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Nursing Faculty Perceptions of Critical Thinking

Cynthia N. Sander
Loyola University Chicago

NURSING FACULTY PERCEPTIONS OF CRITICAL THINKING

by

Cynthia N. Sander

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CHAPTER I

INTRODUCTION

For the past three decades the concept of critical thinking has occupied a significant place in the literature of higher education. Theoretical articles have focused on attempts to define the concept and explore the various attributes and skills of the critical thinker. Researchers have explored various factors that influence or relate to critical thinking ability. Within the past decade the concept of critical thinking has begun to occupy a significant place in nursing literature as well, with a particular emphasis noted within the past four years. This literature has been primarily research focused, and has explored the impact of nursing education on the critical thinking ability of students and practicing nurses and the relationship between critical thinking ability and clinical decision making. Numerous teaching strategies designed to promote critical thinking ability have been described in the literature of both general higher education and nursing education. The reported research has yielded conflicting results with respect to those factors (e.g., specific teaching strategies, curriculum design, college experience) that influence the enhancement of critical thinking ability.

The development of critical thinking ability appears to be universally accepted as a goal of general education within the college and university setting (Bok, 1974; Cobb, 1983; Kaysen, 1974; McMillan, 1987; Sturner; 1973). Kaysen (1974) states that the ideal college graduate should have a well-developed capacity and taste for critical thought. Bok (1974) addresses the importance of developing the capacity for careful analysis as part of the skills and habits of thought that should be acquired in college. Cobb (1983) emphasizes the importance of thinking systematically as a tool for gaining a perspective on what is learned, on the world, and on oneself. Among the goals of general education that Sturner (1973) promulgates is development of cognitive capabilities - those basic analytic, communicative, organizational, and creative skills applicable to most problem-solving or decision-making situations. The development of critical thinking ability is deemed to be a crucial outcome of the educational process, not only because it contributes to the intellectual development of the individual student, but because it contributes to the development of responsible citizenship (Glaser, 1985).

The National League for Nursing (1989) recognizes critical thinking as an essential component of baccalaureate nursing education with the inclusion of the statement "the curriculum emphasizes the development of critical thinking and of progressively independent decision making" as one of

the criteria for accreditation of baccalaureate nursing programs. At the June 1991 biennial meeting of the National League for Nursing, it was reported that critical thinking has been adopted as one of the required outcome criteria for accreditation of baccalaureate nursing programs.

In recent years the critical thinking movement in education has taken significant strides. The Center for Critical Thinking and Moral Critique, located at Sonoma State University, California, has sponsored an Annual International Conference on Critical Thinking and Educational Reform since 1980. The Center for Teaching Thinking, part of The Regional Laboratory for Educational Improvement of the Northeast and Islands, New England, sponsors short summer credit and non-credit courses designed to infuse critical and creative thinking into content areas. Thinkers within the Informal Logic Movement have contributed significantly to theorizing concerning the nature of critical thinking (Siegel, 1988). The University of New Hampshire School of Health and Human Services, Department of Nursing, sponsored a Conference on Critical Thinking as its First Annual Institute on Nursing Education in July 1991. A proposal is being written to fund a Center for Critical Thinking and Nursing Education, to be housed at Ball State University Department of Nursing, Muncie, Indiana. This will serve as a clearing house for critical thinking research and information of particular concern to nursing.

These are but a few examples of the increasing focus on critical thinking nationwide.

Despite the emphasis on critical thinking in the literature and its accepted importance as a goal of higher education, there is no universally accepted definition of the concept (D'Angelo, 1971; Facione, 1984; Furedy and Furedy, 1985; Henderson, 1972; McMillan, 1987). Furthermore, according to Skinner (1976), agreement on a single, concise definition of the concept of critical thinking is difficult, and perhaps impossible, because of the basic assumptions regarding critical thinking held by various experts. McPeck (1981) is highly critical of definitions that place critical thinking in a setting outside of a specific discipline or subject matter. His own definition of critical thinking as reflective skepticism mandates a solid knowledge base in the field to which critical thinking is being applied. According to McPeck, critical thinking needs to be defined contextually for each given discipline.

For all health professionals sound clinical judgment is foundational to the provision of quality client care. In nursing, clinical judgment is carried out within the framework of the nursing process, using intellectual, interpersonal, and technical skills. (The nursing process is a problem solving approach to providing patient care, and involves the steps of assessment and nursing diagnosis, planning, implementation, and evaluation). Critical

thinking is deemed to be an essential intellectual skill for implementation of the nursing process and, hence, for clinical judgment (Tanner, 1986; Yura and Walsh, 1988). In order to carry out the nursing process effectively and to make rational clinical judgments, the critical thinking ability of nursing students needs to be nurtured throughout their educational experience. It generally is assumed that practice in using the linear sequence of thought of the nursing process is a satisfactory method for enhancing critical thinking ability, however, there is no empirical evidence to support this assumption (Tanner, 1986). Research provides little evidence of what specifically enhances this ability in the process of nursing education.

To date there has been no published attempt to define the concept of critical thinking as specific to the discipline of nursing. It appears as though most nurse scholars have accepted the problem solving focused definition of Watson and Glaser (1980). The assumption is that engagement in the nursing process fosters critical thinking ability. The lack of a contextually-based, discipline-specific definition of critical thinking for nursing may serve to impede research in this area. Development of such a definition has potential for facilitating the development of teaching strategies that may foster critical thinking, curriculum designs that promote this, and ultimately may result in higher quality client care provided by

nurses who are able to engage their critical thinking skills at the highest possible level.

Furedy and Furedy (1985) claimed that attitudes are especially important for critical thinking, and that attitudinal studies, both longitudinal and cross-sectional, of both teachers and students are important.

McPeck (1981) critiques contemporary approaches to critical thinking research, stating that researchers have adopted a "basic skills" approach to the topic. Such an approach fails to consider the complexities of interpreting and processing (understanding) information and greatly limits the conception of the process.

In his early work on critical thinking, Ennis (1962) enunciated foci for future work on critical thinking. This list merits mention here. Included in the list is a need to learn at what age students of various types can efficiently master the various aspects of criteria of critical thinking. There also exists a need to know in what curriculum patterns the aspects and/or dimensions are most effectively presented. Should critical thinking be presented in a separate course or integrated into existing courses? If critical thinking is integrated, should all courses be involved, or should just certain courses be selected as vehicles? Other questions that should be addressed in research studies include which methods of teaching are most appropriate and the impact of class size on the development of critical

thinking. The final research focus mentioned by Ennis centers on teachers and the best method for preparing them to teach their students to think critically.

Additional foci for critical thinking research are identified by Furedy and Furedy (1985). Such research should benefit from work being done on how students learn, and should be linked to examining differing approaches to learning among students. Informal inquiry by faculty, gathering data on their own teaching and mechanisms for improving student learning, hopefully will give rise to formal research studies.

Purpose of Study

The overall purpose of this descriptive study was to explore the current status of critical thinking in technical, baccalaureate, and higher degree programs in nursing from the perspective of nursing faculty members across types of programs. This study also addressed the following research question: What are the interrelationships among nursing faculty's level of education (master's vs. doctorate), level of student taught (technical, baccalaureate, graduate) and their perception of the meaning (definition) of critical thinking, level of emphasis on developing the critical thinking ability of their students, and the teaching strategies used to foster critical thinking ability in their students?

Subjects for the study were master's and doctorally prepared faculty teaching in technical, baccalaureate, and graduate programs of study in nursing. An investigator-designed questionnaire, Critical Thinking Inventory, was mailed to subjects in order to obtain the data set for the study. Factor analysis was used to determine the meaning or definition of critical thinking to nursing faculty members. Measures of central tendency and dispersion were used to determine the level of emphasis on developing critical thinking ability of students. Measures of central tendency and dispersion and Pearson correlation were used to identify the teaching strategies used by faculty to foster critical thinking ability. Discriminant analysis and one way analysis of variance was used to determine the relationship between level of education and level of student taught and perceptions of critical thinking, level of emphasis on developing critical thinking ability in students, and teaching strategies used to foster this ability.

Subsequent chapters delineate the process used to conduct this study. Chapter II contains a review of critical thinking as contained in both general education and nursing literature. Chapter III outlines the methodology for the study, including the research questions addressed, sample selection, the procedures used for data collection, instrument development, and the design and statistical analysis. A discussion of the findings and suggestions for

future research are presented in Chapter V. Chapter VI presents a summary of the study.

CHAPTER II

REVIEW OF RELATED LITERATURE

Preview

The concept of critical thinking is heavily pursued in the literature. Close to 2000 articles related to critical thinking were written between 1978 and 1985 (Paul, 1985). An ERIC search conducted by the investigator identified close to 1000 additional articles with critical thinking as a primary or secondary focus published between January 1985 and August 1991. Numerous textbooks on critical thinking are also in print. Given this productivity of scholarship in the area, the value of critical thinking as an outcome of higher education appears to be widely acclaimed.

General education literature abounds with theoretical articles directed at attempts to define the concept, explore the various attributes and skills of the critical thinker, or describe teaching methods that enhance the development of critical thinking ability. Much of the critical thinking research in higher education centers around one of the critical thinking appraisal tools and the relationship of critical thinking to one or more variables, or the utility of critical thinking as a predictor for a particular program of studies. Few studies focus on the level of attainment of

critical thinking skills as part of baccalaureate education, and fewer still focus on identifying those factors that contribute to the improvement of critical thinking ability.

Nursing literature on critical thinking is primarily research oriented, with a handful of articles focusing on teaching strategies for the enhancement of critical thinking ability. Nurse researchers studying critical thinking have embraced the critical thinking definitions of general education experts, with a particular acceptance of the problem solving-focused definition of Watson and Glaser (1980). As is true in general education research related to critical thinking, nursing research focuses on the relationship between results on critical thinking appraisal tools and selected other variables as well as on the use of a given critical thinking appraisal tool as a predictor criterion. Gain scores in critical thinking ability between entry into and exit from nursing programs are also investigated. No published studies have been directed at the identification of those specific factors that contribute to the development of critical thinking ability in nursing students. In addition, there are no published studies designed to investigate nursing faculty perceptions of critical thinking.

Several critical thinking appraisal tools exist, among which are the most widely used Watson-Glaser Critical Thinking Appraisal (WGCTA) and the lesser-used Cornell

Critical Thinking Test (CCTT). The WGCTA was used as the measure of critical thinking ability in all but two of the studies reviewed in this chapter. There are differences of opinion as to its merit in the measurement of critical thinking ability.

Literature reviewed herein includes the following areas: definitions of critical thinking, critical thinking research in general higher education, critical thinking research in nursing education and nursing practice, tests for critical thinking, and teaching of critical thinking abilities.

Definitions of Critical Thinking

Despite the emphasis on critical thinking in the literature and its accepted importance as an outcome of higher education, including nursing education, no universally accepted definition of the concept exists (D'Angelo, 1971; Facione, 1984; Furedy and Furedy, 1985; Henderson, 1972; McMillan, 1987; Siegel, 1988). Furthermore, according to Skinner (1976), agreement on a single, concise definition of the concept of critical thinking is difficult, and perhaps impossible. This lack of definitional consensus has hampered research on critical thinking as well as the interpretation of such research.

Definitions of critical thinking cited in the literature are varied, and range from the narrow to the

broad. Narrow definitions emphasize differences among intellectual activities and also emphasize products of thought; broad definitions focus on the important similarities and commonalities among intellectual activities (Yinger, 1980). Both narrow and broad definitions of critical thinking are discussed in subsequent sections. Associated attributes of critical thinkers are also discussed.

Narrow Definitions

Critical thinking is defined narrowly within the contexts of problem solving and the scientific method or logic (Yinger, 1980). In an early work on critical thinking, Dressel and Mayhew (1954) cited the abilities involved in problem solving as encompassing most of the aspects of critical thinking. These abilities are:

1. to define a problem,
2. to select pertinent information for the solution of a problem,
3. to recognize stated and unstated assumptions,
4. to formulate and select relevant and promising hypotheses, and
5. to draw conclusions validly and to judge the validity of inferences (p. 179-80).

The influence of the Dressel and Mayhew definition has been pervasive over the years, and forms the basis for the definitions of critical thinking formulated by others (Newton, 1977; Watson and Glaser, 1980; Wilson and Wagner,

1981; Young, 1980). Watson and Glaser (1980) specifically build upon the abilities defined by Dressel and Mayhew, defining critical thinking as

> a composite of attitudes, knowledge, and skills which include: (1) attitudes of inquiry that involve an ability to recognize the existence of problems and an acceptance of the general need for evidence in support of what is asserted to be true; (2) knowledge of the nature of valid inferences, abstractions, and generalizations in which the weight or accuracy of different kinds of evidence are logically determined; and (3) skills in employing and applying the above attitudes and knowledge (p. 1).

Watson and Glaser's definition of critical thinking is the operational definition accepted by several researchers in their work on critical thinking, discussed later in this chapter (Ketefian, 1981; Bauwens and Gerhard, 1987; Gross, Takazawa and Rose, 1987; Tiessen, 1987). Still other investigators derive their definition of critical thinking from the work of Watson and Glaser (Matthews and Gaul, 1979; Kemp, 1985).

Newton (1977a) defines critical thinking as being concerned with the process of assimilating and processing information and evaluating ideas, and specific related skills. The skills involved are the five abilities as identified by Dressel and Mayhew (1954). Young (1980) states that critical thinking "can be characterized by the ways in which the contents and mechanisms of human cognition are involved in the solution of problems and the making of decisions and judgments (p. ix)."

According to Skinner (1976), critical thinking involves both a process and the use of certain abilities. Included in the process is an attitude of inquiry and the use of the problem solving approach. Included in abilities are knowledge of facts, principles, theories, abstractions, and generalizations, as well as knowledge of the nature of valid inferences, assumptions, deductions, interpretations, and critical evaluation of arguments. The abilities also include the cognitive skills of comprehension, application, analysis, synthesis, and evaluation. The process and abilities, says Skinner, supplement and complement one other. Skinner's definition of critical thinking thus incorporates the narrow elements of problem solving and logic while also incorporating the broader element of higher cognitive skills.

Also focusing on the problem solving aspect of critical thinking in her definition is Frederickson (1979), who defines critical thinking as "...the ability to recognize the existence of a problem and the ability to logically determine the accuracy and validity of inferences, abstractions and generalizations that are required to analyze and solve a recognized problem (p. 40)." She accepts the abilities identified by Dressel and Mayhew (1954) as part of her definition of critical thinking.

Yinger (1980) regards critical thinking as the cognitive activity associated with evaluating products of

thought. This activity occurs in all aspects of life and is part of the processes of problem solving, decision making, and creativity.

Some of the preceding problem solving-oriented definitions of critical thinking have incorporated within them some elements of logic. It has long been contended that critical thinking is synonymous with logic. Black's classic text, Critical Thinking (1946), is devoted entirely to logic and the scientific method, with sections on deductive logic, language, and induction and scientific method. Although entitled Critical Thinking, the text never specifically refers to the concept of critical thinking as such. Logic is defined by Black as the study of reasoning, which is a type of thinking involving the use of possible truths as evidence in support of other possible truths. Logic may also be defined as criticism, a type of thinking about thinking, exhibiting and defending principles and standards.

Other authors also place emphasis on principles of logic in their definitions of critical thinking. While also defining critical thinking in a broader context, Facione (1984, 1986) states that critical thinking is the process of drawing conclusions logically from sets of statements to various subject matter areas, and further defines it as the ability to present well-reasoned arguments and to evaluate correctly the arguments presented by others (1986). An

argument is an expression of an individual's critical thinking; the argument's adequacy determines the quality of the critical thinking process.

In his classic essay on critical thinking, Ennis (1962), using the approach of logic, defines critical thinking as "the correct assessing of statements (p. 83)." Along with this definition he identifies twelve aspects or characteristics of critical thinking that reveal the relationship of this definition to the principles of logic:

1. Grasping the meaning of a statement.
2. Judging whether there is ambiguity in a line of reasoning.
3. Judging whether certain statements contradict each other.
4. Judging whether a conclusion follows necessarily.
5. Judging whether a statement is specific enough.
6. Judging whether a statement is actually the application of a certain principle.
7. Judging whether an observation statement is reliable.
8. Judging whether an inductive conclusion is warranted.
9. Judging whether the problem has been identified.
10. Judging whether something is an assumption.
11. Judging whether a definition is adequate.
12. Judging whether a statement made by an alleged authority is acceptable (p. 84).

Along with these characteristics Ennis (1962) has identified three dimensions of critical thinking: logical, criterial, and pragmatic. The logical dimension covers

judgments regarding the alleged relationship between meanings of words and statements. The criterial dimension covers knowledge of the criteria for judging statements within a discipline-centered context. The pragmatic dimension consists of judging, in context, when one has adequate evidence in light of the purpose, and whether or not the statement is good enough for the purpose.

The preceding definitions have been narrow in focus, with an emphasis either on problem solving or the use of logic as the hallmark of critical thinking. Broad definitions of critical thinking are explored in the following section.

Broad Definitions

As stated previously, narrow definitions of critical thinking emphasize differences in intellectual activities rather than their commonalities, and tend to emphasize products of thought rather than process. D'Angelo (1971) and Kinney (1980) criticized the problem solving approach to defining critical thinking as a progressively narrowing concept, when it is indeed more broadly inclusive of other skills. According to Kinney, critical thinking is better considered as an expanding, exploratory process. Broad definitions of critical thinking emphasize the exploratory nature of the concept, and seek to relate common aspects of the process. Two major themes pervade broad definitions of

critical thinking: intellectual skepticism and a spirit of inquiry.

In his landmark work on critical thinking, McPeck (1981) defined the concept as "the propensity and skill to engage in an activity with reflective scepticism (p 152)." Critical thinking, he says,

> ...requires the judicious use of scepticism, tempered by experience, such that it is productive of a more satisfactory solution to, or insight into, the problem at hand. .... Learning to think critically is in large measure learning to know when to question something, and what sorts of questions to ask. ...In short, critical thinking does not consist in merely raising questions, as many questions are straightforward requests for information. Nor does it involve indiscriminate scepticism, for that would ultimately be self-defeating, since it leads to an infinite regress. Rather, it is the appropriate use of reflective scepticism within the problem area under consideration. And knowing how and when to apply this reflective scepticism effectively requires, among other things, knowing something about the field in question (p.7).

This analysis of critical thinking, says McPeck, is broad enough to incorporate problem solving processes as well as the processes involved in those skills requiring specific mental effort. It does not restrict critical thinking to assessment of statements, nor to application of the principles of logic.

Berger (1984) speaks of thinking as a general activity, with reasoning and imagination as its two major components. Thinking involves the organization of new information and the reorganization of previously-learned material into forms leading to new responses that may be applied to new situations. Thinking is the mediational

period between learning and responding, and synthesizes new information from the products of memory. Critical thinking, according to Berger, is the product of reasoning; creative thinking is the product of both reasoning and imagination.

According to Facione (1984, 1986), critical thinking is a discursive process that relates reasons to beliefs, providing reasons for what one believes within a specific area of interest. Facione states that it should not be assumed that reasoning and critical thinking are synonymous. Reasoning is a broad concept in which critical thinking is subsumed; not all reasoning is critical thinking, while all critical thinking is good reasoning (Facione, 1984). Brookfield (1987) also views critical thinking as a process involving the recognition and challenging of assumptions underlying beliefs and behaviors. Imagination and the exploration of alternatives to current ways of thinking, believing, and behaving ultimately leads to a reflective skepticism, a questioning of what others might present as absolute truth.

Siegel (1988) promotes a reasons conception of critical thinking, stating that critical thinking involves incorporating all phenomena germane to the rationality of belief and action. A critical thinker seeks reasons on which to base assessments and actions.

Although placing heavy emphasis on the use of logic in promoting critical thinking in nursing, Bandman and Bandman

(1988) define critical thinking in a broad sense as "the rational examination of ideas, inferences, assumptions, principles, arguments, conclusions, issues, statements, beliefs, and actions (p. 5)." In order to arrive at credible beliefs and actions, language is used reflectively to ask challenging questions and to question assumptions. In the view of Bandman and Bandman (1988) such use of language in the process of thinking critically about nursing judgments, activities, and health care issues gives rise to an individual who is an activist in promoting patients' and nurses' rights.

Kurfiss (1988) defines critical thinking as a process of hypothesis testing or generation in which situations, phenomena, questions, or problems are explored. Within this process all available information is integrated so that the ultimate solution may be well justified.

Furedy and Furedy (1985) view critical thinking as an attitude of inquiry, a process of sifting right from wrong via dialogue. Their definition includes the proficiencies necessary for effectively expressing that attitude in both scholarship and discussion by putting opinions to the test of rational argument, thus incorporating elements of logic into their definition. Matthews and Gaul (1979) theoretically define critical thinking as

> ...an attitude of inquiry involving the use of facts, principles, theories, abstractions, deductions, interpretations and evaluation of arguments. This

> ability involves the cognitive skills of comprehension, application, analysis, synthesis and evaluation (p., 19).

Kemp (1985) accepts this theoretical definition of critical thinking.

Earlier it was stated that Ennis defined critical thinking in a narrow sense as the correct assessing of statements (1962). He has since refined this definition to describe critical thinking as "reflective and reasonable thinking that is focused on deciding what to believe or do (1985, p. 45)." Critical thinking, says Ennis, is a clearer concept than higher-order thinking, but involves these skills. Significant features of critical thinking within this framework include focusing on belief and action, making statements in terms of things that people actually do or should do, and establishing criteria to help in evaluation of results.

According to Parker (1985), critical thinking is not a set of skills, but rather a position that one takes in the world, and is characterized by an acknowledgement of the inadequacy of current answers to questions, an informed skepticism about others' claims to knowledge, and a questioning spirit.

Another broad definition of critical thinking is that of Nickerson (1987), who defines the concept as an activity that lends to analysis, and involves careful listening, logic, reflection, contemplation, self-assessment, and goal orientation. Halpern (1990) refers to critical thinking as

directed, purposeful, goal-oriented thinking, while D'Angelo (1971) describes critical thinking as the process of evaluating statements, arguments, and experiences. According to D'Angelo, critical thinking operationally includes the attitudes and skills involved in the evaluation process. Young (1980) contends that it is evaluation that characterizes critical thought, as evaluation engages all the other abilities of human cognition.

The preceding sections have presented various definitions of critical thinking from both narrow and broad perspectives. In the following section some associated attributes of critical thinkers will be discussed.

Attributes of Critical Thinkers

No discussion of critical thinking definitions is complete without a discussion of related attributes (skills and characteristics) as identified by the various experts on critical thinking. Critical thinking may be conceived of as consisting of both abilities or proficiencies as well as attitudes or dispositions (D'Angelo, 1981; Ennis, 1987; Furedy and Furedy, 1985; Siegel, 1988). While there is little unanimity regarding the definition of critical thinking, there are some commonalities regarding the attributes of the critical thinker. Individuals whose concept of critical thinking is more narrowly defined tend to focus discussion of critical thinking characteristics on

associated proficiencies and abilities, most specifically those abilities involved in problem solving or in the application of the principles of logic. Those whose definitions are broader in orientation tend to focus discussion of critical thinking characteristics on associated attitudes and dispositions, with a process orientation. These proficiencies, abilities, attitudes, and dispositions are presented in the following sections.

Proficiencies and Abilities

A review of the abilities and proficiencies of critical thinking identified by various authors reveals that, while there are some differences of opinion as to their nature, these commonalities exist: recognition of stated and unstated assumptions, drawing valid conclusions, judging validity of inferences, and problem solving.

One of the primary proficiencies identified is the ability to recognize stated and unstated assumptions (Dressel and Mayhew, 1954; Facione, 1984; Furedy and Furedy, 1985). According to Dressel and Mayhew (1954), an assumption is that part of an argument that is taken for granted without specific evidence provided as justification. The presence and nature of assumptions within an argument determines whether or not the conclusions reached are indeed acceptable ones. Facione (1984) cites assumption identification as a major component of the argument approach to

critical thinking. These assumptions are the unstated premises that are intended to be taken as additional components in demonstrating the conclusion. According to Furedy and Furedy (1985), the ability to recognize assumptions is an advanced skill, part of the sophisticated abilities essential in the process of disciplined inquiry.

Also among the commonalities identified as one of the proficiencies of critical thinking is the ability to draw valid conclusions and to judge the validity of inferences (Dressel and Mayhew, 1954; Ennis, 1987; Nickerson, 1987). Conclusions that really do follow from the evidence are deemed to be valid, and are a product of "correct" reasoning. Judgment of the validity of inferences includes the ability to discern when conclusions reached are based on common beliefs or personal preconceptions rather than on the collection of evidence (Dressel and Mayhew, 1954). Distinction between logically valid and invalid inferences is seen by Nickerson (1987) as one of a lengthy list of characteristics of good thinkers.

Problem solving was previously cited as one of the frameworks for defining critical thinking in a narrow context. Consequently, problem solving is also viewed as one of the proficiencies of the critical thinker. Dressel and Mayhew's (1954) definition of critical thinking, cited previously, is actually a list of steps involved in problem solving. Based on a survey of definitions of critical

thinking, Walters (1986) concluded that critical thinking is characterized by problem solving that assists the student in identifying, clarifying, evaluating and answering perplexities that arise in the course of their studies. Problem solving abilities are closely linked to the analytical processes of logic. Walters (1986) agrees with Facione (1984) that the steps of the analytic process are also an important part of critical thinking. Furedy and Furedy (1985) place emphasis on the recognition of assumptions, the weighing of evidence, the understanding of logical argument, and spotting partiality.

The preceding discussion of skills and abilities focused on tasks performed by the critical thinker. In the next section the attitudes and dispositions of the critical thinker are presented.

Attitudes and Dispositions

As is true of the skills and abilities attributed to the critical thinker, there are commonalities in attitudes and dispositions. These are: questioning mind, intellectual curiosity, objectivity, open-mindedness, and systematic disposition.

The most frequently cited attitude or disposition associated with critical thinking is that of the questioning mind (D'Angelo, 1971; Furedy and Furedy, 1985; McPeck, 1981; Parker, 1985; Yinger, 1980). Inherent within the concept of

the questioning mind is an attitude of intelligent skepticism, a constructive discontent that is ready to question the assumptions that others may take for granted (McPeck, 1981; Parker, 1985). The questioning mind holds all beliefs open to doubt and withholds judgment regarding the validity of conclusions until sufficient evidence is available (D'Angelo, 1971). The individual with a questioning mind engages in disciplined inquiry in a Socratic fashion, demonstrating a readiness to question all assumptions and recognizing the need to question (Furedy and Furedy, 1985; Yinger, 1980). The questioning mind does not necessarily reject the belief, but suspends judgment regarding the belief until adequate evidence is available upon which to base a conclusion.

Another critical thinking attitude or disposition, closely related to that of the questioning mind, is intellectual curiosity (D'Angelo, 1971; Ennis, 1987; Yinger, 1980). The intellectually curious individual is one who seeks reasons and answers to questions and investigates the causes and explanations of events (D'Angelo, 1971; Ennis, 1987). The questioning mind asks, while the intellectually curious seeks and investigates.

