did the internal subjects.

#### Serendipitous Findings

Several findings emerged from the data regarding the student nurses' actual use of the nursing process as it was taught to them. Although these findings were peripheral to the main theme of the study, they provide some facts that are of interest to nurse educators, since much of the time of the nurse educator is spent, in some form or other, teaching and evaluating the nursing process.

The students in this school of nursing were taught the nursing process according to the Roy Adaptation Model of Nursing and therefore, were instructed in first level and second level assessment, the setting of behavioral outcomes, nursing diagnoses (adapted from the North American Nursing Diagnosis Association classification and the Roy Model), management of second level stimuli (the planning decisions of this study), and evaluation. Within the first level assessment and second level assessment phases of the nursing process, this school of nursing provided these students with subcategories to guide their assessment activities. Similarly, they were provided with the five

categories of planning decisions mentioned throughout this study. Because the nursing process in this form is highly integrated into every nursing theory presentation and every care planning assignment done by students throughout the two years, it would be anticipated that students would provide evidence of the use of this approach when verbalizing their planning process. Such was not the case. In the protocols of several subjects there was reference made to "first levels" and "second levels" and it appeared that most students used and understood these terms, even though the subcategories of these entities were never mentioned. Very few established nursing diagnoses were verbalized, and not one subject mentioned a behavioral outcome in any section of the planning process. The categories of nursing intervention, as can be seen in Tables 4 and 22 were all used by subjects, as interpreted by this researcher. One subject began to name the categories as she wrote her plan. No other subject verbalized these terms. It may be inferred from this data, that subjects were using these categories of planning decisions at a subconscious level. They did not, however, group their planning decisions by category in their verbalization.

Since the purpose of this study did not include the evaluation of the accuracy or quality of the decision making processes used by student nurses when planning care, such judgments were assiduously avoided in the analysis of data. The writer feels compelled, however, in view of the findings and by virtue of her experience as a nurse educator, to comment upon the verbalization of knowledge base illustrated so clearly in the data. Evidence of an understanding of nursing theory and supporting medical science appeared not only in a much lower frequency than expected, but was also very vague and non-specific in nature. As was noted previously, the lack of verbalization of a clear, concise and descriptive knowledge base does not necessarily imply that the students did not have the knowledge. In point of fact, the writer sincerely believes that these students do possess a large and accurate knowledge base. The concern that is raised by poorly articulated rationale for action relates to the image of the nurse as a

professional colleague in an interdisciplinary health care team. Nurses will not be treated with respect by other professionals if they are unable to present their data, concerns, and knowledge base in a manner that conveys the legitimacy of their contribution to patient care. Some approaches that may be taken by nurse educators to address these concerns are outlined in the discussion chapter regarding implications for nursing education.

Although intuitive practice is thought to occur only at the expert level of proficiency (Benner, 1984), a few of the subjects in this study made reference to the fact that intuitive experiences had occurred in their nursing practice. One student gave a specific example as follows:

It was again, a gut instinct. I walked in and he just didn't look right to me, you know. And I thought, well ... I could just, you know, slough it off and think, well, it's just my imagination. But I just called my teacher and I called my grad nurse, and I said, 'He doesn't look right to me' and then we went on that, and in fact, it was a problem. He was bleeding internally, so he was having a lot of problems, but it was just, it's hard to put into words, you just sort of see it, you know, and it's, you don't look right to me.

### Summary of Major Findings

1. The mean, median and standard deviation for the locus of control scores of the sample of female nursing students in the diploma nursing program of the Health Sciences Centre School of Nursing are approximately the same as Cellini and Kantorowski's sample of 183 female college students, thus demonstrating that the present sample was a normative one for present society.

2. More than half of the subjects with an internal locus of control (55.6%) were over 25 years of age, while 30% of the subjects with an external locus of control were over 25 years old. The academic background of both groups was approximately



equivalent. Eight of the subjects were presently employed in work related to nursing outside of school hours.

3. Six decision making elements were identified in the verbal protocol transcripts of the subjects. These six elements were defined as cue, hypothesis, planning decision, knowledge base, search, and assumption. The order of frequency of use of each decision making element was the same for the internal and external subjects in each of the three sections of the planning task. In the Reading Aloud section, the internal subjects verbalized all decision making elements in significantly greater numbers than the external subjects.

In both the Thinking Aloud and the Thinking Aloud and Writing sections, the internal subjects formulated more hypotheses and made more assumptions than the external subjects. The external subjects, on the other hand, searched for more information outside of the available data, than did the internal subjects. Since the emphasis of this study was the planning of care, a more detailed investigation of the categories of the planning decisions made, is now summarized. The number of planning decisions made in the Thinking Aloud and the Thinking Aloud and Writing sections did not differ significantly between the internal and external subjects. In the Thinking Aloud section, the most frequently mentioned categories of planning decisions for both groups fell into the physical care category, followed by assessment decisions. Communication with the patient and communication with support systems occurred with approximately the same frequency within each group, and teaching decisions comprised the least frequently mentioned category.

In the Thinking Aloud and Writing section, the order of frequency of use of the five categories of planning decisions differed between the internal and external subjects. The internal subjects made more assessment than physical care planning decisions, and more decisions to communicate with the patient than to teach the

patient. The external subjects made more physical care than assessment decisions and more teaching decisions than communication with the patient.

Repeated mention of decision making elements between and among the three sections occurred frequently, but did not differ significantly between internal and external subjects.

4. Combinations of the six decision making elements into single, two element, three element, four element and five element complexes according to identified thought segments in the verbal protocols, were analyzed. In the Reading Aloud section, the internals verbalized much more than did the externals, but the most common combination of decision making elements used by both groups was the comparison of cues to knowledge base.

In the Thinking Aloud section, the external subjects used more two element combinations than the internal subjects, and the internal subjects used more four element combinations than the external subjects.

In the Thinking Aloud and Writing section, the external subjects used more single, two element and three element combinations than the internal subjects while the internal subjects again used more four and five element combinations.

In the Thinking Aloud and the Thinking Aloud and Writing sections, the internal subjects included slightly fewer planning decisions within these combinations of decision making elements.

5. In their overall approach to the planning task, the majority of the internal and external subjects evaluated selected cues against their knowledge base in the Reading Aloud section. The internal and external subjects also used a similar approach in the Thinking Aloud and Writing section, which included the verbalization of planning decisions with rationale, a balanced use of decision making elements, and the listing of planning decisions unsupported by other decision making elements. In the Thinking Aloud section however, the internal subjects used the more complex reasoning

processes of combining cues, knowledge and hypotheses to formulate planning decisions, whereas the external subjects used the simpler processes of the direct stimulation of planning decisions from cues or hypotheses, and the use of cues and hypotheses to provide rationale for planning decisions.

6. From an analysis of combinations of decision making elements, eight decision making processes were identified and defined. These processes were labelled as stimulus-response, listing, review/summarizing, non-decision structuring, hypothesize and test, hypothesize and treat, cascading, and sequential combination.

Internal subjects used more non-decision structuring, hypothesize and test, hypothesize and treat, and cascading processes, than did the external subjects. The external subjects used more stimulus-response and listing processes than did the internal subjects.

7. Trends in the use of the identified decision making processes across the three sections of the planning task revealed that for the internal subjects, the use of stimulus-response, listing and non-decision structuring processes decreased from the Reading Aloud to the Thinking Aloud to the Thinking Aloud and Writing section. The review/summarizing, cascading, and sequential combination processes increased as the internal subjects advanced through the planning task. The hypothesize and treat process was used more in the Thinking Aloud and Writing section than the Thinking Aloud section, whereas the reverse was true for the hypothesize and test process.

For the external subjects, the use of stimulus-response and listing processes increased from the beginning to the end of the planning task. The cascading and sequential combination processes were not used by the external subjects in the Reading Aloud section, but their use increased from the Thinking Aloud to the Thinking Aloud and Writing section. The hypothesize and treat and hypothesize and test processes were not prominent in the protocols of the external subjects.

8. Both the internal and external subjects used two techniques identified in this study as Qualifiers and Organizers. Qualifiers were techniques which assisted the subjects to determine what, when, or if, planning decisions might be implemented. The three types of Qualifiers were termed Time Sequencing, in which planning decisions were made in "before" and "after" terms; Priority Setting, in which the subject verbalized the relative urgency or importance of planning decisions by prioritizing them, and Contingency. When using the Contingency technique, subjects weighed the impact of decisions made by others, or external influences, upon their own planning decisions. Organizers were defined as comments made by the subjects to themselves, which seemed to assist them in focusing their thoughts on the direction they wished to take in decision making.

9. Factors perceived to facilitate or inhibit clinical decision making were organized into six categories, i.e. personal qualities, the teacher, other health team members, circumstances/events, inanimate resources, and the institutional environment.

Perceptions of facilitative influences on clinical decision making did not differ significantly between the internal and external groups, with the exception that the external subjects mentioned the positive influence of inanimate resources more frequently than did the internal subjects.

Descriptions of perceived inhibitory influences did demonstrate a difference between the internal and external groups of subjects. The external subjects verbalized more fear of authority figures and teacher expectations than the internal subjects. The external subjects also tended to dwell more upon undesirable personality characteristics and teaching techniques of the teacher, and referred more frequently to fate or chance influences than did the internal subjects.

## CHAPTER IV

### DISCUSSION OF FINDINGS

The findings of this study contribute to the body of knowledge of the cognitive processes used by student nurses to make planning decisions in a specific simulated patient situation. Eight decision making processes used by students when formulating planning decisions for patient care, were identified. A relationship was found between locus of control and the decision making processes used by subjects, as well as their perceptions of inhibitory influences on decision making.

