The Effect of an Educational Model, Developing Nurses' Thinking (DNT), on Nursing Students' Accurate Diagnoses of Patients' Responses to Health Problems

by

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Abstract

The Effect of an Educational Model, Developing Nurses' Thinking (DNT), on Nursing Students' Accurate Diagnoses of Patients' Responses to Health Problems

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Sponsor: Margaret Lunney

This was a quasi-experimental study, pretest and posttest design, to determine whether use of the Developing Nurses' Thinking (DNT) model during two weeks of clinical post conferences improved nursing students' diagnostic accuracy. The DNT model integrates four constructs, patient safety, domain knowledge, critical thinking processes, and repeated practice, to guide students' thinking when interpreting patient data and developing effective plans of care. Two accompanying worksheets helped students to operationalize the model and provided guidance for thinking processes. Students (N = 83) from two baccalaureate degree programs in the first clinical nursing courses volunteered to participate in the study. Two sets of two parallel case studies were developed for the pretest and posttest and validated by three experienced faculty. Diagnostic accuracy was measured on a seven point scale using the Lunney Scoring Method. Statistical analyses included independent t – test, paired t – test, and general linear regression modeling. The results were that both groups of students varied widely in accuracy of nursing diagnosis. The hypothesis was supported in that the intervention group had statistically significant improvement in accuracy posttest scores compared to those in the control group. The results were consistent with previous studies that

accuracy varied and use of a teaching aid such as the DNT model helped nursing students to improve accuracy. The implications are that use of a model that integrates the constructs of patient safety, domain knowledge, critical thinking process, and repeated practice, the DNT model, may help nursing students to develop effective thinking habits in the context of patient safety and improve diagnostic accuracy.

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Dedication

This dissertation is dedicated to my parents Terry and Vinny McCaffery for always helping me believe that anything is possible.

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Chapter One

The Research Objective

Patient safety is a national concern because of the many thousands of unwarranted illnesses and deaths occurring from errors made by health care professionals, including errors made by nurses (Cronenwett, Sherwood, & Gelman, 2009; Institute of Healthcare Improvement, nd.a, nd.c; Institute of Medicine, 2000, 2004; Nolan, 2007). Redesigning a safer healthcare system is a top priority for all healthcare agencies and nursing has been identified as "having the potential for making the biggest impact on a transformation of healthcare delivery to a safer, higher quality, and more cost effective system" (American Association of Colleges of Nursing [AACN], 2008, p. 5). Nurses impact patients' care when they diagnose and treat patients' responses to health problems (NANDA International, 2009; New York State Nurse Practice Act, 2009). To implement the most effective interventions, nurses need to correctly interpret data to derive accurate nursing diagnoses, e.g., *Anxiety*.

Accuracy of nursing diagnosis refers to the match between patient data and a diagnostic statement (Lunney, 1990, 2008a.). "A nursing diagnosis is a clinical judgment about an individual, family or community response to actual or potential health problems/life processes, which provides the basis for definitive therapy toward achievement of outcomes for which a nurse is accountable" (NANDA-I, 2009, p. 367). There are 220 research-based nursing diagnoses approved for inclusion in the NANDA-I classification.

Being able to name patients' responses to health problems using a standard terminology such as NANDA International (I), enables nurses to think about possible

problems and risk states because nurses, as other human beings, think and communicate with words (Hayakawa & Hayakawa, 1990). NANDA-I is an evidence-based classification of human responses to health problems and life processes that includes labels, definitions, and descriptions (NANDA-I, 2009). Use of this classification encourages accurate diagnoses of situations that threaten patient safety, e.g., *Impaired Gas Exchange*, *Ineffective Airway Clearance*, *Decreased Cardiac Output*, *Risk for Shock,* and *Excess Fluid Volume.* Nurses' diagnoses of patients' responses to health problems contribute to patient safety goals by guiding nursing and interdisciplinary interventions to treat these responses at early stages of their occurrence.

Studies have shown that there is wide variation in nurses' interpretations of clinical data, with many of these interpretations being low accuracy (del Bueno, 2005; Hasegawa, Ogsawara & Katz, 2007; Lunney, 2008a, 2009a,b; Muller-Staub, Lavin, Needham, & von Achterberg, 2006a; Tanner, 2006a). One study identified that only 35% of newly graduated registered nurses possessed adequate clinical judgment (del Bueno, 2005). Inaccurate interpretations of patients' responses to health problems increase the risk of inappropriate interventions, which can negatively affect patient safety (del Bueno, 2005; Hasegawa, 2007; JCAHO, 2008; Lunney, Karlik, Kiss, & Murphy, 1997).

Nursing programs are expected to prepare graduates to accurately interpret clinical data and develop plans of care that guide the delivery of high quality, safe, effective, and efficient patient-centered care. Accurate identification of patient's responses to health problems and development of plans of care linked to etiology provide the basis for use of content or domain knowledge. There are no reported studies that

measure the effects on accuracy of nursing diagnoses after teaching students how to develop their thinking processes.

Responding to the need for educational curricula changes to help nursing students accurately identify patients' problems and develop appropriate plans of care in the context of patient safety, the researcher developed and has been using the educational model, Developing Nurses Thinking (DNT), which is the independent variable to be examined in this study. Using the DNT model, the educator and students guide thinking processes for interpretation of patient data, generation of diagnostic hypotheses, selection of accurate nursing diagnoses, and appropriate nursing interventions. The DNT model integrates four constructs of nursing education in order to improve nursing student's intelligence for diagnosing human responses to health problems: (a) patient safety, (b) domain knowledge, (c) critical thinking, and (d) repeated practice. The purpose of this study is to validate that the DNT model performs as expected and to refine the model as indicated by results of the study.

The Problem

What is the effect of using an educational model, Developing Nurses Thinking (DNT), on nursing students' accuracy of nursing diagnoses?

Definitions

Accuracy of Nursing Diagnosis. Accuracy of nursing diagnosis is a rater's judgment about the degree that the diagnostic statement matches the data or cues of a patient's clinical situation (Lunney, 1990). For this study, the accuracy of nursing diagnoses will be measured using students' data interpretations of two written case

studies. The Lunney scoring method (Lunney 1990, 2001) will be used to rate the accuracy of the data interpretations.

Educational Model (DNT). The Developing Nurses' Thinking Model (DNT) is a model for educators to focus on improving students' thinking processes by integrating (a) patient safety, (b) domain knowledge, (c) nursing-specific critical thinking processes, and (d) repeated practice to accurately interpret patient data, name data interpretations, and develop plans of care. The DNT model was used during two weeks, four hours, of clinical post conferences that focused on applying domain knowledge related to respiratory and oxygenation health problems. Students used this model to interpret actual patient data that was collected during clinical experiences.

Patient Safety. Patient safety is "freedom from accidental injury" (IOM, 2000, p 211).

Domain Knowledge. Domain knowledge is the knowledge that nurses use when interpreting patient data to solve patients' problems. The domain knowledge that is used by nursing students is derived from the sciences and humanities and includes pathophysiology of disease states, possible patients' responses to disease, NANDA-I nursing diagnoses, and possible treatment options for effective plans of care.

Critical Thinking in Nursing. Critical thinking in nursing is the mental processes used by nurses to solve domain-specific problems (Scheffer & Rubenfeld, 2000). In this study, the problem to be solved is "what is the accurate diagnosis?" The 17 critical thinking processes identified by Scheffer and Rubenfeld (2000) are being used in this study.

Repeated Practice. Repeated practice is the repetition of a process two or more times (Willingham, 2008). In this study, repeated practice was represented by using the model during four one-hour or two two-hour clinical post conferences that focused on respiratory and oxygenation responses to health problems, such as disease states or the functional status of immobility.

Delimitations

This study was delimited to baccalaureate nursing students in their first clinical nursing course in a public and private nursing school. In this study, beginning students were being taught the educational model because developing nurses' thinking should begin with first semester students.