Objectivity is another attitude or disposition of critical thinking (D'Angelo, 1971; Furedy and Furedy, 1985; Yinger, 1980). Furedy and Furedy (1985) refer to objectivity as disinterested scholarship. The objective critical

thinker relies on empirical evidence and valid arguments, and is not swayed by emotional factors and subjectivity in reaching conclusions (D'Angelo, 1971). Personal values and biases have a strong influence on thinking and may serve as deterrents to critical thinking, particularly when a judgment is needed about affective subject matter (Yinger, 1980). Objectivity suppresses these influences. Objectivity also promotes dialogical and suppositional thinking, considering others' points of view and reasoning from premises with which one disagrees, and withholds judgment in the face of insufficient support (Ennis, 1987).

Closely associated with objectivity is a disposition toward open-mindedness (D'Angelo, 1971; Ennis, 1987; Yinger, 1980). This characteristic of critical thinking implies a willingness to consider a wide variety of beliefs as being potentially relevant to the situation at hand and making judgments without bias or prejudice (D'Angelo, 1971).

Possession of a systematic disposition is another frequently cited attitude of critical thinking (D'Angelo, 1971; Ennis, 1987; Nickerson, 1987; Yinger, 1980). A systematic individual is able to organize thoughts and articulate them concisely and coherently, seeking as much precision as the subject at hand permits (Ennis, 1987; Nickerson, 1987). This individual also follows a line of reasoning consistently to a conclusion and avoids issues that are irrelevant to the subject (D'Angelo, 1971). A

systematic individual is goal-directed, focused and organized in pursuing a line of thought.

In addition to the above more frequently cited attitudes and dispositions of critical thinking, D'Angelo (1971) and Yinger (1980) cite flexibility, decisiveness, honesty and persistence as being desirable attributes of the critical thinker. Ennis (1987) cites the following as being characteristic attitudes and dispositions of critical thinking: seeking a clear statement of the question, well informed, orderly, sensitivity (also cited by D'Angelo, 1971), use of credible sources, and the seeking of alternatives. To this list Nickerson (1987) adds the dispositions of skillful use of evidence, careful listening, creativity, and knowledge of one's own fallibilities. No doubt other characteristics could be added to this list.

Summary

Definitions provide a context within which to interpret the meaning of a specific concept. As has been stated, the concept of critical thinking has a variety of definitions ascribed to it, both narrow and broad. Narrow definitions, specifically problem solving and logic, have an emphasis on products of thought. Broad definitions, which emphasize thought processes, include reflective skepticism, reasoning, relating reasons to beliefs, an attitude of inquiry, reflective thought with an emphasis on belief and

action, informed skepticism, analysis, goal-directed thought, and the process of evaluation. Various skills, abilities, attitudes, and dispositions have been attributed to the critical thinker. These include the recognition of stated and unstated assumptions, drawing valid conclusions, judging validity of inferences, problem solving, a questioning mind, intellectual curiosity, objectivity, open- mindedness, and a systematic disposition.

The variety of definitions contained in the literature serve to underscore the lack of definitional consensus regarding critical thinking. Despite this lack of consensus, tests have been developed that purport to measure critical thinking ability. These tests are addressed in the following section.

Tests of Critical Thinking

The testing of critical thinking ability has long been of interest to educators, and several multiple choice and essay tests have been developed for testing this ability. Among the tests geared toward college students are the Watson-Glaser Critical Thinking Appraisal (WGCTA), the Cornell Critical Thinking Test (CCTT), the New Jersey Test of Reasoning Skills, the Ross Test of Higher Cognitive Processes, and the Ennis-Weir Critical Thinking Test (Baron, 1987). The WGCTA is the most widely used of these tests, and is used almost exclusively in the research reviewed in

this chapter. Both the WGCTA and the CCTT will be discussed along with a brief description of the remaining critical thinking tests. A brief discussion of criteria for evaluation of critical thinking tests concludes this section.

Watson-Glaser Critical Thinking Appraisal (WGCTA)

The Watson-Glaser Critical Thinking Appraisal, developed in 1964 and revised in 1980, is designed to measure some of the abilities involved in critical thinking (Watson and Glaser, 1980). As defined for this test, critical thinking is viewed as

> a composite of attitudes, knowledge, and skills which include: (1) attitudes of inquiry that involve an ability to recognize the existence of problems and an acceptance of the general need for evidence in support of what is asserted to be true; (2) knowledge of the nature of valid inferences, abstractions, and generalizations in which the weight or accuracy of different kinds of evidence are logically determined; and (3) skills in employing and applying the above attitudes and knowledge (Watson and Glaser, 1980, p. 1).

Using the abilities as stated above, the WGCTA provides an estimate of an individual's performance in this composite of abilities by means of five subtests, each capturing a different component of the composite. The subtest on inference distinguishes between degrees of truth or falseness of inferences that are drawn from given data. The subtest on recognition of assumptions asks the test taker to identify unstated assumptions or presuppositions in given statements or assertions. The deduction subtest ascertains whether or not certain conclusions logically

follow from information contained in given statements or premises. The interpretation subtest asks the test taker to weigh evidence and determine if generalizations or conclusions based on given data are justified. The final subtest, evaluation of arguments, discriminates among arguments that are strong and relevant and those that are weak or irrelevant to a particular question.

In addition to the five subtests, the WGCTA contains two types of items, similar in logical structure but different in content: "neutral" and "controversial." Items that are "neutral" in content deal with subject matter, such as the weather and scientific facts, about which people ordinarily do not have strong feelings. Items that are "controversial" in content focus on issues that induce strong feelings, such as political and social issues, and that may affect the ability of some people to think critically.

The current edition of the test consists of two forms (Form A and Form B) that correspond to the earlier forms (Ym and Zm). Studies of the relationship between Forms A and Ym and Forms B and Zm have demonstrated raw score equivalents to correspond closely at the 25th, 50th and 75th percentiles. Forms A and B of the WGCTA have been demonstrated to be equivalent forms through the calculation of alternate-form reliability, with a correlation of responses between the forms of 0.75. Internal consistency of Forms A and B has been established by calculating split-half reliability

coefficients, which range from 0.69 to 0.85. Stability of responses to the WGCTA over time has been established through the test-retest method. The correlation between responses at the two testing times is 0.73. The reliability estimates on Forms A and B are consistent with those established for Forms Ym and Zm and, according to Watson and Glaser (1980), sufficiently high to justify use of the WGCTA for testing and research purposes.

The test authors point out that the validity of a test cannot be established through a single study or correlation coefficient, but rather is a joint characteristic of the test and the purpose for which it is to be used. Because of the lack of agreement on a definition of critical thinking, content validity is difficult to establish. However, teachers and researchers using the test as a basis for assessing critical thinking ability operate from a contextual frame of reference in making their decision. According to Watson and Glaser (1980), the extent to which the user determines that the WGCTA measures specified objectives is an indication of its content validity. Likewise, construct validity is difficult to establish. Construct validity is demonstrated when programs designed to increase critical thinking ability produce an increase in scores on the WGCTA. This has been demonstrated in a variety of studies that use the WGCTA as the measure of critical thinking ability.

The WGCTA has been demonstrated to correlate with a variety of other measures of academic ability. These measures include tests of mental ability and scholastic aptitude, grade point averages, and individual course grades.

The WGCTA is used frequently as a measure of critical thinking ability, as can be seen by its use in a number of the studies discussed in this chapter (Bauwens and Gerhard, 1987; Berger, 1984; Frederickson, 1979; Gross, Takazawa and Rose, 1987; Holmgren and Covin, 1983; Ketefian, 1981; Matthews and Gaul, 1979; Newton, 1977b; Pardue, 1987; Simon and Ward, 1974; Smith, 1977; Sullivan, 1987; Wilson and Wagner, 1981). Despite its popularity, the test is not without its critics. Some experts feel that there is limited correlation between student performance on the WGCTA and evaluation of classroom experiences and written assignments. Because of its multiple-choice format, the WGCTA is conducive to measuring the recognition of valid syllogism, but does not simulate the demands involved in decision making or in constructing essays (Browne, Haas and Keeley, 1978).

McPeck (1981) believes that the WGCTA has serious deficits that weaken its usefulness as a test of critical thinking. Some test items, according to McPeck, create confusion that actually works against the use of critical thinking in responding to the item; directions are sometimes

confusing and difficult to follow. McPeck also maintains that the database established by Watson and Glaser in support of the test does not establish it as a test of critical thinking. The correlations established between the WGCTA and tests of general intelligence and reading ability suggest to McPeck that the WGCTA is measuring IQ or reading ability rather than critical thinking ability. According to McPeck, "there is no statistical evidence that suggests that an independent or unique set of skills, called critical thinking, is being measured" (1981, p. 144).

Cornell Critical Thinking Test (CCTT)

The Cornell Critical Thinking Test, Level Z, is aimed at advanced or gifted high school students, college students and other adults. The authors of this test and its corollary for children ages 4 through 14 years, Level X, are Robert H. Ennis and Jason Millman. The test includes sections on induction, credibility, prediction and experimental planning, fallacies, deduction, definition, and assumption identification (Baron, 1987). The CCTT is comprised of both standardized multiple-choice items and a section of short-answer questions that give the test taker opportunity to respond to questions in an open-ended fashion (McPeck, 1981). Only one research study discussed in this chapter (Garett and Wulf, 1978) used the CCTT as its measure of critical thinking ability.

While McPeck (1981) believes that the CCTT is an improvement over the WGCTA, he repeats his criticism that multiple-choice questions do not allow for the comprehensive judgments characteristic of critical thinking. According to McPeck, the question content in this test is indistinguishable from that contained in other tests of informal logic, and might better be labeled as the "Cornell Informal Logic Tests." Both the CCTT and WGCTA, says McPeck, suffer from a limited conception of critical thinking that undermines their validity as tests of critical thinking ability.

Miscellaneous Tests of Critical Thinking

Several other tests that, at least in part, measure critical thinking ability are available (Baron, 1987). Basic Skills for Critical Thinking, developed by Gary McCuen, is a critical thinking test aimed at high school students. Among its several sections are sections on fact and opinion and on prejudice and reason. The Ross Test of Higher Cognitive Processes, developed by John D. Ross and Catherine M. Ross, is geared toward grades four through college. It contains sections on verbal analogies, deduction, assumption identification, word relationships, sentence sequencing, interpreting answers to questions, information sufficiency and relevance in mathematics problems, and analysis of attributes of complex stick figures. The New Jersey Test of Reasoning Skills, developed by

Virginia Shipman, is also aimed at grades four through college. It includes a heavy emphasis on syllogism, with a lesser emphasis on assumption identification, induction, good reasons, and kind and degree. All of the preceding tests are of the multiple-choice variety.

Baron (1987) describes only one test of critical thinking that is essay in format, The Ennis-Weir Critical Thinking Essay Test, developed by Robert H. Ennis and Eric Weir. This test is geared to grades seven through college. It is intended both for teaching and testing purposes. It includes questions related to getting the point, seeing the reasons and assumptions, stating one's point, offering good reasons, and seeing other possibilities. It also includes questions related to responding to or avoiding equivocation, irrelevance, circularity, reversal of an if-then relationship, overgeneralization, credibility questions, and the use of emotive language to persuade.

Evaluating Tests of Critical Thinking

McPeck (1981) has identified conditions that he believes are important for a bona fide test of critical thinking. These conditions are as follows:

1. That the test be subject-specific in an area.
2. That the answer format permit more than one justifiable answer.
3. That good answers are not predicated on being right, in the sense of true, but on the quality of the justification given for a response.

4. That the test results should not be used as a measure of one's capacity or innate ability, but as a learned accomplishment - which is usually the result of specific training or experience (p. 149).

Assuming that the preceding conditions are valid, it is apparent that the tests discussed herein do not meet these conditions. None of the tests described are specific to a given subject or area of specialization, but rather appear to be tests of logic, problem solving ability, or reading comprehension. Multiple choice tests do not permit more than one justifiable answer nor do they permit justification for a given response. Criteria for evaluating questions on the essay tests are not immediately available to the investigator; however, it is possible that the essay tests permit more than one type of response and allow for justification of responses. The last condition would appear to be in the hands of the individuals interpreting test results rather than a characteristic of the test itself. On the basis of the tests herein described, it would appear that no test of critical thinking exists that is truly a test of critical thinking ability, nor does one exist that is discipline specific.

Critical Thinking Research

Studies in general higher education and nursing education and practice are addressed in the next section. The WGCTA is the test of critical thinking ability most

widely used, and much of the published critical thinking research centers around its relationship to one or more variables, its use as a predictor criterion for a particular program, or the impact of a particular program of studies on critical thinking ability. Few studies focus on the level of attainment of critical thinking skills as part of baccalaureate education, and fewer still focus on identifying those factors that contribute to the improvement of critical thinking ability. This section focuses on research relative to critical thinking, looking first at research in general higher education and then at research in nursing education and practice.

Critical Thinking Research in General Higher Education

The relationship of critical thinking ability to selected personality characteristics of college students was studied by Simon and Ward (1974), Garett and Wulf (1978), and Holmgren and Covin (1983). As part of a British study designed to determine the relationship between performance on the Watson-Glaser Critical Thinking Appraisal (WGCTA), sex of student, type of course pursued, and personality score category, Simon and Ward (1974) found no overall differences between seventy-nine randomly selected senior students enrolled in arts as opposed to science majors. However, a significant difference ($p < .001$) was obtained on results in WGCTA subtest 1 (Inference) between students in

the two majors, with science students attaining an unexplained mean score higher than that of arts students. Unexplained significant differences ($p=.01$) were noted between male and female students in performance on total WGCTA score and on subtests of inference and evaluation of arguments, with males scoring higher than females. No relationship was found between WGCTA and personality inventory scores.

Focusing on specific personality traits of the critical thinker, Garett and Wulf (1978) expanded on Simon and Ward's (1974) work in an effort to determine whether or not superior cognitive development, as measured by the Cornell Critical Thinking Test (CCTT), is associated with greater personality adjustment, as measured by the Minnesota Multiphasic Personality Inventory. They also sought to determine whether or not the CCTT is useful as a predictor of academic achievement for graduate students. One hundred randomly selected graduate students served as the sample. Results indicated that measures of ego development were significantly ($p>.001$) related to critical thinking ability for the female but not for the male. Critical thinking ability was found to be significantly correlated ($p>.05$) with a student's likelihood for success in graduate school as measured by grade point average one year subsequent to administration of the CCTT.

Holmgren and Covin (1983) investigated critical thinking ability and interpersonal values of sixty senior level preservice educational professionals in elementary education, special education, and speech correction. Scores obtained on a Survey of Inter-Personal Values were compared with scores obtained on the WGCTA. No difference was noted between the three groups in critical thinking ability. Significant correlations ($p>.05$) were noted between scores on the WGCTA and the variables of grade point average and English proficiency as measured by an English Proficiency Test. Multiple regression techniques were used to determine the best predictors of grade point average and English proficiency; critical thinking ability and age were the only predictors to make a significant contribution. Results indicated that critical thinking ability appears to be positively related to grade point average and English proficiency as measured by the SIV. Critical thinking ability, according to these investigators, would be a possible criterion for the screening of education majors and for predicting a degree of professional success.

Wilson and Wagner (1981) investigated the predictive validity of both the Scholastic Aptitude Test (SAT) and WGCTA relative to the performance of a sample of college students enrolled in a physics course designed specifically to emphasize the use of critical thinking based on Piagetian principles. The subjects were fifty-five students accepted

into an accelerated university medical school program over a three year period. The WGCTA was administered to all students simultaneously, apparently at variable times following completion of the physics course. Study results demonstrated a positive relationship ($p < .0007$) between WGCTA scores and grades for the physics course. The investigators determined that, while scores on the SAT are more highly predictive, the WGCTA is able to predict success at the college level, particularly for courses designed to emphasize critical thinking. However, the study used a post test only design, and did not measure whether or not students improved in their critical thinking ability as a result of this course.

Keeley, Browne, and Kreutzer (1982) reported results of a cross-sectional study that explored the critical thinking ability of 145 freshman and 155 senior students, both groups randomly selected, as measured by responses under specific questions and general question conditions. Both freshman and senior students were asked to respond to one of two essays, which differed in length and quantity of arguments, under four study conditions: specific questions, long essay; specific questions, short essay; general question, long essay; general question, short essay. Elaborate scoring procedures were developed for each set of study conditions and interrater reliability was established. Results indicated that seniors generally surpassed freshmen

in their critical thinking abilities. However, the differences were not very large, reflecting specific deficiencies on the part of the seniors. Seniors specifically surpassed freshmen in expressing both controversies and conclusions and in identifying assumptions, with the most striking difference occurring in the latter. There was no difference, however, between the two groups in their performance on other cognitive tasks. The lack of significant difference between the groups was viewed as evidence of failure of both groups to perform cognitively at a high level. The investigators suspected that insufficient practice and reinforcement of critical thinking skills accounted for the relatively limited ability of the seniors to perform at the level that might be expected. This study highlights the need for more direct training of students in the development of their critical thinking skills.

In an exploratory study, Smith (1977) investigated the relationship between specific classroom behaviors (active behavior) and changes in level of critical thinking. Both the WGCTA (pre and post tests) and the Chickering Critical Thinking Behaviors test (post test), a behavioral self-report index, were used to determine the critical thinking ability of the students. Classroom interactions (active involvement) were recorded in twelve different classrooms, with a total of 138 students participating, over the course of a term and analyzed using the Flander's

Interaction Analysis System. Those factors identified as being most positively related to a change in level of critical thinking were student participation at a high cognitive level, encouragement of students' ideas by faculty, and peer-to-peer interaction. This study supported an argument that active involvement of students in the learning process is important in the refinement of critical thinking skills.

Newton (1977b) investigated the impact of high-level questioning in high school class room settings on critical thinking skills. She hypothesized that student critical thinking skills increase as cognitive classroom behavior is raised. Eight social studies classes of eleventh and twelfth grade students were given the WGCTA. The experimental group (four classes) was consistently given high-level questions in their daily instruction; the remaining four classes served as the control group. At the conclusion of the semester both groups again were given the WGCTA. A statistically significant difference ($p=.01$) in gain scores was demonstrated between the two groups, indicating that high-level questioning may be emphasized in an effort to stimulate the critical thinking ability of students.

With two exceptions, the research reviewed in this section used the WGCTA as the measure of critical thinking ability, and defined critical thinking within the context of problem solving. Garett and Wulf (1978) defined critical

thinking as the ability to assess statements correctly, and used the CCTT as their measure of critical thinking ability. Keeley, Browne and Kreutzer (1982) viewed critical thinking as an evaluative process, and designed a series of essay questions to test this ability. Critical thinking ability was not significantly related to measures of personality in one study (Simon and Ward, 1979) but in a similar study (Garett and Wulf, 1978) this relationship was shown to be positive for females but not for males. Garett and Wulf (1978) demonstrated a significant correlation between critical thinking ability and college grade point average. Critical thinking scores were found to be an appropriate predictor criterion for various programs of study (Holmgren and Covin, 1983; Wilson and Wagner, 1983). The college experience was shown to have a positive impact on critical thinking ability, but not to the degree that might be anticipated (Keeley, Browne and Kreutzer, 1982). An interactive classroom environment (Smith, 1977) and the use of higher order questioning (Newton, 1977b) were demonstrated to contribute to the enhancement of critical thinking ability. These studies were conducted, for the most part, within the general higher education environment. Critical thinking research in nursing education and practice is addressed in the following section.

McMillan (1987) reviewed twenty-seven studies that investigated either the effect of specific instructional

variables, courses, or a specific program, each designed to enhance critical thinking, on critical thinking. He found little evidence that any of these factors contributed to the enhancement of critical thinking in college students, rather, he concluded that these studies present evidence that it is the college experience itself that promotes the growth of critical thinking ability. He also concluded that separating the effects of maturation and out-of-class experiences from that of the curriculum is difficult. This same argument may be applied to the research on impact of specific programs or teaching strategies presented herein.

Critical Thinking Research in Nursing Education and Practice

Matthews and Gaul (1979) investigated the relationship between concept attainment and cue perception in deriving a nursing diagnosis and the relationship between critical thinking and the ability to derive a nursing diagnosis. Subjects were senior and graduate nursing students selected via a purposive sampling technique; two groups consisting of both levels of students were established. One group (n=42) received a case study intended to measure ability in nursing diagnosis as well as a Concept Mastery Test, while the other group (n=48) received a different case study, also designed to measure ability in nursing diag- nosis, and the WGCTA. Findings from the critical thinking portion of the study indicated that there was no difference in performance

between graduate and undergraduate students on the WGCTA. A difference existed between undergraduate and graduate students in their ability to derive nursing diagnoses, as determined in the critical thinking study. However, no overall relationship was found between critical thinking score and the ability to derive nursing diagnoses.

Ketefian (1981) studied the relationship between critical thinking, educational preparation, and developmental levels of moral reasoning among selected groups of nurses. Specifically, she sought to determine the relationship between critical thinking and moral reasoning, whether or not there was a difference in moral reasoning between professional and technical nurses, and whether or not critical thinking and educational preparation together would predict greater variance in moral reasoning than either variable alone. Seventy-nine registered nurses from diploma, associate degree, and baccalaureate educational backgrounds were administered the WGCTA and Rest's Defining Issues Test, a test of moral reasoning. Ketefian found that critical thinking level and the development of moral reasoning were highly correlated ($r=.5326$, $p=.001$). Nurses with professional (baccalaureate) education were more advanced in their level of moral reasoning than were those who had received technical (diploma or associate degree) education. Together critical thinking ability and level of nursing education accounted for over thirty-two percent of the

variance in moral reasoning. Although this study did not address the relationship of basic educational preparation on the critical thinking ability of practicing nurses, by inference it can be assumed that the nurses with a professional educational background had a higher level of critical thinking ability than did those nurses with a technical educational background.

Frederickson (1979) investigated the development of critical thinking among nursing students in a baccalaureate degree program during the nursing course sequence, and sought to determine if there was a relationship between critical thinking ability and academic achievement in the nursing major. She also sought to determine if critical thinking in general improved during the nursing course sequence and if critical thinking was rewarded by higher grades in the nursing courses. The WGCTA was administered to fourteen volunteer nursing students upon entry into and completion of nursing studies in the undergraduate program. WGCTA score results were divided into high and low scores, using the national average score as the dividing point. Analysis of findings demonstrated a significant difference ($t=2.78$, $p>.01$) between entry and exit WGCTA scores, with the primary source of difference being improved scores among those students with a low WGCTA score at entry. There was no significant difference between entry and exit scores of students who initially scored high on the WGCTA. It was

also found that students who obtained higher critical thinking scores achieved higher grade point averages than did students with low critical thinking scores at entry ($t=2.18$, $p>.05$). Specific factors related to the gain in critical thinking ability of those initially scoring low were not identified, nor was a reason identified for the lack of significant gain in critical thinking scores among those who initially had scored high.

Berger (1984) conducted a preliminary descriptive longitudinal study in order to ascertain changes in critical thinking ability throughout a nursing program. The WGCTA was administered to 137 baccalaureate nursing students at freshman and senior levels. Study findings indicated that critical thinking scores increased significantly during the nursing program, although levels of significance were not stated. WGCTA scores and grade point average in both nursing and science were not found to be significantly correlated, although nursing and science grade point averages were correlated. Specific factors contributing to the gain in critical thinking scores were not identified. The investigator stated that scores increased during the nursing program, but the level of contribution of nursing, as opposed to other factors, was not addressed.

Gross, Takazawa, and Rose (1987) evaluated the impact of the nursing curriculum on students' ability to think critically and assessed the merit of the WGCTA as a selec-

tion criterion for admission as compared to other criteria. Critical thinking was defined for this study as a problem solving process. Subjects were students enrolled in an associate degree program (n=45) and a basic baccalaureate program (n=37) within the same university. The WGCTA was administered to students at entry into and exit from the respective programs. The results of a paired *t* test revealed highly significant differences ($p>.000$) between WGCTA scores at entry and exit for students in both programs, more so for the baccalaureate students. No significant differences in critical thinking ability were found between the groups. For the baccalaureate group, the exit WGCTA was found to be a predictor for scores on the National Council Licensure Exam (NCLEX-RN), although grade point average was the best predictor for the NCLEX-RN score. The investigators concluded that the nursing curriculum at this university contributed to improvement in the critical thinking ability of nursing students. As with previously cited studies of a similar nature, specific factors contributing to the gain in critical thinking scores were not identified.

Bauwens and Gerhard (1987) conducted a longitudinal study of 177 baccalaureate nursing students in order to identify the objective early predictors of success in a baccalaureate program of nursing education. Predictor variables in the study were WGCTA scores and grade point

averages as obtained at entry into the upper division major. Outcome variables were exit WGCTA scores, cumulative grade point averages, nursing grade point averages, and NCLEX-RN scores. No significant gain scores between entry and exit WGCTA scores were demonstrated by *t* test. The nursing cumulative grade point average was highly predictable from the entry grade point average. Stepwise multiple regression revealed that critical thinking ability and academic achievement both contributed significantly to the prediction of NCLEX-RN scores. The WGCTA was determined to be useful as a pre-admission screening tool for applicants to this baccalaureate nursing program. According to the investigators, the lack of significant gain scores in critical thinking ability suggests that specific nursing educational experiences do not produce an increase in critical thinking ability. In the investigators' analysis, this may be related to the emphasis of the WGCTA on logic rather than process. They believe that perhaps logical critical thinking is essential to the problem solving process as used in nursing, and speculate that the problem solving process (nursing process) may exert less influence on existing logical critical thinking patterns.

Sullivan (1987) investigated whether or not critical thinking, creativity, and clinical performance improved during nursing program enrollment, if academic performance increased, and if there was any significant relationship

among these three abilities and the academic performance of RN students at the beginning and end of a baccalaureate completion program. The fifty-one subjects, selected as an intact purposive sample, were given the WGCTA, a test of creative thinking, and a nursing scale. The WGCTA and creative thinking tests were administered at entry into and exit from the program. The nursing scale was used as an evaluative tool throughout the program. No significant differences were found in entry and exit critical thinking scores; an unexplained statistically significant decrease was found in creativity scores. The investigators speculated that the lack of gain in critical thinking ability reflects the fact that these were registered nurse students returning for the baccalaureate degree, and already had well-developed critical thinking skills.

Pardue (1987) investigated the differences in critical thinking ability and decision making skills among 121 associate degree, diploma, baccalaureate, and master's-prepared nurses, selected by stratified random sampling. Participants in the study completed both the WGCTA and a decision making questionnaire. One way analysis of variance results indicated that there was a significant difference ($F=7.20$, $p=.001$) in critical thinking ability among groups; a Scheffe post hoc analysis revealed that baccalaureate and master's prepared nurses have a statistically significant

(p=.05) higher level of critical thinking ability than do associate degree or diploma prepared nurses.

Tiessen (1987) sought to determine what selected variables correlate most strongly with the critical thinking abilities of nursing students enrolled in a four-year baccalaureate school of nursing. A convenience sample of 150 freshman through senior nursing students participated in the study. Independent variables were SAT verbal and quantitative scores; grade point average; age; total number of undergraduate college credit hours in the natural sciences, behavioral/social sciences, arts and humanities, and professional nursing courses. Data were analyzed via multiple regression. The SAT quantitative score correlated most strongly with critical thinking ability ($r=.55$, $p>.05$), and accounted for fourteen percent of the variance in critical thinking scores.