In order to discuss the decision making processes used by the student nurses in this study in a manner that is consistent with the analysis of the data, it is necessary to include the identified relationships between locus of control orientation and the decision making processes. Furthermore, it is important to the explanation of the findings, that mention be made of the contribution of the theoretical framework at crucial points. Therefore, the research questions are grouped together for discussion. Similarities between internal and external subjects are considered first, followed by their differences. Responses to the followup questions are then considered in relation to the face validity of the simulated patient situation as perceived by the subjects, and in view of the intentions of the researcher. Evidence of locus of control orientation reflected in the responses of the subjects is summarized. Further elucidation of the findings through the perspective of the theoretical framework completes the discussion. The remainder of the chapter includes the limitations of the study, implications of the findings and recommendations for nursing education and nursing practice, and recommendations for further research.

## Research Questions 1 and 2

What decision making processes do student nurses use in planning nursing care?  
Is there a relationship between locus of control and clinical decision making processes used by student nurses in planning nursing care?

The decision making processes of the subjects in this study were examined with respect to the subjects' use of each of the defined decision making elements, followed by their use of combinations of decision making elements. From these data, eight decision making processes were identified. Each of these three aspects of the analysis, i.e. the use of individual decision making elements, combinations of decision making elements, and the use of decision making processes, is discussed according to the commonalities and the differences that existed between the internal and external subjects.

### The Use of Individual Decision Making Elements

The fact that the order of frequency of use of each decision making element was the same for all subjects in each section, leads to the conclusion that a similar overall approach to the planning task was taken.

In the Reading Aloud section, many cues were accessed and compared to the subjects' knowledge base. A few hypotheses were made and some planning decisions were formulated. This approach made use of decision making elements which were similar to those in the model of diagnostic reasoning as described by Elstein et al. (1978), with one important difference. Whereas, in the model of diagnostic reasoning, hypotheses were made on the basis of cues, and knowledge was used to validate the hypothesis prior to making a decision, these subjects used their knowledge base to evaluate cues and then formulated hypotheses, which they sometimes did, and sometimes did not attempt to validate, prior to making a planning decision. As Muzio

(1985) and Benner (1984) have suggested, the high incidence of the use of facts as the basis for decisions may be characteristic of students, as opposed to the use of hypotheses, which is more common in the experienced practitioner.

In the Thinking Aloud section, planning decisions were the most frequently occurring decision making element, followed by cues, hypotheses, and knowledge base. This would tend to indicate that the general approach to planning in this section was the use of cues, hypotheses and knowledge in various ways to justify planning decisions that were being made.

In the Thinking Aloud and Writing section, planning decisions and knowledge base were the predominant decision making elements followed by hypotheses and lastly, cues. Subjects were instructed to continue to verbalize their rationale for planning decisions as they wrote them down, which may account for the high incidence of knowledge base in relation to planning decisions in this section. It would also be expected that the number of cues would decrease in this section, as final decisions were being made, and the cue information was no longer needed.

The fact that the subjects in this study increased the number of hypotheses, instances of knowledge base, and planning decisions from the beginning to the end of the planning task may be reflective of the equal weighting of all pieces of information that is characteristic of the novice level of practice (Benner, 1984). As more information was considered and compared to the subjects' knowledge base, the more planning decisions were generated. The activation of hypotheses early in the planning task, which was found in studies of diagnostic reasoning in nursing (Tanner et al., 1987) was also evident in the findings of this study. All subjects generated hypotheses either upon initial contact with the data, or at the beginning of the Thinking Aloud section. This finding indicates that the subjects began to interpret the available information prior to thorough data collection. This is in conflict with the

teaching of nursing process, in which a thorough collection of data is advocated, prior to judgment and decision making.

In the Thinking Aloud section, physical care planning decisions were the most frequent, followed by assessment, communication with the patient, and support systems, and finally, teaching the patient. The order of frequency of the five categories may have been influenced by the patient situation that constituted the planning task. The patient was in moderate distress, and in an unknown state of health. Therefore, it could be anticipated that assessment of the patient would be of prime importance. The subjects felt a great deal of empathy for the patient, which might have translated itself into the placing of the patient's discomfort slightly ahead of assessment. Alleviating the patient's psychosocial distress and reporting findings to other personnel were also important interventions. When a patient is in considerable distress, patient teaching is not of immediate concern. Notwithstanding this interpretation, and the fact that it unfortunately reflects the prioritization of these categories of intervention in actual clinical practice, a higher frequency of planning decisions was expected in the categories of communication with the patient, communication with support systems, and patient teaching, given the heavy emphasis that is placed on these aspects of patient management by this school of nursing.

Some differences in the verbalization of individual decision making elements occurred between the internal and external subjects. The internal subjects verbalized more decision making elements in the Reading Aloud section than the external subjects. This proactive involvement with the available information is characteristic of persons with an internal locus of control.

In the Thinking Aloud and Thinking Aloud and Writing sections, the internal subjects formulated more hypotheses and made more assumptions (although still very few), than the external subjects. The generation of hypotheses presupposes a well developed knowledge base from which to access such hypothetical alternatives, and a



propensity to be inquisitive. The external subjects' sustained search for validating information outside of the available data might be interpreted as a reluctance to make a decision in the face of ambiguity.

The order of frequency of the five categories of planning decisions differed between the internal and external subjects in the Thinking Aloud and Writing section. The internal subjects chose more assessment than physical care planning decisions, and more decisions to communicate with the patient and support systems, than to teach the patient. Persons with an internal locus of control have been observed to make more cautious, deliberately planned approaches in a chance situation (Liverant & Scodel, 1960), and are more active information seekers than persons with an external locus of control (Davis & Phares, 1967). Since the state of the patient in this simulated situation was ambiguous to some extent, the gathering of assessment data and consultation with others in addition to providing a basic level of care and comfort, indicates an awareness of possible complications other than the suggested wound infection. The external subjects' choice of physical care and teaching decisions may represent an acceptance of the diagnosis of wound infection, with little thought as to what else might be wrong, if anything.

#### Combinations of Decision Making Elements

Examination of the frequency of combinations of decision making elements revealed that the most common combination to occur upon initial contact with the patient situation, i.e. in the Reading Aloud section, was the comparison of cues to knowledge base without further attempts to process information. This finding is consistent with those of Gale and Marsden (1982), who discovered that problem solvers made interpretive or evaluative responses to clinical data as soon as it was encountered. Furthermore, two and three element combinations were the most frequently used combinations in all sections of the protocols, by all subjects. Viewed from the

perspective of information processing theory, the use of short decision making combinations may be interpreted as evidence that the subjects were processing information in small pieces, i.e. serially, rather than summatively. The external subjects used more combinations of decision making elements that contained planning decisions than did the internals. The internals' higher incidence of use of the non-decision structuring technique, in which planning decisions do not appear, may account for this difference. It would seem that the internals, therefore, did more cognitive processing of information before making decisions than did the externals. Of the eight decision making processes identified in the protocols of subjects, those processes that consisted of one or two decision making elements, such as stimulus-response, listing, and review/summarizing were the simpler, less cognitively demanding processes. Those processes that consisted of combinations of three, four, or five decision making elements, such as non-decision structuring, hypothesize and test, hypothesize and treat, cascading, and sequential combination represented the more cognitively complex processes.

Although all decision making combinations were represented in the protocols of both internal and external subjects, the internal subjects used more single, two, three and four element combinations than the externals in the Reading Aloud section. The internals also used more four element combinations in the Thinking Aloud section than did external subjects, and in the Thinking Aloud and Writing section, the internals used more four and five element combinations than did the externals. In the Thinking Aloud section, the external subjects used more two element combinations than the internal subjects, and in the Thinking Aloud and Writing section, the externals used more single, two and three element combinations than did the internals. Thus, the internal subjects demonstrated a higher use of the more cognitively complex processes than did the external subjects in all sections of the planning task.

### Decision Making Processes

The stimulus-response and listing processes primarily involved the recall of information from storage in memory. Non-decision structuring represented the refashioning of information provided, with facts from memory, hypotheses, questions, and assumptions, prior to making any decisions, much like taking a piece of a jigsaw puzzle and trying to see where it fits. A distinction was made between the hypothesize and test and hypothesize and treat processes. Hypothesis testing has long been recognized as a common component of diagnostic reasoning, and indeed, of generic problem solving. Farrell and Tamblyn (1987) found in their pilot study of the cognitive processes of the practising nurse in a surgical intensive care unit and a cardiovascular thoracic unit, that their sample of nurses used a hypothesis and test approach. The difference observed in the decision making processes of student nurses when making planning decisions, was their generation of a nursing intervention directly from an unvalidated hypothesis. The subjects appeared to accept the hypothesis as a certainty and made plans to deal with it. Perhaps this is indicative of novice behavior (Benner, 1984), or the "black and white" syndrome frequently observed by this nurse educator. Cascading and sequential combinations included a variety of decision making complexes either in contingency states, or in some way, associated with each other. Both of these processes were interpreted to represent complex reasoning. Their structure, however, supported the information processing theory contention that human beings process information serially, even when a larger number of information units are being considered. The review/summarizing process was a very simple recall of previously verbalized information.

All eight of the decision making processes identified in this study were present in the protocols of both internal and external subjects. Differences did exist, however,

between the internal and external subjects in the frequency of use of the various processes, and the pattern of usage across the three sections of the planning task.