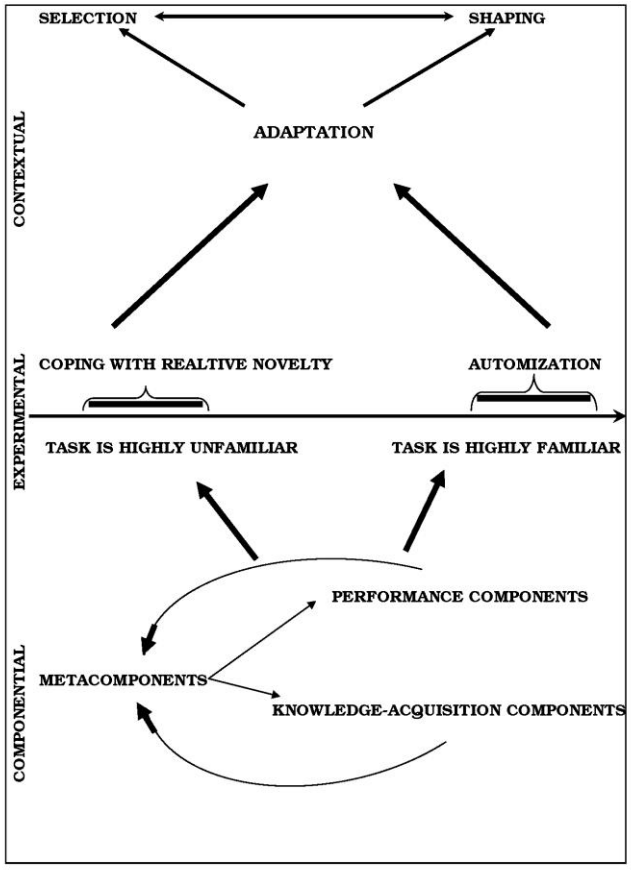
Theoretical Framework

The theoretical framework for this study is Sternberg's Theory of Human Intelligence, The Triarchic theory (Sternberg, 1985, 1988, 1997). In the Triarchic theory, intelligence is defined as a type of "mental self-management" (Sternberg, 1988, p. 11) that is purposively used to choose, adapt, and shape "real-world environments relevant to one's life and abilities" (Sternberg, 1988, p. 65; See Figure 1.2). Successful intelligence occurs when individuals capitalize on strengths and compensate for or correct weaknesses (Sternberg, 1997). Intelligence relates to the interaction of the "internal world of the individual, the external world, and the experience with the world that mediates between the internal and external worlds" (1988, p. 57-58). This theory refutes traditional theories that intelligence is represented by psychometric measures, such as IQ tests, and postulates that intelligence is improved through learning with education and

practice in the real world, e.g., nursing practice experience (Sternberg, 1988, 1997; see Figure 1).

The Internal World (componential). The Triarchic theory associates the internal environment, or information- processing, with three universal components; metacognitive, knowledge acquisition, and performance (Sternberg, 1988). Use of these

Figure 1.1



Relationships among the various aspects of the triarchic theory of human intelligence

Source: From *The triarchic mind: A new theory of human intelligence* (p. 68), by R.J. Sternberg, 1988, New York: Penquin Books. Reprinted with permission.

components represents analytical intelligence that can be described as involving "conscious direction of … mental process to find a thoughtful solution to a problem" (Sternberg, 1997, p. 155) and make decisions.

Metacomponents are the executive branch of thought processes that guide, direct, monitor, and evaluate problem solving (Sternberg, 1988, 1997). These components are used to identify problems to be solved and determine the intellectual course of action to derive solutions. These components monitor outcomes of the processes and redirect thinking strategies when desired outcomes are not realized. For example, when nurses interact and assess patients they must be able to determine if a phenomenon exists that requires intervention. They then must decide what types of thinking skills are needed to understand the meaning, extent, and urgency of the phenomena, and plan appropriate interventions. This component monitors the accuracy of the interpretation and redirects thinking processes if accuracy is not confirmed. Metacomponents determine what and how to communicate with other health professionals, and evaluate the effectiveness of interventions. The metacomponents regulate and monitor thinking by requiring the person to reflect on the integrity of thinking processes (Sternberg & Williams 1998). Once the metacomponents have determined a strategy to solve nursing problems, the metacomponents activate the performance components (Sternberg, 1985, 1988).

Performance components are used in the execution of problem solving and involve encoding, clustering, and comparing and contrasting information (Sternberg, 1985, 1988). For example, when nurses evaluate assessment data, they must encode and cluster cues to determine meaning and develop hypotheses. They may apply standards such as NANDA-I defining and related characteristics of patient problems to determine if

the cues either confirm or disconfirm the proposed hypothesis. When additional knowledge and information is required to solve nursing problems, the metacomponents activate the knowledge acquisition components (Sternberg, 1985, 1988).

Knowledge acquisition components select the type and source of knowledge required to solve problems (Sternberg, 1985, 1988). Using the knowledge acquisition components, nurses choose the evidence-based criteria upon which to base a diagnosis and interventions. Examples of resources with evidence-based criteria are data-based research articles, books on nursing diagnoses, and hospital protocols. Knowledge acquisition also leads nurses to obtain more information from patients and families and validate the accuracy of problems with patients and other health care professionals

The External World (contextual). In Sternberg's theory, the external world is included because intelligence is believed to occur in relation to the adaptation, shaping, and selection of environments (Sternberg, 1985, 1988, 1997). This is a type of practical intelligence. For example, nurses may care for multiple patients with varying respiratory assessment findings. The meanings of these findings will be determined within the context of presenting manifestations, past history, risk states, and patients' experience of the phenomena. In order to promote positive patient outcomes, solutions will be selected and adapted to meet the individual needs of each patient

The Experience of the Individual. Specific mental processes occur on a continuum from new or novel to routine or automatic. The three components of the internal environment described above are "applied to tasks and situations at varying levels of experience" (Sternberg, 1988, p. 60, 1997). This component of intelligence addresses how well a task is performed and repeated practice improves performance. For

example, nurses who frequently care for patients with respiratory problems will automatically conduct respiratory assessment and derive the meanings of findings without more regulated and deliberate thought processes (Benner, 1984).

Implications for Using Sternberg's Theory. Using Sternberg's theory, the purpose of education is to generate successful intelligence in students (Sternberg 1997, Sternberg & Williams, 1998). Educators accomplish this goal by developing integrated learning environments that promote the use of memory, analytical, and experiential thinking abilities in which students learn by doing (Sternberg & Williams, 1998). Memory is promoted by students completing class assignments, acquiring data, and then using that data to solve problems. Analytical thinking is promoted by the use of structured systems to interpret the meaning of data to derive conclusions. Experiential thinking is promoted by providing repeated practice with similar tasks. Structuring education programs in this way enables students to capitalize on strengths and identify and correct weaknesses (Sternberg & Williams, 1998).

Development of Nurses' Thinking Model

The Developing Nurses' Thinking (DNT) model integrates Sternberg's call for instruction and repeated practice of critical thinking with domain knowledge to improve intelligence. The DNT model addresses Sternberg's three environments in which intelligence is developed: the internal environment in which domain knowledge is attained and critical thinking processes occur, the external environment in which the context such as patient safety is considered, and the effect of experience is attained through repeated practice of using the thinking processes with domain knowledge. Using this model, improvement in accurate identification of patients' responses to health

problems is considered an indicator of improved intelligence in relation to the specific types of situations presented to students.

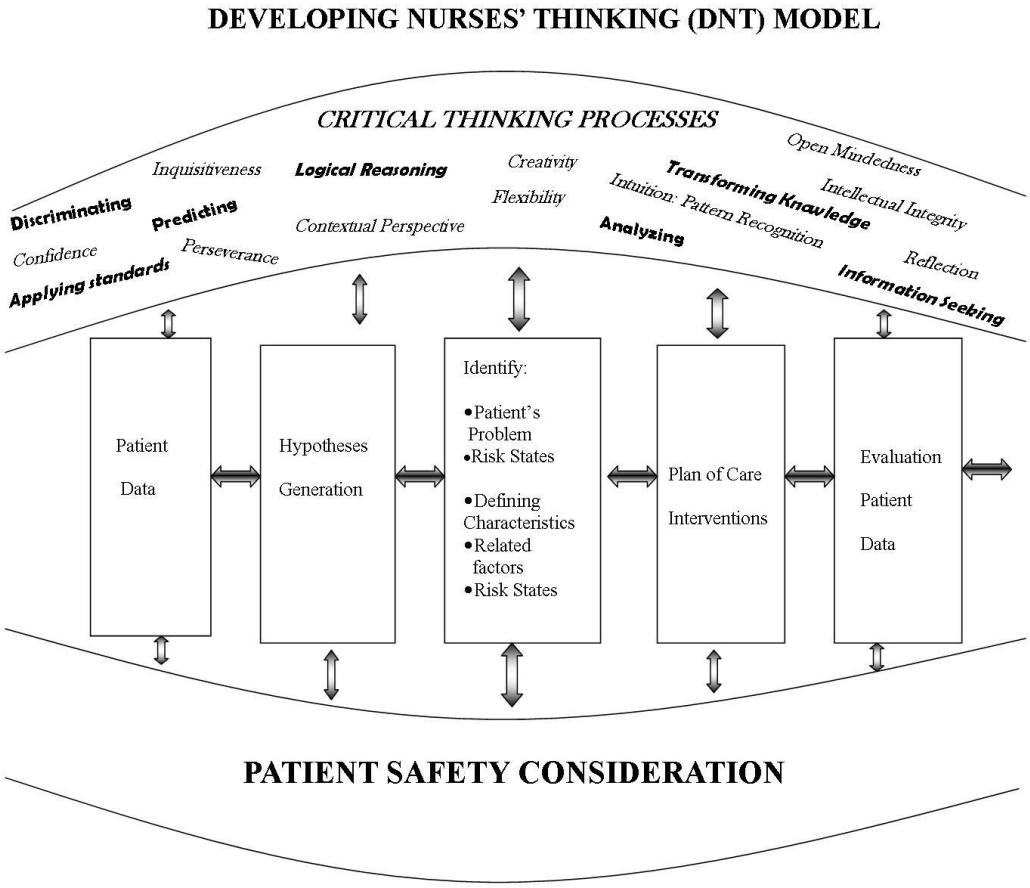
The DNT educational model is used to help students learn to think like nurses (Scheffer & Rubenfeld, 2000, 2010; Tanner, 2006a). Two worksheets are used to guide students thinking and actively engage them in the learning process (Appendix A). Use of the worksheets promotes identification of the thinking processes needed to identify accurate diagnoses as the basis for plans of care and provides a thinking map on which students can reflect after conclusions have been made. Four research-based components were integrated to help students develop thinking processes. i.e., patient safety, domain knowledge, critical thinking processes, and repeated practice (see Figure 1.2). The model facilitates students' purposeful use of each component.