In summary, the WGCTA was the only test of critical thinking ability used in the studies reviewed in nursing education and practice; critical thinking was defined within a problem solving context in all of the studies cited. Conflicting results were shown in the relationship between critical thinking ability and grade point average, in the impact of nursing studies on the critical thinking ability of nursing students, and in the impact of type of basic nursing education program on critical thinking ability. Fredrickson (1979) demonstrated a positive correlation

between critical thinking ability and grade point average while Berger (1984) did not find such a correlation. Significant gain scores in critical thinking ability throughout the nursing program were demonstrated by Fredrickson (1979), Berger (1984), and Gross, Takazawa, and Rose (1987). Bauwens and Gerhard (1987) found no gain in critical thinking ability among basic baccalaureate nursing students; Sullivan (1987) also found no gain in critical thinking ability among registered nurse students who had returned for the baccalaureate degree. Pardue (1987) found that nurses with a professional educational background had a higher level of critical thinking ability than did nurses prepared at the technical level; Gross, Takazawa, and Rose (1987) did not find this difference. Critical thinking ability was found to be a predictor of success on the national nursing licensure examination (Gross, Takazawa, and Rose, 1987; Bauwens and Gerhard, 1987). Critical thinking was also found to be positively correlated with level of moral reasoning (Ketefian, 1981) and scores on the Scholastic Aptitude Test (Tiessen, 1987).

Teaching Critical Thinking

Traditional college teaching has been criticized for its emphasis on teaching facts, that is, presenting students with voluminous information to be learned without providing the conceptual framework upon which the student can build

within a given discipline (McPeck, 1981; Meyers, 1986). Little more than lip service has been given to the teaching of critical thinking, and few concrete strategies promote its development (Newton, 1977a). Furedy and Furedy (1985) identify several forces that may actually inhibit the teaching of critical thinking. The concept of critical thinking implies criticism, which society views as negative. Students and teachers are preoccupied with vocational education, and thus may ignore thinking as a component of study. Faculty may have faulty perceptions as to the extent to which critical thinking is developed in students, assuming that teaching basic skills promotes critical thinking. Many teachers have a compulsion to cover certain content, and thus ignore process in their teaching. Together or separately, these forces may impede the development of critical thinking in higher education.

Critical thinking is not a discrete skill and cannot be taught in isolation from discipline-specific content (Arons, 1985; McPeck, 1981; Meyers, 1986). And critical thinking cannot be developed without a specific focus on fostering this ability in the classroom. Meyers (1986) succinctly describes the important role of the teacher in fostering this ability:

> Critical thinking abilities do not develop unaided during a course of study, nor will they arise solely from students' listening to lectures, reading texts, and taking exams. Teachers must know explicitly what they mean by <u>critical thinking</u> in the context of their disciplines and must

> provide opportunities for students to practice critical thinking skills and attitudes. Attempting to visualize analytical frameworks, sharing their own methods of problem solving with students, talking with colleagues, engaging in faculty seminars -- by these means or any others, teachers in all disciplines need to assume responsibility for teaching the skills and attitudes of critical inquiry (p. 115).

The teaching of critical thinking involves creating an atmosphere of disequilibrium so that students' old thinking processes are challenged and new thinking processes are developed in an atmosphere of support (Meyers, 1986). Meyers maintains that teaching the skills and attitudes of critical thinking requires a rethinking of the role of the teacher as lecturer, reconsidering the amount of classroom time spent on content, and increasing the emphasis on process. Content and process can both be taught in limited class time, but content must be decreased when thinking processes are explicitly taught.

Brookfield (1987) has devised several "rules of thumb" that guide his actions in the facilitation of critical thinking ability. First and foremost, he believes that there is no standard model for facilitating critical thinking, an outgrowth of his belief that critical thinking processes are unique to the individual. Given this, he believes that a range of teaching approaches is necessary, and perfection in these approaches is seldom found. Frustration and struggle often result when old thinking process are challenged, resulting in an unhappy learner who is

nonetheless growing in critical thinking ability. Finally, Brookfield believes that facilitating critical thinking involves taking risks in attempting to capture those points in time when thinking can be challenged.

Norris (1985) maintains that there is little evidence of the long-term impact of instruction on critical thinking processes and criticizes the research that has been done for using insensitive indices of effectiveness. McMillan (1987) also believes that research fails to support the use of specific teaching strategies to enhance critical thinking. Nonetheless, there are those educators who believe that the process of critical thinking is indeed teachable. Despite the fact that there is no universally accepted definition of critical thinking, there is agreement that critical thinking is an essential component of the curriculum and, therefore, should be taught (Klaassens, 1988b, McPeck, 1981). Higher intellectual processes, says Arons (1985), can be fostered if there is attention paid to the development of these processes throughout the curriculum. While little research has been done to determine what pedagogical methods best promote critical thinking, there is no shortage of opinion as to what these methods might be. These methods include interaction, reflection, case studies, use of logic, writing, higher cognitive questioning, concept analysis, and computer simulation. The issue of transfer of learning and peda-

gogical methods for promoting critical thinking are addressed in the following section.

Transfer of Learning

It is often assumed that transfer of critical thinking skills from one setting to another is an automatic process. Contemporary research, however, reveals that instruction offered in one context does not often transfer to other contexts (Perkins, 1987; Sternberg, 1987). Consequently, thinking skills taught out of the context of discipline-specific instruction may well have little influence on performance within the discipline.

If transfer does not occur automatically, what then will foster this process? Arons (1985) maintains that there is often a mismatch between students' level of cognitive development and the cognitive level of material that is presented to college students. This is particularly true early in the college experience, and in the areas of science and mathematics. Much of the curricular material given students, he says, requires reasoning capacity beyond their level of cognitive development. Students are expected to deal with this material without help in developing their critical thinking ability, and thus resort to memorization rather than actual understanding of the material. Arons states that specific development of critical thinking ability is possible, but is not readily transferable from

one discipline to another. This transfer is facilitated, he believes, by simultaneous exposure to development of intellectual skills in several different disciplines.

Pedagogical Methods

A number of teaching methods have been promoted as being effective in promoting critical thinking ability. These are described in the following subsections.

Interactive Classroom Environment

One of the methods recommended as appropriate for the development of critical thinking skills is that of interaction in the classroom setting. Once interest in a topic has been captured, a highly interactive classroom environment is essential for retention of this interest, and for full development of the student's critical thinking skills (Meyers, 1986). Active practice of the art of critical thinking promotes development of this skill, and classroom exercises and assignments that force students to do so are important. Interaction involves questions that generate discussion of problems and encourage students in the formulation of judgments. Brookfield (1987) refers to this process as a "learning conversation." According to Paul (1982, 1987), critical thinking skills are best developed in dialogical settings involving a series of reciprocal creative acts wherein individuals imagine themselves in cate-

gorically different roles in relation to the topic under discussion. Smith's (1977) study on classroom interaction, previously described, lends credence to the importance of an interactive environment in the development of critical thinking ability.

Reflection

Meyers (1986) claims that critical thinking is best nurtured when students have adequate time to become engaged in reflection. To this end, he advocates the use of longer rather than shorter class sessions, stating that the traditional fifty or sixty minute class session is antithetical to serious reflective thought. The critical thinking definitions set forth by McPeck (1981), Ennis (1985), and Nickerson (1987) all contain reference to reflection, lending support to providing opportunity for reflection as a teaching strategy for promoting critical thinking ability.

Case Studies

Gezi and Hadley (1970) advocate the use of case studies for the promotion of critical thinking ability in nursing students. Case studies present clinical situations along with questions specifically designed to challenge thought and to raise curiosity. The use of case studies actively engages the student in exploring alternatives in a meaningful situation.

Use of Logic

A review of the various definitions of critical thinking reveals the relationship claimed by many between critical thinking and the principles of logic (Bandman and Bandman, 1988; Black, 1946; Ennis, 1962; Facione, 1984; Henderson, 1972). A review of college curricula would most likely reveal the inclusion of courses in logic as part of general education requirements, based on the assumption that such courses promote critical thinking. According to Facione (1986), the focus on critical thinking in academia should be "to teach and test skills related to properly constructing and evaluating arguments understood as occurring within those areas of human intellectual endeavor where it is possible to express in language the inferential relationships between one's beliefs (p. 223)." The system of logic places great emphasis on the proper construction and evaluation of arguments.

Despite the claims of many that logic and critical thinking are synonymous and that teaching logic will promote critical thinking skills, there are those who are critical of this approach. Meyers (1986) maintains that there is little carry over between understanding the skills of logic and applying critical thinking skills in other disciplines. He states that the most serious deficiency of teaching logic as a surrogate for critical thinking is its inability to help the student to construct alternatives and possible

alternatives for oneself. Logic, he says, can help a student to justify some thesis or argument, but it cannot help the student to discover one; it is knowledge and information from within a specific discipline, not logic, that makes a particular solution credible. Using the logic approach to critical thinking would be easier but not necessarily as effective as there are many diverse logics. No single system of logic is applicable to all disciplines, nor to all areas within a discipline (McPeck, 1981). Arons (1985) would contend critical thinking ability would be enhanced by simultaneous exposure to the skills and principles of logic and to the thinking processes required within a specific discipline.

Writing

Writing is another avenue by which critical thinking skills may be developed. Olson (1984) describes writing as a learning tool that heightens and refines thinking through the process of problem solving. Olson compares the skills involved in the writing process, namely pre-writing, pre-composing, writing, sharing, revising, editing, and evaluating, as being comparable to Bloom's taxonomy of the cognitive domain, which she equates with the thinking process. The thinking process, she says, recapitulates the writing process, and vice versa. The process of writing taps all levels of thinking and, therefore, is a means for

promoting the development of critical thinking skills. As a dialectical, repetitive process, writing is inseparable from thinking. Writing provides a framework within which high order thinking skills may be developed, and the student equipped to handle content and decision making (Allen, Bowers, and Diekelmann, 1989). Meyers (1986) maintains that writing a series of short analytical papers is a mechanism by which critical thinking skills can be practiced, and is more effective in promoting such skills than is the writing of one major term paper. Writing has been demonstrated to impact significantly upon critical thinking ability, particularly when combined with reading (Tierney, Soter, O'Flahavan, and McGinley, 1989). The use of journals or logs has also been promulgated as a mechanism for facilitating the development of critical thinking ability (Hahnemann, 1988).

Higher Cognitive Questioning

Newton (1977a, b) addresses the significance of higher cognitive questioning as a basis for developing critical thinking ability. While she addresses this topic primarily in relation to elementary and high school students, the theoretical basis applies equally well in the higher education setting. Higher cognitive questioning stimulates the process of inquiry, thus promoting reflective critical thought. Questioning in this manner requires students to

use knowledge in a problem solving manner, rather than primarily assimilating facts. Using Bloom's taxonomy, Newton breaks down questioning styles within the context of the higher levels of cognition. Analytical questions require the student to break an idea into a logical order of assumptions, facts, opinions, and conclusions. The key to analytical questioning is logical order. Synthesis questions require the student to create a new statement, plan or product, with the key for these questions being creation. Evaluative questions require judgment on the basis of criteria or standards, the key being to judge. Such questions stimulate students to use a variety of viewpoints regarding information that is imbedded in a task; the role of the teacher is to establish questions that engage the student's activities (Newton, 1977a).

Concept Analysis

Kemp (1985) advocates the use of concept analysis as a strategy for promoting critical thinking. Critical thinking is an abstract, conceptual skill, time-consuming in its application. Teaching such a skill is a challenge, particularly in disciplines such as nursing that are highly performance oriented. The rigorous process of concept analysis, says Kemp, promotes critical thinking by encouraging the organized investigation of an abstract idea, improving clarity and preciseness in the communication of

ideas, providing specific procedures that promote understanding of these concepts, and developing strict processes for the operationalization of variables for research studies. This is in harmony with the processes described by both Arons (1985) and Facione (1984). Procedures that Kemp advocates for concept analysis include identification of existing definitions, parameters, and essential attributes of the concept; development of cases; identification of antecedents and consequences; and operationalization of the concept.

Computer Simulation

The advent of computer technology has opened up new avenues for teaching and learning. Klaassens (1988b) explored the efficacy of computer assisted instruction in providing simulations of clinical situations in nursing. Such an opportunity would allow the student opportunity for developing critical thinking skills in the decision making process without jeopardizing the life or well being of a patient. In a small pilot study Klaassens (1988a) demonstrated that computer simulation can be an effective tool in both teaching content and in promoting critical decision making skills.

Recapitulation

The literature reviewed herein has explored definitions of critical thinking as well as research relative to critical thinking as conducted in both general higher education and nursing education and practice. Literature advocating various teaching strategies as appropriate methods for promoting critical thinking ability was also reviewed.

The lack of consensus regarding a definition of critical thinking was apparent in the various meanings accorded to it. Narrow definitions included those of problem solving (Dressel and Mayhew, 1954; Skinner, 1976; Newton, 1977a, Yinger, 1980; Young, 1980; Watson and Glaser, 1980) and logic (Black, 1946; Ennis, 1962; Facione, 1984). Broad definitions included reflective skepticism (McPeck, 1981), synthesis of new information from products of memory (Berger, 1984), a discursive process relating reasons to beliefs (Facione, 1984), attitude of inquiry (Furedy and Furedy, 1985), reflective and reasonable thought that guides beliefs or actions (Ennis, 1985), informed skepticism and a questioning spirit (Parker, 1985), activity that lends to analysis (Nickerson, 1987), purposeful and goal-oriented thinking (Halpern, 1990), and the process of evaluation (D'Angelo, 1971). Characteristic attributes of the critical of the critical thinker were also explored.

Narrow definitions of critical thinking have been critiqued as being too restrictive and not incorporating the exploratory components of the concept (D'Angelo, 1971; Kinney, 1980; McPeck, 1981). Despite this criticism, all but one of the studies reviewed used a narrow definition of critical thinking, usually that of problem solving. Keeley, Brown, and Kreutzer (1982) considered critical thinking to be an evaluative process, a broad interpretation of the concept. The tests of critical thinking described in this chapter are designed to assess critical thinking from either a problem solving or logical perspective, perhaps contributing to this emphasis in critical thinking research. Even using problem solving as a frame of reference, different conceptualizations of critical thinking may lead to different interpretations of the same empirical data set (D'Angelo, 1971; Furedy and Furedy, 1985).

A variety of teaching strategies have been promulgated as promoting critical thinking, yet few of these strategies have been supported by empirical evidence. The WGCTA, which defines critical thinking as problem solving, was used as a criterion for measurement of gain in this ability in the two studies that explored the impact of specific teaching strategies (Newton, 1977b; Smith, 1977).

McPeck (1981) is highly critical of definitions that place critical thinking in a setting outside of a specific discipline or subject matter. His own definition of

critical thinking as reflective skepticism mandates a solid knowledge base in the field to which critical thinking is being applied. McPeck is also critical of contemporary approaches to critical thinking research, indicating that the "basic skills" approach used does not consider the complexities of critical thinking. Critical thinking research published since this statement was made does not vary greatly from the research that prompted the statement.

The operational definition of critical thinking used in related nursing research has been that of problem solving. However, there has been no published attempt to explore the concept of critical thinking as specific to nursing. Furedy and Furedy (1985) advocate attitudinal studies of both faculty and students regarding critical thinking. There is no published research related to nursing faculty attitudes toward critical thinking, nor is there research regarding teaching strategies used in nursing education in a deliberate attempt to foster critical thinking ability. Research on the influence of level of education of nursing faculty as well as the level of student taught on faculty perception of critical thinking and emphasis upon its development is also lacking.

Given what is reported above, more research on the concept of critical thinking in nursing is warranted. The study reported here was an attempt to explore and describe nursing faculty perception of the meaning of critical

thinking, level of emphasis given to developing student critical thinking ability, and teaching strategies used to foster critical thinking ability in students in technical and professional programs in nursing.

CHAPTER III

METHOD

This chapter addresses the methodology used to conduct this study. The research questions addressed are first presented. Subsequent sections focus on research design, subject selection, instrumentation, pilot study, data collection, data reduction, and data analysis.

Research Questions

The following research questions were addressed in this study:

1. How do nursing faculty define critical thinking?
2. To what extent do nursing faculty emphasize the development of critical thinking in their teaching?
3. What teaching strategies do nursing faculty use to foster critical thinking ability in their students?
4. What differences and/or interrelationships exist among nursing faculty members' level of educational preparation, level of student taught and their perception of the meaning (definition) of critical thinking, level of emphasis on developing the critical thinking ability of students, and types of teaching strategies used to foster critical thinking ability in students?

Research Design

Nursing faculty perceptions of critical thinking were examined within the context of a descriptive, exploratory

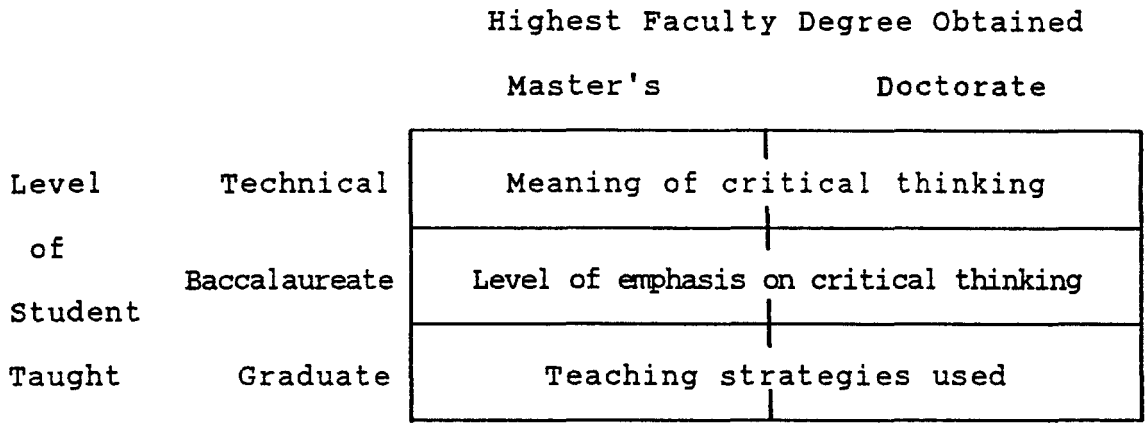
survey research design. Data collection was conducted by means of a mailed questionnaire.

The pros and cons of the survey approach to research were carefully considered. Survey research enables accurate assessment of whole populations of people through sample selection to discover the relative incidence, distribution, and interrelations of selected variables (Kerlinger, 1986). The best survey research is conducted by means of personal interviews; other mechanisms for survey research include the panel, telephone surveys, and the mailed questionnaire. Mailed questionnaires have serious drawbacks because of the potential lack of response and the inability to follow up on responses. On the other hand, survey research has the advantage of flexibility, broadness of scope, and the generation of large amounts of information. Data gathered, however, tends to be superficial in nature and, because of lack of control over independent variables, does not permit inference as to causality (Polit and Hungler, 1987).

With these characteristics in mind, the exploratory survey approach was selected because of the very limited knowledge base related to the meaning of critical thinking in the nursing profession. Recognizing the strengths and weaknesses of survey methodology, the mailed questionnaire approach was selected as the mechanism for data collection because of the potential for reaching a large national sample of nursing faculty teaching in technical,

baccalaureate, and graduate programs of study in nursing, the population selected for study. Careful questionnaire design and follow-up procedures in the mailing process were used in an attempt to overcome some of the reported weaknesses inherent in a survey approach.

The overall analytic paradigm used to address research question four was as follows:



The independent variables consisted of highest faculty degree obtained (master's or doctorate) and level of student taught (technical, baccalaureate, or graduate). The dependent variables were perception of meaning (definition) of critical thinking, level of emphasis on the development of critical thinking ability, and type of teaching strategies used to promote critical thinking ability.

Subjects

The population for this study was all master's and doctorally prepared nurse faculty members of Sigma Theta

Tau, International who identified themselves as teaching in technical, baccalaureate, or graduate programs of study in nursing in the United States. Sigma Theta Tau, International, the honor society for nursing, was selected as a convenient representative source for accessing nurse faculty members based on the assumption that the majority of nurse faculty members have been elected to membership in this organization. Diploma and associate degree programs in nursing were classified together as technical programs in keeping with the American Nurses' Association's position on initial preparation for nursing (ANA, 1965).

A sample of 1000 nurse faculty members was randomly selected, using a table of random numbers, from a list, provided by Sigma Theta Tau, of individuals meeting the above criteria. A total of 633 usable questionnaires were returned. Of these, 414 respondents were prepared at the master's degree level, 195 were prepared at the doctoral level, one indicated "other," and 23 did not indicate their highest level of education. One hundred fifty nine respondents taught at the technical level (diploma or associate degree), 283 taught at the baccalaureate level, 166 taught at the graduate level, 3 indicated "other," and 22 did not indicate what level of student they taught. Table 1 provides a comparison of faculty degree level and level of student taught.

Table 1.--Highest Faculty Degree Obtained and Level of Student Taught

	Master's	Doctorate	Total
Technical	149	8	157
Baccalaureate	231	52	283
Graduate	33	133	166
Other	1	2	3
Total	414	195	609

For all faculty the mean number of years involved in teaching was 13.2 years, with a standard deviation of 7.3 years. The median was 12 years in teaching and the mode was 10 years, with a range of 1 to 40 years. Table 2 provides a breakdown of years of teaching experience based on level of student taught. Table 3 provides a breakdown a breakdown of years of teaching experienced based on the highest faculty degree obtained.

Table 2.--Years of Teaching Experience Broken Down by Level of Student Taught

	Mean	S.D.	Median	Mode	Range	n
Technical	11.7	6.8	10	10	1-30	157
Baccalaureate	13.4	7.6	12	10	1-40	283
Graduate	14.2	7.2	13	10	1-34	166
All	13.2	7.3	12	10	1-40	606

Table 3.--Years of Teaching Experience Broken Down by Highest Faculty Degree Obtained

	Mean	S.D.	Median	Mode	Range	n
Master's	12.5	7.4	11	10	1-40	414
Doctorate	14.5	6.9	14	10	1-34	195
All	13.2	7.3	12	10	1-40	606

Three hundred and seventy-one subjects (58.6 percent) indicated that they had not received any specific preparation for teaching critical thinking while 213 (33.6 percent) indicated that they had received such preparation. Forty-nine subjects did not respond to this question. Of those subjects who indicated that they had been prepared to teach critical thinking, 43 were prepared through workshops or conferences, 12 through seminars, 65 through formal academic preparation, while 26 had been self-instructed. Sixty two respondents indicated that they had been prepared to teach critical thinking in more than one of the listed ways.

Respondents were requested to indicate the number of selected scholarly activities in which they had engaged over a five year period. These activities included number of funded or non-funded research projects, number of publications in refereed journals, and number of refereed posters or papers presented. Table 4 summarizes these activities.

Table 4.--Selected Scholarly Activities of Subjects Between January 1, 1985 and Fall 1990.

	Number of Funded or Non-funded Research Projects	Number of Refereed Publications	Number of Refereed Posters or Presentations
One	135	114	82
Two	113	56	69
Three	77	34	52
Four	27	16	29
Five or More	39	58	102
TOTALS	391	278	334

Instrumentation

Critical Thinking Inventory

Development of Critical Thinking Inventory

In order to answer the research questions addressed in this study the investigator developed an 88 item questionnaire entitled the Critical Thinking Inventory[1] (Appendix A). A framework incorporating variables identified in the review of critical thinking literature guided the development of this instrument. The questionnaire construction guidelines of Dillman (1978), Belson (1981), and Lees-Haley (1980) were followed as the instrument was developed.

[1]The Critical Thinking Scale (Jones and Brown, 1989) is a questionnaire directed to deans and directors of nursing programs and designed to provide a description of critical thinking as interpreted and applied in baccalaureate nursing programs. This instrument did not meet the needs of this study.

In order to develop questions that obtain the desired information, it is important to understand the differences among types of questions. Questions may be classified as requesting one of four types of information: attitudes, beliefs, behavior, and attributes (Dillman, 1978). Attitude questions describe how people feel about something, reflecting their views about the desirability of something, and require them to show whether they have positive or negative views about the "attitude object." Belief questions are assessments about what a person thinks is true or false and may be designed to test a person's knowledge of specific facts. Such questions elicit a person's perceptions of past, present, and future reality. Behavior questions elicit information about what a person has done in the past, is currently doing, or plans to do in the future. Attribute questions solicit information about what a person is, and are usually referred to as personal or demographic characteristics.

Questions may be structured as open-ended, close-ended with ordered choices, close-ended with unordered response choices, or partially close-ended (Dillman, 1978). Open-ended questions allow the respondent to create an individualized answer. Close-ended questions with ordered choices provide answers that are a gradation of answers along a single dimension of thought or behavior. The respondent must choose a dimension along the continuum for

his or her response. Close-ended questions with unordered response choices also provide answers, but a choice is given among discrete, unordered categories that allow the respondent to select the response that reflects his or her situation. Partially close-ended questions provide choices but also allow respondents the freedom to create their own answer. All four question types were used in the Critical Thinking Inventory.

A review of critical thinking literature revealed three general themes related to the topic: conceptual analyses of the definition of critical thinking, discussion of attributes of the critical thinker, and teaching/learning strategies for the enhancement of critical thinking ability. These were discussed in depth in the literature review of Chapter II. Three scales, one of which was used in two formats, were developed that captured the essence of these themes. The first scale, Concept, was used in a belief question designed to determine how nursing faculty analyze the conceptual definitions of critical thinking contained in the literature. The literature-derived definitions were as follows: analysis, creativity, criticism, decision making, deductive reasoning, goal-directed thinking, evaluation, hypothesis testing, inductive reasoning, information processing, inquiry, judgment, logic, problem solving, reflective thinking, and synthesis. Four additional Concepts not derived from critical thinking literature were

included in order to reflect a lower level of cognitive activity within the scale. These were as follows: application, comprehension, concrete thinking, and recall.

In order to obtain information with respect to the degree to which each of the literature-derived definitions reflect nursing faculty perceptions of the meaning of critical thinking, a rating scale using the concept analysis approach of Wilson (1969) was developed. This Likert-type quasi-interval rating scale forced respondents to determine into which of five cases or categories each of the listed conceptual definitions fell: "model," "borderline," "related," or "contrary." A description of these cases as derived from Wilson (1969) follows. A "model" case is an example or instance of the concept under discussion. A "borderline" case is one that has some features in common with the specific concept, but some important features of the concept are missing. A "related" case is not an example or instance of the specific concept, but has an important connection to the concept at hand. A "contrary" case is not an example of the concept, and may be opposite to the concept. An "uncertain" category was added to cover those instances in which respondents could not determine to what extent the listed concept was representative of critical thinking. This belief question provided a means for gaining information regarding nursing faculty perception of the meaning of critical thinking.

The second scale, Attribute, developed the theme of attributes of the critical thinker, and sought to determine nursing faculty perceptions of the importance of these attributes to nursing. As derived from the literature, eighteen attributes were identified as follows: analytical mind, assumption recognition, constructive discontent, drawing of valid conclusions, goal orientation, flexibility, informed skepticism, inquiring mind, intellectual curiosity, knowledge of logic, objectivity, open-mindedness, organization, persistence, precision, problem solving ability, spirit of inquiry, and valid inference recognition. An "other" category was added in order to provide respondents opportunity to list other attributes that they felt important; the majority of respondents who listed such additional attributes listed affective rather than cognitive attributes. A five point Likert-type quasi-interval scale response ranging from "strongly disagree" to "strongly agree" was provided, along with a "no opinion" rating possibility. This second scale, used in the context of a belief question, provided a means for gaining additional information regarding faculty perceptions of the meaning of critical thinking.