#### Frequency of Use of Decision Making Processes

The internal subjects used hypothesize and test, hypothesize and treat, cascading and non-decision structuring processes more than did the external subjects. All of these processes involve the synthesis and/or linking of information from short term memory (the simulated patient situation) and long term memory (the subject's knowledge base), and thus represent a high level of cognitive processing. Of particular note, is the significant increase in frequency of the non-decision structuring process by the internal subjects over the external subjects. Non-decision structuring is a powerful process that assists the subject to arrange, shape, and interrelate information until, like a kaleidoscope, the pieces fall into place and have meaning for the subject. The high incidence of use of this process suggests that the internal subjects are actively processing the information, and not just responding to it automatically.

The external subjects, on the other hand, used more stimulus-response and listing processes than did the internal subjects. These two processes involve very little application of knowledge or restructuring and reorganizing of information, thus suggesting a more superficial interaction between subject and task. The planning decisions that arise from these processes appeared more or less spontaneously from memory.

#### Trends in the Use of Decision Making Processes

The internal and external subjects were alike in that the use of non-decision structuring decreased in frequency as the planning task progressed, and the use of review/summarizing, cascading and sequential combination processes increased. Since non-decision structuring represents the reshaping and reorganizing of information prior to the formulation of planning decisions, this trend is to be expected

as planning decisions are proliferated and consolidated. The increased use of review/summarizing in the Thinking Aloud and Thinking Aloud and Writing sections represents the reinforcement of previously made planning decisions, which, as a natural consequence of the cognitive task, increased as final decisions were being made. It is the contention of this researcher that the review/summarizing process, within which much of the repetition of individual decision making elements occurred, served to momentarily retain meaningful data in the short term memory (STM) of the subjects in order to facilitate further information processing. At other times, it served as a plateau in processing, during which, it is proposed, subjects subconsciously freed space in short term memory for further processing.

Cascading and sequential combination processes, being more cognitively complex than review/summarizing, were interpreted as the subjects' attempts to cope with the increasing bulk of data that was perceived by subjects to be worthy of attention, as the planning exercise advanced. The internal subjects used these processes much more than did the external subjects.

The internal and external subjects differed in the use of stimulus-response, listing, hypothesize and test and hypothesize and treat processes. The internal subjects decreased the use of stimulus-response and listing processes from the Reading Aloud to the Thinking Aloud to the Thinking Aloud and Writing sections, whereas the external subjects increased the use of these processes from section to section. Since these two processes involve the simple recall of knowledge from long term memory (LTM), it is apparent that the internal subjects quickly surveyed their knowledge and relinquished these processes in favor of more complicated problem solving operations, while the external subjects, in keeping with their more superficial view of the data, continued to respond semi-automatically to the task and relied on their general knowledge base of surgical nursing care to formulate a plan of action. This perspective is further supported by the paucity of complex decision making processes used by the external

subjects, i.e. the cascading, sequential combination, hypothesize and test, and hypothesize and treat processes.

The internal subjects used more hypothesize and test processes in the Thinking Aloud section than in the Thinking Aloud and Writing section. Since the development of planning decisions to validate an hypothesis indicates a degree of uncertainty about the hypothesis, it is understandable that more of this reasoning would be done in the Thinking Aloud section. Conversely, in the Thinking Aloud and Writing section, the internal subjects used more of the hypothesize and treat process than in the Thinking Aloud section. If the Thinking Aloud and Writing section represents the portion of the task in which final planning decisions are solidified, as was intended, then treatment decisions based on an accepted hypothesis would be expected to occur more often in this section than in the Thinking Aloud section. As mentioned, the external subjects used very few of either of these processes.

#### Research Questions 3 and 4

What factors do student nurses perceive to be facilitative to them in their clinical decision making processes in planning nursing care?

Is there a relationship between locus of control and factors which student nurses perceive to be facilitative to them in clinical decision making?

There were six categories of influences acknowledged by the subjects of this study to facilitate clinical decision making as described in the findings. In terms of personal qualities of the student, an adequate knowledge base and thorough preparation for clinical practice were perceived as important to successful clinical decision making. In addition, good interpersonal relationships with patients, teacher, and staff nurses, a recognition of their own limitations and the ability to seek help, experience in similar situations, and self confidence all contributed to good decision making. Characteristics

of teachers that were perceived as helpful, were the ability to instil self confidence in the student and to act as a resource. These findings bear a striking resemblance to the findings of a study by Windsor (1987) designed to elicit the perceptions of student nurses regarding what facilitates their learning in the clinical setting. As predicted, however, the influences on clinical decision making perceived by the student nurses in this study differed considerably from those perceived by medical surgical nurses in the study by Prescott et al. (1987). The two major categories of personal and organizational influences that emerged from their study contained both positive and negative influences, but these influences were more concerned with relationships with other health team members and nursing care delivery systems than the more educationally oriented factors mentioned by the students in this study. The only difference of interest between the internal and external subjects in the present study was the positive influence of a variety of inanimate resources mentioned by the external subjects. Persons with an external locus of control are not generally known to seek information actively from the environment, as such comments would seem to indicate. An alternative explanation may be the reluctance of the external subjects to interact with teachers or other authority figures, whom they tend to fear. According to social learning theory, individuals behave in a manner that maximizes positive reinforcements in any situation. If external subjects have experienced negative reinforcements from authority figures, specifically from their teachers or other nurses when seeking assistance, it is understandable that they would find inanimate references a more positive source of information.

#### Research Questions 5 and 6

What factors do student nurses perceive to be inhibitive to them in their clinical decision making processes in planning nursing care?

Is there a relationship between locus of control and factors which student nurses perceive to be inhibitive to them in clinical decision making?

Influences perceived by the subjects to inhibit clinical decision making also fell into the six categories identified for the facilitative influences. Lack of knowledge, personal problems, lack of self confidence, nervousness and fear of doing something wrong were mentioned as powerful inhibitors of clinical decision making. Certain questioning practices of teachers were perceived as interfering with students' ability to make decisions, as well as differences in expectations from teacher to teacher. Information from staff that conflicted with that taught by the school, and rejection by staff nurses and doctors were also perceived as influencing the students' clinical decision making in a negative way. Uncooperative or noncompliant patients, a wide variety of unexpected events, and unanticipated changes in patient condition made clinical decision making difficult, at best. Again, factors perceived by student nurses to be detrimental to learning in the clinical setting, as described by Windsor (1987) closely resemble the factors perceived by the student nurses in this study to inhibit clinical decision making. Interestingly, many of the environmental factors identified by Farrell and Tamblin (1987) to affect graduate nurses' cognitive processes, were mentioned by the subjects of this study as specific factors that interfere with clinical decision making. Some of these environmental influences included the quality of change of shift reports, disruptions from other health professionals, other nurses' organization, the presence of uncommon disease conditions or procedures, and the degree of mental alertness of patients.

Locus of control did seem to mediate students' perceptions of these deleterious factors more strongly than the facilitative factors. Consistent with the literature, the external subjects demonstrated a clear tendency to attribute unrealistic expectations and negative personality characteristics of the teacher as reasons for some of their difficulties in clinical decision making. Also consistent with the literature, was the



reference by the external subjects to fate or chance influences as interfering with clinical decision making. These findings support the belief of social learning theory that the nature of the anticipation of certain reinforcements in life, developed over time through various social learning experiences, contributes to a person's behavior. The similarity between the facilitative and inhibitory influences found in this study and those of Windsor (1987) suggests that either the students in this study did not discriminate between learning experiences and clinical decision making, or that students' perceptions of influences on learning and clinical decision making were similar.

#### Followup Questions

The questions asked of subjects following the planning task were aimed at obtaining selected perceptions of the task, in order to assess the effectiveness of the planned structural aspects of the simulated patient situation. A second purpose was to determine whether or not anxiety was perceived by the subjects to interfere with their thinking processes during the planning task.

It was evident from the responses to three of the followup questions concerning characteristics of the simulated patient situation, that the purpose of several deliberately structured aspects of the patient situation were achieved. The situation was intended to be a novel and somewhat ambiguous one for this study sample, to allow maximum opportunity for the influence of locus of control to operate. As anticipated, the exposure of the subjects to patients who had had a cholecystectomy was relatively infrequent, with the exception of two of the internal subjects.

In order to diminish the anxiety that might be associated with the planning task, the situation was designed to delimit the knowledge base required to deal with the task, to be of a medium level of difficulty, and to be perceived as realistic. The mean

perceived difficulty of the task was 4.6, which is in the range of medium complexity, as anticipated. All subjects except one felt that the situation was realistic. The majority of the subjects, when asked how they felt about actually performing the task, volunteered that it was not as difficult as they had anticipated. Although almost all of the subjects admitted to some apprehension about the task, only one subject felt that the process of verbalization interfered with her ability to think and plan.

The majority of subjects, both internal and external, when asked to verbalize their perceptions of how they approached the care planning process, described a symptomatic approach, coupled with an awareness of priorities. The internal subjects articulated their awareness of their approach to planning more clearly than the external subjects. Benner (1984) states that advanced beginners learn to set priorities based on individual patient needs and situations, but continue to treat all aspects and attributes of situations as equally important. These subjects demonstrated concern about priority setting, but appeared to determine priorities from their store of knowledge of context free rules that guide action, which is characteristic of the novice. In addition, all subjects requested a great deal of specific information they would like to have known in order to facilitate their decision making in the patient situation, and most of this requested data concerned objective attributes that could be recognized as important without situational experience. Thus it appears that these senior diploma nursing students were in a phase of transition between novice and advanced beginner levels of proficiency. The internal subjects requested a larger number of pieces of information than the external subjects, and found the patient history information more helpful to decision making than did the externals. This finding is consistent with the active information seeking and processing characteristics of internal subjects as described in the literature.