Using the DNT model, the educator incorporates patient safety as the context for decision making by asking students to consider patient safety at each step. For example, the student may ask, "if this is the problem, does it pose a risk to the patient's safety. If yes, what is that risk?"

Patient safety is included in all aspects of the thinking process and considered when prioritizing plans of care. The concept of patients' safety is imbedded in the model to assure its inclusion in students' thinking habits and promote its consideration in all nurse-patient interactions.

Nursing's domain knowledge is used with the model, e.g., knowledge of disease states, patients' responses to health problems, and related nursing care. Students apply knowledge of nursing diagnosis labels, defining characteristics, and related factors

Figure 1.2: The Developing Nurses' Thinking (DNT) Model



(NANDA-I, 2009) to derive possible diagnoses and confirm or disconfirm diagnostic hypotheses. Development of appropriate plans of care requires that students correctly identify the diagnoses and identify evidenced-based interventions to meet patient goals.

Critical thinking processes are thought processes that are "dependant on domain knowledge and repeated practice" of thinking skills (Willingham, 2008, p. 22). The 17 critical thinking processes that are important for nursing were named and defined in a Delphi study by Scheffer & Rubenfeld (2000). These are 7 cognitive skills: "analyzing, applying standards, discriminating, information seeking, logical reasoning, predicting and

transforming knowledge", and "10 habits of the mind: confidence, contextual perspective, creativity, flexibility, inquisitiveness, intellectual integrity, intuition, open-mindedness, perseverance, and reflection" (Scheffer & Rubenfeld, 2000, p. 353).

These nursing-specific critical thinking processes are used in the model to introduce students to thinking processes that are important for identification of accurate diagnoses (Lunney, 2001, 2009b). At each step of thinking about data from a specific patient, either from clinical practice or a written case study, the necessary thinking processes are identified. Students specify which cognitive skill(s), e.g., *analyzing*, and which habit of the mind, e.g., *intellectual integrity*, is being used. The discussion of critical thinking processes promotes the formation of thinking habits (Sternberg, 1988, 1998).

Students use the DNT model to structure their thinking when considering patients' data. For example, they may identify the process of *analyzing* when identifying cues to be clustered for the generation of diagnostic hypotheses or *flexibility* to assure that flexible thought processes are included when choosing hypotheses. When diagnostic hypotheses are generated, the processes of *applying standards* and *discriminating* may be used to confirm or disconfirm the hypotheses. Attention to *intellectual integrity* may be used to assure that students are not guessing when *applying standards* and are using appropriate domain knowledge. At each step of thinking processes, students are directed to consider patients' safety. For example, "if this diagnosis is selected, will it impact the patient's safety? If yes, what is that risk?" Based on the identified nursing diagnosis, a plan of care, including interventions, is developed. When using the model, not all critical

thinking processes are always used; students actively consider which of the thinking processes are needed.

Repeated practice in the use of thinking processes to interpret patient data is needed to establish this type of thinking as a habit and to facilitate understanding of the process (Willingham, 2008). Formation of thinking habits can occur when processes are repeatedly used to solve domain-specific problems (Sternberg, 1988, 1997; Willingham, 2008).

Nursing studies support each component of the educational model (e.g., Crispin & Daffurn, 1998; Scheffer & Rubenfeld, 2000; Hasegawa et. al. 2007; Palese, De Silvestre, Valoppi & Tomietto, 2009). However, there are no nursing studies of the integration of these four components to help nursing students develop their use of thinking concepts to achieve improved interpretations of clinical data.

Research Hypothesis

Nursing students who are taught and practice the Developing Nurses' Thinking (DNT) model, to interpret patient data, will have greater improvements in accuracy of nursing diagnosis for the two specified written case studies than nursing students who do not use the DNT model.

Need for the Study

Delivery of safe care has been identified in a report published by the Institute of Medicine (2000) estimating that as many as 98,000 deaths occur in hospitals per year as a result of errors. Identification of patients at risk for serious health problems such as cardiac arrest occurs most frequently by nurses because they are the health care professionals that provide 24 hour care to hospitalized patients (Buist et al., 2002; Clarke

& Aiken, 2003). Accuracy of nurses' interpretations of patient data are needed so that appropriate interventions can be initiated. Yet, studies have shown that accuracy of nursing diagnoses of patient responses to health problems varies widely, which means that many data interpretations are inaccurate (del Bueno, 2005; Hasegawa et al., 2007; Lunney, Karlik, Kiss & Murphy, 1997; Lunney 2008a; Tanner, et. al, 1987).

In del Bueno's (2005) study of clinical judgment (n = 31,401), it was found that many inexperienced nurses incorrectly used nursing diagnosis labels thereby negatively impacting accuracy. The use of standardized names, as in the NANDA-I nursing diagnosis classification system, is needed because it includes definitions, defining characteristics and related factors that help nursing students to understand and communicate patients' responses to health problems (Hayakawa & Hayakawa, 1990; NANDA-I, 2009).

Evidence of the effectiveness of educational strategies is needed for implementation of such strategies in schools of nursing (Cruz, Pimenta, Lunney, 2009; Muller-Staub, Needham, Odenbreit, Lavin & van Achterverg, 2008; Tanner, 2006a, 2006b). Nursing curricula need to incorporate educational strategies and models to promote accurate identification of patients' responses to health problems so that graduates will deliver safe nursing care (AACN, 2008; Cronenwett, Sherwood, Gelman, 2009; Cronenwett, et. al., 2007).

An educational model is needed to motivate students to accurately identify priority patient responses to health problems (Sternberg, 1988, 1997; Sternberg & Williams, 1998) in the context of promoting patient safety outcomes. Studies that relate to patient safety are particularly needed (AACN, 2008; Cronenwett, Sherwook, Gelmon,

2009; del Bueno, 2005; IOM, 2000, 2003, 2004). Asking questions that prompt nursing students to think about the relation of data interpretations to patient safety or risk may provide the confidence needed for them to communicate patient safety issues to others by stating an accurate diagnosis. Incorporating the concept of patients' safety into an educational model highlights its importance in all aspects of the diagnostic reasoning process and provokes consideration and implications in all nursing decisions.

Specific types of domain knowledge are needed in educational models because knowledge of health problems, possible responses to health problems, and how these responses occur, i.e., pathophysiology, serve as the foundation upon which nurses can think about data interpretations (Gordon, 1994). Using Sternberg's theory and research evidence in critical thinking, it was shown that domain knowledge must be integrated with critical thinking processes in order to improve thinking and intelligence (Sternberg, 1988, 1997; Willingham, 2007)

The critical thinking processes that are important for nursing were identified in research and need to be included in educational models to provide nursing students with the names and definitions of thinking processes (Scheffer & Rubenfeld, 2000). In studies with nurses, instruction in the self-regulation of thinking processes was shown to improve diagnostic accuracy (Cruz, et. al., 2009; Muller-Staub, et. al., 2008). When teachers provide beginning nursing students with opportunities to practice critical thinking with domain knowledge to interpret and name clinical data, it may improve intelligence for diagnostic accuracy (Sternberg, 1988; Willingham, 2007, 2008). The 17 critical thinking skills and habits of the mind identified in research and the NANDA-I diagnoses serve as a framework for students to structure thinking and diagnostic reasoning and develop

habits of thinking to accurately interpret assessment data (Cholowski & Chan, 2004; NANDA-I, 2009; Scheffer & Rubenfeld, 2000).