An additional scale, used in two ways, was developed related to teaching strategies deemed appropriate for the development and enhancement of critical thinking ability. Teaching/learning strategies as derived from the literature

were listed, and are as follows: concept analysis, writing, case studies, reflective dialogue, journals/logs, simulation, computer assisted instruction, and higher order questioning. Based on the experience of the investigator, additional teaching/learning strategies used in nursing education were added to the scale in order to cover the range of strategies frequently used in nursing education. These were as follows: written nursing care plans, lecture, discussion, programmed instruction, multiple choice examinations, essay examinations, role play, research/theory critique, games, and debate. An "other" option was added to the list to allow respondents to write in a strategy that was not listed.

In order to answer the question of what teaching strategies are used to foster critical thinking ability in nursing students, the same list was used in two scales. The first scale, Frequency, was used to determine the frequency with which faculty used these teaching/learning strategies. A five point Likert-type quasi-interval scale was developed with the possible responses of "never," "seldom," "usually," "frequently," and "always," with a "not applicable" category also available. In order to avoid the problem of different opinions of what the intermediate range responses meant, the categories of "seldom," "sometimes," and "frequently" were defined as being used in 25 percent, 50 percent, and 75 percent of the situations in which the strategy would be

appropriate. The same list of strategies was used in a second scale, Value, in order to determine the level of agreement as to the value of each teaching strategy for the development of critical thinking ability in nursing students. Each strategy was rated on a five point Likert-type quasi-interval scale ranging from "strongly disagree" to "strongly agree", with an additional rating column for "no opinion."

The four scales, Concept, Attribute, Frequency, and Value, comprised the majority of the questionnaire. An open-ended question provided respondents the opportunity to write their personal definition of critical thinking. Responses were coded in terms of "narrow," "broad," "combined," and "other." Additional forced choice questions sought to determine the importance attached to the development of critical thinking ability, and the level of emphasis placed on the development of this ability. Additional attribute questions sought specific demographic information about the respondents, and formed a basis for data analysis.

Testing of Instrument

Pilot Study

Prior to formal data collection, a pilot study was conducted in order to determine the clarity of the questionnaire, to establish reliability of the questionnaire, and to refine the data collection procedure. A total of 120

nursing faculty names were selected from the catalogs of five senior colleges or universities and two community colleges located in a large mid-western metropolitan area. The questionnaire and cover letter were mailed to all 120 pilot subjects, and were followed up with a reminder post card mailed two weeks after the initial mailing. A total of 43 completed questionnaires were returned for a response rate of 34 percent. University or college addresses were used for the pilot study. It should be noted that a number of letters were apparently lost in the institutional mail system, or were significantly delayed in processing through the system.

Minimal changes were made in the instrument as a result of findings related to the pilot study data set. These were primarily clarifications of responses in the demographic information segment of the questionnaire.

Reliability of Instrument

Cronbach's alpha was used to establish the reliability of the four scales. Reliabilities established during the pilot study were as follows:

Scale	Standardized Item Alpha
Concept	.8234
Attribute	.8812
Frequency	.7108
Value	.8318

Scale reliability was re-established following formal data collection, again using Cronbach's alpha. This procedure is discussed in the section describing data reduction.

Validity of Instrument

Content validity of the Critical Thinking Inventory was derived from the review of critical thinking literature that formed the basis for the development of this instrument.

Procedure

Data Collection

The survey method known as the Total Design Method (Dillman, 1978) guided the formal data collection process. Based on a theory of social exchange, this method, when used in its entirety, has been demonstrated to yield return rates of 70 to 80 percent. The method provides guidelines for printing of the questionnaire and a procedure for mailing and follow-up. Crosby, Ventura, and Feldman (1989) used the Total Design Method to obtain data on the practice of Veterans Administration nurse practitioners and realized a return rate of 93 percent.

The 1000 randomly-selected subjects were sent the cover letter (Appendix B), the data collection instrument, Critical Thinking Inventory (Appendix A), and a return envelope. One week after the initial mailing a follow-up

postcard (Appendix C) was sent to all subjects with the exception of those individuals who had already returned the questionnaire. Three weeks after the initial mailing a second letter (Appendix D), a replacement copy of the instrument, and a return envelope were sent to all subjects who had not yet responded. A third letter by registered mail as advocated by Dillman (1978) was not sent in order to avoid the appearance of harassment of subjects.

Subjects who chose not to participate in the study were asked to return their questionnaires unanswered. A total of 726 questionnaires were returned, 633 of which were usable for data analysis purposes. Three questionnaires were rejected as not meeting criteria for the sample and 90 questionnaires were returned unanswered. A summary of the return rate of questionnaires by week is presented in Table 5. While it is difficult to know to what mailing subjects were actually responding, it appears that the response to the initial mailing was 290 returned questionnaires, 256 of these being usable. The postcard mailing appeared to yield an additional 278 responses, with 244 of these usable. The third mailing appeared to yield 158 further responses, 133 of these being usable. It would appear that an additional follow-up letter as recommended by Dillman would not have yielded a significant gain in returns. Although the return rate is highly respectable according to mailed questionnaire standards, the return rate was not as high as predicted for

use of the Total Design Method (Dillman, 1978; Crosby, Ventura, and Feldman, 1989). The length of the questionnaire and the complexity of the scales may have contributed to this lower return rate.

Table 5.--Number of Questionnaires Returned by Week

Week	Number Returned	Number Acceptable	Number Unanswered	Number Rejected	Cumulative Percentage
1*	2	2			.2
2+	288	254	33	1	29.0
3	196	171	24	1	48.6
4#	82	73	9		56.8
5	89	75	14		65.7
6	28	24	4		68.5
7	18	14	4		70.3
8	9	7	2		71.2
9	5	5			71.7
10-18	9	8		1	72.6
Totals	726	633	90	3	

*Initial letter mailed beginning of week

+Follow-up post card mailed beginning of week

#Second letter mailed beginning of week

Data Reduction

Questionnaire responses were entered into a computer data file for analysis. The Statistical Package for the Social Sciences, version 10, (SPSSx) was used for data analysis purposes (SPSS Inc., 1990). Responses of uncertain, no opinion, or not applicable were coded as missing data and not included in subsequent data analysis.

Responses to demographic data items on highest faculty degree obtained (DEGREE) and level of student taught (STULEV) were collapsed in order to aid data analysis. Original response categories for DEGREE were "baccalaureate in nursing", "master's in nursing", "master's in another field", "doctorate in nursing", "doctorate in another field", and "other". The response categories of "master's in nursing" and "master's in another field" were combined and recoded as "master's". The response categories of "doctorate in nursing" and "doctorate in another field" were combined and recoded as "doctorate."

Original response categories for STULEV were "diploma," "associate degree," "baccalaureate," "graduate," "both baccalaureate and graduate," and "other." The response categories of "diploma" and "associate degree" were combined and recoded as "technical" (ANA, 1965). The response categories of "graduate" and "both baccalaureate and graduate" were combined and recoded as "graduate."

Written responses to the open-ended question requesting a personal definition of critical thinking were reviewed by the investigator and coded as to whether they represented a "narrow", "broad", "combination of narrow and broad", or "other" view of critical thinking. Responses coded as "narrow" contained an emphasis on problem solving or logic. Responses coded as "broad" contained an emphasis on inquiry or the evaluative process. Responses coded as

"combination of narrow and broad" contained reference to both narrow, problem solving or logic, and broad, inquiry or evaluative processes, aspects of critical thinking. Those responses that could not be identified as belonging to any of the above categories were coded as "other."

The four scales, Concept, Attribute, Frequency, and Value, were subjected to Cronbach's alpha to confirm their reliability. The resultant alpha scores for the formal study and a comparison to pilot study alphas are contained in Table 6.

Table 6.--Comparison of Pilot Study and Formal Study Cronbach's Alpha Results for Concept, Attribute, Frequency, and Value Scales

Scale	Pilot Study Alpha	Formal Study Alpha
Concept	.8234	.8197
Attribute	.8812	.8468
Value	.8318	.7701
Frequency	.7108	.7944

Item-total statistics were examined for each scale in order to determine if scale reliability would be improved by removal of any variable within the scale. Based on this review, it was determined that the reliability of the Concept and Attribute scales would not be improved with the removal of any variables from either scale. Consequently, these scales remained intact for subsequent data analysis.

Based on evidence that reliability for the Value scale might increase with removal of the variable "lecture" from the scale, the Cronbach alpha was recalculated. This recalculation resulted in a reduction of the Cronbach alpha coefficient from .7701 to .7682. Consequently, the Value scale also remained intact for subsequent data analysis.

Based on evidence that reliability for the Frequency scale would increase with the removal of the variable "multiple choice examination," the Cronbach alpha was recalculated. This recalculation improved the alpha. Based on examination of item-total statistics, it was evident that the additional removal of the variable "lecture" would improve the reliability for the Frequency scale. Recalculation of Cronbach's alpha supported this, but examination of item-total statistics indicated that the additional elimination of the variable "nursing care plan" from the scale would further improve the reliability. Results of Cronbach's alpha with the deletion of specified scale variables for the Frequency scale is shown in Table 7. Except where otherwise noted, subsequent data analysis was conducted with the variables "multiple choice examination," "lecture," and "nursing care plan" removed from the Frequency scale.

CHAPTER IV

RESULTS

This chapter addresses the procedures used for data analysis and the results of this analysis. The research questions that guided the study provide the framework for the organization of the chapter.

Results Related to Research Question One

The first research question to be addressed by this study was: How do nursing faculty define critical thinking? Two approaches were used to address this question. First of all, a factor analytic principal components analysis with Varimax rotation was performed on the Concept (CTI, Q-6) and Attribute (CTI, Q-7) scales. In addition, descriptive statistics were applied to the coding of responses to the open-ended question requesting subjects to provide a personal written definition of critical thinking (CTI, Q-5). Each of these approaches are presented within the following subsections.

Factor Analysis of the Concept and Attribute Scales

An exploratory factor analysis of the Concept and Attribute scales was performed in order to determine nursing

Table 7.--Results of Cronbach's Alpha for Frequency Scale with Removal of Selected Variables from Scale

Variable Deleted	Frequency Alpha
Intact Scale	.7944
Multiple Choice Examination (MCE)	.8127
MCE and Lecture	.8240
MCE, Lecture, and Nursing Care Plan	.8304

Data Analysis

The first research question, how do nursing faculty define critical thinking, was addressed by means of factor analysis of the scales Concept and Attribute. Responses to the open-ended question requesting a personal definition of critical thinking provided a second means of answering the first research question. The coded responses were analyzed by means of descriptive statistics.

Two questionnaire items addressed the extent of nursing faculty emphasis on the development of critical thinking in their teaching. One question asked respondents to rate the degree of importance attached to critical thinking as an essential attribute of a professional nurse; the other asked respondents to indicate whether they seek to promote critical thinking ability on a continuum of indirect to direct. Responses to both questions were analyzed through measures of central tendency and dispersion.

For analysis of the teaching strategies used by nursing faculty to foster critical thinking ability in their students several approaches were taken. Measures of central tendency and dispersion were analyzed for all items in the intact Frequency scale and placed in rank order, as was true for the Value scale. Pearson correlation was conducted on a pair by pair basis for matched items in the intact Frequency and Value scales to determine if faculty used the teaching learning methods that they valued as promoting critical thinking. Factor analysis of the corrected Frequency and Value scales was then used to determine those teaching strategies most frequently used by the subjects and those most highly valued as a means of promoting the critical thinking ability of students.

Discriminant analysis and one way analysis of variance were used to determine the differences and interrelationships that exist among nursing faculty member's level of educational preparation, level of student taught and their perception of the meaning of critical thinking, level of emphasis on developing the critical thinking ability of students, and teaching strategies used to foster critical thinking ability in students? Scheffe's test, with the minimum level of significance set at .01, was used for a posteriori analysis of each statistically significant F Value in order to determine the source of differences.

Summary

A descriptive, exploratory survey design was used to study nursing faculty perceptions of critical thinking. Subjects were 633 nursing faculty teaching in technical, baccalaureate, and graduate programs in nursing. An investigator-designed questionnaire, Critical Thinking Inventory, was the instrument used for data collection. Data reduction was carried out to collapse categories for selected demographic variables and to increase reliability of the four scales. Data were analyzed using measures of central tendency and dispersion, Pearson correlation, discriminant analysis, one way analysis of variance, and factor analysis. The results of data analysis are addressed in Chapter IV.

faculty's definition of critical thinking. The principal components analysis procedure was selected since it is reported to be the solution of choice if the primary purpose of a study includes the reduction of a larger number of variables down to a smaller number of variables (Stevens, 1986; Tabachnik and Fidell, 1983).

To ease the interpretability of the identified components, Varimax rotation, an orthogonal rotation, was used. In Varimax rotation each factor tends to load high on a smaller number of variables and low or very low on the remaining variables, easing interpretation of the resulting factors (Stevens, 1986). In orthogonal rotations the factors are uncorrelated with one another; the solutions offer ease of description and interpretation of results. This is considered to be appropriate to an exploratory study, however, it is recognized that reality may be somewhat strained as the factors may actually be related to one another (Tabachnik and Fidell, 1983). A loading cutoff size of 0.50 was selected rather than the usual "rule of thumb" of 0.30 in order to increase the probability that the selected variables are actually measures of the factor. With this loading, there is an approximately twenty-five percent overlap in variance between the variable and the factor (Tabachnik and Fidell, 1983).

Missing data were handled by using a mean substitution procedure. Thus all cases were used in the analyses

with substitutions treated as valid data. These substitutions did not affect the factor solution.

Principal Components Analysis of the Concept Scale

Principal components analysis with Varimax rotation was applied to the Concept Scale as contained in Q-8 of the Critical Thinking Inventory (see Appendix A). The Concept Scale contained twenty variables, each a conceptual or theoretical definition of critical thinking as derived from the literature. This scale was designed to identify characteristics of critical thinking, one of two dimensions of a definition of critical thinking. Examination of the correlation matrix for this scale revealed no redundancy among the variables and, therefore, all variables were entered into the analysis.

A six-factor solution was obtained with eigenvalues above 1.0. These six factors could be described as Exploration, Resolution, Reasoning, Understanding, Knowledge, and Criticism-Creativity. The sixth factor, Criticism-Creativity, explained only 5.4 percent of the variance and contained only two variables that loaded highly on the factor; these two variables had a low correlation (r=.27). For these reasons, a maximum of five factors, excluding Criticism-Creativity, was specified. The resulting five-factor structure appeared to be clear and interpretable.

A total of sixteen variables from the original twenty item scale entered into the final five-factor solution and explained forty-four percent of the variance. These sixteen variables are considered to be representative of characteristics of critical thinking. The range for these variables was from 1 (Model - an example or instance of the concept of critical thinking) to 4 (Contrary - is not an example or instance of critical thinking). Reliability determination for this sixteen-item scale revealed a Cronbach's alpha coefficient of .79. A moderate reliability was demonstrated for each of the subscales. A summary of the principal components analysis for the Concept scale, including eigenvalues, percent of variance, loading ranges, and Cronbach's alpha coefficients for the five factors is provided in Table 8. A complete list of factor loadings, correlation coefficients, and means and standard deviations for the Concept scale are presented in Appendix E.

Table 8.--Concept Scale Principal Components Analysis Summary

Factors	Number	Eigen-value	Percent Variance	Loading	Cronbach Alpha
1 Exploration	3	4.36	21.8	.62-.76	.61
2 Resolution	3	1.67	8.4	.55-.74	.62
3 Reasoning	3	1.47	7.4	.61-.76	.62
4 Understanding	4	1.24	6.2	.53-.65	.60
5 Knowledge	3	1.16	5.8	.58-.74	.56
Total	16		44.0		

The first factor was labeled Exploration (Table 9). Three variables showed high loadings on Factor 1 and corresponding low loadings on the remaining factors. Exploration and processing of thoughts and ideas is a consistent dimension across these three variables. The composite mean for the variables comprising this factor, 2.030, ranked fourth among the five factors. The range of means was 1.902 to 2.100, the standard deviation ranged from .874 to .938, and the variance ranged from .763 to .800.

Table 9.--Concept Factor 1 - Exploration

Conceptual Definition	Loading	Mean	S.D.	Variance
Inquiry	.76	1.892	.895	.800
Information Processing	.64	2.098	.938	.880
Reflective Thinking	.62	2.100	.874	.763
Composite Mean		2.030		

The second factor was labeled Resolution (Table 10). Three variables showed high loadings on Factor 2 and corresponding low loadings on the remaining factors. Resolution, the act of deciding or answering, was found to be a consistent dimension of these variables. The composite mean for this factor, 1.555, ranked third among the five factors. The range of means was 1.437 to 1.786, the range of standard deviations was .750 to .911, and the variance range was from .562 to .830.

Table 10.--Concept Factor 2 - Resolution

Conceptual Definition	Loading	Mean	S.D.	Variance
Problem Solving	.74	1.437	.874	.763
Decision Making	.72	1.443	.750	.562
Judgment	.55	1.786	.911	.830
Composite Mean		1.555		

The third factor was labeled Reasoning (Table 11). It also contained three variables that loaded highly on Factor 3 and had corresponding low loadings on the remaining factors. These variables have as a common dimension the process of reasoning. The composite mean of 1.520 was the lowest mean of the five factors. The mean range was from 1.481 to 1.558, the standard deviation range was from .750 to .911, and the variance range was from .562 to .830.

Table 11.--Concept Factor 3 - Reasoning

Conceptual Definition	Loading	Mean	S.D.	Variance
Inductive Reasoning	.76	1.520	.795	.631
Deductive Reasoning	.73	1.481	.766	.587
Hypothesis Testing	.61	1.558	.853	.728
Composite Mean		1.520		

The fourth factor was labeled Understanding (Table 12). Four variables loaded highly on this factor and had

corresponding low loadings on the remaining variables. These variables appear to capture the higher levels of cognition as described by Bloom (1956) and have understanding as their common dimension. The composite mean, 1.528, ranked second lowest among the five factors. The range of means was from 1.191 to 2.007; standard deviations ranged from .519 to .911 and variance ranged from .269 to .830.

Table 12.--Concept Factor 4 - Understanding

Conceptual Definition	Loading	Mean	S.D.	Variance
Analysis	.65	1.191	.519	.269
Synthesis	.62	1.327	.657	.432
Comprehension	.55	2.007	.911	.830
Evaluation	.53	1.587	.828	.686
Composite Mean		1.528		

The fifth factor was labeled Knowledge (Table 13). Three variables loaded highly on Factor 5 with corresponding low loadings on the remaining factors. Two of the variables, concrete thinking and recall, are dimensions of knowledge, the lowest level of cognition (Bloom, 1956). A third variable, application, is considered by Bloom to be a component of higher levels of cognition, but is often referred to as a component of lower levels of cognition. Consequently, it was determined that these three variables

have knowledge as a common dimension. This label of knowledge also captures the essence of field-specific knowledge, considered an essential ingredient of critical thinking (McPeck, 1981). The composite mean was 2.769, the highest of the five factors. In contrast to the composite means for the other factors, this composite mean reflected response code 3, Related - importantly related to critical thinking but not considered to be an example or instance of critical thinking. Although it represented only 5.8 percent of the variance, it was retained in the factor solution in order to reflect the importance of knowledge as a basis for critical thinking. The range of means within this factor was 2.125 to 3.119. Standard deviations ranged from .874 to .937 and variance ranged from .763 to .899.

Table 13.--Concept Factor 5 - Knowledge

Conceptual Definition	Loading	Mean	S.D.	Variance
Concrete Thinking	.74	3.062	.939	.882
Application	.62	2.125	.948	.899
Recall	.58	3.119	.874	.763
Composite Mean		2.769		

Principal Components Analysis of the Attribute Scale

Principal components analysis with Varimax rotation was applied to the Attribute Scale as contained in Q-9 of the Critical Thinking Inventory (see Appendix A). The

Attribute Scale contained eighteen variables, each describing a characteristic of critical thinkers, one of the two dimensions of critical thinking, as derived from the literature. Examination of the correlation matrix for this scale revealed no redundancy among the variables and, therefore, all were entered into the analysis.

A four-factor solution was obtained with eigenvalues above 1.0. These factors could be described as Perseverance and Open-mindedness, Intellectual Curiosity, Analytical Orientation, and Informed Skepticism. This factor structure (Table 14) contained some factorial complexity but generally appeared to be clear and interpretable.

A total of sixteen variables from the original eighteen-item scale entered into the final four-factor solution, and explained 51.3 percent of the variance. One variable, precision, loaded highly on two factors and appeared to be a main source of the factorial complexity. Because of almost identical loading on each factor, "precision" was included in both Factor 1 and Factor 3. These sixteen variables are considered to be representative of characteristics of critical thinkers. The range for these variables was from "strongly agree" (5) to "strongly disagree" (1). The reliability of this sixteen-item scale was .83; subscales had moderate Cronbach's alpha coefficients. A summary of eigenvalues, percent of variance, loading ranges, and Cronbach's alpha coefficients for the

Attribute scale is presented in Table 14. A complete list of factor loadings, correlation coefficients, and means and standard deviations for the Attribute scale are contained in Appendix F.

Of particular interest here is the fact that "problem solving ability" did not load highly on any of the factors. This variable carried the highest mean (4.845) of all the variables on this scale, but the lowest variance (.138). Its failure to discriminate and load heavily on any factor may be attributed to this low variance.

Table 14.--Attribute Scale Principal Components Analysis Summary

Factors	Number	Eigen-value	Percent Variance	Loading	Cronbach Alpha
1 Perseverance and Open-mindedness	7	4.84	26.9	.50-.72	.75
2 Intellectual Curiosity	3	1.83	10.2	.70-.81	.77
3 Analytical Orientation	4	1.39	7.7	.51-.69	.66
4 Informed Skepticism	3	1.16	6.5	.60-.70	.64
Total	16*		51.3		

*One variable, precision, was included in both Factor 1 and Factor 3

The first factor was labeled Perseverance and Open-mindedness (Table 15) and contained seven variables.

Six variables loaded highly on Factor 1 with corresponding low loadings on the remaining factors. A seventh variable, precision, loaded highly on two factors with low loadings on the remaining factors and, as previously stated, was consequently included in both factors. A review of the seven variables indicated two dimensions of commonality. Organization, persistence, goal-orientation, and precision have as a common dimension perseverance, the act of specific pursuit of a goal. Objectivity, flexibility, and open-mindedness share open-mindedness as a common dimension. The composite mean, 4.476, was the second highest of the four factors. Variable means ranged from 4.708 (open-mindedness) to 4.234 (precision). Standard deviations ranged from .499 to .695 and variance ranged from .249 to .483.

The second factor was labeled Intellectual Curiosity (Table 16). Three variables loaded highly on Factor 2 with corresponding low loadings on the remaining factors. The composite mean for this factor, 4.760, was the highest of the four factors. Variable means ranged from 4.662 to 4.829. Standard deviations ranged from .394 to .532 and variance ranged from .155 to .283.

The third factor was labeled Analytical Orientation (Table 17), containing four variables. Three variables loaded highly on Factor 3 with corresponding low loadings on the remaining factors. One variable, precision, loaded

highly on both Factors 1 and 3, and was entered into both solutions. The common dimension for these four variables was analytical processes. The composite mean, 4.369, ranked third among the factors. Variable means ranged from 4.694 to 4.197, standard deviations ranged from .441 to .663, and variance ranged from .195 to .439.

Table 15.--Attribute Factor 1 - Perseverance and Open-Mindedness

Attribute	Loading	Mean	S.D.	Variance
Organization	.72	4.475	.614	.377
Objectivity	.63	4.477	.658	.433
Flexibility	.61	4.694	.524	.275
Persistence	.60	4.315	.663	.439
Open-mindedness	.55	4.708	.499	.249
Goal-orientation	.55	4.427	.652	.425
Precision	.50	4.234	.695	.483
Composite Mean		4.476		

Table 16.--Attribute Factor 2 - Intellectual Curiosity

Attribute	Loading	Mean	S.D.	Variance
Inquiring Mind	.81	4.829	.394	.155
Intellectual Curiosity	.81	4.791	.441	.195
Spirit of Inquiry	.70	4.662	.532	.283
Composite Mean		4.760		

Table 17.--Attribute Factor 3 - Analytical Orientation

Attribute	Loading	Mean	S.D.	Variance
Analytical Mind	.69	4.694	.521	.271
Valid Inference Recognition	.55	4.351	.641	.410
Knowledge of Logic	.52	4.197	.441	.195
Precision	.51	4.234	.663	.439
Composite Mean		4.369		

The fourth factor was labeled Informed Skepticism (Table 18). Three variables loaded highly on Factor 4 with corresponding low loadings on the remaining factors. The composite mean, 4.004, is the lowest for the four factors. Variable means ranged from 3.889 to 4.095; standard deviations ranged from .776 to .831 and variance ranged from .603 to .690.

Table 18.--Attribute Factor 4 - Informed Skepticism

Attribute	Loading	Mean	S.D.	Variance
Informed Skepticism	.76	4.027	.831	.690
Constructive Discontent	.76	3.889	.827	.684
Assumption Recognition	.60	4.095	.776	.603
Composite Mean		4.004		

Personal Definitions of Critical Thinking

One hundred and fifty seven subjects (24.8 percent) responded to the open-ended question requesting respondents to provide their personal written definition of critical thinking (CTI, Q-5). These personal definitions were coded as to whether they represented a "narrow," "broad," "combination," or "other" perspective on critical thinking. "Narrow" definitions contained an emphasis on problem solving or logic while "broad" definitions contained an emphasis on inquiry or the evaluative process. "Combination" definitions contained elements of both "narrow" and "broad" definitions while definitions classified as "other" could not be categorized otherwise. The frequency and valid percentage of responses in each category were as follows:

Category	Frequency	Percentage
Narrow	106	67.5
Broad	16	10.2
Combination	11	7.0
Other	24	15.3

As indicated above, the majority of personal definitions of critical thinking fell within the category of "narrow," containing elements of either problem solving or logic. Relatively few subjects defined critical thinking in a broad sense.

Following are two examples of personal definitions classified as "narrow:"

The ability to use existing knowledge and past experiences to define and prioritize options for reaching a mutually satisfactory solution to a perceived problem.

The ability to problem solve or make a decision about a situation by using a combination of stored knowledge from previous learning.

Following are two examples of personal definitions of critical thinking classified as "broad:"

The ability to analyze, develop solutions, and evaluate actions.

Appraisal of apparent and implied aspects of a situation. Consideration of alternatives and the thinking through of the probable outcomes of each alternative. Reflection on the dimensions of a situation beyond the immediate time frame, i.e. contemplation of the concept of suffering beyond that of the patient having pain in the here and now.

Following are two examples of personal definitions of critical thinking classified as "combination:"

Critical thinking is a composite of thinking skills including reflective skepticism, assessing alternate viewpoints, and problem solving which includes the generation of hypotheses.

Critical thinking is the process of making judgments about a situation (set of observed data) using all relevant knowledge. Analysis and synthesis are key operations, critical thinking does <u>not</u> rely on set responses, merely following protocol, or use of pre-planned approaches. Critical thinking requires independence, problem solving, creativity, and appropriate autonomy.

Following are two examples of personal definitions of critical thinking classified as "other:"

The ability to assess the immediate situation, place it in the "larger context" and respond/act/ intervene accordingly to promote a higher level of functioning for self, patient, and/or family.