### Interpretation of Findings From the Perspective of the Theoretical Framework

The theoretical framework of this study provided a useful perspective from which to view the findings. Two important concepts from information processing theory were beneficial to an understanding of the findings of this study. These two concepts are "chunking" and serial processing.

Information processing theory proposes that human information processing capacity is limited by the structure of, and relationship between, short term memory (STM) and long term memory (LTM). Information in the form of symbols or "chunks" occupies space in STM while it is being actively processed, i.e. attended to, or verbalized. The space available in STM is limited, according to Miller (1956) to seven such symbols, plus or minus two symbols. The size and complexity of these symbols, or "chunks" vary according to the human being's past experience and the extent of that person's knowledge base. For novices, these "chunks" may consist of only one piece of data, whereas for experts, a single "chunk" may represent a large and complex body of knowledge. Many such "chunks" are stored in LTM which is a potentially infinite capacity network of knowledge gained from study and experience, and are accessible to active processing when triggered, or brought forward to STM. Since the capacity of STM is limited and LTM is not, it follows that humans process information serially, or in small amounts, consistent with the complexity and depth of the individual's repertoire of symbolic knowledge.

Evidence of serial processing by the subjects of this study was manifested by the high incidence of the use of two and three element combinations of decision making elements, and the decision making processes of review/summarizing, non-decision structuring, cascading and sequential combination.

The students in this study were very emphatic about the deleterious effects of questioning by the teacher during the performance of a psychomotor skill,

particularly the preparation of medications, which is a very common time for teachers to assess their students' knowledge base. This concern can be readily understood when viewed through the perspective of information processing theory. Short term memory can only hold information that is being attended to, at the time. Novices, in particular, use more STM resources than experienced nurses do, in order to accomplish unfamiliar tasks. Having to access LTM for information regarding drug action, side effects, etc., while simultaneously attending to the psychomotor task, is a very difficult cognitive maneuver (Ericsson & Simon, 1984). Thus, the student is unable to access information from LTM, and the teacher assumes lack of knowledge. This type of assumption merits closer examination.

The extent to which the students in this study have developed "chunks" could only be properly determined by a content analysis of the transcripts. Although this type of analysis was not completed, there is evidence in the protocols that the subjects do possess some "chunks" that have particular meaning for them in terms of planning decisions for the patient, e.g., nursing interventions for pain, wound infection, and routine post-operative care. These "chunks" were not necessarily in the form of diagnostic hypotheses, but rather, represented clusters of planning decisions that were learned as context free nursing actions. It may be that the hypotheses in the hypothesize and treat decision making process used by the subjects in this study, are examples of this form of "chunking."

Newell and Simon (1972) stress that "chunks" are developed through learning over time, and are not innate. It is upon this point that social learning theory articulates with, and extends, information processing theory as the basis of this study. Social learning theory views the individual as a composite of past life experiences and learning opportunities, which shape and influence the person's behavior potential in future situations. From a variety of experiences that would be impossible to trace, a person develops and cultivates certain attitudes and coping behaviors that have proven

to be comfortable ways of dealing with life. It is postulated by social learning theory that these learned coping behaviors are aimed at maximizing positive reinforcements in any situation, and that it is the anticipation of certain reinforcements which accounts for goal directed behavior. Persons who anticipate that reinforcements in life are in the control of other people, or forces external to themselves, have been described in the literature as making decisions based on "hunches" or past experiences (Liverant & Scodel, 1960), less likely to make independent decisions (Neaves, 1989), and indeed, aversive to decision making altogether (Harrison, Lewis, & Straka, 1984). The construct of locus of control has been studied so extensively, that a consistent profile of characteristic attitudes and behaviors for persons with an internal or external locus of control has been established in the literature. Some of the decision making behaviors identified in this study, as well as the perceptions of subjects regarding influences upon their decision making are consistent with the characteristics of persons with an internal or external locus of control. For example, the internal subjects in this study interacted earlier and more thoroughly with the data in the patient situation, used more complex decision making processes, and analyzed the situation in more depth, than did the external subjects. The external subjects approached the planning task in a more superficial, "cut and dried" manner which was reflected in the decision making processes they used. Internal subjects demonstrated a more favorable attitude towards teachers and other authority figures, and less reluctance to interact with them, than did the external subjects.

### Conclusion

The findings of this study indicated that senior diploma nursing students with an internal or external locus of control used similar decision making processes in the task of planning care. Differences between internal and external subjects were demonstrated, however, in the frequency and pattern within which these processes

were used throughout the three sections of the task. The internal subjects interacted earlier and more thoroughly with the data, engaged in more cognitive processing prior to making planning decisions, and demonstrated a higher use of the more cognitively complex decision making processes of non-decision structuring, hypothesize and test, hypothesize and treat, and cascading, than did the external subjects. The external subjects increased the use of the less cognitively demanding stimulus-response and listing processes from the beginning to the end of the planning task, whereas the internal subjects decreased the use of these processes while advancing through the planning task.

Consistent with the concepts of information processing theory, the findings also suggest that these student nurses, both internal and external, tended to process information serially when making planning decisions for patient care. Evidence of serial processing was manifested by the high incidence of the use of two and three element combinations of decision making elements, and the serial nature of the decision making processes of review/summarizing, non-decision structuring, cascading and sequential combination.

The subjects of this study typified some of the characteristics of novice behavior as described by Benner (1984). The tendency to weigh all pieces of data equally is reflected in the increased numbers of hypotheses, knowledge statements and planning decisions from the first to last sections of the planning task. Other examples of novice behavior demonstrated by the subjects were the predisposition to select more of their decisions on the basis of factual data, rather than hypotheses, to generate some of their planning decisions from unvalidated hypotheses, and to establish priorities based on their store of knowledge of context free nursing actions, rather than on the individual patient's needs and situation.

Some important findings were made regarding the students' use of the nursing process as a decision making framework. Contrary to the systematic and stepwise

approach of collecting data, interpreting data to formulate nursing diagnoses, setting expected outcomes, and then making care planning decisions based on the diagnosis and designed to achieve the set goals, the students in this study began to interpret available data not only prior to a complete data collection, but in fact, almost upon initial contact with the information. Furthermore, many of them did not formulate established nursing diagnoses, nor did they set expected outcomes prior to making planning decisions. In terms of total numbers, the type of planning decisions made most frequently were assessment and physical care decisions, while decisions to teach the patient were mentioned the least often in the verbalization of all subjects. A final observation of importance to nurse educators, was the generally vague and poorly articulated rationale for planning decisions that was verbalized by most of the subjects, both internal and external.

All subjects perceived similar categories of influences upon their clinical decision making processes, but a difference existed between the internal and external subjects' perceptions of factors that inhibit the decision making of student nurses. The external subjects placed a much greater emphasis on the detrimental effect upon their clinical decision making of undesirable personality characteristics and teaching techniques of the teacher, than did the internal subjects. In addition, the external subjects referred more frequently to fate or chance influences on decision making than did the internal subjects, who appeared to perceive more personal control over the progress of their clinical decision making skills.

#### Limitations of the Study

1. The small sample size and the volunteer nature of the subject recruitment, limit generalizability of the findings to other groups of student nurses.

2. The representativeness of the patient situation in terms of all possible decision making tasks, and the non-clinical setting in which the decision making took place, limit generalizability.

3. The simulated patient situation was developed by the investigator, and therefore its validity and reliability is not established.

4. Information processing is contingent upon the demands of the task (Payne, 1982). Some characteristics of the planning task in this study that may have influenced the findings, are as follows:

a) The subjects were highly sensitive to priority setting in the verbal protocols. This concern may have been due, in part, to the verbal protocol example which the students read, and listened to, prior to engaging in the planning task itself. At the end of the verbal protocol example, the script states, "So first, I guess I better, ... then, ... and then ... ." When discussing the followup questions with the subjects however, this concern with prioritizing emerged again, unsolicited. Whether or not the example given was a significant influence, therefore, cannot be determined.

b) The subjects generated more assessment and physical care planning decisions than the other categories of patient management decisions. Subjects were instructed that no further information outside of the simulated patient situation was available to them. It is possible that this instruction may have limited the strategies subjects were able to use to organize data and make decisions. Muzio (1985) discovered to the contrary, however, that much of the relevant data elicited by her subjects was not directly used in decision related reasoning.

5. Consistent with social learning theory and information processing theory, it is recognized that the decision making processes identified and described in this study represent a sampling of behavior within a specific time period, with a specific situation, and as such, provide only partial information about the cognitive processes of the subjects.



6. Because of the small sample size and the qualitative nature of the data, statistical significance of the findings could not be determined.

### Implications and Recommendations for Nursing Education

The findings of this study have implications for nursing education not only in the realm of decision making processes and locus of control, but also in the manner in which student nurses are taught the nursing process. These implications are now discussed.