Repeated practice is needed with domain-specific knowledge because, without it, students' only attain a superficial understanding of an issue or problem (Willingham, 2007). Knowledge of the deep structure of patients' responses to health problems can be attained when thinking processes and domain-specific knowledge are integrated and repeatedly practiced. For example, nursing students who care for patients with similar responses to health problems, e.g. oxygenation disturbances, should come to recognize these problems when encountered in the future (Tanner, 2006a; Willingham, 2008).

This study will measure the effects of teaching and using the Developing Nurses' Thinking (DNT) Model on accuracy of nursing students' diagnoses. NANDA-I will be used with the DNT model for naming nursing diagnoses. The DNT model focuses on the concept of patients' safety and incorporates domain knowledge with nursing-specific critical thinking processes, and repeated practice to accurately interpret patient data, name the interpretation, and develop plans of care (Appendix A). The process of using the DNT model will be repeated during clinical post conferences in two schools of nursing over a two week period for a total of four hours.

Chapter II

Review of the Literature

This literature review focuses on the dependent variable, accuracy of nursing diagnoses, and the independent variable, the educational model of Developing Nurses' Thinking. Theories and research that relate to accuracy of nursing diagnoses are described and include the NANDA-International classification of nursing diagnoses. Supporting research are explained for dimensions of the Developing Nurses' Thinking (DNT) model, i.e. patients' safety, domain knowledge, critical thinking processes, and repeated practice

Accuracy of Nursing Diagnoses

Previous nursing studies have shown that accuracy of nurses' interpretations of patient data vary widely, which means it is a problem that should be addressed (del Bueno, 2005; Cruz et al., 2009; Hasegawa et al., 2007; Lunney, 1992, 2001, 2008a; Lunney et al., 1997). This portion of the review will focus on literature regarding accuracy of nursing diagnoses both nationally and internationally and NANDA-I standardized nursing language and its impact on accuracy.

Nurses accurately identify patients' responses to health problems when they correctly interpret data, or cues, and state the meaning of the cues in diagnostic statements that match the cues (Lunney, 2008a; Lunney & Paradiso, 1995; Muller-Staub, et al, 2006a). Once data are interpreted, diagnostic statements are generated to effectively communicate to patients and interdisciplinary team members so that a plan of care can be developed. When data interpretations do not match with relevant patient data, subsequent interventions are not likely to help patients. Data interpretations vary

among nurses because determining a person's response is a complex process (Lunney, 1990, 1992). Each person has the potential to respond differently to health problems and life processes (Munhall, 1993). Also, many of the human responses identified as nursing diagnoses conceptually overlap with one another, such as powerlessness and hopelessness, which means that sophisticated analysis and logical reasoning are needed to achieve accuracy (Lunney & Paradiso, 1995).

In a review of research literature from 1966 to 2000, Lunney (2001) described the findings and conclusions from 25 studies in relation to factors within three main categories that influence accuracy, the nature of the diagnostic task, the situational context, and the diagnostician. The nature of diagnostic tasks differs in the relevance of data, amount of available data, and complexity of the diagnostic task. The findings of six studies were that increased amount of patient data, low relevant cues, and more complex clinical presentations decreased nurses' diagnostic accuracy. The situational contexts that affect nursing diagnostic accuracy were identified in seven studies as time constraints and the role of nurses in the healthcare delivery system. With time restrictions for the diagnostic process, nurses moved quickly to the phase of hypothesis-testing, rather than continuing with hypothesis generation. Diagnostician characteristics, identified in 21 studies, were educational preparation, thinking abilities, and experience in nursing. Nurses with higher levels of education and those who received specific education on the diagnostic process were more likely to identify accurate diagnoses. In teaching the diagnostic process, the teaching aids used in two of studies were shown to have a positive influence on accuracy. Five studies that included years of nursing experience were not conclusive. However, the findings were consistent with Benner's

(1984) framework, novice to expert, in that nurses were more accurate in diagnosing clinical situations with which they had experience.

One of the older studies reviewed by Lunney (2001) bears specific mention (Thiele, 1991) because it found that almost 30% of beginning students inaccurately diagnosed written clinical cases, after being taught the content in class and having the content reinforced in clinical experiences. Written case studies were administered to junior students (n = 82) during a two-hour clinical conference. Students correctly selected relevant cues 68% to 85% of the time and inaccurately selected non relevant cues as relevant 50% to 60% of the time. Diagnostic accuracy was found in 72% of student selections, however, that was with over-selection of cues. Students who were most accurate in choosing nursing diagnoses selected fewer cues when making their diagnosis. The rates of both accuracy and inaccuracy revealed students' lack of discrimination and prioritization between relevant and non relevant cues. The investigator recommended that educational teaching models be used to promote students' decision making and that "novice students must deliberately and consciously sort through cues to identify meaning" (p. 617).

The importance of variance in accuracy to the real world of nursing was noted in a clinical study of the accuracy of practicing nurses (N = 62) in three hospitals with 153 patients (Lunney et al., 1997). The mean years of experience of the nurses was eight years with 50% having bachelor's degrees and 50% having diploma or associate degrees. Scoring of diagnostic accuracy was conducted using the Lunney Scoring Method that consists of a range of diagnostic accuracy scores from +5, for the highest accuracy diagnoses, to -1, the least accurate diagnoses. Interrater reliability of accuracy ratings

was 0.95 using Spearman's rank-order correlation. Staff nurses assessed and diagnosed one to three patients who were admitted for elective procedures and whom they did not know. Nurses were asked to assess for actual psychosocial diagnoses and to state the most accurate diagnosis on the study form. Following staff nurse patient assessments, two masters prepared nurses who were extensively trained to rate accuracy simultaneously assessed the same patient and determined the most accurate diagnosis based on patient cues. These diagnoses were then considered the most accurate and staff nurse diagnoses were compared to these. Accuracy scores spanned all levels of accuracy, +5 to -1, which supports the validity of the scale. Accuracy scores were not significantly different for the three hospitals so data were collapsed to determine the mean score of 3.36 (*SD* = 1.74). A relatively high percentage of nurses' diagnoses (33%) were scored below 3, which is interpreted as low accuracy. There were no significant differences in accuracy for nurses with higher educational levels or attendance at continuing education classes. Discussion of factors that may have lead to low accuracy scores were the nature of the task with a possibility that lower scores occurred with complex cases. Diagnostician factors may have negatively impacted nurses' accuracy scores, such as knowledge of psychosocial patient responses, inadequate hypotheses generation, communication skills, and validation of nursing diagnoses with patients.

In a study of the nursing diagnosis of *pain*, nurses' pain ratings were compared with patients' pain ratings, i.e., the benchmark for accuracy, and it was found that nurses underestimated patient's pain (Puntillo et al, 2003). The accuracy of pain intensity scores by emergency department (ED) nurses were found to be less than 50% in a study that included 37 nurses and 156 patients. A research assistant asked all adult patients who

presented to the ED with complaints of pain to rate their pain using a visual pain scale with scores ranging from 0 to 10, 0 being no pain and 10 the "worst possible pain" (p. 172). The triage nurse subsequently assessed and asked patients to rate their pain using the same scale. Fifty four of 156 patients initially assessed in the triage area were reassessed using the same process when they were brought into the ED; same patients but different nurses. Significant differences were found between nurses' and patients' means in pain intensity scores in both the triage and clinical areas (5.1 +/- 2.4 versus 7.5 +/- 2.2, $p < .001$ and 4.2 +/- 2.3 versus 7.7 +/- 2.2, $p < .001$, respectively). The reason for the underestimation of pain intensity by nurses is not clear but inaccurate pain diagnoses by nurses can have a negative effect on patient outcomes by "causing appropriate treatment to be withheld" (p. 174).