Evaluation of information in regard to accuracy and relevance.

Results Related to Research Question Two

The second research question to be addressed by this study was: To what extent do faculty emphasize the development of critical thinking in their teaching? This question was addressed by examining the descriptive statistics applied to the instrument item (CTI, Q-2) that asked the respondents to indicate the approach that they used to foster critical thinking ability along a continuum from "direct" (5) to "indirect" (1). A response of "direct" was interpreted to mean that the subjects deliberately emphasized the development of critical thinking in their teaching, while a response of "indirect" was interpreted to mean that there was no deliberate emphasis on the development of critical thinking in the teaching process.

Results of analysis revealed a mean of 3.554 with a standard deviation of 1.215. The median response was 4 while the mode was 3. Table 19 contains the frequency and percentage of responses for each category.

Table 19.--Frequency and Percentage of Responses for Level of Emphasis on Teaching Critical Thinking

Response Category		Frequency	Percentage
Direct	5	163	25.8
	4	167	26.4
	3	182	28.6
	2	43	6.8
Indirect	1	56	8.8
No response		23	3.6

Based on the above data, it would appear that over half (52.2%) of the subjects perceived themselves as directly emphasizing critical thinking in their teaching. Approximately one fourth (28.6%) of the subjects were both direct and indirect in their level of emphasis on critical thinking in their teaching, while less than one fifth of the subjects (15.6%) perceived themselves as indirectly emphasizing critical thinking in their teaching.

Finally, it should be noted that responses to one additional questionnaire item provide further insight into the level of emphasis placed on the teaching of critical thinking in nursing (CTI, Q-1). Virtually all subjects indicated that critical thinking is either "very important" or "highly important" as an attribute of a professional nurse (n=591, 93.4%). Twenty-four subjects (3.8 percent) rated critical thinking as an important attribute of a professional nurse, while two subjects (.3 percent) rated critical thinking as somewhat important and two rated it as

not at all important. Fourteen subjects failed to respond to this question.

Results Related to Research Question Three

The third research question to be addressed was: What teaching strategies do nursing faculty use to foster critical thinking ability in nursing students? Data analysis consisted of the computation of descriptive statistics and a Pearson correlational analysis applied to the complete Frequency (CTI, Q-8) and Value (CTI, Q-9) scales and a factor analysis procedure applied to the Value scale. These analyses are described in separate subsections.

Responses to two additional questionnaire items provided additional insight into teaching strategies used to promote critical thinking. In response to the question regarding transferability of critical thinking (CTI, Q-3), 129 subjects (20.4 percent) responded that it transfers without deliberate instruction while 353 subjects (55.8 percent) indicated that critical thinking ability transfers with deliberate instruction. One hundred thirty six subjects (21.5 percent) were uncertain about the transferability of critical thinking, and fifteen subjects did not respond to this item.

In response to the question regarding the best method for teaching critical thinking (CTI, Q-9), four subjects (.6 percent) indicated that it was best taught in a separate

course while 378 subjects (59.7 percent) indicated that it was best taught when integrated within the context of nursing course work. Two hundred thirty-four subjects (37 percent) indicated that a combination of a separate course in critical thinking and integration of critical thinking into nursing course work was the best method, while five subjects (.8 percent) preferred an "other" approach. Twelve subjects did not respond to this question.

Descriptive Statistics for the Frequency Scale

Within the Frequency scale subjects were requested to rate how often they used the listed teaching strategies. Each strategy was rated on a continuum of "always" (5) used in those situations in which it is appropriate, to "never" (1) used in those situations in which it is appropriate. Intermediate responses were "frequently" (4), used in about 75 percent of the situations in which it is appropriate, "sometimes" (3), used in about 50 percent of the situations in which it is appropriate, and "seldom" (2), used in about 25% of the situations in which it is appropriate. Measures of central tendency and dispersion for the intact Frequency scale are contained in Table 20, and are provided in rank order. Results of this analysis indicated that five of the listed teaching strategies, discussion, written nursing care plans, multiple choice examinations, lecture, and written papers, were used "frequently" in appropriate situations.

All other strategies were used on a "sometimes" or "seldom" basis.

The Frequency scale, along with the Value scale, generated a large amount of comment from respondents. Technology-dependent teaching strategies, specifically computer assisted instruction, were reported to be not always available to faculty and therefore were unable to be used despite the value attached to that strategy. Many respondents, particularly those teaching in associate degree programs, indicated that institutional policy required them to use multiple choice examinations regardless of preference. Some indicated that multiple choice examinations were necessary because of the nature of the national nurse licensure examination, a faulty impression. Others indicated that they did not know what was meant by certain strategies, most specifically higher order questioning.

Table 20.--Rank Ordered Measures of Central Tendency and Dispersion for the Frequency Scale

Scale Item	Mean	S.D.	Median	Mode	Range
Discussion	4.203	.717	4	4	2-5
Written nursing care plans	4.126	.979	4	5	1-5
Multiple choice examinations	4.039	1.167	4	5	1-5
Lecture	4.006	.835	4	4	1-5
Written papers	3.928	.968	4	4	1-5
Case studies	3.531	.831	4	4	1-5
Concept analysis	3.461	.955	4	4	1-5
Higher order questioning	3.453	.949	4	4	1-5
Reflective dialogue	3.370	.994	3	3	1-5
Journals/logs	3.115	1.257	3	3	1-5
Research/theory critique	3.109	1.161	3	4	1-5
Simulations	2.823	.941	3	3	1-5
Role play	2.749	.900	3	3	1-5
Computer Assisted Instruction	2.486	1.050	3	3	1-5
Essay examinations	2.461	1.229	3	3	1-5
Debate	2.322	1.106	2	1	1-5
Programmed instruction	2.260	.963	2	2	1-5
Games	2.219	.947	2	2	1-5

Descriptive Statistics for the Value Scale

Within the Value scale, subjects were requested to rate their level of agreement or disagreement as to the value each of the listed teaching strategies, identical to those on the Frequency scale, has for the development of critical thinking ability. Each strategy was rated on a continuum ranging from "strongly agree" (5) to "strongly disagree" (1). Measures of central tendency and dispersion for the intact Value scale are reported in Table 21, and are

provided in rank order. Results of this analysis indicated that thirteen of the listed strategies are perceived as valuable for the development of critical thinking ability. Neutrality was expressed for computer assisted instruction, games, multiple choice examinations, lecture, and programmed instruction.

Table 21.--Rank Ordered Measures of Central Tendency and Dispersion for the Value Scale

Scale Item	Mean	S.D.	Median	Mode	Range
Higher order questioning	4.430	.665	5	5	1-5
Concept analysis	4.414	.667	4	5	1-5
Discussion	4.396	.545	4	4	2-5
Research/theory critique	4.301	.753	4	5	1-5
Reflective dialogue	4.228	.658	4	4	1-5
Case studies	4.205	.689	4	4	1-5
Written papers	4.149	.749	3	3	1-5
Debate	4.147	.787	4	4	1-5
Written nursing care plans	4.038	.879	4	4	1-5
Essay examinations	3.974	.784	4	4	1-5
Simulations	3.808	.746	4	4	1-5
Role play	3.701	.754	4	4	1-5
Journals/logs	3.676	.890	4	4	1-5
Computer Assisted Instruction	3.497	.832	4	4	1-5
Games	3.446	.816	3	4	1-5
Multiple choice examinations	3.429	1.002	4	4	1-5
Lecture	3.032	.975	3	3	1-5
Programmed instruction	2.891	.953	3	3	1-5

Pearson Correlation Analysis of Frequency and Value Scales

In order to determine whether or not faculty use the teaching strategies that they value most highly for the teaching of critical thinking, a Pearson correlation analysis, conducted on a pair by pair basis for matched items in each of the intact scales was conducted. These correlations, compared to the rank order of strategies within each scale, are presented in Table 22.

Table 22.--Pearson Correlation Analysis for Frequency and Value Scales on a Pair by Pair Basis Compared to Rank Order for Each Scale

Teaching Strategy	Pearson Correlation*	Frequency Rank	Value Rank
Discussion	.2332	1	3
Written nursing care plans	.4818	2	9
Multiple choice examinations	.4589	3	16
Lecture	.2733	4	17
Written papers	.4064	5	7
Case studies	.3502	6	6
Concept analysis	.3671	7	2
Higher order questioning	.4317	8	1
Reflective dialogue	.4362	9	5
Journals/logs	.4533	10	13
Research/theory critique	.4267	11	4
Simulations	.4078	12	11
Role play	.4388	13	12
Computer Assisted Instruction	.2906	14	14
Essay examinations	.3109	15	10
Debate	.3460	16	8
Programmed instruction	.4591	17	18
Games	.4725	18	15

*All correlations significant at $p<.0001$

Principal Components Analysis of the Value Scale

Principal components analysis with Varimax rotation was applied to the Value Scale as contained in Q-9 of the Critical Thinking Inventory (see Appendix A). The Value Scale contained eighteen variables, each a teaching/learning strategy used in nursing education as derived from the literature and the experience of the investigator. Examination of the correlation matrix for this scale revealed no redundancy among the variables and, therefore, all were entered into the analysis.

A five-factor solution was obtained with eigenvalues above 1.0. These factors were described as Simulation Activities, Critique, Interactive Activities, Objective Question Activities, and Writing and Lecture. This factor structure (Table 23) contained some factorial complexity but generally appeared to be clear and interpretable. One variable, written papers, loaded highly on two factors, Factor 2 (.53) and Factor 5 (.59), but was assigned to Factor 5 because of its higher loading on that factor.

A total of sixteen variables from the original eighteen-item scale entered into the final five-factor solution, and explained 54.1 percent of the variance. These sixteen variables represent teaching/learning strategies deemed valuable for the enhancement of critical thinking ability. Response ranges for these variables were from "strongly agree" (5) to "strongly disagree" (1). The

reliability of this sixteen-item scale was .74; subscales showed moderate Cronbach's alpha coefficients. Table 22 provides a summary of the factor, including eigenvalues, percent of variance, loading ranges, and Cronbach's alpha coefficients. Appendix G provides complete factor loadings, correlation coefficients, and means and standard deviations for the Value scale.

Table 23.--Value Scale Principal Components Analysis

Factors	Number	Eigen-value	Percent Variance	Loading	Cronbach Alpha
1 Simulation Activities	3	3.51	19.5	.72-.81	.74
2 Critique	3	2.41	13.4	.62-.74	.58
3 Interactive Activities	4	1.51	8.7	.51-.71	.59
4 Objective Question Activities	3	1.15	6.4	.64-.79	.67
5 Writing and Lecture	3	1.11	6.2	.59-.66	.45
Total	16		54.1		

The first factor was labeled Simulation Activities (Table 24). Three variables loaded highly on Factor 1 with corresponding low loadings on the remaining factors. All three variables contained variants of role assumption and simulation; simulation activities is the dimension common to all. The composite mean for this factor, 3.652, is fourth highest of the five factors. Variable means range from

3.446 to 3.701; standard deviations range from .746 to .816 and variance ranges from .556 to .667.

Table 24.--Value Scale Factor 1 - Simulation Activities

Teaching Strategy	Loading	Mean	S.D.	Variance
Role Play	.81	3.701	.754	.569
Simulation	.80	3.808	.746	.557
Games	.72	3.446	.816	.667
Composite Mean		3.652		

The second factor was labeled Critique (Table 25). Three variables loaded highly on Factor 2 with corresponding low loadings on the remaining variables. As stated previously, one variable, written papers, loaded highly on both Factor 2 and Factor 5, but was assigned to Factor 5, on which it had the higher loading. Critique, a critical estimate or discussion, is the dimension common to all three variables. The composite mean, 4.141, is the second highest of the five factors. Variable means ranged from 3.974 to 4.301. Standard deviations ranged from .784 to .787 and variance ranged from .567 to .620.

Table 25.--Value Factor 2 - Critique

Teaching Strategy	Loading	Mean	S.D.	Variance
Research/Theory Critique	.74	4.301	.753	.567
Essay Examination	.63	3.974	.784	.614
Debate	.62	4.147	.787	.620
Composite Mean		4.141		

The third factor was labeled Interactive Activities (Table 26). Four variables loaded highly on this factor and had corresponding low loadings on the remaining factors. These variables have as a common dimension interaction with others. Discussion and reflective dialogue take place in a group setting; concept analysis and case studies frequently are group activities, although they may be written assignments. The composite mean, 4.311, was the highest of the five factors. Variable means ranged from 4.205 to 4.414. Standard deviations ranged from .545 to .689 and variance ranged from .298 to .475.

Table 26.--Value Factor 3 - Interactive Activities

Teaching Strategy	Loading	Mean	S.D.	Variance
Discussion	.71	4.396	.545	.298
Concept Analysis	.64	4.414	.667	.445
Case Studies	.55	4.205	.689	.475
Reflective Dialogue	.51	4.228	.658	.433
Composite Mean		4.311		

The fourth factor was labeled Objective Question Activities (Table 27). Three variables loaded highly on Factor 4 with corresponding low loadings on the remaining factors. These variables consist of question and answer activities, with questions frequently based on behavioral objectives. Objective question activities is the dimension common to all three variables. The composite mean, 3.272, is lowest of the five factors. Variable means range from 2.891 to 3.497, standard deviations range from .832 to 1.002, and variance ranges from .691 to 1.004.

Table 27.--Value Factor 4 - Objective Question Activities

Teaching Strategy	Loading	Mean	S.D.	Variance
Computer Assisted Instruction	.79	3.497	.832	.691
Programmed Instruction	.77	2.891	.953	.907
Multiple Choice Exams	.64	3.429	1.002	1.004
Composite Mean		3.272		

The fifth factor was labeled Writing and Lecture (Table 28), with three variables loading highly. Two variables loaded highly on Factor 5 with corresponding low loadings on the remaining factors. One variable, written papers, also loaded highly on Factor 2, but was assigned to Factor 5 because of its higher loading level on this factor. Written nursing care plans and written papers have the

common dimension of writing. The loading of lecture on this factor is unexplained, and thus it is included as such in the factor label. The composite mean, 3.740, is the third highest among the five factors. Variable means ranged from 3.032 to 4.145; standard deviations ranged from .740 to .957 and variance ranged from .561 to .950.

Table 28.--Value Factor 5 - Writing and Lecture

Teaching Strategy	Loading	Mean	S.D.	Variance
Lecture	.66	3.032	.957	.950
Written Nursing Care Plans	.65	4.038	.889	.790
Written Papers	.59	4.149	.749	.561
Composite Mean		3.740		

Results Related to Research Question Four

The fourth research question to be addressed by this study was: What are the differences and/or interrelationships among nursing faculty members' level of educational preparation, level of student taught and their perception of the meaning (definition) of critical thinking, level of emphasis on developing the critical thinking ability of students, and teaching strategies used to foster critical thinking ability in students? Independent or grouping variables for this question were level of educational preparation (master's or doctorate (DEGREE)) and level of

student taught (technical, baccalaureate, or graduate (STULEV)). Dependent or discriminating variables were faculty perception of the meaning (definition) of critical thinking, level of emphasis on developing the critical thinking ability of students, and teaching strategies used to foster critical thinking ability in students. A one way analysis of variance procedure and a discriminant analysis were used to address this question.

Relationships Among DEGREE and STULEV, Meaning and Teaching Strategies

Analysis of Variance

First of all, the differences across DEGREE and faculty perception of the meaning (definition) of critical thinking, DEGREE and teaching strategies used, STULEV (categories) and faculty perception of the meaning of critical thinking, and STULEV (categories) and teaching strategies used were examined using a one way analysis of variance procedure (ANOVA). The Concept and Attitude scales were used to measure meaning; the Frequency and Value scales were used to measure teaching strategies. The null hypotheses being tested were either, for DEGREE, mean (master's) = mean (doctorate) or, for STULEV, mean (technical) = mean (baccalaureate) = mean (graduate). An alpha of 0.05 was set as the level of significance for the F scores. The Scheffe' *a posteriori* procedure, with the level of significance established at .01, was used to determine the source of

difference for any significant F scores for STULEV. A summary of ANOVA results is contained in Table 29.

Table 29.--Summary of ANOVA Results for DEGREE and STULEV and Faculty Perceptions of Critical Thinking and Teaching Strategies Used

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
CONCEPT BY DEGREE					
Between Groups	1	.0037	.0037	.0222	.8815
Within Groups	581	95.5514	.1645		
Total	582	95.5551			
CONCEPT BY STULEV					
Between Groups	2	.2595	.1298	.7899	.4544
Within Groups	579	95.1125	.1643		
Total	581	95.3720			
ATTRIBUTE BY DEGREE					
Between Groups	1	.0006	.0006	.0059	.9389
Within Groups	590	58.4548	.0991		
Total	591	58.4554			
ATTRIBUTE BY STULEV					
Between Groups	2	.6661	.3330	3.3906	.0343
Within Groups	588	57.7545	.0982		
Total	590	58.4206			

Scheffe' procedure revealed that no two groups were significantly different at the .01 level of significance

Table 29.--(continued)

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
FREQUENCY BY DEGREE					
Between Groups	1	8.6284	8.6284	30.7702	.0000
Within Groups	593	166.2862	.2804		
Total	594	174.9146			
FREQUENCY BY STULEV					
Between Groups	2	16.4065	8.2033	30.4552	.0000
Within Groups	593	159.7278	.2694		
Total	595	176.1344			
Scheffe' procedure revealed that the three groups differed from one another at the .01 level of significance					
VALUE BY DEGREE					
Between Groups	1	.0141	.0141	.1164	.7331
Within Groups	594	72.1031	.1214		
Total	595	72.1172			
VALUE BY STULEV					
Between Groups	2	.1547	.0773	.6366	.5295
Within Groups	594	72.1685	.1215		
Total	596	72.3231			

These ANOVA results did not indicate a statistically significant difference for the following: Concept and DEGREE, Attribute and DEGREE, Value and DEGREE, Concept and STULEV, Attribute and STULEV, and Value and STULEV. Therefore, the null hypotheses could not be rejected in these instances. Neither highest faculty degree obtained nor level of student taught impacted faculty perception of

the meaning of critical thinking (concept and attribute) or teaching strategies valued for the promotion of critical thinking ability.

However, as indicated in Table 29, ANOVA results for DEGREE and frequency did reveal a statistically significant difference between master's and doctorally prepared faculty ($F(1,593) = 30.7702$; $p<.05$). On this basis the null hypothesis related to DEGREE and frequency was rejected. ANOVA results for STULEV and frequency demonstrated a statistically significant difference among faculty teaching in technical, baccalaureate, or graduate programs in nursing ($F(2,593) = 30.4552$; $p<.05$), with the Scheffe' procedure indicating that all three groups differed from one another. Therefore, the null hypothesis related to STULEV and frequency was also rejected. Both highest faculty degree obtained and level of student taught appear to influence the frequency with which various teaching strategies are used.

While some statistically significant results were obtained via the one way analysis of variance procedure, it is recognized that this could have been an artifact of the large sample size (Stevens, 1986). Consequently these significant findings were subjected to further analysis, discussed in the next subsection.

Discriminant Analysis

In order to determine whether or not the scores on the four scales, Concept, Attitude, Frequency, and Value, discriminated among the DEGREE and STULEV groups, further analysis was conducted with multiple discriminant analysis, using the stepwise RAO V selection method (Stevens, 1986).

The results of this procedure failed to reveal significant differences among the vectors of the two DEGREE groups and among the vectors of the three STULEV groups. For DEGREE the group centroids for master's and doctorate were found to be -.16169 and .36218, which was not a significant separation. For STULEV the group centroids on Function 1 for technical, baccalaureate, and graduate were found to be -.51056, .01122, and .49399; on Function 2 the centroids were -.09861, .11604, and -.10729. Once again, the separations were not found to be significant for either function. For DEGREE, where prior probability of correct classification of subjects was 50 percent, 59.09 percent of the subjects were correctly classified. For STULEV, where prior probability of correct classification of subjects was approximately 33 percent, the percent of "grouped" cases correctly classified was 44.01. Neither percentage was a significant improvement over prior probability.

Ex Post Facto Analysis

Based on the lack of findings from the discriminant analysis, other grouping variables were then examined ex post facto as a possible source of differentiation in scale scores. Preparation for teaching critical thinking and years of teaching experience were used as grouping variables. Neither analysis yielded significant results.

Although the four scales, Concept, Attribute, Frequency, and Value, all demonstrated adequate internal consistency on Cronbach's alpha, they failed to discriminate among subjects. Consequently, another ex post facto analysis was conducted in an attempt to determine differences among the groups within DEGREE and STULEV. The scores on the individual variables from each scale, totaling seventy in number, were then analyzed, again with a multiple discriminant analysis procedure using the stepwise RAO V selection method. Results for DEGREE and STULEV groups are presented separately in what follows.

DEGREE. The results of the discriminant analysis for DEGREE revealed significant differences between the means of the two groups. When the group centroids were plotted, a wide separation of groups was found on the discriminant function. Centroid locations were 0.94460 for Group 1 (master's) and -1.21155 for Group 2 (doctorate). Canonical

discriminant functions revealed an eigenvalue of 1.15544 and a Wilks' lambda of 0.4639433

The initial variable to enter the step-wise analysis, frequency of research/theory critique, took approximately twenty percent of the variance (Wilks' lambda 0.79866). With a large number of variables entering the step-wise analysis, nineteen of the seventy variables contributed significantly to the discriminant functions. The relative contributions of the significant variables to the function are presented in Table 30. An examination of the relative contribution of the variables indicates that the two variables with the largest coefficients were frequency of research/theory critique and analysis. Because critique is an analytical process, it was determined that the function taps analysis or analytical processes.

An examination of the nineteen variables contributing to the discriminant function revealed that eight were derived from the Concept scale (analysis, informed skepticism, evaluation, recall, information processing, hypothesis testing, synthesis, and deductive reasoning). Three variables were derived from the Attribute scale (persistence, open-mindedness, and assumption recognition). Three variables (frequency of research/theory critique, frequency of computer assisted instruction, and frequency of simulation) were derived from the Frequency scale. The remaining five variables (value of case study, value of

reflective dialogue, value of nursing care plans, value of written papers, and value of concept analysis) were derived from the Value scale.

Table 30.--Standardized Discriminant Function Coefficients for Variables Grouped by DEGREE

Variable	Coefficients Function I (Analysis)
Frequency Research/Theory Critique****	-.81462
Analysis****	-.57760
Informed skepticism****	-.27710
Persistence***	.37684
Frequency Computer Assisted Instruction**	.44957
Evaluation**	.31028
Value Case Study**	.35230
Recall**	-.36666
Value Reflective Dialogue**	-.18461
Frequency Simulation*	-.35532
Information Processing*	.17652
Hypothesis Testing*	.18970
Open-mindedness*	.28189
Value Nursing Care Plans*	.26507
Value Written Papers**	-.22019
Synthesis**	.20301
Assumption Recognition*	-.25696
Deductive Reasoning*	.19391
Value Concept Analysis*	-.16136

* $p \leq .05$
** $p \leq .01$
*** $p \leq .001$
**** $p \leq .0001$

Prior probability for correct classification of subjects by DEGREE was fifty percent. In this analysis, 76.78 percent of the subjects were correctly classified. The complete classification results are contained in Table 31.

Table 31.--Percent and Number of Cases Correctly Classified on the Basis of DEGREE

Actual Group	Number of Cases	Predicted Group Group 1 Master's	Group 2 Doctorate
Master's (1)	203	150 73.9%	53 26.1%
Doctorate (2)	120	22 18.3%	98 81.7%
Ungrouped Cases	17	11 64.7%	6 35.3%

Note: Missing data not included in analysis

STULEV. The results of the discriminant analysis for STULEV revealed significant differences among the vectors of means for the three groups. When group centroids were plotted, wide separation of the three groups on the first discriminant function was found. Centroid locations were -2.10808 for Group 1 (Technical), -0.06100 for Group 2 (Baccalaureate), and 1.37431 for Group 3 (Graduate). Separation of a lesser degree occurred on the second discriminant function; centroid locations for Groups 1, 2, and 3 were -0.58823, 0.76224, and -0.51882. The eigenvalue for Function 1 was 1.69586 with a Wilks' lambda of 0.2607937. The eigenvalue for Function 2 was less than 1.0 and, therefore, the function was not likely to be meaningful.

The initial variable to enter the step-wise analysis, frequency of research/theory critique, took approximately forty-four percent of the variance (Wilks' lambda 0.56786). Again, a large number of variables entered the step-wise analysis, with twenty-three of the seventy total variables contributing significantly to Function 1. Contributions of the significant variables to the function are presented in Table 32.

An examination of the relative contribution of the measures in Table 32 indicated that Function I taps analysis or analytical processes. The variable loading most heavily was the frequency of use of research/theory critique as a teaching strategy, a strategy that relies heavily on analytical processes. This was followed by the moderate loading of analysis, one of the definitional concepts. These variables also loaded most heavily for DEGREE. All other variables loaded at low levels.

An examination of the twenty-three variables contributing to the discriminant function reveals that six were derived from the Concept scale (analysis, synthesis, decision making, evaluation, criticism, and logic). Five variables were derived from the Attribute scale (analytical mind, objectivity, goal orientation, assumption recognition, and persistence). Five variables (frequency of research/theory critique, frequency of computer assisted instruction, frequency of essay examinations, frequency of

concept analysis, and frequency of journals/logs) were derived from the Frequency scale. The remaining seven variables (value of nursing care plan, value of essay examinations, value of concept analysis, value of research/theory critique, value of debate, value of journals/logs, and value of reflective dialogue) were derived from the Value scale.

Table 32.--Standardized Discriminant Function Coefficients for Variables Grouped by STULEV

Variable	Coefficients Function I (Analysis)
Frequency Research/Theory Critique****	.93066
Value Nursing Care Plans****	-.17871
Analysis****	.40985
Analytical Mind***	.21566
Frequency Computer Assisted Inst***	-.34430
Frequency Essay Examinations***	.33394
Synthesis**	-.29523
Decision Making**	.30908
Value Essay Examinations**	-.25338
Evaluation**	-.24179
Criticism*	-.17608
Value Concept Analysis*	.21123
Frequency Concept Analysis*	-.19675
Value Research/Theory Critique*	-.19807
Objectivity*	.04025
Frequency Journals/Logs*	.02346
Value Debate*	.18855
Goal Orientation*	-.17131
Logic*	-.17210
Assumption Recognition*	.09834
Persistence*	-.12357
Value Journals/Logs*	-.16142
Value Reflective Dialogue*	.13055

* $p \leq .05$
** $p \leq .01$
*** $p \leq .001$
**** $p \leq .0001$

Prior probability for correct classification of subjects by DEGREE was approximately thirty-three percent. In this analysis, 67.9 percent of the subjects were correctly classified. The complete classification results are contained in Table 33.

Table 33.--Percent and Number of Cases Correctly Classified on the Basis of STULEV

Actual Group	Number of Cases	Group 1 Tech	Group 2 Bacc	Group 3 Grad
Technical (1)	81	67 82.7%	12 14.8%	2 2.5%
Baccalaureate (2)	163	37 22.7%	89 54.6%	37 22.7%
Graduate (3)	108	4 3.7%	21 19.4%	83 76.9%
Ungrouped Cases	18	4 22.2%	6 33.1%	8 44.4%

Note: Missing data not included in analysis

A comparison of the variables entering analysis for DEGREE and STULEV reveals that ten of the seventy total variables entered both analyses. Analysis, synthesis, and evaluation entered from the Concept scale; persistence and assumption recognition entered from the Attribute scale. Frequency of research/theory critique, and frequency of computer assisted instruction entered from the Frequency scale while value of reflective dialogue, value of written papers, and value of concept analysis entered from the Value scale.