#### Decision Making and the Nursing Process

Based upon the writer's experience and the observations made in this study, most student nurses are novices in clinical decision making. Consistent with the literature on novice behavior, it seems that they tend to weigh all pieces of data equally. Given this characteristic, and the fact that they are equipped with only a beginning knowledge of medical sciences and nursing theory, they are then faced with the onerous expectation in clinical practice that they will obtain, analyze, synthesize, and make patient care management decisions based on a thorough collection of data. This writer is in strong agreement with Muzio (1985) who states that "Educational expectations of student performance ... that prescribe summative processing of multiple variables and a thorough search of available data should be reasonably altered to allow serial processing and judgment based on adequate rather than complete data" (p. 112). Thiele and Sloan (1987) reported in a recent survey of nurse educators that the ability of students to obtain and interpret data was considered more important by educators than the actual writing of the nursing care plan. It would seem, then, that nurse educators are already beginning to support cognitive processing as the basis of clinical decision making. If we accept the assumption of information processing

theory that the human mind processes information serially, and that evidence of this type of cognitive functioning exists in the findings of this study, it is clearly futile to expect a student nurse, especially a novice, to attempt to process a large and thorough mass of data at one time, particularly in the summative manner prescribed by the usual approach to nursing process. Based upon the findings of this study therefore, it would seem reasonable to speculate that the energy usually invested in teaching the nursing process as a decision making framework, might be better utilized in the teaching of logic and reasoning for the actual problem solving and planning of patient care. Most of the students enjoyed the planning task used in this study, and found it realistic. One of the ways to implement the recommendation to devote more teaching time to logic and reasoning rather than the nursing process, is to create seminars for students which incorporate a minimal data set and various levels of ambiguity and complexity. Such teaching strategies would help students learn to make planning decisions under circumstances that more closely reflect actual clinical experience. In clinical practice situations, nurse educators should assist students to focus their assessment and data gathering activities upon what is actually relevant in a patient situation. Students, especially novices, should not be expected to collect all the data, and to know what to do with it once it is collected, until after they have acquired sufficient knowledge and had sufficient opportunity to practice determining which data are relevant, which are less relevant, and what kinds of decisions they need to make, based on the data.

Most of the subjects in this study did not appear to find nursing diagnoses and expected outcomes of care as helpful guideposts in their deliberations about planning decisions. Although this discrepancy between concepts taught and student behavior may be indicative of novices, it does raise a serious question: Is it really necessary to document these aspects of care planning on charts and Kardexes?

It has been suggested in this study that asking students questions while they are performing a task, may result in their inability to access the required information

from LTM, even though it may be there. Although this poses a difficult problem for teachers, it is recommended that alternative approaches to sampling a student's knowledge in clinical practice situations be developed. In many cases, it is the timing of questions that creates the concern, rather than the questions themselves. The writer is cognizant of the fact that involved in this recommendation is a re-examination of some closely held philosophical beliefs. For example, one such belief is that a teacher must know what the student knows, prior to performing a complicated psychomotor skill, regardless of the fact that direct teacher supervision is being provided.

In the light of the difficulties the subjects of this study demonstrated in verbalizing scientific rationale associated with their thinking processes, it is recommended that clinical learning experiences such as nursing rounds at the bedside be instituted in nursing education programs. Experiences similar to nursing rounds would provide opportunities for students to verbalize to their peers, the rationale for their opinions and decisions. One important expectation of such rounds should be the development and practice of professional dialogue which is both accurate and concise. As emphasized in the serendipitous findings, practice in the skill of articulating nursing knowledge will assist the student as a graduate professional nurse to increase the credibility of the contribution of nursing to patient care in the interdisciplinary arena.

#### Locus of Control

Studies have shown that college students in general (Cellini & Kantorowski, 1982) and nursing students in particular (Dufault, 1985), are becoming more external. It is a fundamental belief of social learning theory that, difficult as it may be, locus of control beliefs can be changed or modified through experience and new learning situations. Because effective decision making is critical to current nursing practice, and because

this study suggests that locus of control affects decision making processes, it is recommended that strategies to assist students to become more internal be implemented in basic nursing education programs. Behaviorally oriented strategies such as assertiveness training for externals, may help them to see how changes in their approach can change life events, and thus enhance a belief in internal locus of control. It is important, however, to be sensitive to cultural diversity in this recommendation. Assertiveness training may, in some instances, be culturally incongruent. Further research into the effect of this internalization strategy in different cultures, and possible alternative strategies, would be valuable. Teachers who are attuned to the behaviors of external students can help by challenging these students' externally oriented verbalizations, assisting them to recognize the contingencies between their behaviors and outcomes. In addition, if nurse educators become convinced that the use of teaching approaches which build a student's self confidence and self esteem will also increase internality, they could enact a major role in assisting students to learn to make effective clinical decisions. Exposing external students to a clinical setting in which the decision making style used provides an exemplary role model, may also increase internality. Courses such as the one described by Dufault (1985) where neophytes in the profession become increasingly aware of the role of nursing today and the issues facing the profession, could serve to increase internality.

#### Implications and Recommendations for Nursing Practice

The findings of this study revealed a paucity of planning decisions that related to teaching the patient. In view of this finding, it might prove beneficial for nursing service agencies to develop more teaching tools that form a part of the patient's chart. One such example is the teaching guidelines that exist for assisting patients to learn how to cope with a colostomy. Through the effective use of such tools, where the

practice of accountability for patient education is stressed, not only for student nurses, but for all nurses who care for patients, the practice of patient education could be increased.

Another finding of this study which has implications for nursing practice is the student's perception of the powerful roles that the head nurses and staff nurses can play, either positively or negatively, in the development of the ability of student nurses to make clinical decisions. Both head nurses and staff nurses should examine the clinical unit's philosophy regarding student learning, and together develop strategies that will be beneficial to student functioning in the realm of clinical decision making. Included in these strategies might be ways of demonstrating support for students in the clinical setting.

#### Recommendations For Further Research

Several directions for further research are suggested by this study.

1. The focus of this study was to describe the decision making processes used by student nurses when planning care. The content and quality of the planning decisions made, particularly teaching decisions, and the accuracy of interventions, were not assessed or evaluated. A secondary analysis of the data could be conducted to determine whether or not a difference in the quality of plans existed between the internal and external subjects. The realization of differences, if any, in the quality of plans generated by internal students compared to those generated by external students, would further elucidate the role that locus of control orientation assumes in clinical decision making. In addition, such an analysis might provide further information regarding the presence and nature of symbolic knowledge or "chunks" that have been acquired by the students.
2. The research using information processing theory proposes that the use of different information processing strategies may produce functionally equivalent

behaviors (Rodgers & Housel, 1987; Simon, 1978). A secondary analysis of the data from this study which revealed whether or not the final planning decisions made by internal and external subjects were similar, would provide valuable data to support or refute the contention that locus of control differentially influences the types of planning decisions student nurses make.

3. Nineteen of the 20 subjects in this study were female, and the internal subjects were a slightly older age group than the external subjects. A replication study comparing the decision making processes used by male and female subjects in various age groups, might help determine if gender or age differences in decision making processes exist.

4. The pattern of decision making processes used by internal subjects in planning care differed from the pattern used by external subjects. This sample of subjects were in the novice category. A study of decision making processes used by experts, both internal and external, would provide data to support or refute the hypothesis that the construct of locus of control is as strong an influence on decision making processes as is level of expertise.

5. Since decision making processes are believed to be contingent upon the demands of the task, the use of the decision making processes that were identified in this study should be examined in a variety of patient situations.

6. Studies should be designed to test the effectiveness of internalization strategies instituted by nursing education programs upon locus of control.

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## Appendix A

Principles (Assumptions) of Social Learning Theory

1. The unit of investigation for the study of personality is the interaction of the individual and his or her meaningful environment.

Corollary 1. The study of personality is the study of learned behavior. Learned behavior is behavior that is modifiable, that changes with experience.

Corollary 2. Investigation of personality requires the study of experience or sequences of events. Its method is historical, for an analysis of any behavior involves the investigation of the conditions preceding its appearance.

2. Personality constructs are not dependent for explanation upon constructs in any other field (including physiology, biology, or neurology). Scientific constructs for one mode of description should be consistent with constructs in any other field of science, but no hierarchy of dependency exists among them.

3. Behavior as described by personality constructs takes place in space and time. Although all such events may be described by psychological constructs, it is presumed that they may also be described by physical constructs as they are in such fields as physics, chemistry, and neurology. Any conception that regards the events themselves, rather than the description of the events, as different is rejected as dualistic.

Corollary 1. Any conception of behavior wherein "physiological behavior" is conceived of as "causing" "personality behavior" or vice versa is rejected as dualistic. (There is an implication that there are two kinds of events rather than different descriptions of the same event).

Corollary 2. Any conception of behavior wherein explanation is made on the basis of the interaction of body with mind is rejected as dualistic.

4. Not all behavior of an organism may be usefully described with personality constructs. Behavior that may usefully be described by personality constructs appears in organisms of a particular level or stage of complexity and a particular level or stage of development.

Corollary 1. Physiological or other constructs may be used in describing some of the conditions present when personality characteristics are first acquired.

Corollary 2. Physiological or other constructs may be used by psychologists for any practical purpose.

Corollary 3. The human organism may interact with itself using learned meanings (or symbols) which describe in physiological terms or terms characteristic of other modes of description.

5. A person's experiences (or [a person's] interactions with his [or her] meaningful environment) influence each other. Otherwise stated, personality has unity. New experiences are a partial function of acquired meanings, and old acquired meanings or learnings are changed by new experience. Perfect prediction of acquired behavior would ideally require a complete knowledge of previous experience. (Unity is defined in terms of relative stability and interdependence. As the individual becomes more experienced, personality becomes increasingly stable. The process of mediated stimulus generalization accounts in large part for this increasing stability and generality of responses to a class of situations. Individuals tend to select new experiences and interpretations of reality on the basis of previous experiences and conceptualizations. However, the presence of relative stability and generality does not mean that specificity of response and change with new experience are not also important principles of behavior. From Rotter, 1982a, p. 8).