Accuracy in nursing diagnoses was shown to vary among highly educated and experienced Brazilian nurses in a quasi-experimental study test the effects of a continuing education course on critical thinking (Cruz et al., 2009). Thirty-nine Brazilian nurses with baccalaureate degrees or higher completed 16 hours of continuing education over a four day period. Two validated case studies with interrater reliability of 0.96 were used to measure diagnostic accuracy in pre and post tests. Accuracy was measured using the Lunney scoring method. The findings were that there were significant differences between the pre and post test accuracy scores for case study one ($z = -2.63$, $p = .008$) and case study two ($z = -2.04$, $p = .042$), with overall improvement in accuracy ($z = -3.34$, $p = .001$). On average, the accuracy scores improved in 20.5% of participants in case study one and in 38% of participants for case study two. Notably, high percentages of participants did not achieve the highest levels of accuracy for either case study (case

study one (CS1) = 64.1%; case study two (CS2) = 71.8%). Possible explanations for lower accuracy scores could be participant lack of knowledge concerning concepts depicted in the case studies or that the course was not specific enough on how to apply critical thinking processes.

Diagnostic accuracy was also shown to vary in experienced medical-surgical Japanese nurses (Hasegawa et al., 2007). Surveys that included two case studies, an examination to test nursing diagnosis knowledge, and the Positions on Nursing Diagnoses Scale (PND) to measure attitude toward nursing diagnoses were mailed to 440 nurses from nine hospitals. The response rate was 85% (n = 376). A majority of respondents were female (97%) and were prepared in associate degrees nursing programs (58%). The nurse diagnostic competencies measured were accurate identification of nursing diagnosis label, ability to discriminate between high and low relevance cues and determine defining characteristics, and analysis of data or cues to determine diagnostic related factors and risk states. The case studies and priority nursing diagnoses were validated for content validity by 16 nurse experts and test-retest reliability was estimated with nursing students (Spearman's correlation coefficient: CS1 r_s = .446 +/- .40; CS2 r_s = .34 +/- .106). Findings of the study revealed that only 35% of the participants demonstrated all three competencies for case study one and 53% for case study two . The overall competency rates for determining accurate or relatively accurate diagnoses were 53% (n = 201) for case study one and 60% (n = 249) for case study two. Years of experience was positively related to competency in identifying priority diagnostic labels and nurses who were responsible for identifying nursing diagnoses in their professional roles had the highest percentage of competency rates for identifying defining

characteristics, related factors, and risk states. Knowledge of nursing diagnoses definitions was positively correlated with competency in identifying the accurate diagnostic label, case study one, accuracy 73% ($df = 2$, $x^2 = 23.79$, $p = < .0001$), and case study two, accuracy 81% ($df = 2$, $x^2 = 21.74$, $p = < .0001$). Nurses showed higher competencies in data analysis and data determination than in identification of diagnostic labels, suggesting that knowledge of nursing diagnoses influences diagnostic competency.

The clinical judgment of 30,000 nurses, both experienced and inexperienced, in identifying high priority patient problems was evaluated by del Bueno (2005). In addition, the nurses' abilities to select timely and effective interventions were measured. Over the 10 year study period, the nurses completed the Performance Based Development System (PBDS) assessment to "assess nurses' critical thinking and interpersonal skills ability" (p. 278). This assessment included three critical thinking and clinical judgment exercises. The PBDS is a valid and reliable tool that has been used in over 350 health care agencies in over 46 states. The first exercise requires the nurse to identify priority patient situations and "effectively manage those that are urgent" (p. 278). The second exercise is a visual activity in which nurses must recognize and manage intravenous complications. The third exercise, which was the one that carried the most weight in scoring, was nurse recognition and timely management of patients' problems by evaluating a series of video simulations. Analysis of data revealed that, for inexperienced nurses, a maximum of 35% possessed adequate clinical judgment, and, for experienced nurses, a maximum of 72% possessed adequate clinical judgment. Many inexperienced nurses inappropriately used nursing diagnoses when identifying patients'

problems. When nurses are not able to accurately interpret clinical data and identify priority problems, "the patient's problem is unlikely to be safely managed" (del Bueno, 2005, p. 279).

Nursing diagnostic accuracy was shown to vary in each study and being that diagnoses serve as the foundation upon which interventions are selected and quality outcomes achieved, low accuracy is a problem that needs to be addressed in both students and practicing nurses. Students need to be taught about accuracy and how to achieve accuracy because they should be ready to provide safe nursing care when they graduate.

NANDA International Classification of Nursing Diagnoses. Naming patients' responses to health problems using NANDA-I promotes understanding of the phenomena being named, allows nurses to monitor for accuracy by comparing assessment cues to diagnoses, and positively affects nurses' communication of patients' problems (Hayakawa & Hayakawa, 1990; Lunney, 2008a,b; Scheffer & Rubenfeld, 2000). Use of a standardized nursing language when naming patients' responses to health problems further promotes accuracy and communication because the name or label given to particular phenomena has the same meaning for all members of the health care team (Hayakawa & Hayakawa, 1990; NANDA-I, 2009).

"A nursing diagnosis is a clinical judgment about an individual, family or community response to actual or potential health problems/life processes, which provides the basis for definitive therapy toward achievement of outcomes for which a nurse is accountable" (NANDA-I, 2009, p. 367). Development and approval of nursing diagnoses by NANDA-I requires a rigorous conceptual and theoretical-driven process that includes submission of evidenced based references and examples of use of the

diagnoses with “appropriate interventions and outcomes” (NANDA-I, 2009, p. 41). NANDA-I (2009) approves research-based nursing diagnoses that are developed by nurses from a variety of countries to represent the focus of nursing care. Submissions must follow the guidelines of the Diagnosis Development Committee. Diagnostic categories include problems, risk states, and health promotion diagnoses. Submissions of new NANDA-I diagnoses include the diagnostic label, definition, defining characteristics, and related factors as indicated. All new diagnoses must be accompanied by supporting current literature to support the concept upon which the diagnosis is based and the attributes outlined.

Standardization of diagnostic nursing language facilitates understanding of human responses to health problems and life processes. NANDA-I diagnostic components are as follows: the diagnostic label gives a name to the diagnosis; the definition provides a succinct description that differentiates it from other diagnoses; defining characteristics are observable or inferred patient data or cues that cluster as manifestations of the diagnoses and help to confirm or disconfirm diagnoses; risk factors are psychological and physiological health states or factors that increase vulnerability for a problem response; and related factors are factors that are associated or contributing to problem diagnoses and that have a patterned relationship with the diagnosis.

While evidence is needed to develop new NANDA-I diagnoses, approved diagnoses continue to undergo subsequent validation, e.g., Carlson-Catalano et al. (1998). In a clinical study in two hospitals, the defining characteristic, etiologies, and interventions for three frequently used respiratory diagnoses, *ineffective breathing pattern, ineffective airway clearance,* and *impaired gas exchange,* were determined.

Eight advanced degree nurses received 30 hours of training to collect data and rate nursing diagnoses for 76 patients experiencing one of the respiratory diagnoses. The Clinical Differentiation of Respiratory Nursing Diagnoses (CDRND) tool, validated by experts in respiratory nursing with a CVI of 0.92, was used to collect data. Defining characteristics were weighted so means above .50 were considered accepted as defining characteristics and those above .80 were accepted as major defining characteristics. Data analysis found that few of the defining characteristics met the .50 level and only one met the .80 level. *Ineffective breathing pattern* or *ineffective airway clearance* was found in 55% of patients with the remaining patients experiencing two or more respiratory nursing diagnoses. *Ineffective gas exchange* was only found in combination with other respiratory responses. Fewer defining characteristics were found for each diagnosis, suggesting that these diagnoses may be more efficiently made by decreasing the number of defining characteristics.

A standardized nursing language evaluation matrix was derived from a review of the literature in a study conducted in Switzerland (Muller-Staub, Lavin, Needham & van Achterberg, 2006b). Four standardized nursing languages, chosen by 20 Swiss nursing experts, were evaluated. The criteria included: the classification describes the knowledge and subject matter for which nurses are responsible; the classification system is conceptually driven and the process is transparent; and each diagnosis has a description, diagnostic criteria, "and etiologies with an exactness that allows for differentiation among diagnoses" (p. 705). NANDA-I international classification of nursing diagnoses was the only language to meet all criteria. In many countries, NANDA-I is also the classification that is most frequently used.

In a retrospective analysis of medical records for patient admissions (n = 123,241) in a university hospital in the southeastern U.S., nursing diagnoses (NDX) were "significantly associated with five hospital outcome variables" (p < . 001) (p. 541) (Welton & Halloran, 2005). Analysis focused on daily nursing assessments that included nursing diagnoses (NDXs) and discharge summaries that included medical diagnoses expressed as diagnosis-related groups (DRG), and all payer refined DRGs (APR-DRG). Frequency of occurrence was calculated for 61 daily NDXs documented during the hospital stay. Multivariate regressions were performed on the independent variables of NDX, DRG, and APR-DRG and dependent variables "hospital length of stay, ICU length of stay, total charges, probability of death, and discharge to a nursing home" (p. 543). Relationships between all the independent variables and patients' outcomes were found to be statistically significant (p < .0001). Beta weights of NDX differed by discharge outcome. For example "the highest weighted NDX for ICU stay prediction were impaired life support systems, impaired verbal communications and (clinical) instability" (p. 544) while nursing home discharge was associated with "self-care deficits, altered thought process, and bowel incontinence" (p. 544). Addition of NDX to models with DRGs and APR-DRG and patients' outcomes demonstrated improved "explanatory power (R2) and model discrimination (c statistic) from 30% to 146%. (p. 541). This study found that NDX is a predictor of patient outcomes and provided understanding of patients responses to health problems that contributed to overall patient care.