Emphasis on Teaching Critical Thinking

DEGREE

The questionnaire item addressing the approach faculty use to foster critical thinking ability was described in an earlier subsection. Descriptive statistics summarizing the level of emphasis on the development of critical thinking based on the educational preparation of faculty are contained in Table 34.

Table 34.--Descriptive Statistics for Emphasis on the Development of Critical Thinking Based on DEGREE

	Mean	SD	Median	Mode	Range
Master's	3.537	1.229	4.000	3.000	1 - 5
Doct orate	3.605	1.189	4.000	3.000	1 - 5
All	3.554	1.215	4.000	3.000	1 - 5

A comparison of frequency of responses and percentages between master's and doctorally prepared faculty is provided in Table 35. For both groups over half of the subjects perceived themselves to directly and deliberately emphasize the development of critical thinking in their teaching. Between one quarter and one third of both groups are direct and indirect in their approach to emphasizing critical thinking. Less than ten percent of both groups report that they indirectly emphasize critical thinking in their teaching.

Table 35.--Comparison of Level of Emphasis on Teaching Critical Thinking Based on DEGREE

Response	Category	Master's Frequency	Master's Percentage	Doctorate Frequency	Doctorate Percentage
Direct	5	105	25.4	53	27.2
	4	115	27.8	48	24.6
	3	117	28.3	55	28.2
	2	26	6.3	16	8.2
Indirect	1	41	9.9	13	6.7
No response		10	2.4	10	5.1

One way analysis of variance (ANOVA) was used to test for differences in level of emphasis on teaching critical thinking across DEGREE(s). The statistical null hypothesis was Master's mean = Doctorate mean. An alpha of 0.05 was set as the statistical level of significance.

ANOVA results (Table 36) for level of emphasis on the teaching of critical thinking failed to demonstrate a statistically significant difference between master's and doctorally prepared faculty groups ($F_{1,587} = .3997$; $p>.05$). The null hypothesis, therefore, could not be rejected. Educational preparation did not appear to make a difference in the level of emphasis given to teaching critical thinking.

Table 36.--Results of Analysis of Variance Direct by DEGREE

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	1	.5915	.5915	.3997	.5275
Within Groups	587	868.6377	1.4798		
Total	588	869.2292			

STULEV

Descriptive statistics summarizing the level of emphasis on the development of critical thinking based on the level of student taught are contained in Table 37.

Table 37.--Descriptive Statistics for Emphasis on the Development of Critical Thinking Based on STULEV

	Mean	SD	Median	Mode	Range
Technical	3.314	1.324	3.000	3.000	1 - 5
Baccalaureate	3.637	1.158	4.000	4.000	1 - 5
Graduate	3.660	1.191	4.000	5.000	1 - 5
All	3.554	1.215	4.000	3.000	1 - 5

Table 38 provides a comparison of frequency of responses and percentages between faculty based on the level of student taught. For baccalaureate and graduate groups, approximately fifty-five percent of the subjects perceived themselves as directly and deliberately emphasizing the development of critical thinking in their teaching compared to approximately forty-five percent of the technical group.

Between twenty-five and thirty percent of all groups are neutral in their approach to emphasizing critical thinking. Between twelve and fifteen percent of the baccalaureate and graduate groups reported that they indirectly emphasize critical thinking in their teaching compared to twenty-two percent of the technical group.

Table 38.--Comparison of Level of Emphasis on Teaching Critical Thinking Based on STULEV

		Technical		Baccalaureate		Graduate	
Response		Freq	Percent	Freq	Percent	Freq	Percent
Direct	5	36	22.6	72	25.4	50	30.1
	4	36	22.6	84	29.7	43	25.9
	3	49	30.8	79	27.9	43	25.9
	2	11	6.9	14	4.9	16	9.6
Indirect	1	24	15.1	21	7.4	10	6.0
No response		2	1.9	13	4.6	4	2.4

One way analysis of variance (ANOVA) was used to test for differences in level of emphasis on teaching critical thinking across STULEV categories. The statistical null hypothesis was mean (technical) = mean (baccalaureate) = mean (graduate). An alpha of 0.05 was set as the statistical level of significance. The Scheffe' a posteriori procedure, with the level of significance established at .01, was used to determine the specific source of difference among groups.

The ANOVA results (Table 39) for level of emphasis on the teaching of critical thinking demonstrated a statistically significant difference among faculty teaching in technical, baccalaureate, or graduate programs in nursing ($F\ 2,585) = 4.3068$; $p<.05$). However, the Scheffe' procedure failed to reveal a specific source of difference among the groups. The null hypothesis, therefore, was not rejected. Level of student taught does not appear to make a significant difference in the level of emphasis given to teaching critical thinking.

Table 39.--Results of Analysis of Variance Direct by STULEV

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	2	12.6682	6.3341	4.3068	.0139
Within Groups	585	860.3658	1.4707		
Total	587	873.0340			

No two groups were significantly different at the .01 level on the Scheffe' procedure

Summary of Results

Research Question One ("How do nursing faculty define critical thinking?") was addressed by means of principal components analysis with Varimax rotation of the Concept and Value Scales. Analysis of the Concept scale yielded a five-factor solution. Critical thinking was characterized as consisting of Exploration, Resolution, Reasoning,

Understanding, and Knowledge components. Analysis of the Attribute scale yielded a four-factor solution. Critical thinkers were characterized as being Perseverant and Open-minded, Intellectually Curious, having an Analytical Orientation, and being Skeptical. Descriptive statistics were used to examine personal definitions of critical thinking, which provided further insight into Question One. The majority (67.5 percent) of those responding provided a narrow definition of the construct, with an emphasis given to problem solving or logic.

Research Question Two ("To what extent do faculty emphasize the development of critical thinking in their teaching?") was addressed by an examination of measures of central tendency and dispersion. Virtually all (93.4 percent) faculty believe that critical thinking is important to nursing. Over half of the respondents perceived themselves as directly emphasizing critical thinking in their teaching; approximately one fourth perceived themselves as both direct and indirect in their approach to teaching critical thinking while less than one fifth claimed to be indirect in approach.

Research Question Three ("What teaching strategies do nursing faculty use to foster critical thinking ability in nursing students?") was answered through an examination of descriptive statistics and a Pearson correlation analysis of the Frequency and Value scales and a principal components

analysis of the data set using a Varimax rotation of the Value scale. Five teaching strategies were used at least frequently in appropriate situations. All other strategies were used on a "sometimes" or "seldom" basis. Thirteen of the teaching strategies were perceived as valuable for the development of critical thinking ability in nursing students; neutrality was expressed regarding the value of the remaining five strategies. A Pearson correlation analysis conducted on a pair by pair basis for matched items in each scale showed at least moderate statistically significant levels of correlation ($.23<r<.48$) between the frequency of use of the strategy and the value attached to that strategy. A principal components analysis of the Value scale yielded a five-factor solution of teaching learning strategies perceived as having value for the promotion of critical thinking ability (Simulation Activities, Critique, Interactive Activities, Objective Question Activities, and Writing and Lecture).

Research Question Four was addressed by means of a combination of a one way analysis of variance procedure and discriminant analysis procedure. An attempt was made to determine differences and/or interrelationships across DEGREE and STULEV categories in the perception of meaning of critical thinking and teaching strategies used to promote critical thinking.

Results of one way analysis of variance revealed that neither highest faculty degree obtained nor level of student taught influenced faculty perception of the meaning of critical thinking (concept and attribute) or teaching strategies valued for the promotion of critical thinking ability. However, both highest faculty degree obtained and level of student taught appear to influence the frequency with which various teaching strategies were used.

However, a discriminant analysis procedure failed to reveal significant differences among the vectors of the two DEGREE groups and among the vectors of the three STULEV groups. Subsequent ex post facto discriminant analysis also failed to reveal significant differences when preparation for teaching critical thinking and years of teaching experience were used as grouping variables. Further ex post facto discriminant analysis using DEGREE and STULEV as the grouping variables and the seventy individual variables from the four scales as the discriminating variables did reveal significant differences between the means for both DEGREE and STULEV. Nineteen variables, derived from all four scales, contributed to the discriminant functions for DEGREE while twenty-three variables contributed to the discriminant functions for STULEV.

Results of one way analysis of variance indicated that neither highest faculty degree obtained nor level of student

taught influences the level of emphasis placed on the teaching of critical thinking.

A discussion of the results of data analysis and suggestions for future research are presented in the next chapter.

CHAPTER V

DISCUSSION

This chapter presents a discussion of the results related to each of the four research questions. A general discussion and suggestions for future research are also presented.

Definition of Critical Thinking

A two-part definition of critical thinking in nursing was derived from a principal components analysis of the Concept and Attribute scales. Results of Concept scale analysis yielded a five-dimensional definition of characteristics of critical thinking in nursing (critical thinking as exploration, resolution, reasoning, understanding, and knowledge). Results of Attribute scale analysis yielded a four-dimensional definition of characteristics of critical thinkers in nursing (critical thinkers characterized by the attributes of perseverance and open-mindedness, intellectual curiosity, analytical orientation, and informed skepticism).

The five characteristics of critical thinking derived from the Concept scale capture the essence of both narrow and broad definitions of critical thinking (Yinger, 1980).

Exploration and understanding capture the expanding, exploratory nature of critical thinking (Kinney, 1980) while resolution and reasoning capture the essence of problem solving, logic, and the scientific method (Yinger, 1980). Knowledge, the final characteristic, is essential as a basis for critical thinking (McPeck, 1981, 1990). Results from this study yielded an index of 16 items that define the characteristics of critical thinking in nursing. The loading of 16 items at 0.50 or higher on five dimensions indicates that critical thinking in nursing is multi-dimensional. Exploration, reasoning, understanding, and knowledge rather than just resolution, which incorporates problem solving, seem to be appropriate descriptors of the concept critical thinking.

It is apparent from the principal components analysis of the Concept scale that nursing faculty define critical thinking as a multi-dimensional construct. Yet when faculty articulated their own definition of critical thinking, the primary definition was that of problem solving, particularly as actualized within the nursing process. It is interesting to note that only twenty-five percent of subjects responded to the invitation to write their own definition of critical thinking. The time factor involved in generating such a response or failure to have given any thought to such a definition may explain this limited response. Many of these written definitions simply stated that critical thinking was

problem solving or decision making. No attempt was made to analyze written definitions in relation to the ratings on the Concept and Attribute scales; this would be an interesting exercise. However, it was noted that one subject who defined critical thinking as decision making rated decision making on the Concept scale as "borderline," meaning that important elements of critical thinking were missing. On this basis it would appear that there might be inconsistencies between articulated definitions of critical thinking and ratings on the Concept scale. It is also possible that nursing faculty conceptualize problem solving as being a broader construct than is presented in the general critical thinking literature.

The four dimensions of characteristics of critical thinkers as derived from the Attribute scale (perseverance and open-mindedness, intellectual curiosity, analytical orientation, and informed skepticism) contain behaviors supportive of both narrow and broad definitions of characteristics of critical thinking, thus lending credence to a multi-dimensional definition of critical thinking. An analytical orientation is most closely associated with narrow definitions while intellectual curiosity and informed skepticism are most closely associated with a broad interpretation. Perseverance and open-mindedness is associated with both narrow and broad interpretations. Problem solving ability did not enter into this factor solution because of

the low variability associated with it (.138). There was strong agreement among subjects as to problem solving as a characteristic of critical thinkers; almost eighty-five percent of respondents were in strong agreement and almost fifteen percent were in agreement with this characteristic (see Appendix F). Consequently, problem solving ability should be viewed as another characteristic of critical thinkers in nursing.

This study yielded an index of 16 attributes or characteristics of critical thinkers in nursing. The nursing literature indicates that problem solving ability is the primary attribute of critical thinkers. The loading of the 16 items or behaviors, exclusive of problem solving ability, at 0.50 or above on four dimensions indicates that the perceived attributes of critical thinkers are actually multi-dimensional, rather than exclusively related to problem solving ability. Perseverance and open-mindedness, intellectual curiosity, analytical orientation, and informed skepticism are all appropriate descriptors of critical thinkers.

A Varimax rotation procedure was used in the principal components analysis of the Concept and Attribute scales as well as the Value scale, discussed later. As an orthogonal rotation, Varimax rotation assumes that there is no correlation among the factors. Because there most likely is correlation among the factors identified for these scales,

additional analysis using an oblique rotation would provide further insight into nursing faculty's perception of critical thinking.

The findings of this portion of this study are in contrast to those reported by Jones and Brown (1991), who sought to determine perceptions of critical thinking as it is characterized in nursing curricula. Subjects were 230 deans and directors of professionally accredited baccalaureate and higher-degree schools of nursing. Results of the Jones and Brown survey indicated that critical thinking is narrowly defined in nursing curricula as a variant of the scientific method, a rational-linear problem-solving activity reflecting the nursing process. Jones and Brown concluded that the apparent confusion in defining and using critical thinking skills indicated that the deans and directors in their sample were unclear about the mechanisms and operations of critical thinking.

The overall purpose of the study reported here was to determine nursing faculty beliefs about critical thinking, not to determine how critical thinking is defined within the curriculum. It is quite possible that individual faculty define critical thinking in a broad sense, but that it is interpreted within the nursing curriculum in a more narrow sense. Development of critical thinking ability within the nursing curriculum has been a professional accreditation criterion for some time; only recently has it become an

outcome criterion. In many nursing programs there has been no specific interpretation of critical thinking within the curriculum; nursing faculty are currently grappling with this issue, as was evident from many of the written comments included on the Critical Thinking Inventory (CTI).

Level of Emphasis on the Teaching of Critical Thinking

Nursing faculty are in agreement that critical thinking is an important attribute of a professional nurse. Given this, it would seem reasonable to assume that faculty would teach in a manner that would emphasize the enhancement of critical thinking ability. However, only about half of the subjects perceived themselves as directly emphasizing critical thinking in their teaching in order to promote or enhance this ability in nursing students. Neither the DEGREE categorization (master's or doctorate) nor the STULEV categorization (technical, baccalaureate, graduate) influenced responses to this question.

Because a self-report was used, there is no way to know if this is an accurate representation of the actual level of emphasis placed on the development of critical thinking ability by individual faculty. A weakness of this study is that the terms "direct" and "indirect" were not defined within the CTI, a fact noted by a number of the respondents. Consequently subjects may have been interpreting this question differently, yielding unreliable

results. Many respondents commented that they did not know how or if they emphasized critical thinking in their teaching.

It is interesting to note that over half of the subjects reported that they had had no preparation for the teaching of critical thinking and that discriminant analysis revealed that perception of critical thinking was not influenced by preparation for teaching this. The lack of preparation for teaching critical thinking may account for a lack of direct emphasis on the teaching of critical thinking. It might also account for the relatively limited use of some teaching/learning strategies, such as debate and higher order questioning, that are perceived to have value for enhancing this ability.

The inconclusive evidence regarding the level of emphasis on the teaching of critical thinking by individual faculty indicates that while faculty value critical thinking and wish to promote this in their teaching, they do not necessarily know how to do this. With critical thinking receiving ever greater attention as a desired outcome of higher education, both at the general and professional levels of instruction, the need to prepare faculty to promote this is great. Teaching strategies valued for the promotion of critical thinking are discussed in the next section. Faculty appear to need and want assistance in determining how best to use these strategies in a manner

deliberately designed to enhance critical thinking ability. A specific and deliberate focus on the teaching of critical thinking would appear necessary in order to achieve this goal.

Teaching Strategies Used to Foster Critical Thinking

The results of this study revealed that there is a general belief among nursing faculty that deliberate instruction in critical thinking facilitates the transfer of critical thinking skills from one setting or discipline to another. Faculty also believe that critical thinking is best enhanced when it is integrated within nursing courses or when taught within nursing courses in combination with a specific course in critical thinking. Whether or not faculty act on these beliefs is uncertain. McPeck (1990) purports that the development of critical thinking skills engages the power of the disciplines as the primary force for understanding complex concepts and information and depends upon the philosophy of these disciplines to provide the required critical dimension to one's understanding. While critical thinking skills might be the focus of a course specifically designed to enhance these, it is only as the use of these abilities are emphasized in all aspects of the nursing curriculum and within the framework of the discipline that these abilities will be maximally developed.

Frequency of Use of Teaching Strategies

The most frequently used teaching/learning strategies were discussion, written nursing care plans, multiple choice examinations, lecture, and written papers (Table 20). This finding is similar to that reported by Jones and Brown (1991), who found that discussion, term papers, and case studies were used in over 75 percent of respondent nursing programs as mechanisms for promoting critical thinking; multiple choice examinations were used by 65 percent of respondents. The least frequently used teaching/learning strategies as identified in this study were computer assisted instruction, essay examinations, debate, programmed instruction, and games.

Multiple choice examinations and lecture, identified as two of the most frequently used strategies, carried a neutral assessment as to value in the promotion of critical thinking ability (see Table 21). In contrast, debate, one of the least frequently used strategies, was rated as having moderately high value in the promotion of critical thinking. As indicated in Table 22, there were statistically significant low to moderate positive correlations between the frequency of use of teaching/learning strategies and the perceived value assigned to these strategies in the promotion of critical thinking. The fact that these correlations were all statistically significant may be attributed to the large sample size (Stevens, 1986).

What is not clear from this study is whether or not faculty actually teach in a manner that fosters critical thinking. Strategies used have been identified, as has the value attached to these strategies. Based on the correlation coefficients, there is limited evidence that faculty tend to use those strategies perceived to have value in the enhancement of critical thinking skills. However, lecture, a strategy deemed to have limited value for the promotion of critical thinking, is among the most frequently used of the strategies. This may occur for a variety of reasons. Lecture is an expedient method for presenting a large amount of content in a short amount of time. It takes relatively less effort to plan and implement a lecture than it does to plan more innovative teaching/learning situations. Heavy workloads, including time-consuming clinical teaching responsibilities, particularly for faculty in technical and baccalaureate programs, may limit the amount of time available to plan innovative approaches to teaching. Miller and Malcolm (1991) maintain that lecture continues to be the predominant teaching strategy because it fits with the thinking style of many nursing faculty. In consequence, it becomes the preferred teaching style without thought as to its appropriateness for either the content being presented or the students' mode of learning.

One of the primary deterrents to the use of critical thought-provoking strategies in nursing education, in both

classroom and clinical settings, appears to be lack of knowledge of how to implement this. It was apparent from the many comments subjects included in the CTI that nursing faculty need and want assistance in developing mechanisms for enhancing this ability in their students.

Probably the most significant deterrent to the promotion of critical thinking is a lack of commitment to its value in nursing education. Several subjects commented on this. In the words of one respondent

> Critical thinking is more often taught <u>out</u> of students than taught to students. How often have you heard students say after an exam "Now I know what you expect me to know." The only critical thinking involved is the process of determining what the instructor expects. From there forward it is more a process of emulating the instructor's thinking and learning do's and don'ts than critical thinking.
>
> The pressure of preparing students for nursing licensure examination and critical care expertise on entry into practice has turned instructors into producers of <u>nursing robots</u>, not critical thinkers! Somehow the "neck lock" has to be broken. Give students a chance to "think: and they just might develop critical thinking skills on their own.

Faculty threatened by students who think critically and arrive at a conclusion different from their own are not going to promote this in their students. Faculty must be flexible enough and strong enough to value diversity and do all in their power to stretch the minds of their students and colleagues rather than to foster conformity.

Value of Teaching Strategies

The principal components analysis of the Value scale yielded a five-factor solution of categories of teaching strategies perceived as having value for the promotion of critical thinking in nursing. These strategies are simulation activities, critique, interactive activities, objective question activities, and writing and lecture.

Simulation activities include role play and games, neither of which have been addressed in the literature as strategies that have the potential for enhancing critical thinking. There are many approaches to simulation, also part of this factor, including computer simulation and interactive video. Computer simulation has been addressed as a useful tool in enhancing critical thinking ability (Klaassens, 1988a). Interactive video, a relatively new advancement in educational computer technology, is used in nursing education as a tool for practicing decision making without endangering patient safety. There is an increasing emphasis in the literature on the relationship between critical thinking and clinical judgment and decision making. Although the empirical evidence to support this relationship is at present limited (Brooks and Shepherd, 1990; Yocum, 1985), it is reasonable to assume that this relationship does exist.

Critique includes research/theory critique, essay examinations, and debate. Critique implies a critical

discussion, one that involves careful analysis and judgment or judicious evaluation. Neither research/theory critique nor essay examinations have been addressed in the literature relative to critical thinking. Research/theory critique relies heavily on analysis, the definition most strongly identified as being an exemplar of critical thinking (see Appendix E). As a class, examinations are used primarily as an evaluation tool to determine whether or not students have attained course objectives. Although not documented as such in the literature, many faculty maintain that examinations are also a learning tool, and that essay examinations in particular provide evidence of a student's ability to engage in the processes of analysis, synthesis, and evaluation, all aspects of understanding. Debate is advocated as a strategy for promoting the skills of argumentation, the process by which justification is presented (Bell, 1991; White, Beardsley, Peters, and Supples, 1990). Bell (1991) states that debate is particularly useful at the graduate level, where nurses are being prepared for advanced practice that requires the highest level of skill in addressing patient care, organizational, and health policy issues.

Interactive activities include discussion, concept analysis, case studies, and reflective dialogue. Concept analysis has been addressed as a process that promotes critical thinking by encouraging the organized investigation of abstract ideas, improving clarity and precision in the

communication of ideas, and providing specific procedures that promote understanding of these concepts (Kemp, 1985). Gezi and Hadley (1970) advocate the use of case studies as a tool for actively engaging the student in exploring alternatives in a meaningful situation. An interactive classroom environment has been demonstrated to have a positive impact upon the critical thinking ability of students (Smith, 1977). The activities identified by Smith as being most positively related to a change in level of critical thinking were student participation at a high cognitive level, encouragement of students' ideas by faculty, and peer-to-peer interaction. These are all elements of discussion and reflective dialogue. Higher order questioning, a strategy that was confusing to some respondents, did not load on any Value factor, but could be considered a component of interactive activities. Newton (1977b) demonstrated this to be an effective mechanism for impacting critical thinking.

Objective question activities include computer assisted instruction, programmed instruction, and multiple choice examinations. Computer assisted instruction can be a variant of programmed instruction, but can also be used to provide simulation activities (Klaassens, 1988b). As is true for essay examinations, multiple choice examinations may be used as a learning tool as well as an evaluative tool. In strongly agreeing that multiple choice

examinations are of value in promoting critical thinking, one subject commented "Yes, it can be done!"

Writing and lecture include written nursing care plans, written papers, and lecture. The loading of lecture on this factor is unexplained, but may possibly be attributed to sampling error (Kerlinger, 1986). Lecture is a frequently used teaching strategy, particularly at the technical and baccalaureate levels, that faculty perceive as having limited value in the promotion of critical thinking. It is possible that lecture is a critical thought-provoking mechanism for the student who is inclined to think in that mode. Writing has been promoted as a tool that heightens and refines thinking through the process of problem solving (Olson, 1984), and provides a framework for the use of higher order thinking skills (Allen et al, 1989; Hahnemann, 1988; Meyers, 1986). It has been demonstrated to impact significantly upon critical thinking ability, particularly when combined with reading (Tierney et al, 1989). Journals or logs also did not load on any factor, but are a form of writing supported as having value in promoting critical thinking.

While a number of teaching strategies have been advocated as effective tools for the promotion of critical thinking ability, there is limited empirical evidence to support the efficacy of teaching/learning strategies other than interactive classroom environments, higher order

questioning, and writing. Further study is warranted in order to identify those teaching/learning strategies most useful in promoting critical thinking. Simulation activities, critique, interactive activities, objective question activities, and writing and lecture are five categories of teaching/learning activity that can provide a framework for conducting further study.

Impact of DEGREE and STULEV

Although not addressed in the literature, an *a priori* expectation of this study was that nursing faculty would be differentiated in their perception of the definition of critical thinking, their level of emphasis on the teaching of critical thinking, and teaching strategies used to promote critical thinking on the basis of both the highest faculty degree obtained (master's or doctorate (DEGREE)) and level of student taught (technical, baccalaureate, graduate (STULEV)). This expectation was upheld in only a very limited fashion.

The ANOVA results revealed differences in responses to the Frequency scale across both the DEGREE and STULEV categories. However, this overall difference was not clearly supported by discriminant analysis of the same data set. The discriminant analysis using the four scales (Concept, Attribute, Frequency, and Value) failed to differentiate among faculty when grouped by DEGREE and

STULEV, as well as when grouped ex post facto by preparation for teaching critical thinking and years of teaching experience. Differentiation among faculty groups (DEGREE and STULEV) occurred only when the 70 items from the four scales were used individually as the discriminating variables. Frequency of use of research/theory critique was the initial variable to enter the step-wise analysis for both DEGREE and STULEV, taking a large percentage of the variance for both (Tables 30 and 32). A review of the overall mean and the means for groups within DEGREE and STULEV (see Appendices E through H) revealed a marked difference among the means for this variable. For all other variables entering either or both analyses there are lesser differences among the means (see Tables 30 and 32 and Appendices E through H). It is not surprising that there are differences in the frequency with which research/theory critique is used. It is assumed that doctorally prepared faculty are thoroughly grounded in the critique, generation, and use of research and theory and thus could be expected to use this in their teaching. Master's programs in nursing generally have a greater emphasis on clinical practice than on research. The different foci of technical, baccalaureate, and graduate study in nursing engender different levels of expectation in the critique of research and theory. Analysis was the variable with the next highest coefficient for both DEGREE and STULEV. As research/theory

critique relies heavily on analytical processes, the two variables are closely related.

Over 75 percent of subjects were correctly classified on the basis of DEGREE. A number of subjects whose highest degree was the master's indicated that they were involved in doctoral study or had achieved doctoral candidacy status. This can partially explain the finding that 26.1 percent of master's prepared faculty were incorrectly predicted to be a part of the doctorally prepared group. Another explanation of this finding is that undergraduate faculty frequently work with graduate faculty, and thus have absorbed some of their values and practices. Less simple to explain is the finding that 18.3 percent of doctorally prepared faculty were incorrectly predicted to be a part of the master's prepared group. A possible explanation is that some doctorally prepared faculty teach in a setting where other faculty are primarily master's prepared and thus might be influenced by their perspectives.

Over 65 percent of respondents were correctly classified on the basis of STULEV. Approximately 83 percent of subjects teaching in technical programs were correctly classified as teaching at that level while the remainder were incorrectly classified as teaching in baccalaureate (14.8%) or graduate (2.5%) programs. Possible reasons for these incorrect classifications are prior involvement in such programs, close association with such programs, or

involvement of subjects in doctoral study. Approximately half (54.6%) of the subjects teaching in baccalaureate programs were correctly classified. The remainder were classified as teaching at either the technical (22.7%) or graduate (22.7%) level. Possible reasons for incorrect classification of baccalaureate faculty at the technical level include prior or recent involvement in such programs or a constricted conceptualization of critical thinking. Possible reasons for incorrect prediction of baccalaureate faculty at the graduate level include close association with graduate programs and faculty and involvement of master's prepared baccalaureate faculty in a doctoral program.