Corollary 1. One cannot truly speak of the "cause" or "etiology" of behavior as described by personality constructs but only of the conditions, present and antecedent, necessary for the occurrence of the behavior. Such descriptions are never "ultimate" or final.

6. Behavior as described by personality constructs has a directional aspect. It may be said to be goal-directed. The directional aspect of behavior is inferred from the effect of reinforcing conditions. (This directional nature of behavior, accounting for selective response to cues and for choice behavior, is the motivational focus of SLT. The individual seeks to maximize his or her positive reinforcements in any situation. Learned behavior is goal-directed, and new goals derive their importance for the individual from their associations with earlier goals. From Rotter, 1982a, p.10).

Corollary 1. The needs of a person as described by personality constructs are learned or acquired. Early goals or needs (and some later ones) may be spoken of as arising owing to the association of new conditions with the reinforcement of physiological homeostatic movements, and most later goals or needs arise as means of satisfying earlier learned goals.

Corollary 2. Early acquired goals in humans (which play a great role in determining later goals) appear as the result of satisfactions and frustrations which, for the most part, are entirely controlled by other people.

Corollary 3. In order for any behavior to occur regularly in a given situation or situations, it must have been made available to the person using it by leading to some reinforcement or reinforcements during previous learning experiences.

Corollary 4. A person's behaviors, needs, and goals are not independent but belong in functionally related systems. The nature of these relationships is determined by previous experience.

7. The occurrence of a behavior of a person is determined not only by the nature or importance of goals or reinforcements but also by the person's anticipation or expectancy that these goals will occur. Such expectations are determined by previous experience and can be quantified. (This principle is an attempt to handle the question of how the individual in a given situation behaves in terms of potential reinforcers. The assumption is that a concept dealing with anticipation of reinforcement is necessary in order to account for behavior directed at specific goals. In short, one needs a concept other than simple value of reinforcement to account for human behavior. From Rotter, 1982a, p. 10.)

From: Rotter, Julian B. (1954). General principles for a social learning framework of personality study. In Rotter, Julian B. Social learning and clinical psychology (Chapter 4, pp. 82-104). New York: Prentice-Hall, Inc.

Rotter, Julian B. (1982a) Introduction. In Julian B. Rotter (Ed.), The development and applications of social learning theory: Selected papers (pp. 1-11). New York: Praeger.



## Appendix B

Laws of Qualitative Structure For Human Problem Solving

1. A few, and only a few, gross characteristics of the human information-processing system are invariant over task and problem solver. The information-processing system is an adaptive system, capable of molding its behavior, within wide limits, to the requirements of the task and capable of modifying its behavior substantially over time by learning. Therefore, the basic psychological characteristics of the human information-processing system set broad bounds on possible behavior but do not determine the behavior in detail.

2. These invariant characteristics of the information-processing system are sufficient, however, to determine that it will represent the task environment as a problem space and that the problem solving will take place in a problem space.

3. The structure of the task environment determines the possible structures of the problem space.

4. The structure of the problem space determines the possible programs (strategies) that can be used for problem solving.

From: Simon, H.A. (1978). Information processing theory of human problem solving. In W.K. Estes (Ed.), Handbook of learning and cognitive processes, Vol. 5: Human information processing (pp. 271-295). New Jersey: Lawrence Erlbaum.

## Appendix C

Explanation of the Study

Dear Student,

You are invited to participate in a research study about the clinical decision making processes of student nurses.

The study has two purposes, to describe how student nurses think when making decisions about planning nursing care, and to describe factors that student nurses perceive to help, or interfere with, the making of clinical nursing decisions.

This study is being conducted by Sharon Tschikota, a student in the Master of Nursing program at the University of Manitoba, Winnipeg, Manitoba. The investigator's thesis advisor is Professor Cynthia Cameron, School of Nursing, University of Manitoba (474-8240).

You do not have to participate in this study. If you do not wish to participate, your status in the school, and your relationship with the investigator will not be affected in any way.

Your participation in the study will involve a minimum of one and a half to a maximum of three hours of your time, divided into two sessions. The study will be conducted at a time that is mutually convenient for you and the investigator.

In the first session, you will be asked to recall specific examples from your clinical experience that either helped, or interfered with, your clinical decision making. You will also be asked questions about your age, educational background, and experience in nursing related work. This will be tape recorded. Finally, you will be asked to complete a questionnaire.

In the second session, you will be asked to read a patient situation and plan care for this patient while thinking out loud. You will listen to a "thinking aloud" process on a tape prior to your participation, to familiarize you with the method. Your "thinking out loud" will be tape recorded. You will also be asked to write down your plan of care as it is finalized. You will then be asked some questions about your reaction to the situation. This is not a test. There are no wrong answers. The focus of the study is on the thinking processes of student nurses as care is being planned.

If you do agree to participate, your involvement in the study will remain strictly confidential. The information you provide will be identified by a code number. Your identity will be known only to the investigator. When the study is complete, the tape recordings will be erased. Teachers in the school of nursing will not be aware of the names of those students agreeing to participate. You may withdraw from the study at any time. It is important to this research that participants will feel comfortable in verbalizing their thoughts, and that they have a telephone. If you feel that you meet these criteria and are interested in participating, please fill in the bottom portion of this form, and place it in Sharon Tschikota's mailbox (#139) at the reception desk in the school of nursing.

I appreciate your consideration of this request, and look forward to your participation!

Yours truly,

Sharon Tschikota

Yes, I would be interested in participating in the research study of the processes of clinical decision making used by student nurses in planning nursing care.

NAME: \_\_\_\_\_ PHONE NUMBER: \_\_\_\_\_

## Appendix D

Interview QuestionnairePart A: Demographic Information

1. Gender: Male\_\_\_\_\_ Female\_\_\_\_\_
2. Age (at last birthday) \_\_\_\_\_
3. Ethnic/cultural background \_\_\_\_\_
4. Languages spoken other than English \_\_\_\_\_
5. Marital Status \_\_\_\_\_
6. Dependents (specify) \_\_\_\_\_
7. What was your educational preparation before entering nursing?
  - a) Complete grade 12 (20 credits) \_\_\_\_\_
  - b) English 300, Math 300, and Science 300 only \_\_\_\_\_
  - c) No grade 12 subjects \_\_\_\_\_
  - d) University credits (please specify) \_\_\_\_\_
  - e) University degree (please specify) \_\_\_\_\_
  - f) Certificates or diplomas held (please specify) \_\_\_\_\_
  - g) Other (please specify) \_\_\_\_\_
8. If you have had any experience in nursing-related work prior to entering this program, please describe.
9. Are you presently employed in nursing-related work outside of school hours? Please specify.
10. In what clinical area are you presently having your clinical experience?

Part B: Perceived Influences on Clinical Decision Making

I would like you to recall some specific decision making situations that you were involved in while in clinical practice, and think about these two questions:

1. What specific things (people, events, circumstances) helped you to determine what was wrong with your patient and what you should do about it?
2. What specific things (people, events, circumstances) made it difficult for you to determine what was wrong with your patient and what you should do about it?

## Appendix E

## The Rotter Internal External Locus of Control Scale

Scoring - the higher the score the more external the individual.

## Social Reaction Inventory

This is a questionnaire to find out the way in which certain important events in our society affect different people. Each item consists of a pair of alternatives lettered a or b. Please select the one statement of each pair (and only one) which you more strongly believe to be the case as far as you're concerned. Be sure to select the one you actually believe to be more true rather than the one you think you should choose or the one you would like to be true. This is a measure of personal belief; obviously there are no right or wrong answers.

Please answer these items carefully but do not spend too much time on any one item. Be sure to find an answer for every choice. For each numbered question make an X on the line beside either the a or b, whichever you choose as the statement most true.

In some instances you may discover that you believe both statements or neither one. In such cases, be sure to select the one you more strongly believe to be the case as far as you're concerned. Also try to respond to each item independently when making your choice; do not be influenced by your previous choices.

## Remember

Select that alternative which you personally believe to be more true.

I more strongly believe that:

1.  a. Children get into trouble because their parents punish them too much.  
 b. The trouble with most children nowadays is that their parents are too easy with them.
- E 2.  a. Many of the unhappy things in people's lives are partly due to bad luck.  
 b. People's misfortunes result from the mistakes they make.
3.  a. One of the major reasons why we have wars is because people don't take enough interest in politics.  
E  b. There will always be wars, no matter how hard people try to prevent them.
4.  a. In the long run people get the respect they deserve in this world.  
E  b. Unfortunately, an individual's worth often passes unrecognized no matter how hard he tries.
5.  a. The idea that teachers are unfair to students is nonsense.  
E  b. Most students don't realize the extent to which their grades are influenced by accidental happenings.
- E 6.  a. Without the right breaks one cannot be an effective leader.  
 b. Capable people who fail to become leaders have not taken advantage of their opportunities.