NANDA-I and Accuracy. In a systematic review of the literature, outcomes related to documentation and accuracy of nursing diagnoses were studied (Muller-Staub, et. al. 2006a.). A collaborative of Swiss, U.S., and German researchers reviewed 36

articles published between 1982 and 2004. The researchers specifically examined "the effects of nursing diagnostics on the quality of patient assessments; frequency of documented nursing diagnoses; accuracy of nursing diagnoses…..and coherence among diagnoses, interventions and outcomes" (p. 518). The review included 14 studies of "effects of nursing diagnostics" and "reported qualitative improvements in the assessment of nursing care problems through the use of nursing diagnoses" (p. 519). One study showed significant correlation between patient satisfaction with nursing diagnoses and quality of nursing diagnoses ($p = < .03$). Another analysis showed that use of nursing diagnoses improved communication between nurses and patients, with nurses developing a better understanding of patients' health situations. Ten studies regarding frequency of nursing diagnoses found that nursing diagnoses are frequently recorded and vary among clinical sites and settings. In 14 studies, accuracy of nursing diagnoses with related signs/symptoms and etiologies were identified. Results supported that accuracy and comprehensiveness of diagnoses varies greatly and that nurses have difficulty stating accurate diagnoses. Coherence among nursing diagnoses, interventions and patient outcomes was found in eight articles with no conclusive evidence that improvement in use of standardized nursing diagnoses improved patient outcomes. However, three studies showed correlations among nursing diagnoses, interventions, and outcomes; implementation of a nursing information system that used "standardized NANDA, NIC, and NOC" (p. 523) found improvement in patient outcomes.

Use of standardized nursing languages, such as NANDA-I, may promote effective communication between interdisciplinary team members. Cioffe, Scott & Senior, (2009) conducted a qualitative exploratory descriptive study that supports the need for

standardized nursing languages to communicate priority patient problems. Seventeen experienced RNs in Australia were interviewed to determine the meaning of 'concerned about patient' (p. 179). 'Concerned about patient' was defined as a subjective nursing judgment upon which nurses can activate medical emergency teams (MET) to provide early intervention for deteriorating clinical status. Concerned about patient was recognized as a predictor to patients' outcomes but was difficult to quantify and open to interpretation because there was no definition or defining characteristics. Criterion for activating the MET included objective physiological data such as blood pressure, heart rate, respiratory rate, and changes in neurological status as well as the subjective trigger of 'concerned about patient.' Findings included the following 10 cues for concern: "noisy breathing, inability to talk in sentences, increasing supplemental oxygen requirements to maintain oxygen saturation, agitation, impaired mentation, impaired cutaneous perfusion, not expected trajectory, new or increasing pain, new symptom and new observation" (p. 182). Six of the 10 cues of concern described physiological manifestations that were already included in activation criteria and were related to oxygenation, perfusion, and neurological changes but were not communicated as such. Communication about priority patient problems is likely to improve with use of standardized language, such as nursing diagnoses.

Accuracy in interpreting assessment findings and communicating them is best accomplished when all members of the team, including patients and families, have clear understandings of the phenomena of concern. This was supported in a study of communication of "vital signs and the Early Warning Score" (Andrews & Waterman, 2005, p. 473) to determine how nurses use this information to communicate patients'

deterioration to physicians. Interviews using a grounded theory approach were conducted in the United Kingdom (U.K.) in one general medical and one surgical patient care unit. Forty four participants included: "30 nurses, 7 doctors, and 7 healthcare support workers" (p. 475) and described quantifiable evidence, such as the Early Warning Score, as the most effective means to communicate significant changes in patients' conditions. The Early Warning Score provided a concise, precise, and "unambiguous means of communicating deterioration, and confidence in using medical language" (p 478). The investigators recommended that the standardized language of The Early Warning Score should be supported in the U.K. and that nursing curriculum should continue to emphasize physiology and pathophysiology to promote accurate assessment of patient data

Diagnosing patients' responses to health problems is a complex process. Use of standardized languages, such as NANDA-I, promotes accuracy of diagnosing patients responses by having research- based criteria upon which to make and validate diagnoses and diagnostic labels that can be communicated to patients, families and interdisciplinary team members

The Educational Model, Developing Nurses' Thinking

An educational model was developed by the researcher to reflect theory and research related to applying thinking processes with domain knowledge in the context of patient safety. The model includes the dimensions of patients' safety, domain knowledge, critical thinking processes, and repeated practice. It is hypothesized that providing nursing students with this model will promote development of nursing thinking habits, which will improve accuracy of nursing diagnoses.

Patients' Safety. Patient safety is positively impacted by timely and accurate assessments, interpretations, and interventions for patients' problems and changes in conditions (IHI, nd.a,b,c; IOM, 2000, 2004; JACHO, 2008). In hospitals, nurses monitor changes in patients' conditions 24 hours per day, seven days per week and are frequently the first to identify early changes (Clarke & Aiken, 2003; Wynn, Engelke, Swanson, 2009). Nurses have the potential and responsibility to promote positive patient outcomes and safety when they accurately identify patients' problems and act quickly to intervene or refer problems to other health care providers (Clare & Aiken, 2003).

Patient safety is defined as "freedom from accidental injury; ensuring patient safety involves the establishment of operational systems and processes that minimize the likelihood of errors and maximizes the likelihood of intercepting them when they occur" (IOM, 2000, p 211). The IOM estimated that as many as 98,000 deaths per year occur in hospitals as a result of preventable medical errors, including nursing errors, and costs between $17 and $29 billion dollars per year (2000, 2004). The IOM proposed that errors in planning and execution of care occur during all phases of patient admission from diagnosis to treatment.

Higher standards and expectations for safety improvements should be established by professional organizations and licensing bodies to assure that health professionals have competence and knowledge of patient safety practices (IOM, 2000, 2004). In accordance with this recommendation, organizations such as the Joint Commission revised their National Safety Goals (2008) to require improvement in the recognition and treatment of changes in patients' conditions, especially prevention and early intervention for cardio-pulmonary arrests.

Adult patients often experience physiological decline prior to cardiopulmonary arrests and present with acute respiratory or cardiac abnormalities (Buist, et. al, 2002; Chan, Kalid, Longmore, Kosiborod & Spurtus, 2008). The need for early interventions that address' these changes spurred the development of specialized interdisciplinary hospital-based response teams. Health care facilities initiated the use of emergency response teams to decrease mortality and morbidity by early recognition and interventions for serious changes in patients' clinical status (Saver, 2006). Since 1990, Medical Emergency Teams (MET) were broadly implemented in the U.K. and Australia (Crispin & Dafurn, 1998) and began appearing in the U.S. as rapid response teams (RRT). The RRTs being established in U.S. hospitals are an initiative of the Institute for Healthcare Improvement's (IHI) goal to save 100,000 lives (Saver, 2006). Nurses are frequently the first to detect significant changes in patients' conditions and activate these teams (Buist, et al., 2002), suggesting that nurses' assessments of cardiac and pulmonary status have the potential to impact patient outcomes.

Implementation of the MET in Australia was associated in one hospital with a significant reduction in cardiac arrests and patient mortality from cardiac arrests (Buist et. al., 2002). The MET activation criteria included problems with airway, breathing, circulation, neurological changes and "concern about patient" (p. 389). In a chart review study, all hospital admissions in 1996 (n =19, 317) prior to implementation of the MET, were compared with those in 1999 (n =22, 847), after implementation of the MET. Following an educational program that outlined activation criteria and protocol, the MET was activated by bedside nurses or physicians when changes in condition were identified and pre-determined criteria were met. Prior to establishing the MET, cardiac arrest

events were 3.77 per 1000 admissions (n =73) and decreased to 2.05 per 1000 admissions (n =47; p = 0.001). Mortality related to cardiac arrest was 77% (56 patients) and decreased to 55% (26 patients) (p = 0.001). Eighty-four percent of calls initiating the MET were placed by nurses suggesting that nurses accurately identified significant changes in patients' conditions and contributed to decreased patient mortality.