Approximately 77 percent of faculty teaching in graduate programs were correctly classified. Possible explanations for incorrect classification at either the technical level (3.7%) or baccalaureate level (19.4%) include recent involvement in such programs or a constricted conception of critical thinking in comparison to the majority of subjects teaching at the graduate level.

While some differentiation of subjects occurred on specific items within the four scales on discriminant analysis, this differentiation was not great and would be expected on the basis of both DEGREE and STULEV. The differentiation detected using the ANOVA results related to the frequency of use of teaching strategies also would be expected. Overall, it would appear that nursing faculty

have a unified perception of the characteristics of critical thinking and critical thinkers, and have a similar perspective on the value of various teaching/learning strategies for the promotion of critical thinking ability.

General Discussion

Subjects for this study were a randomly-selected sample of master's and doctorally prepared nurse faculty teaching in technical, baccalaureate, and graduate programs in nursing who were also members of Sigma Theta Tau, International. Results of this study can be generalized only to this population.

Critical thinking continues to be addressed within the nursing literature. While problem solving continues to be the primary definition of critical thinking of some (Brooks and Shepherd, 1990; Miller and Malcolm, 1991; Pond, Bradshaw, and Turner, 1991; White et al, 1990), others are questioning narrow interpretations of critical thinking and viewing it within a broader context (Jones and Brown, 1991; Kintgen-Andrews, 1991). The results of this study indicate that nursing faculty perceive critical thinking to be a broad construct that incorporates problem solving, but is not exclusively problem solving. Studies done to date that define critical thinking in nursing as problem solving have actually studied only one component of this construct.

As the enhancement of critical thinking ability is a major issue in nursing education today, it is imperative that the concept be well understood. A focus on problem solving as the definition of critical thinking greatly constricts the concept, particularly when the nursing process is used as the mechanism for implementing problem solving. Indeed, some would question whether or not the use of the nursing process actually impedes the development of critical thinking (Jones and Brown, 1991). Critical thinking in nursing is much more than the assessment and diagnosis of patient needs and the planning, implementation, and evaluation of patient care. It is also much more than enactment of the scientific method. It goes beyond that to incorporate inquiry, the search for more effective answers, and open-ness to new ideas. It provides insight into meanings and relationships. Given the rapidity with which knowledge in nursing science becomes obsolete, the ability to think critically is essential.

Nursing is crucially involved in patient care issues related to health promotion, health maintenance, and health restoration. Nursing is also crucially involved in organizational and health policy issues. It is imperative that nursing education at all levels prepare its graduates to assume their rightful roles in dealing with these issues. Nurses prepared to think critically are prepared to deal with patient care, organizational, and health policy issues

at the highest possible level. The results of this study indicate that critical thinking in nursing is indeed multi-dimensional. Preparing students of nursing to think critically in a multi-dimensional sense is a challenge that cannot be ignored. Faculty themselves must be well grounded in critical thinking, committed to it as an outcome of nursing and higher education, and seek explicitly to enhance this ability in their students.

Implications for Further Study

The results of this descriptive, exploratory study has provided an empirically based definition of critical thinking in nursing, including characteristics of critical thinking and characteristics of critical thinkers. Additional testing of the definitional scales, Concept and Attribute, is recommended, with some revision to the Concept scale. A number of subjects found the response code for this scale difficult and time consuming; an agree-disagree continuum might be better understood. A replication of this study using a revised response code for the Concept scale and a confirmatory factor analysis approach is recommended. Oblique rather than orthogonal rotation is recommended if preliminary findings indicate intercorrelations among factors.

The findings from this study also yielded five categories of teaching/learning strategies that are

perceived to be of value in the promotion of critical thinking ability in nursing. Further study is recommended in order to determine which strategies are of greatest value; this study has identified categories of strategies that could provide a framework for such study. Inclusion of variables such as learning style in such studies is recommended. The same category of strategy could be studied across several levels of student (technical, baccalaureate, graduate) to determine if it is more effective in enhancing critical thinking at one level than another.

Also identified in this study was the frequency with which faculty used various teaching/learning strategies. Field studies could be conducted to determine whether or not faculty actually implement these strategies in a manner specifically designed to enhance critical thinking ability.

Development of a discipline-specific test of critical thinking would enhance the study of critical thinking in nursing and facilitate documentation of it as an outcome of nursing education. The characteristics of critical thinking and critical thinkers as identified in this study would provide a useful framework for the development of such a test.

It would be interesting to use the CTI in modified format to compare nursing faculty perceptions of critical thinking with that of faculty of other disciplines. Similarities and differences among disciplines in relation

to their perceptions of critical thinking could thus be ascertained.

It would also be interesting to modify the CTI for use with nurse administrators in health care agencies. Nursing education prepares its graduates for work in a variety of health care settings. It would be well to know if there is congruence between nurse faculty and nurse administrators in their conceptualization of critical thinking.

On the basis of this study, critical thinking in nursing appears to be a multi-dimensional concept. This needs to be corroborated by further study. Continuing research on critical thinking in nursing is needed in order to determine how best it is enhanced and how critical thinking influences and is influenced by other behaviors in nursing. Valuing and promoting critical thinking is essential for the forward movement of the discipline of nursing.

CHAPTER VI

SUMMARY

Critical thinking has been an issue of interest and concern in general higher education for several decades. Over the past ten years it has become an issue of increasing interest and concern in nursing education with a particular emphasis noted on this topic in nursing literature over the past three years. This study focused on determining the status of critical thinking in technical, baccalaureate, and graduate programs in nursing from the perspective of nursing faculty.

Given the general lack of consensus regarding the definition of critical thinking, one of the research questions sought to determine nursing faculty perception of the definition of critical thinking. The second research question focused on the level of emphasis on the development of critical thinking ability in nursing education while the third question dealt with teaching strategies for the promotion of critical thinking ability. The final question sought to determine whether or not faculty differed in their response to the preceding questions on the basis of highest faculty degree obtained or level of student taught.

A descriptive, exploratory survey design was used to study nursing faculty perceptions of critical thinking. Subjects were 633 nursing faculty teaching in technical, baccalaureate, and graduate programs in nursing. An investigator-designed questionnaire, Critical Thinking Inventory, was the instrument used for data collection. The instrument was pilot tested prior to formal data collection. Data reduction was carried out to collapse categories for selected demographic variables and to increase reliability of the four scales, Concept, Attribute, Frequency, and Value. Data were analyzed using measures of central tendency and dispersion, Pearson correlation, discriminant analysis, one way analysis of variance, and principal components analysis with a Varimax rotation.

Based on the results of the principal components analysis of the Concept and Attribute scales, nursing faculty view critical thinking as a multi-dimensional construct. Analysis of the Concept scale yielded a five-factor solution. Critical thinking was found to be characterized as Exploration, Resolution, Reasoning, Understanding, and Knowledge. Analysis of the Attribute scale also yielded a four-factor solution. Critical thinkers were found to be characterized by Perseverance and Open-mindedness, Intellectual Curiosity, Analytical Mode, and Informed Skepticism. Written definitions of critical thinking by 25 percent of the respondents, however, yielded

a narrow definition of the construct, with an emphasis on problem solving or logic.

Subjects were in almost complete agreement that critical thinking is an essential attribute of a professional nurse. Over half of the respondents perceived themselves as directly emphasizing critical thinking in their teaching; approximately one fourth perceived themselves as both direct and indirect in their approach to teaching critical thinking while less than one fifth are indirect in approach.

Five teaching strategies (discussion, written nursing care plans, multiple choice examinations, lecture, and written papers) were reported to be used at least frequently in appropriate situations. All other strategies were reported to be used on a "sometimes" or "seldom" basis. Thirteen of the teaching strategies were perceived as valuable for the development of critical thinking ability in nursing students. Neutrality was expressed as to the value of the remaining five strategies. Pearson correlation conducted on a pair by pair basis for matched items in each scale showed low to moderate statistically significant levels of correlation between the frequency of use of the strategy and the value attached to that strategy. Although there was a tendency for faculty to report the use of teaching/learning strategies deemed of value in the promotion of critical thinking, lecture, which was not

perceived as having great value in promoting critical thinking, was one of the most frequently used strategies. Principal components analysis of the Value scale yielded a five-factor solution of categories of teaching/learning strategies having value for the promotion of critical thinking ability: Simulation Activities, Critique, Interactive Activities, Objective Question Activities, and Writing and Lecture.

It was hypothesized that faculty would differ in their perceptions of critical thinking on the basis of highest faculty degree obtained and level of student taught. This expectation was only partially supported. ANOVA findings revealed that neither highest faculty degree obtained nor level of student taught influenced faculty perception of the meaning of critical thinking (concept and attribute), level of emphasis on the teaching of critical thinking, or teaching strategies valued for the promotion of critical thinking ability. However, both highest faculty degree obtained and level of student taught appeared to influence the frequency with which various teaching strategies are used. However, further analysis of the same data set using a discriminant analysis procedure failed to reveal significant differences among the vectors of the two DEGREE groups and among the vectors of the three STULEV groups. Subsequent ex post facto discriminant analysis using the seventy individual variables from the four scales as the

discriminating variables did reveal significant differences between the means for both DEGREE and STULEV. Nineteen variables, derived from all four scales, contributed to the discriminant function for DEGREE while twenty-three variables contributed to the discriminant function for STULEV. In both instances the function tapped analytical processes.

Critical thinking in nursing, as defined by the nursing faculty in this study, appears to be a multi-dimensional construct incorporating both expanding, exploratory elements and the elements of problem solving, logic, and the scientific method. Behaviors supportive of these elements are seen as essential characteristics of the professional nurse. Nursing faculty are committed to critical thinking and its importance to nursing. Certain teaching/learning strategies are viewed as being of value in the promotion of critical thinking. Continuing research on critical thinking in nursing is needed in order to determine how best it is enhanced and how critical thinking influences and is influenced by other behaviors in nursing. Valuing and promoting critical thinking is essential for the forward movement of the discipline of nursing.

Appendix A

CRITICAL THINKING

INVENTORY

CRITICAL THINKING INVENTORY

Please respond to the following questions from the perspective of your personal understanding of critical thinking.

Q- 1 There is diversity of opinion as to the degree of importance of critical thinking in nursing. Please indicate the degree of importance that you attach to critical thinking as an essential attribute of a professional nurse. (Circle the appropriate number)

1 NOT AT ALL IMPORTANT
2 SOMEWHAT IMPORTANT
3 IMPORTANT
4 VERY IMPORTANT
5 HIGHLY IMPORTANT

Q- 2 Some faculty members seek to foster the critical thinking ability of nursing students in a direct manner while others seek to foster this ability in an indirect manner. Please indicate the approach that you use to fostering critical thinking ability in your students. (Circle the appropriate number)

1 INDIRECT
2
3
4
5 DIRECT

Q- 3 There is a range of opinion as to whether or not skills taught in one discipline are directly transferable to another discipline without deliberate instruction to facilitate such transfer. In your opinion, is critical thinking ability as developed in general studies courses readily transferable to nursing studies without deliberate instruction, or is deliberate instruction required? (Circle the appropriate number)

1 TRANSFERS <u>WITHOUT</u> DELIBERATE INSTRUCTION
2 UNCERTAIN
3 TRANSFERS <u>WITH</u> DELIBERATE INSTRUCTION

Q- 4 There is disagreement among faculty members as to the best method for teaching critical thinking. Some believe that critical thinking should be taught in a separate course while others believe that it should be taught in integrated fashion with discipline-specific content. Please indicate your opinion as to the best method for fostering critical thinking ability in nursing students. (Circle the appropriate number)

1 A SEPARATE COURSE IN CRITICAL THINKING
2 INTEGRATION OF CRITICAL THINKING INTO NURSING COURSE WORK
3 A COMBINATION OF 1 AND 2
4 OTHER (specify)_____

Q- 5 Some nursing faculty members have developed their own definition of critical thinking. If you have a personal definition of critical thinking, please share this in the space provided below.

Q- 6 Decide which one of the four words (MODel, BORderline, RELated, CONtrary, UNCertain) as defined below best describes the 20 listed term's representation of critical thinking in nursing. Please circle the appropriate descriptive word for each term.

MOD Is an example or instance of the concept of critical thinking. A model case.
BOR Important features of critical thinking are missing. A borderline case.
REL May be importantly connected to critical thinking but not an example or instance of critical thinking. A related case
CON Is not an example or instance of critical thinking. A contrary case.
UNC You are uncertain as to whether or not this term is representative of critical thinking.

1.	Analysis.....	MOD	BOR	REL	CON	UNC
2.	Application.....	MOD	BOR	REL	CON	UNC
3.	Comprehension.....	MOD	BOR	REL	CON	UNC
4.	Concrete thinking.....	MOD	BOR	REL	CON	UNC
5.	Creativity.....	MOD	BOR	REL	CON	UNC
6.	Criticism.....	MOD	BOR	REL	CON	UNC
7.	Decision making.....	MOD	BOR	REL	CON	UNC
8.	Deductive reasoning.....	MOD	BOR	REL	CON	UNC
9.	Goal-directed thinking.....	MOD	BOR	REL	CON	UNC
10.	Evaluation.....	MOD	BOR	REL	CON	UNC
11.	Hypothesis testing.....	MOD	BOR	REL	CON	UNC
12.	Inductive reasoning.....	MOD	BOR	REL	CON	UNC
13.	Information processing.....	MOD	BOR	REL	CON	UNC
14.	Inquiry.....	MOD	BOR	REL	CON	UNC
15.	Judgment.....	MOD	BOR	REL	CON	UNC
16.	Logic.....	MOD	BOR	REL	CON	UNC
17.	Problem solving.....	MOD	BOR	REL	CON	UNC
18.	Recall.....	MOD	BOR	REL	CON	UNC
19.	Reflective thinking.....	MOD	BOR	REL	CON	UNC
20.	Synthesis.....	MOD	BOR	REL	CON	UNC

Q- 7 Please indicate by circling the appropriate letter(s) the extent of your agreement or disagreement as to whether the attributes listed below should be characteristic of a professional nurse.

SD STRONGLY DISAGREE
D DISAGREE
N NEUTRAL
A AGREE
SA STRONGLY AGREE
NO NO OPINION

1.	Analytical mind.....	SD	D	N	A	SA	NO
2.	Assumption recognition.....	SD	D	N	A	SA	NO
3.	Constructive discontent.....	SD	D	N	A	SA	NO
4.	Draw valid conclusions.....	SD	D	N	A	SA	NO
5.	Goal-orientation.....	SD	D	N	A	SA	NO
6.	Flexibility.....	SD	D	N	A	SA	NO
7.	Informed skepticism.....	SD	D	N	A	SA	NO
8.	Inquiring mind.....	SD	D	N	A	SA	NO
9.	Intellectual curiosity.....	SD	D	N	A	SA	NO
10.	Knowledge of logic.....	SD	D	N	A	SA	NO
11.	Objectivity.....	SD	D	N	A	SA	NO
12.	Open-mindedness.....	SD	D	N	A	SA	NO
13.	Organization.....	SD	D	N	A	SA	NO
14.	Persistence.....	SD	D	N	A	SA	NO
15.	Precision.....	SD	D	N	A	SA	NO
16.	Problem solving ability.....	SD	D	N	A	SA	NO
17.	Spirit of inquiry.....	SD	D	N	A	SA	NO
18.	Valid inference recognition.....	SD	D	N	A	SA	NO
19.	Other (specify)_____	SD	D	N	A	SA	NO

Q- 8 Please indicate by circling the appropriate word the frequency with which you use the following teaching strategies in either the classroom or practicum setting.

NEVER - never used in any situation in which it is appropriate
SELDOM - used in about 25% of the situations in which it is appropriate
SOMETIMES - used in about 50% of the situations in which it is appropriate
FREQUENTLY - used in about 75% of the situations in which it is appropriate
ALWAYS - used in all situations in which it is appropriate
N/A - not appropriate in my situation

1. Written nursing care plans.....	NEVER	SELDOM	SOMETIMES	FREQUENTLY	ALWAYS	N/A
2. Written papers.....	NEVER	SELDOM	SOMETIMES	FREQUENTLY	ALWAYS	N/A
3. Lecture.....	NEVER	SELDOM	SOMETIMES	FREQUENTLY	ALWAYS	N/A
4. Discussion.....	NEVER	SELDOM	SOMETIMES	FREQUENTLY	ALWAYS	N/A
5. Concept analysis.....	NEVER	SELDOM	SOMETIMES	FREQUENTLY	ALWAYS	N/A
6. Case studies.....	NEVER	SELDOM	SOMETIMES	FREQUENTLY	ALWAYS	N/A
7. Programmed instruction	NEVER	SELDOM	SOMETIMES	FREQUENTLY	ALWAYS	N/A
8. Multiple choice examinations.....	NEVER	SELDOM	SOMETIMES	FREQUENTLY	ALWAYS	N/A
9. Essay examinations....	NEVER	SELDOM	SOMETIMES	FREQUENTLY	ALWAYS	N/A
10. Reflective dialogue...	NEVER	SELDOM	SOMETIMES	FREQUENTLY	ALWAYS	N/A
11. Role play.....	NEVER	SELDOM	SOMETIMES	FREQUENTLY	ALWAYS	N/A
12. Simulations.....	NEVER	SELDOM	SOMETIMES	FREQUENTLY	ALWAYS	N/A
13. Computer Assisted Instruction.....	NEVER	SELDOM	SOMETIMES	FREQUENTLY	ALWAYS	N/A
14. Games.....	NEVER	SELDOM	SOMETIMES	FREQUENTLY	ALWAYS	N/A
15. Research/theory critique.....	NEVER	SELDOM	SOMETIMES	FREQUENTLY	ALWAYS	N/A
16. Debate.....	NEVER	SELDOM	SOMETIMES	FREQUENTLY	ALWAYS	N/A
17. Journals/logs.....	NEVER	SELDOM	SOMETIMES	FREQUENTLY	ALWAYS	N/A
18. Higher order questioning.....	NEVER	SELDOM	SOMETIMES	FREQUENTLY	ALWAYS	N/A
19. Other (specify) _____	NEVER	SELDOM	SOMETIMES	FREQUENTLY	ALWAYS	N/A

Q- 9 Please indicate by circling the appropriate letter(s) your level of agreement or disagreement as to the value of the following teaching strategies for the development of critical thinking ability in nursing students.

SD STRONGLY DISAGREE
D DISAGREE
N NEUTRAL
A AGREE
SA STRONGLY AGREE
NO NO OPINION

1. Written nursing care plans.....	SD	D	N	A	SA	NO
2. Written papers.....	SD	D	N	A	SA	NO
3. Lecture.....	SD	D	N	A	SA	NO
4. Discussion.....	SD	D	N	A	SA	NO
5. Concept analysis.....	SD	D	N	A	SA	NO
6. Case studies.....	SD	D	N	A	SA	NO
7. Programmed instruction.....	SD	D	N	A	SA	NO
8. Multiple choice exams.....	SD	D	N	A	SA	NO
9. Essay examinations.....	SD	D	N	A	SA	NO
10. Reflective dialogue.....	SD	D	N	A	SA	NO
11. Role play.....	SD	D	N	A	SA	NO
12. Simulations.....	SD	D	N	A	SA	NO
13. Computer Assisted Instruction.....	SD	D	N	A	SA	NO
14. Games.....	SD	D	N	A	SA	NO
15. Research/theory critique.....	SD	D	N	A	SA	NO
16. Debate.....	SD	D	N	A	SA	NO
17. Journals/logs.....	SD	D	N	A	SA	NO
18. Higher order questioning.....	SD	D	N	A	SA	NO
20. Other (specify _____	SD	D	N	A	SA	NO

Please share some information about yourself.

Q-10 Have you had specific preparation for teaching critical thinking?

1 NO (go to Q-11)
2 YES (go to Q-10a)

Q-10a Please indicate by circling the appropriate number how you were prepared to teach critical thinking.

1 WORKSHOP/CONFERENCE
2 SEMINAR
3 FORMAL ACADEMIC PREPARATION
4 SELF-INSTRUCTED
5 OTHER (specify)_____

Q-11 What is your current academic rank? (Circle the appropriate number)

1 LECTURER
2 INSTRUCTOR
3 ASSISTANT PROFESSOR
4 ASSOCIATE PROFESSOR
5 PROFESSOR
6 OTHER (specify)_____

Q-12 Please circle the number that corresponds to your highest degree.

1 BACCALAUREATE IN NURSING
2 MASTER'S IN NURSING
3 MASTER'S IN ANOTHER FIELD
4 DOCTORATE IN NURSING
5 DOCTORATE IN ANOTHER FIELD
6 OTHER (specify)_____

Q-13 Please indicate the number of years that you have served as a nursing faculty member.

_____ years

Q-14 Please indicate the level of nursing student that you teach. (Circle the appropriate number)

1 DIPLOMA
2 ASSOCIATE DEGREE
3 BACCALAUREATE
4 GRADUATE
5 BOTH BACCALAUREATE AND GRADUATE
6 OTHER (specify)_____

Q-15 Which of the following best describes the setting in which you teach? (Circle the appropriate number)

1 DIPLOMA NURSING PROGRAM
2 COMMUNITY OR JUNIOR COLLEGE
3 PRIVATE LIBERAL ARTS COLLEGE
4 PUBLIC LIBERAL ARTS COLLEGE
5 PRIVATE UNIVERSITY
6 PUBLIC UNIVERSITY
7 OTHER (specify)_____

Q-16 How many funded or non-funded research projects have you participated in as principal investigator or co-investigator since January 1, 1985? (Circle the appropriate number).

1 NONE
2 ONE
3 TWO
4 THREE
5 FOUR
6 FIVE OR MORE

Q-17 How many articles published in refereed journals have you authored or co-authored since January 1, 1985? (Circle the appropriate number).

1 NONE
2 ONE
3 TWO
4 THREE
5 FOUR
6 FIVE OR MORE

Q-18 How many refereed papers or poster sessions have you presented at conferences since January 1, 1985? (Circle the appropriate number)

1 NONE
2 ONE
3 TWO
4 THREE
5 FOUR
6 FIVE OR MORE

Is there anything else that you would like to share about critical thinking in either nursing education or nursing practice? If so, please use this space for that purpose.

Your response to this questionnaire is deeply appreciated. If you would like an abstract of study results, please check the box on the return envelope and print your name and address below it. The abstract will be sent to you as soon as the study is completed.

APPENDIX B

INITIAL COVER LETTER

October 22, 1991

Dear

You are invited to participate in a research project to investigate faculty perceptions of critical thinking in nursing. In recent years critical thinking has gained the attention of nursing educators because of its importance to nursing education and practice, yet little is known about how critical thinking is defined in nursing. As a nursing faculty member, you are in a unique position to help provide a description of critical thinking from your own perspective. Your thoughtful response to this questionnaire will help to provide insight into the nature of critical thinking in nursing.

All information will be reported as group data and, therefore, you may be assured of complete confidentiality. The questionnaire has an identification number for mailing purposes only to check your name off the mailing list when your questionnaire is returned. Your name will never be placed on the questionnaire. Completion and return of the survey will be considered evidence of your willingness to participate and your consent to have the information used for the purposes of this study.

You may receive an abstract of study results by checking the box on the return envelope and printing your name and address below it. Please do not put this information on the questionnaire itself. Please complete the questionnaire within the next 3-5 days and return it in the enclosed self-addressed stamped envelope.

I would be most happy to answer any questions that you might have. Please write, or call me at 1-708-383-6200, ext. 6529. Or, call me collect in the evening at 1-708-668-6778.

Thank you for your assistance.

Sincerely,

Cynthia N. Sander, MSN, RN
Acting Dean, West Suburban College of Nursing
PhD Candidate, Loyola University Chicago

APPENDIX C

ONE WEEK FOLLOW-UP POSTCARD

October 29, 1990

One week ago a questionnaire seeking your input regarding nursing faculty perceptions of critical thinking was mailed to you. If you have already completed and returned the questionnaire please accept my sincere thanks for your participation. If you have not already returned it, please take a few minutes to do so. Your participation is important in order to have an accurate representation of how nursing faculty define critical thinking.

If by some chance you did not receive the questionnaire, or it has been misplaced, please call me during the day at 708/383-6200, ext. 6529, or during the evening collect at 708/668-6778, and I will send you one immediately.

Cynthia N. Sander, RN, MSN
Concordia University-West Suburban College of Nursing
Erie at Austin
Oak Park, IL 60302

APPENDIX D

THREE WEEK FOLLOW-UP LETTER

November 12, 1990

Dear

About three weeks ago I wrote to you seeking your participation in a study to investigate nursing faculty perceptions of critical thinking. Although it is possible that your response is in the mail, as of today I have not received your completed questionnaire.

This study has been undertaken because it does not appear that we have a good or universal understanding of what critical thinking really means in nursing.

I am writing to you again because of the significance each questionnaire has to the usefulness of this study. Your name was randomly selected from a list, provided by Sigma Theta Tau, of individuals who had identified themselves as faculty members. In order for the results of this study to be truly representative of faculty members perceptions of critical thinking in nursing, it is important that each person in the sample return their questionnaire.

In the event that your questionnaire has been misplaced, a replacement is enclosed. If you have already responded, please accept my sincere thanks for your participation.

Your cooperation is greatly appreciated.