- E 7. \_\_\_\_\_ a. No matter how hard you try some people just don't like you.  
\_\_\_\_\_ b. People who can't get others to like them don't understand how to get along with others.
8. \_\_\_\_\_ a. Heredity plays the major role in determining one's personality.  
\_\_\_\_\_ b. It is one's experiences in life which determine what they're like.
- E 9. \_\_\_\_\_ a. I have often found that what is going to happen will happen.  
\_\_\_\_\_ b. Trusting to fate has never turned out as well for me as making a decision to take a definite course of action.
10. \_\_\_\_\_ a. In the case of the well prepared student there is rarely if ever such a thing as an unfair test.  
E \_\_\_\_\_ b. Many times exam questions tend to be so unrelated to course work that studying is really useless.
11. \_\_\_\_\_ a. Becoming a success is a matter of hard work, luck has little or nothing to do with it.  
E \_\_\_\_\_ b. Getting a good job depends mainly on being in the right place at the right time.
12. \_\_\_\_\_ a. The average citizen can have an influence in government decisions.  
E \_\_\_\_\_ b. This world is run by the few people in power, and there is not much the little guy can do about it.
13. \_\_\_\_\_ a. When I make plans, I am almost certain that I can make them work.  
E \_\_\_\_\_ b. It is not always wise to plan too far ahead because many things turn out to be a matter of good or bad fortune anyhow.
14. \_\_\_\_\_ a. There are certain people who are just no good.  
\_\_\_\_\_ b. There is some good in everybody.
15. \_\_\_\_\_ a. In my case getting what I want has little or nothing to do with luck.  
E \_\_\_\_\_ b. Many times we might just as well decide what to do by flipping a coin.
- E 16. \_\_\_\_\_ a. Who gets to be the boss often depends on who was lucky enough to be in the right place first.  
\_\_\_\_\_ b. Getting people to do the right thing depends upon ability; luck has little or nothing to do with it.
- E 17. \_\_\_\_\_ a. As far as world affairs are concerned, most of us are the victims of forces we can neither understand, nor control.  
\_\_\_\_\_ b. By taking an active part in political and social affairs the people can control world events.
- E 18. \_\_\_\_\_ a. Most people can't realize the extent to which their lives are controlled by accidental happenings.  
\_\_\_\_\_ b. There really is no such thing as "luck".
19. \_\_\_\_\_ a. One should always be willing to admit his mistakes.  
\_\_\_\_\_ b. It is usually best to cover up one's mistakes.
- E 20. \_\_\_\_\_ a. It is hard to know whether or not a person really likes you.  
\_\_\_\_\_ b. How many friends you have depends upon how nice a person you are.

- E 21. \_\_\_\_\_ a. In the long run the bad things that happen to us are balanced by the good ones.  
\_\_\_\_\_ b. Most misfortunes are the result of lack of ability, ignorance, laziness, or all three.
- E 22. \_\_\_\_\_ a. With enough effort we can wipe out political corruption.  
\_\_\_\_\_ b. It is difficult for people to have much control over the things politicians do in office.
- E 23. \_\_\_\_\_ a. Sometimes I can't understand how teachers arrive at the grades they give.  
\_\_\_\_\_ b. There is a direct connection between how hard I study and the grades I get.
24. \_\_\_\_\_ a. A good leader expects people to decide for themselves what they should do.  
\_\_\_\_\_ b. A good leader makes it clear to everybody what their jobs are.
- E 25. \_\_\_\_\_ a. Many times I feel that I have little influence over the things that happen to me.  
\_\_\_\_\_ b. It is impossible for me to believe that chance or luck plays an important role in my life.
- E 26. \_\_\_\_\_ a. People are lonely because they don't try to be friendly.  
\_\_\_\_\_ b. There's not much use in trying too hard to please people, if they like you, they like you.
27. \_\_\_\_\_ a. There is too much emphasis on athletics in high school.  
\_\_\_\_\_ b. Team sports are an excellent way to build character.
- E 28. \_\_\_\_\_ a. What happens to me is my own doing.  
\_\_\_\_\_ b. Sometimes I feel that I don't have enough control over the direction my life is taking.
- E 29. \_\_\_\_\_ a. Most of the time I can't understand why politicians behave the way they do.  
\_\_\_\_\_ b. In the long run the people are responsible for bad government on a national as well as on a local level.

From: Lefcourt, Herbert M. (1976). Locus of control: Current trends in theory and research. Hillsdale, New Jersey, Lawrence Erlbaum Associates, Publishers. (John Wiley & Sons), p.177-180.

## Appendix F

### Simulated Patient Situation

#### Instructions To Subjects

The following is a typical clinical situation that requires independent nursing interventions. You are being asked to do 3 things:

1. Please read the situation out loud, and include any thoughts you might have, as you do this.
2. Continue to think out loud including the reasons for your thoughts, as you develop a plan of care for this patient. I am interested in the thinking process that leads up to the choice of nursing interventions, so please remember to include all your thoughts as you decide on a plan. If you are silent for a while, I will ask "What are you thinking now?" You do not have to follow any specific format. The task is only to develop a plan of nursing intervention. You may write notes on the typed situation, and on the blank paper provided.
3. When you are satisfied with your plan, write it on the form provided (a blank page with the word "Plan" at the top, and room for the Subject Code), while continuing to think aloud. I will collect the typed simulated patient situations, and the paper provided for notes.

Do not write down the rationale for your chosen interventions. The reasons behind your choices will have been made clear as you were thinking out loud.

Do you have any questions?

Please begin.

#### Simulated Patient Situation

Mrs. Esther Hill is a 40 year old woman who has had a cholecystectomy and exploration of the common bile duct, and is a patient on an adult surgical ward. Since her second child was born nine years ago, she has experienced six attacks of severe right upper quadrant abdominal pain that radiates to both shoulders and is accompanied by intermittent jaundice. She was diagnosed as having acute cholecystitis and cholelithiasis. Her last attack occurred six weeks ago and was more severe and prolonged than previous ones. Her doctor admitted her for surgery.

Mrs. Hill is 160 cm. tall (5 feet, 4 inches) and weighs 50 Kg. (110 lbs.). She is a light smoker (less than 20 cigarettes per week). She does not participate in regular exercise,

preferring to control her weight through dieting. Upon admission she conversed pleasantly with the nurse, telling her all about her husband and two sons, aged 16 and 9. Her vital signs on admission were BP 132/86, TPR 37-72-20.

Mrs. Hill's surgery went well. She had a minimal blood loss during surgery. The surgeon's report stated that her gallbladder was enlarged, slightly inflamed, and contained two large stones and a large amount of "gravel". Two stones were removed from the common bile duct and a T-tube was inserted. A penrose drain was inserted through a separate stab wound. She had a right subcostal incision.

Mrs. Hill arrived on the ward with a nasogastric tube in place, an intravenous of 5% dextrose and half saline running at 100 cc./hr., a T-tube to straight drainage, and a large abdominal dressing. She had an order for Demerol 100 mg. IM q3-4h prn for pain and Phenergan 25 mg. IM q3-4h prn for nausea.

Mrs. Hill's first and second postoperative day were uneventful, and she progressed normally towards recovery. Her nasogastric tube has been removed, and she is beginning to take clear fluids. Her intravenous is still running at 50 cc./hr.

In morning report on her third postoperative day, you, her nurse, are informed by the night nurse that Mrs. Hill seemed to need a little more encouragement during the evening to get out of bed and was reluctant to do her deep breathing and coughing exercises. There was a moderate amount of serosanguinous drainage through her dressing last evening and so it was changed. The incision was a little swollen and moist looking, and the skin edges were slightly reddened. The night nurse suggests that Mrs. Hill might be developing a wound infection.

When you go into Mrs. Hill's room after report, she is lying on her back in bed with her knees drawn up. She tells you she is having a lot of pain in her abdomen, and she looks flushed and uncomfortable. The skin on her neck feels warm and clammy to the touch. She says she "feels funny ... not very well". She begins to cry.

Develop a plan of care that you will implement this morning for Mrs. Hill's suspected early wound infection. The information provided, is the only information available to you right now.

Please think out loud as you develop this plan, giving as thorough a report of your thinking as you can. Remember, there are no right or wrong answers. It is the thinking about your plan that is important.



## Appendix G

### Verbal Protocol Example

#### Procedure

Subjects will be provided with this typed situation. The instructions to subjects will be read aloud to them. The tape recorder will then be turned on so that subjects may hear the verbal protocol example.

#### Instructions to Subjects

Listen to the subject on the tape. She is going to follow the same procedure that will be asked of you in the simulated patient situation, except that, in this example, the focus is on planning in a non-nursing situation. First, she will read the situation out loud. She will develop a plan, while thinking out loud, of what to do in this situation. She will include the reasons behind her thinking, and any other thoughts she has while developing the plan.

#### Example Situation

You are a nurse working an 8 hour day shift (0700-1500 hours). You have had a busy day and you suspect that you will not be able to leave right at 1500 hours. At lunch time, you get a message that Rhonda, an old friend and former classmate is in town for a few hours, and would like to meet you for supper. She has to leave for the airport at 2000 hours. You are to call her back by 1500 hours. You were very close to Rhonda, and would like to see her. However, you had plans to go to the football game tonight with your friend, Al. The football game starts at 1930 hours, and you have to go home after work to feed and walk your dog, have a shower and get dressed.

#### Script of Verbal Protocol Example

OK, let's see. The situation says, you are a nurse working an 8 hour day shift (0700-1500 hours). You have had a busy day and you suspect that you will not be able to leave right at 1500 hours. ... What else is new? I hate 8 hour shifts - you never have enough time to get your work done, and then you feel guilty putting in for overtime!