In another Australian study, the actions of nurses in one hospital were evaluated when they assessed changes in patients' conditions that matched the MET activation criteria (Crispin & Daffurn, 1998). In a retrospective chart review of 178 patients the investigators examined nursing documentation in the 24-hour period prior to MET activation for patient assessment data and the time the MET was activated. Categories for activating the emergency team included cardiac arrest, problems with airway or breathing, change in levels of consciousness and 'other,' which included prolonged chest pain, seizures and hypotension. Nurses responded without delay to significant changes in patients' conditions 68.4% of the time. Delays in activation occurred most frequently in the wards. In this study, bedside nurses identified significant changes in patients' conditions that meet the MET activation criteria but did not always initiate the call. The most common response was to call a junior medical resident, which caused a delay in treatment in 15 of 84 patients who waited more than three hours.

These findings are consistent with a descriptive, cross-sectional, correlational study to analyze the relation of nurses' educational level and engagement in the early recognition process and activation of the RRT in 138 RRTs with 75 patients (Wynn, et al., 2009). The most common reasons that nurses activated the team were "sudden change in patient condition" and "steady decline in patient condition" (p. 44). Evaluation

of documentation noted that for 78% (*n* =55) of patients there was a delay in activation of the emergency team with 16% (*n* =12) longer than eight hours. Nurses independently activated the team 61.3% of the time and 37.3% of the time at the request of another RN, physician, or family member. Independent activation of the RRT was associated with educational level, BSN ($p = .01$) and experience, greater than 3 years, ($p = .04$). Nurses engagement was measured using the Manifestations of Early Recognition (MER) scale with Cronbach's alpha reliability of .91, which measured "knowing the patient/family, knowing the system/institution and pushing the boundaries of practice to obtain what patients need and knowing the skills of self" (p 42). The results of these studies suggest that nurses are able to identify significant changes in patients' conditions but in some cases they either do not appreciate the implications of these changes or do not choose the appropriate action.

Because nurses have integral roles in identifying risks for patients' safety and initiation of emergency response teams, it is important to understand their experiences (Cioffi, 2000a, 2000b). Nurses' experiences in calling the MET team were described in a qualitative study of 32 nurses with at least five years experience from two hospitals who had initiated MET responses in the two year period since implementation. The researcher conducted audio-taped unstructured interviews. Two consultants validated that the extracted themes were consistent with the expected experiences. Five main categories were identified: "uncertainty associated with calling, identification of change in patient's condition, identification of 'at risk' situations, associated feelings, and valuing of the MET" (Cioffe, 2000a, p. 110). These nurses used "knowing the patient" and predicting what they should look like to help them decide if patients were in trouble.

In the U.S., nurses' involvement in patient safety was investigated in an analysis of 8,606 closed cases of alleged malpractice filed between 1992 and 2007 (Ross & Ranum, 2009). The investigators selected 93 cases from day surgery and Post Anesthesia Care Unit (PACU) units. The top 10 risks to patient safety were: "clinical judgment, patient assessment issues (*n* =36), communication between patient/family and providers (*n* = 23), technical performance (*n* =23), staff issues (*n* =20), selection and management of therapy (*n* =20), communication among providers (*n* = 16), lack of or insufficient documentation (*n* =16), policy and protocol issues (*n* =14), patient factors (*n* =14), and patient monitoring (*n* =11)" (p. 145). In day surgery units, "25% of the cases (*n* =15) listed nursing as the primary responsible service involved in the case" (p. 145). In PACUs, nurses were identified as the responsible discipline in 39% of cases (*n* =13). This study suggests that if nurses improve accuracy of identification of patients' problems the most effective plans of care can be implemented and the incidence of alleged malpractice claims with nurse as the primary responsible discipline may decline.

Domain knowledge. "Knowledge, theoretical and clinical, affects both diagnosis and treatment planning" (Carnevali & Thomas, 1993, p. 145). The reflective, creative, and critical thinking necessary for nursing practice, "presupposes that the knowledge work of reading, memorizing, drilling, writing, and practicing has been done" (Pesut & Herman, 1998, p. 34). What the nurse "knows" affects how patient data are interpreted and patients' responses to health problems are identified (Carnevali & Thomas, 1993). For example, a nurse who does not know that the cues of restlessness, increased respiratory rate, and non productive cough with wheezing should be used to consider the diagnosis of ineffective *airway clearance* will not administer the appropriate

interventions, such as timely notification of other health providers. The ability for nurses to make clinical judgments that include accurate identification of patients' responses to health problems requires various types of knowledge derived from both science and theory and improves with experience (Tanner, 2006a).

Knowledge of nursing diagnoses was shown to be important to accuracy in Hasegawa et. al.'s (2007) study of Japanese nurses' diagnostic competencies. A covariable in the study was knowledge of nursing diagnoses. A six-question multiple choice test that included nursing diagnoses, definitions, defining characteristics, related factors, and risk states was completed by participants. The findings regarding knowledge of the nursing diagnosis *ineffective therapeutic regimen management* was correct definition 64% (n = 239), correct defining characteristics 70% (n =265), and correct related factors 63% (n = 236). Knowledge related to the nursing diagnoses *risk for infection* was: correct definition 50% (n = 188); and correct identification of risk factors 84% (n = 315). Knowledge of nursing diagnoses was positively correlated with accurate identification of nursing diagnoses; case study one, accuracy 73% (df = 2, x^2 = 23.79, p = < .0001), and case study two, accuracy 81% (df = 2, x^2 = 21.74, p = < .0001). Suggestions to improve diagnostic accuracy competency in Japan included the need for continuing education in nursing diagnostics and national standards for nursing diagnostics.

In a study of the relations among prior knowledge, motivation in decision making, quality of diagnostic reasoning, and total and focal nursing diagnoses accuracy, it was suggested that knowledge is necessary but not sufficient for diagnostic accuracy (Cholowski & Chan, 2004). The sample was 135 second year nursing students from an

Australian university. All students attended five weeks of mental health lectures followed by a knowledge test that consisted of three questions with two parts each. The first part of each question required students "to list isolated pieces of information e.g. list five coping strategies….." (p. 87-88) and reflected accessibility of information or recall knowledge. The second part of each question required students to structure and relate answers, "e.g. explain some of the factors that would influence a person's choice of coping strategies" (p. 88), to determine knowledge structuring. Knowledge structuring was measured using The Structuring Scale. In earlier studies, interrater reliability was rated as 83%; in this study, the Pearson r indicated an interrater reliability of 0.77 - 0.88. Students were given a validated written case study "followed by a 7- minute videotaped interview with a patient" (p. 88). Possible nursing diagnoses were generated and scored by three mental health faculty on a scale from 0 to 4, 4 being the most comprehensive. Students' were asked; "to name four important nursing diagnoses" (p. 88), from the four chosen diagnoses to identify one priority or focal diagnosis, and then to give a written rationale. The results indicated that prior knowledge did not directly influence diagnostic accuracy; path analysis indicated that diagnostic reasoning was a mediator of knowledge and diagnostic accuracy. The authors suggest that knowledge alone is not sufficient to promote problem solving in nursing students and that structuring and accessibility of knowledge with "high quality diagnostic reasoning" (p. 93) is necessary.

In a qualitative study, 12 nursing students described three factors that influence their decision making, i.e., knowledge of patients' responses to health problems, fear, and confidence (Baxter & Rideout, 2006). A "qualitative intrinsic case study" (p. 121) was used to explore the students' perceptions in their first clinical rotation on an in-patient

unit in a baccalaureate program in Canada. Student journals, based on guidelines to focus on clinical decision-making, and unstructured interviews were used to collect data. Inductive and constant comparative processes were used to identify three key encounters in which decision-making occurred with patients, with nurses, and with the instructor. Factors that were described as influencing students' decision-making were knowledge, fear, and level of confidence. Student-patient encounters were identified as the most complex decision-making environment. The most common response to identification that a clinical decision should be made was to seek help. Student knowledge was described in relation to increased confidence and helping them to make independent decisions, and to determine if a clinical decision was necessary. One student said: "Sometimes I know there's a problem, but I don't have the knowledge to take action right away, so I say I have to ask someone. But if I see the same problems again and again, I will start taking action by myself" (p. 124).