Cordially,

Cynthia N. Sander, MSN, RN
Acting Dean, West Suburban College of Nursing
PhD Candidate, Loyola University Chicago

Appendix E

CONCEPT SCALE: FACTOR LOADINGS, CORRELATIONS, AND MEANS AND STANDARD DEVIATIONS

Concept Scale Factor Loadings

Variable	Factor 1	2	3	4	5
INQUIRY	.76	.14	-.01	.12	-.02
INFORMATION PROCESSING	.64	.26	.03	.05	.29
REFLECTIVE THINKING	.62	-.14	.11	.12	.11
LOGIC*	.43	.36	.26	-.04	.05
PROBLEM SOLVING	.13	.74	.19	.04	.06
DECISION MAKING	-.05	.72	.17	.14	.16
JUDGMENT	.30	.55	-.05	.21	.07
INDUCTIVE THINKING	.12	-.01	.76	.12	.01
DEDUCTIVE THINKING	.01	.23	.74	.04	.17
HYPOTHESIS TESTING	-.01	.07	.61	.28	-.15
GOAL-DIRECTED THINKING*	.03	.24	.47	.12	.34
ANALYSIS	.12	.03	.20	.65	.06
SYNTHESIS	.32	.08	.18	.62	-.08
COMPREHENSION	-.22	.23	-.00	.55	.43
EVALUATION	.01	.39	.08	.54	.02
CONCRETE THINKING	-.03	.17	.17	-.10	.74
APPLICATION	.23	-.02	-.02	.40	.62
RECALL	.37	.00	.00	.02	.58
CRITICISM#	.03	.01	.01	.01	-.04
CREATIVITY#	.11	.10	.14	.14	.05
Eigenvalue	4.36	1.67	1.47	1.24	1.16
Percent Variance	21.80	8.40	7.40	6.20	5.80

*Variable failed to load on any factor
#Variable loaded on deleted Factor 6

Concept Scale Correlation Matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1 ANALYSIS	1.00																			
2 COMPREH	.23	1.00																		
3 APPLICAT	.26	.34	1.00																	
4 CONCRETE	.11	.17	.30	1.00																
5 CREATIVE	.13	.10	.10	.05	1.00															
6 CRITICM	.13	.06	.04	0.00	.27	1.00														
7 DECISION	.19	.27	.19	.18	.12	.16	1.00													
8 DEDUCT	.19	.14	.10	.16	.09	.11	.28	1.00												
9 GOALDIRE	.16	.24	.21	.15	.14	.07	.27	.34	1.00											
10 EVAL	.29	.28	.24	.01	.15	.21	.29	.16	.24	1.00										
11 HYPOTHES	.22	.06	.07	0.00	.08	.08	.16	.26	.24	.21	1.00									
12 INDUCT	.18	.11	.11	.07	.14	.08	.17	.45	.24	.17	.33	1.00								
13 INFOPROC	.15	.07	.31	.19	.04	.03	.19	.14	.21	.16	.02	.09	1.00							
14 INQUIRY	.17	.02	.24	.02	.17	.11	.10	.05	.08	.14	.06	.12	.42	1.00						
15 JUDGE	.18	.20	.24	.10	.14	.15	.33	.16	.15	.29	.08	.12	.26	.26	1.00					
16 LOGIC	.22	.07	.17	.11	.19	.21	.22	.27	.20	.20	.14	.22	.23	.30	.32	1.00				
17 PROBSOL	.14	.20	.14	.14	.11	.08	.45	.24	.26	.24	.17	.16	.25	.21	.27	.30	1.00			
18 RECALL	.08	.18	.33	.24	.04	.01	.16	.10	.24	.15	.03	.04	.33	.20	.21	.20	.17	1.00		
19 REFLECT	.13	.04	.19	.03	.16	.18	.09	.09	.13	.11	.05	.16	.25	.33	.27	.24	.06	.26	1.00	
20 SYNTHES	.32	.21	.17	.03	.18	.02	.19	.14	.18	.22	.17	.20	.22	.22	.23	.16	.19	.10	.24	1.00

Concept Scale Means and Standard Deviations Arranged by Factors for All, DEGREE, and STULEV

	ALL		DEGREE MASTER'S		DOCTORATE	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
FACTOR 1 Exploration						
Inquiry	1.892	.895	1.907	.893	1.842	.897
Information Processing	2.098	.938	2.105	.947	2.062	.924
Reflective Thinking	2.100	.925	2.085	.909	2.114	.958
Composite Means	2.030		2.030		2.006	
FACTOR 2 Resolution						
Problem Solving	1.437	.751	1.405	.741	1.506	.766
Decision Making	1.443	.75	1.409	.725	1.492	.786
Judgment	1.786	.911	1.808	.93	1.721	.868
Composite Means	1.555		1.541		1.573	
FACTOR 3 Reasoning						
Inductive Reasoning	1.520	.795	1.549	.815	1.431	.732
Deductive Reasoning	1.481	.766	1.464	.748	1.475	.781
Hypothesis Testing	1.558	.853	1.527	.851	1.607	.839
Composite Means	1.520		1.513		1.504	
FACTOR 4 Understanding						
Analysis	1.191	.519	1.154	.455	1.25	.597
Synthesis	1.327	.657	1.327	.655	1.309	.644
Comprehension	2.007	.911	21.947	.915	2.091	.879
Evaluation	1.587	.828	1.598	.825	1.559	.835
Composite Means	1.528		1.476		1.55	
FACTOR 5 Knowledge						
Concrete Thinking	3.062	1.002	3.019	1.007	3.119	.996
Application	2.125	.948	2.137	.956	2.051	.928
Recall	3.119	.874	3.065	.894	3.25	.817
Composite Means	2.769		2.740		2.807	
Not included in solution/Did not load						
Creativity	1.993	.939	2.037	.942	1.874	.914
Criticism	2.140	1.067	2.249	1.086	1.902	1.007
Goal-directed Thinking	2.024	.927	1.989	.915	2.094	.964
Logic	1.715	.857	1.741	.853	1.654	.856
CONCEPT SCALE MEAN	1.880		1.876		1.870	
LOW	1.191		1.154		1.250	
HIGH	3.119		3.065		3.250	

Appendix E

CONCEPT SCALE: FACTOR LOADINGS, CORRELATIONS, AND MEANS AND STANDARD DEVIATIONS

	STULEV					
	TECHNICAL		BACCALAUREATE		GRADUATE	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
FACTOR 1 Exploration						
Inquiry	1.986	.903	1.848	.887	1.876	.898
Information Processing	2.000	.894	2.107	.959	2.159	.946
Reflective Thinking	2.224	.922	2.004	.883	2.132	.984
Composite Mean	2.070		1.986		2.056	
FACTOR 2 Resolution						
Problem Solving	1.307	.691	1.424	.737	1.574	.797
Decision Making	1.331	.664	1.438	.740	1.519	.810
Judgment	1.858	.962	1.749	.889	1.765	.901
Composite Means	1.499		1.537		1.619	
Factor 3 Reasoning						
Inductive Reasoning	1.539	.833	1.504	.780	1.500	.775
Deductive Reasoning	1.367	.673	1.462	.734	1.561	.853
Hypothesis Testing	1.511	.771	1.562	.888	1.579	.850
Composite Means	1.472		1.509		1.547	
FACTOR 4 Understanding						
Analysis	1.126	.405	1.178	.494	1.253	.600
Synthesis	1.333	.662	1.294	.628	1.387	.742
Comprehension	1.864	.881	1.961	.932	2.150	.863
Evaluation	1.631	.825	1.544	.818	1.604	.843
Composite Means	1.489		1.494			1.597
FACTOR 5 Knowledge						
Concrete Thinking	2.933	1.009	3.051	1.001	3.171	.989
Application	2.076	.929	2.136	.956	2.079	.960
Recall	3.108	.890	3.085	.892	3.208	.818
Composite Means	2.706		2.757		2.819	
Not included in solution/Did not load						
Creativity	2.115	.958	1.980	.924	1.901	.926
Criticism	2.500	1.096	2.094	1.063	1.901	.998
Goal-directed Thinking	1.906	.903	1.984	.925	2.192	.957
Logic	1.732	.851	1.714	.843	1.686	.877
CONCEPT SCALE MEAN	1.872		1.856		1.910	
LOW	1.126		1.178		1.253	
HIGH	3.108		3.085		3.208	

Appendix F

ATTRIBUTE SCALE: FACTOR LOADINGS, CORRELATIONS, AND MEANS AND STANDARD DEVIATIONS

Attribute Scale Factor Loadings

Factor	1	2	3	4
ORGANIZATION	.73	.01	.12	-.02
OBJECTIVITY	.63	.02	.23	-.06
FLEXIBILITY	.61	.23	-.28	.21
PERSISTENCE	.60	.20	.16	.22
OPEN-MINDEDNESS	.55	.37	-.06	.16
GOAL ORIENTATION	.54	-.06	.31	.01
INQUIRING MIND	.08	.81	.12	.05
INTELLECTUAL CURIOSITY	.04	.81	.14	.09
SPIRIT OF INQUIRY	.12	.70	.23	.17
ANALYTICAL MIND	-.04	.21	.69	.09
INFERENCE RECOGNITION	.20	.25	.55	.37
KNOWLEDGE OF LOGIC	.20	.28	.52	.19
PRECISION	.50	-.06	.51	.08
DRAW VALID CONCLUSIONS*	.35	.09	.44	.17
PROBLEM SOLVING ABILITY*	.34	.32	.35	-.08
INFORMED SKEPTICISM	.03	.18	.05	.76
CONSTRUCTIVE DISCONTENT	.02	.05	.07	.76
ASSUMPTION RECOGNITION	.13	.02	.30	.60
Eigenvalue	4.84	1.83	1.39	1.16
Percent Variance	26.90	10.20	7.70	6.50

*Variable failed to load on any factor

Attribute Scale Correlation Matrix

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	ANALMIND	1.00																	
2	ASSUMREC	.21	1.00																
3	CONSDISC	.16	.30	1.00															
4	VALIDCON	.27	.21	.17	1.00														
5	GOALORIE	.15	.14	.11	.27	1.00													
6	FLEXIBLE	.03	.13	.09	.19	.26	1.00												
7	SKEPTIC	.15	.30	.41	.18	.03	.17	1.00											
8	INQMIND	.23	.12	.13	.23	.11	.16	.21	1.00										
9	INTCUR	.20	.15	.13	.17	.11	.15	.23	.63	1.00									
10	KNOWLOG	.34	.24	.19	.28	.23	.13	.22	.24	.34	1.00								
11	OBJECT	.11	.13	.05	.26	.35	.20	.01	.12	.08	.29	1.00							
12	OPENMIND	.13	.21	.14	.24	.18	.33	.13	.25	.24	.25	.40	1.00						
13	ORGANIZE	.10	.11	.03	.25	.31	.31	.16	.11	.10	.18	.33	.25	1.00					
14	PERSIST	.15	.21	.18	.24	.26	.27	.20	.23	.20	.26	.29	.32	.48	1.00				
15	PRECISE	.19	.24	.05	.30	.32	.11	.18	.10	.13	.27	.32	.19	.42	.41	1.00			
16	PROBSOLA	.27	.13	.10	.24	.20	.23	.06	.25	.20	.22	.20	.26	.26	.22	.30	1.00		
17	SPIRIT	.26	.23	.16	.16	.08	.16	.22	.46	.48	.30	.13	.32	.21	.35	.17	.31	1.00	
18	INFERREC	.34	.36	.25	.32	.25	.15	.30	.25	.28	.38	.22	.21	.20	.36	.35	.26	.44	1.00

Attribute Scale
Means and Standard Deviations Arranged by Factors

	ALL		MASTER'S		DOCTORATE	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
FACTOR 1 Perseverance & Open-mindedness						
Organization	4.47	.61	4.54	.48	4.36	.65
Objectivity	4.48	.66	4.52	.63	4.37	.71
Flexibility	4.69	.52	4.72	.50	4.65	.55
Persistence	4.32	.66	4.36	.63	4.22	.72
Open-mindedness	4.72	.50	4.73	.47	4.64	.56
Goal-orientation	4.43	.65	4.44	.65	4.41	.67
Precision	4.23	.69	4.24	.70	4.24	.69
Composite Mean	4.48		4.51		4.41	
High	4.72		4.73		4.65	
Low	4.23		4.24		4.22	
FACTOR 2 Intellectual Curiosity						
Inquiring Mind	4.83	.39	4.83	.39	4.81	.42
Intellectual Curiosity	4.79	.44	4.78	.46	4.81	.41
Spirit of Inquiry	4.66	.53	4.66	.53	4.66	.55
Composite Mean	4.76		4.76		4.76	
FACTOR 3 Analytical Mode						
Analytical mind	4.69	.52	4.66	.56	4.77	.42
Valid Inference Recognition	4.35	.64	4.29	.65	4.44	.63
Knowledge of Logic	4.20	.72	4.16	.70	4.24	.72
Precision	4.23	.69	4.24	.70	4.24	.69
Composite Mean	4.37		4.34		4.42	
FACTOR 4 Informed Skepticism						
Informed Skepticism	4.03	.83	3.94	.87	4.22	.68
Assumption recognition	4.09	.78	4.03	.76	4.18	.81
Constructive discontent	3.89	.83	3.86	.82	3.92	.83
Composite Mean	4.00		3.94		4.11	
DID NOT LOAD						
Problem Solving Ability	4.84	.37	4.86	.35	4.80	.42
Draw valid conclusions	4.75	.46	4.74	.47	4.76	.46
ATTRIBUTE SCALE MEAN	4.47		4.46		4.47	
HIGH	4.84		4.86		4.81	
LOW	3.89		3.86		3.92	

	TECHNICAL		BACCALAUREATE		GRADUATE	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
FACTOR 1 Perseverance & Open-mindedness						
Organization	4.59	.53	4.52	.62	4.31	.63
Objectivity	4.51	.63	4.57	.60	4.27	.75
Flexibility	4.74	.46	4.72	.49	4.61	.60
Persistence	4.31	.60	4.37	.64	4.23	.77
Open-mindedness	4.67	.51	4.76	.46	4.65	.55
Goal-orientation	4.50	.64	4.45	.61	4.31	.73
Precision	4.29	.69	4.24	.69	4.19	.71
Composite Mean	4.52		4.52		4.37	
High	4.74		4.76		4.65	
Low	4.29		4.24		4.19	
FACTOR 2 Intellectual Curiosity						
Inquiring Mind	4.80	.40	4.84	.38	4.82	.42
Intellectual Curiosity	4.71	.50	4.82	.40	4.81	.46
Spirit of Inquiry	4.51	.57	4.72	.50	4.70	.53
Composite Mean	4.67		4.79		4.77	
FACTOR 3 Analytical Mod						
Analytical mind	4.54	.60	4.74	.52	4.78	.42
Valid Inference Recognition	4.20	.64	4.40	.62	4.39	.66
Knowledge of Logic	4.07	.71	4.26	.67	2.17	.78
Precision	4.29	.69	4.24	.69	4.19	.71
Composite Mean	4.28		4.41		3.88	
FACTOR 4 Informed Skepticism						
Informed Skepticism	3.86	.90	4.01	.86	4.21	.69
Assumption recognition	3.95	.69	4.09	.80	4.20	.80
Constructive discontent	3.79	.81	3.92	.83	3.90	.85
Composite Mean	3.87		4.01		4.10	
DID NOT LOAD						
Problem Solving Ability	4.84	.37	4.88	.32	4.78	.44
Draw valid conclusions	4.79	.41	4.74	.46	4.70	.52
ATTRIBUTE SCALE MEAN	4.43		4.50		4.33	
HIGH	4.84		4.88		4.82	
LOW	3.79		3.92		2.17	

APPENDIX G

FREQUENCY SCALE: MEANS AND STANDARD DEVIATIONS FOR ALL, DEGREE, AND STULEV

	ALL		DEGREE			
			MASTER'S		DOCTORATE	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Written Nursing Care Plans	4.13	.98	4.26	.85	3.78	1.18
Written Papers	3.93	.97	3.76	1.01	4.26	.79
Lecture	4.01	.83	4.06	.83	3.88	.84
Discussion	4.20	.72	4.14	.71	4.33	.70
Concept Analysis	3.46	.95	3.33	.93	3.71	.94
Case Studies	3.53	.83	3.52	.81	3.55	.90
Programmed Instruction	2.26	.96	2.34	.96	2.09	.85
Multiple Choice Exams	4.04	1.17	4.29	1.01	3.50	1.30
Essay Examinations	2.46	1.23	2.23	1.19	2.95	1.19
Reflective Dialogue	3.37	.99	3.24	.97	3.63	1.00
Role Play	2.75	.90	2.74	.87	2.78	.97
Simulations	2.82	.94	2.85	.92	2.75	.99
Computer Assisted Inst.	2.49	1.05	2.52	1.07	2.40	1.02
Games	2.21	.95	2.20	.95	2.22	.97
Research/theory Critique	3.11	1.16	2.77	1.12	3.78	.93
Debate	2.32	1.11	2.12	1.04	2.73	1.15
Journals/Logs	3.12	1.26	3.10	1.30	3.17	1.20
Higher Order Questioning	3.45	.95	3.31	.94	3.72	.91
FREQUENCY SCALE MEAN	3.20		3.15		3.29	
HIGH	4.20		4.29		4.33	
LOW	2.21		2.12		2.09	

	STULEV					
	TECHNICAL		BACCALAUREATE		GRADUATE	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Written Nursing Care Plans	4.39	.75	4.25	.82	3.56	1.26
Written Papers	3.38	1.07	4.01	.92	4.27	.76
Lecture	4.15	.76	4.07	.83	3.75	.87
Discussion	4.04	.76	4.19	.72	4.35	.66
Concept Analysis	3.24	.91	3.43	.95	3.68	.98
Case Studies	3.44	.74	3.52	.85	3.63	.89
Programmed Instruction	2.45	.97	2.27	.96	2.08	.96
Multiple Choice Exams	4.67	.59	4.20	1.00	3.16	1.34
Essay Examinations	1.77	.97	2.44	1.20	3.12	1.16
Reflective Dialogue	3.06	.91	3.36	1.00	3.69	.99
Role Play	2.68	.84	2.78	.89	2.77	.98
Simulations	2.98	.85	2.79	.95	2.72	.99
Computer Assisted Inst.	2.67	1.07	2.48	1.03	2.33	1.06
Games	2.26	.91	2.19	.95	2.18	1.00
Research/theory Critique	1.97	.88	3.23	.98	3.90	.85
Debate	1.86	.96	2.22	1.06	2.88	1.10
Journals/Logs	2.85	1.30	3.18	1.29	3.27	1.17
Higher Order Questioning	3.15	.94	3.44	.94	3.70	.91
FREQUENCY SCALE MEAN	3.06		3.23		3.28	
HIGH	4.67		4.25		4.35	
LOW	1.77		2.19		2.08	

APPENDIX H

VALUE SCALE: FACTOR LOADINGS, CORRELATIONS, AND MEANS AND STANDARD DEVIATIONS

Value Scale Factor Loadings

Variable	Factor 1	2	3	4	5
ROLE PLAY	.81	.03	.13	-.05	.06
SIMULATION	.80	-.02	.06	.20	.05
GAMES	.72	.16	.07	.15	.01
RESEARCH/THEORY CRIT.	-.10	.74	.21	-.03	.03
ESSAY EXAM	.17	.63	-.001	.09	.05
DEBATE	.11	.62	.26	-.03	-.19
DISCUSSION	.06	-.10	.71	-.01	.32
CONCEPT ANALYSIS	-.76	.25	.64	.12	-.16
CASE STUDY	.23	.04	.55	.23	.05
REFLECTIVE DIALOGUE	.23	.35	.51	-.11	-.13
HIGHER ORDER QUESTIONING*	.09	.04	.39	.48	-.10
JOURNALS/LOG*	.32	.21	.34	-.02	.18
COMPUTER ASSISTED INST.	.23	-.01	.16	.79	.1
PROGRAMMED INSTRUCTION	.07	-.01	.01	.77	.11
MULTIPLE CHOICE EXAM	-.04	.004	.01	.64	.35
LECTURE	.003	-.25	.16	.26	.66
WRITTEN NURSING CARE PLANS	.11	.004	.01	.19	.65
WRITTEN PAPERS	.06	.53	.01	-.11	.59

*Variable failed to load on any factor

Value Scale Correlation Matrix

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	VNCP	1.00																	
2	VPAPERS	.23	1.00																
3	VLECTURE	.27	.14	1.00															
4	VDISC	.14	.14	.27	1.00														
5	VCONANAL	.04	.09	-.03	.25	1.00													
6	VCASESTU	.14	.11	.10	.26	.26	1.00												
7	VPI	.18	.04	.29	.11	.04	.17	1.00											
8	VMCE	.27	.07	.32	.05	.01	.09	.35	1.00										
9	VESSAY	0.00	.25	-.01	.12	.13	.12	.06	.05	1.00									
10	VDIALOG	-.05	.16	-.08	.27	.29	.20	.02	-.10	.25	1.00								
11	VROLEPLA	.13	.06	.08	.14	.08	.18	.07	0.00	.14	.25	1.00							
12	VSIM	.17	.06	.09	.14	.03	.22	.17	.11	.09	.13	.56	1.00						
13	VCAI	.20	.01	.20	.12	.06	.20	.50	.34	.04	0.00	.14	.35	1.00					
14	VGAMES	.10	.12	.04	.10	.10	.23	.17	.08	.20	.20	.42	.45	.22	1.00				
15	VCRITIQ	.07	.28	-.08	.08	.27	.12	-.04	-.06	.27	.28	.04	-.02	-.01	.05	1.00			
16	VDEBATE	-.01	.18	-.15	.11	.29	.18	-.05	-.10	.25	.30	.16	.10	-.01	.13	.04	1.00		
17	VJOURLOG	.06	.22	.07	.17	.16	.29	.13	.05	.15	.22	.22	.15	.05	.29	.15	.16	1.00	
18	VHOQ	.06	.19	-.02	.26	.25	.15	0.00	-.01	.14	.31	.12	.10	-.01	.13	.36	.20	.23	1.00

Value Scale
Means and Standard Deviations Arranged By Factors
for All, DEGREE, and STULEV

	ALL		DEGREE: MASTER'S		DEGREE: DOCTORATE	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
FACTOR 1 Simulation Activities						
Role Play	3.70	.75	3.71	.73	3.70	.82
Simulations	3.81	.75	3.82	.73	3.79	.77
Games	3.45	.82	3.44	.81	3.46	.85
Composite Mean	3.65		3.65		3.65	
FACTOR 2 Critique						
Research/theory Critique	4.30	.75	4.18	.78	4.51	.63
Essay Examinations	3.97	.78	3.93	.80	4.06	.73
Debate	4.15	.79	4.07	.81	4.29	.72
Composite Mean	4.14		4.06		4.29	
FACTOR 3 Interactive Activities						
Discussion	4.40	.55	4.40	.53	4.42	.56
Concept Analysis	4.41	.67	4.39	.67	4.46	.67
Case Studies	4.21	.69	4.22	.70	4.17	.68
Reflective Dialogue	4.23	.66	4.15	.66	4.38	.63
Composite Mean	4.31		4.29		4.36	
FACTOR 4 Objective Question Activities						
CAI	3.50	.83	3.56	.79	3.37	.90
Programmed Instruction	2.89	.95	2.98	.93	2.73	.96
MCEs	3.43	1.00	3.57	.95	3.15	1.04
Composite Mean	3.27		3.37		3.08	
FACTOR 5 Writing & Lecture						
Lecture	3.03	.97	3.03	.97	3.01	.99
Written NCPs	4.04	.88	4.11	.82	3.83	.09
Written Papers	4.15	.75	4.07	.76	4.31	.69
Composite Mean	3.74		3.74		3.72	
DID NOT LOAD						
Journals/Logs	3.68	.89	3.69	.91	3.65	.88
Higher Order Questioning	4.43	.67	4.39	.67	4.48	.68
VALUE SCALE MEAN	3.88		3.87		3.88	
HIGH	4.43		4.40		4.51	
LOW	2.89		2.98		2.73	

	STULEV					
	TECHNICAL		BACCALAUREATE		GRADUATE	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
FACTOR 1 Simulation Activities						
Role Play	3.73	.73	3.70	.74	3.69	.81
Simulations	3.93	.64	3.82	.75	3.89	.79
Games	3.47	.82	3.45	.82	3.42	.82
Composite Mean	3.71		3.66		3.60	
FACTOR 2 Critique						
Research/theory Critique	4.01	.78	4.30	.74	4.52	.68
Essay Examinations	3.84	.87	3.94	.81	4.14	.64
Debate	3.89	.73	4.15	.82	4.35	.71
Composite Mean	3.91		4.13		4.34	
FACTOR 3 Interactive Activities						
Discussion	4.36	.49	4.44	.56	4.40	.55
Concept Analysis	4.26	.63	4.49	.67	4.44	.69
Case Studies	4.18	.70	4.22	.73	4.24	.63
Reflective Dialogue	4.06	.65	4.21	.65	4.41	.65
Composite Mean	4.22		4.34		4.37	
FACTOR 4 Objective Question Activities						
CAI	3.68	.77	3.53	.81	3.26	.86
Programmed Instruction	3.05	.94	2.90	.96	2.76	.92
MCEs	3.73	.89	3.53	.98	3.02	1.01
Composite Mean	3.49		3.32		3.01	
FACTOR 5 Writing & Lecture						
Lecture	3.20	.95	2.94	1.01	3.01	.95
Written NCPs	4.24	.72	4.08	.84	3.72	1.01
Written Papers	3.88	.75	4.20	.73	4.32	.71
Composite Mean	3.77		3.74		3.68	
DID NOT LOAD						
Journals/Logs	3.63	.87	3.72	.91	3.64	.92
Higher Order Questioning	4.33	.69	4.49	.62	4.41	.73
VALUE SCALE MEAN	3.86		3.90		3.86	
HIGH	4.36		4.49		4.52	
LOW	3.05		2.90		2.76	

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VITA

The author, Cynthia Neomi Sander, is the daughter of Ellen Neomi Peterson Sander and the late Paul Hjalmar Sander. She was born on October 19, 1939 in Chicago, Illinois.

Her elementary education was obtained in the public schools of Chicago, Illinois and Nybro, Sweden. Her secondary education was completed in 1956 at Glenbard Township High School in Glen Ellyn, Illinois.

In June 1956 Ms. Sander entered Wheaton College, Wheaton, Illinois, and completed her freshman year of studies. She entered West Suburban Hospital School of Nursing, Oak Park, Illinois, in September 1957 and received her diploma in nursing in November 1960. She re-entered Wheaton College in September 1961 and graduated with the degree Bachelor of Science with a major in nursing in August 1962.

The recipient of a United States Public Health Service Traineeship, Ms. Sander enrolled in graduate study at the University of Pennsylvania in September 1967. She received the degree Master of Science in Nursing with a major in nursing of children and a minor in education in August 1969.

Between 1960 and 1963 Ms. Sander held a position as pediatric staff nurse at West Suburban Hospital, Oak Park, Illinois. From 1963 to 1966 she served as Instructor in Pediatric Nursing at The Genesee Hospital School of Nursing, Rochester, New York and from 1966 to 1967 as Instructor in Pediatric Nursing at the Hospital of the University of Pennsylvania School of Nursing, Philadelphia, Pennsylvania. In September 1969 she assumed a faculty position as Instructor and subsequently Assistant Professor at The University of Iowa, College of Nursing, Iowa City, Iowa, where she remained until December 1975. During 1976 and 1977 she served as Sister-Tutor at the Gundersen-Horness Mission Hospital School of Nursing in Karanda, Zimbabwe, Africa. From 1978 to 1982 she held the position of Assistant Professor at the University of Illinois at the Medical Center, College of Nursing, Chicago, Illinois. In 1983 she joined the faculty of West Suburban College of Nursing, Oak Park, Illinois, as Assistant Professor. In 1985 she assumed the role of Academic Dean and from 1990 to 1991 served as Acting Provost. She currently is a faculty member at the rank of Associate Professor at West Suburban College of Nursing.

Ms. Sander is a member of the American Nurses' Association; the Illinois Nurses Association; the National League for Nursing; the Illinois League for Nursing; the Association for Care of Children's Health; Sigma Theta Tau,

International, Alpha Lambda Chapter; and the American Association of Higher Education.

She has co-authored one article, "Nurses' Perceptions of Pediatric Nurses' Functions," published in the Spring 1982 issue of Children's Health Care. In June 1991 she presented a poster, "Nursing Faculty Perceptions of Critical Thinking," at the National League for Nursing biennial convention in Nashville, TN. In February 1992 she presented a paper, "Nursing Faculty Perceptions of Critical Thinking," at the annual meeting of the NLN Council of the Society for Research in Nursing Education Forum in San Francisco, CA.

The dissertation submitted by Cynthia N. Sander has been read and approved by the following committee:

Dr. Anne M. Juhasz, Director
Professor, Educational Psychology
Loyola University of Chicago

Dr. Elizabeth Brophy
Associate Professor, Nursing
Loyola University of Chicago

Dr. Ronald A. Morgan
Associate Professor, Educational Psychology
Loyola University of Chicago

The final copies have been examined by the director of the dissertation and the signature that appears below verifies the fact that any necessary changes have been incorporated and that the dissertation is now given final approval by the Committee with reference to content and form.

The dissertation is, therefore, accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

March 23, 1992
Date

Anne M Juhasz
Director's Signature