OK, at lunch time, you get a message that Rhonda, an old friend and former classmate is in town for a few hours ... a few hours! Boy, that's not much time ... and would like to meet you for supper. She has to leave for the airport at 2000 hours ... let's

see, that's 8 o'clock, and I don't get off 'til 3 - if I'm lucky! ... You are to call her back by 1500 hours - OK ... You were very close to Rhonda and would like to see her ... OK, so that's like if Mary came to town - I would sure like to see her again! We had so much fun together in nursing school! ... However, you had plans to go to the football game tonight with your friend, Al. - Uh, Oh! The football game starts at 1930 hours, and you have to go home after work to feed and walk your dog, have a shower and get dressed. Wow!

OK. Let's see what I'm looking at here. I might not get off work at 3, I have to go home, feed and walk the dog, shower, meet Rhonda for supper and get to the football game by 7:30 pm. Well, for starters, Al was probably coming to get me about 5:30 so we would have time for a quick bite to eat before the game. The situation doesn't say if Al knows Rhonda, but maybe Al and I could meet Rhonda at the Pizza Hut at 6 and drive her to the airport. But, on the other hand, I don't know if we'd be able to have supper, drive her to the airport, and get back to the game between 6 and 7:30 pm. So maybe I'd better ask her if she would mind getting a cab to the airport. I don't know how much fun it would be for Al to sit and listen to two nurses gab about nursing and stuff all supper either. Most men really don't like "shop talk".

Because I'm so busy at work, I better see how I can be ready, even for 5:30. It'll take me half an hour to get home, and at least an hour and a half to look after the dog and get showered and dressed. So if I leave right at 3 that would take 'til 5 o'clock. If Al can come to pick me up at 5, we could meet Rhonda at 5:30, and that would give us a little more time. Maybe my head nurse can get someone else to cover my patients for me if I'm not finished by 3, so I could leave. And if not, maybe I could get another nurse that's working today to help me so I can be finished on-time. Most nurses are really willing to help each other out for things like this. In fact, that's an even better idea. OK, that's what I'll do! - I'll ask another nurse to help me, and I'll call Al and see if he can come earlier. And I'll try not to just talk about nursing all supper. We'll probably all get along just fine, anyway. And I'll ask Rhonda if she doesn't mind taking a cab to the airport after supper. When she hears what I'm up against, she'll understand. So first, I guess I better find a nurse to help me, then phone Al to see if my plan is OK with him, and then phone Rhonda and work out the details with her.

## Appendix H

### Followup Questions

1. How many patients have you cared for with a cholecystectomy?
2. Did the patient(s) have, or develop, a wound infection?
3. Was the description of the situation realistic?
4. What information would you like to have had, that was not given?
5. How would you rate this situation in terms of difficulty for making decisions about what nursing interventions to plan? Choose a number between 1 (very easy) and 9 (very difficult).
6. Did you have a general approach to the task of developing a plan of care? If so, what was it?
7. Did you find some information more helpful than others for your decision making? If so, what was more helpful?
8. How did you feel while doing this exercise?

## Appendix I

Consent Form

This certifies that I, \_\_\_\_\_, agree to participate in the study conducted by Sharon Tschikota, a Master's Student in Nursing at the University of Manitoba on the clinical decision making processes of student nurses. The purposes of this research are to describe how student nurses think when making decisions about planning nursing care for a patient, and to describe the student nurses' perceptions of factors that facilitate or hinder their clinical decision making. I have been given a copy of the written explanation of the study and have had an opportunity to ask questions.

I understand that my participation will involve a minimum of one and a half hours to a maximum of three hours of my time, divided into two sessions. In the first session, I understand that I will be asked questions about what I think helps or interferes with my clinical decision making on wards, and that I will also be asked questions about my age, educational background and experience in nursing related work. This part of the session will be tape recorded. I will then be asked to complete a questionnaire. This part of the session will not be tape recorded.

In the second session, I will be asked to:

1. listen to a taped example of a "thinking aloud" process to familiarize me with the method.
2. think aloud while planning nursing care for a written patient situation.
3. think aloud while writing out the final plan of care.

I understand that I will be asked some questions about my reaction to the situation after completing the care plan, and that this entire session will be tape recorded. I understand that my name will not be used on the tapes or any written materials used in this study.

I understand that I may withdraw from the study at any time without affecting my future association with Sharon Tschikota or the Health Sciences Centre School of Nursing in any way. I understand that my participation will be of no direct benefit to me. I have been informed that the tape recordings will be erased at the conclusion of the study. I understand that it will not be possible to identify me in the report of this study or any future publications that might arise from this study.

If necessary, I am aware that I may contact Sharon Tschikota at 668-4251 or her advisor, Professor Cynthia Cameron, at 474-8240 at any time during the study. My signature below indicates my willingness to participate in the study.

Date: \_\_\_\_\_

(Participant)

(Investigator)

I would like a summary of the results of this study.

Yes \_\_\_\_\_ No \_\_\_\_\_

## Appendix J

Letter of Access to the Director of the Health Sciences Centre School of Nursing

160 Keedian Drive,  
Birds Hill, Manitoba,  
R0E 0H0

Mr. Douglas W. Kinley,  
Director,  
Health Sciences Centre School of Nursing,  
700 McDermot Avenue,  
Winnipeg, Manitoba.  
R3E 0T2

(Date)

Dear Mr. Kinley,

As you know, I am a student in the Master of Nursing Program at the School of Nursing, University of Manitoba. I am ready to commence my research study investigating the clinical decision making processes of diploma nursing students while planning nursing care. My thesis advisor is Professor Cynthia Cameron, School of Nursing, University of Manitoba, 474-8240. Enclosed please find a copy of my thesis proposal. My proposal has been approved by the Ethical Review Committee, School of Nursing, University of Manitoba, and the Director of Research, Health Sciences Centre.

My proposed study is an exploration of the decision making processes student nurses use when developing nursing interventions for the care of a patient. In addition, I am interested in what factors they perceive as inhibiting or facilitating their clinical decision making on wards. It is anticipated that knowledge arising from this investigation will contribute to a better understanding of students' reasoning abilities in the planning aspect of the nursing process. The resulting information may suggest fruitful avenues for research into educational strategies to assist students in the care planning process.

I would like to obtain the participants for this study from the second year class of the Health Sciences Centre School of Nursing. I would like the opportunity to meet with small groups of students to distribute the Explanation of the Study (Appendix G, proposal) and answer questions, if the students have any. Interested students may then contact me by depositing the bottom portion of the Explanation of the Study into my mailbox at the School of Nursing. I will phone the students and thus, maintain their confidentiality.

Ethical considerations regarding anonymity, consent, and the right to withdraw are addressed in the Explanation of the Study and will be further explained to those students agreeing to participate in the study. Participation will involve a minimum of one and a half to a maximum of three hours of each student's time.

Please contact me at home (668-4251) or at work (Ext. 3450) should you wish to discuss this request further.

I am looking forward with anticipation to hearing from you.

Sincerely,

Sharon E. Tschikota,  
R.N., B.N., M.N. Candidate.

## Appendix K

### Assumptions of the Study

1. Students will reveal their true thoughts while verbalizing during the verbal protocol and interview sessions.
2. Verbalization is accepted as an indirect measure of cognitive processes.
3. When decision making is recalled from a specific situation, the decision maker can consciously identify specific factors that influenced the decision.
4. Locus of control is a stable personality characteristic representative of a person's usual approach to life situations.
5. Decision making is primarily a cognitive process. This study makes no assumptions regarding the characteristics of that process.

## Appendix L

### Definitions

Clinical decision making in nursing refers to the cognitive process(es) leading up to, and including, the conceptualization of nursing problems (nursing diagnoses) and the formulation of plans for nursing intervention (patient management).

Clinical decision making is a specialized process of problem solving that applies, in addition to general problem solving skills, a discipline-specific knowledge base to a dynamic and uncertain nurse-patient situation, aimed at the achievement of implicit as well as explicit goals. The obligation of the decision maker to be accountable for taking some action upon the conclusions reached, is inherent in the concept of clinical decision making in nursing.

Three sets of variables influence the process of clinical decision making; the personal characteristics of the nurse, such as nursing knowledge base, personality characteristics, and experience in nursing; the personal characteristics of the patient, including physiological, psychological, and sociological status, the personality characteristics of the patient, and the patient's perceptions of his/her situation; and external, environmental factors, such as the physical environment, the presence of individuals other than nurse and patient, the availability of technology and resources, and time factors.

Clinical decision making in nursing is characterized by the demand to make decisions in the presence of an incomplete data base and varying degrees of uncertainty regarding the probable outcome. The process of clinical decision making is shaped by unique, situation-dependent variables arising from the psychological situation of the nurse, the psychological situation of the patient, and the external environment.

Clinical decision making in nursing encompasses the terms "problem solving", "clinical judgment", "clinical reasoning process", "diagnostic reasoning", and "clinical inference", as seen in the literature.

Problem solving is a generic, goal-directed cognitive process that involves the recognition of a problem state, and the generation of a series of successive approximations towards the desired goal until a satisfactory solution to the perceived problem is found. Problem solving is a general cognitive skill that seeks resolution of a

problem, but does not inherently include an obligation to act upon the solution, once found.

The Nursing Process is a series of interrelated steps or phases which provide the nurse with an organized approach to data collection, nursing diagnosis, and the planning, implementation, and evaluation of patient care. The nursing process functions as a framework within which the results of clinical decision making are organized, but it does not provide direction for the cognitive processes involved in executing each step or phase.