In an exploratory study of factors that influenced the decision making of 50 critical care nurses from three hospitals in Canada, knowledge and experience were considered most important when making rapid decisions (Baumann & Bourbonnais, 1982). Nurses based their decisions on patients presenting problems, such as pain and changes in oxygenation and not medical diagnoses. The researchers used semi-structured interviews, which were validated by a statistician, and a critical care case study to collect data. The case study represented a familiar clinical situation in which a patient crisis was imminent. One investigator collected all interviews, which were taped and transcribed to determine categories and sequences related to rapid decisions, and factors influencing decision-making. Participants were requested to provide rationale for rapid decisions

such as “seek medical help, assess vital signs, give oxygen, assess monitor pattern, describe pain, give nitroglycerine then morphine sulphate” (p. 440). Findings of the study were that the participants had difficulty substantiating their decisions “with a sound knowledge base” (p. 443) and did not always give a rationale. Knowledge and experience were identified as the most important factors with 98% of the participants’ ranking either knowledge only or in combination with other identified factors of experience, stress, role modeling, and values. The findings indicate that nurses “were making many rapid decisions in crisis situations prior to seeking medical help” (p. 443).

Critical Thinking Processes. Nursing students need to learn how to think like nurses to solve nursing problems (Benner, 1984; Tanner, 2006a, Willingham, 2008). This is a complex process and difficult to teach because patients’ respond differently to health problems, situations range from simple to complex, and there may be overlapping of nursing diagnoses making it challenging to identify the priority diagnoses (Corcoran 1986; Lunney, 2008a,c; Willingham 2008). In addition to traditional nursing content such as growth and development, pathophysiology, and diagnostic aspects of patients’ disease states and related nursing care, educators can teach critical thinking process in the context of nursing domain knowledge to develop nursing students’ thinking abilities (Agbedia, Ofi & Ibeagha, 2008; Banning, 2007; Kuiper & Pesut, 2004; Lunney, 1992, 2001, 2008a, c; Sternberg, 1988; Sternberg & Williams,1998; Tanner, 2006a; Willingham, 2007). In order to teach students about thinking processes, educators need to consistently use specific concepts of thinking, especially thinking concepts that are known to be important for nursing.

The thinking concepts that are important to nursing were identified in a Delphi study of international nurse experts on critical thinking (Scheffer & Rubenfeld, 2000). Critical thinking is the "purposeful self-regulatory judgment which results in interpretation, analysis, evaluation, and inference as well as the explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which judgment is based" (Facione, 1990, p. 2). Specific types of critical thinking processes are characteristic of different knowledge domains, e.g., nursing (Willingham, 2008). The study sought to identify both cognitive skills and habits of the mind that were necessary for nurses in any practice setting. The term *Habits of Mind* was chosen to characterize both cognitive and affective aspects of critical thinking. One hundred and thirty five nurses were invited to participate and 86 agreed. Study duration was two years and was concluded in 1998 during which time five rounds of data collection, analysis, and a consensus statement emerged of cognitive skills and habits of the mind. The number of nurses that participated in each round varied with 55 nurses participating in the final round. A strong consensus statement regarding critical thinking in nursing was established with seven cognitive skills and 10 habits of the mind (see Table 2.1).

This study provided the components of critical thinking that nurses can use to structure and monitor their thinking processes and a common language to communicate and describe thinking to others. Evaluation of thinking processes by students promotes "a valuable habit that can be retained beyond the novice period" (p. 357).

Table 2.1 Components of Critical Thinking for Nursing

Cognitive Skills:

Analyzing: separating or breaking a whole into parts to discover their nature, function and relationships.

Applying standards: judging according to established personal, professional or social rules or criteria.

Discriminating: recognizing differences and similarities among things or situation and distinguishing carefully as to category or rank.

Information seeking: searching for evidence, facts or knowledge by identifying relevant sources and gathering objective, subjective, historical, and current data from those sources.

Logical reasoning: drawing inference or conclusions that are supported in or justified by evidence.

Predicting: envisioning a plan and its consequences.

Transforming knowledge changing or converting the condition, nature, form, or function of concepts among contexts.

Habits of the Mind:

Confidence: assurance of one's reasoning abilities.

Contextual perspective: considerate of the whole situation, including relationships, background and environment, relevant to some happening.

Creativity: intellectual inventiveness used to generate discover, or restructure ideas; imagining alternatives.

Flexibility: capacity to adapt, accommodate, modify or change thoughts, ideas, and behaviors.

Inquisitiveness: an eagerness to know by seeking knowledge and understanding through observation and thoughtful questioning in order to explore possibilities and alternatives.

Intellectual integrity: seeking the trough through sincere, honest processes, even if the results are contrary to one's assumptions and beliefs.

Intuition: insightful sense of knowing without conscious use of reason.

Open-mindedness: a viewpoint characterized by being receptive to divergent views and sensitive on one's biases.

Perseverance: pursuit of a course with determination to overcome obstacles.

Reflection: contemplation upon a subject, especially one's assumptions and thinking for the purposes of deeper understanding and self-evaluation.

Variance in Nurses' Thinking Abilities. In the last few decades, many studies have shown variance in nurses' thinking abilities, supporting the need to teach students how to think (Tanner, 2006a). Four studies that relate thinking processes to diagnostic abilities are included in this review (Agbedia, Ofi & Ibeagha, 2008; Cruz et al, 2009; Lunney, 1992; Muller-Staub et al., 2008).

Divergent thinking abilities were shown to vary widely in 86 female nurses with one to five years nursing experience from five hospitals and two graduate schools in New

York City (Lunney, 1992). Three validated case studies and the Utility Test and Possible Jobs Test, valid and reliable tools that were frequently used in educational psychology, were used to test the hypotheses that the divergent thinking factors of fluency, flexibility, and elaboration were positively correlated with accuracy of nursing diagnoses. Accuracy of nursing diagnoses was measured using three case studies and scored using the Lunney Scoring Method that rates accuracy on a continuous 7-point scale from high to low. Fluency and flexibility were measured using the Utility Test. Fluency is the ability to process many pieces of data while flexibility is the ability to switch from categories or classes when considering potential hypotheses or diagnoses. Elaboration, or the ability to structure and make connections between data to determine meaning, was tested using the Possible Jobs Test. Participants' scores on divergent thinking abilities varied widely, fluency = 6 to 41.5, flexibility = 0 to 27.5, and elaboration = 7 to 30.5, with specific skills correlated to each case study. Using the Spearman rank order correlation, fluency was correlated with case study two, flexibility was correlated with case study two, and elaboration was correlated with both case studies two and three. Stepwise multiple regression determined fluency a significant predictor of accuracy in case study two (F *change* = 9.012; p = <.01). The study findings support the proposition that the thinking abilities needed to solve the case studies were case specific and that not all divergent thinking skills are needed to solve every case.

Cognitive (thinking) strategies used by practicing nurses to derive diagnoses was studied in 486 randomly sampled nurses from "Government, Mission and Private Hospitals" (p. 113) in Nigeria (Agbedia, Ofi & Ibeagha, 2008). The study tested the variables of age, nursing experience, nursing education, disposition toward critical

thinking, and critical thinking skills in a causal model of clinical judgment. Instruments used to measure the potential causal links were biographical data, the California Critical Thinking Disposition inventory (CCTDI), the California Critical Thinking Skill Test (CCTST), and a Clinical Judgment Test. The CCTDI and CCTST have been used extensively in the U.S. and U.K. and were validated by Nigerian nurses and psychologists with reframing of five questions on the CCTST to match Nigerian nomenclature. The CCTDI measured attitudes and beliefs in relation to critical thinking. The CCTST measured "core critical thinking skills of analysis, interpretation, inference, evaluation and explanation" (p. 114). Clinical judgment was measured using a researcher developed and validated test (test-retest reliability, $r = 0.60$) to measure nursing judgment in clinical settings. Path and regression analysis were used to determine causal relations and path coefficients for the model in which clinical judgment was the dependent variable. Critical thinking had the "strongest positive influence on clinical judgment….with a total effect of 0.340 (93%) out of 0.635" (p. 118). Direct linkages were also found between nursing education and disposition for critical thinking and clinical judgment. The direct path from educational preparation to clinical judgment "infers that academic process is a more important influence on clinical judgment than clinical experience" (p. 119). Implications for the direct and strongly positive path from critical thinking to clinical judgment support the integration of "critical thinking into the framework of (the) nursing process" (p. 120).

Instruction in the thinking needed for clinical reasoning following implementation of NANDA-I, Nursing Intervention Classification (NIC), and Nursing Outcomes Classification (NOC) in nursing documentation produced significant

improvements in quality of nursing diagnosis and etiology, specific interventions, and outcomes (Muller-Staub et al., 2008). A clustered randomized study in a Swiss hospital included nursing staff from six comparable patient care units. The control group (three units) received classic case study discussion while the experimental group (three units) received guided interactive clinical reasoning instruction during five months of instruction, 22.5 hours. Guided clinical reasoning included questioning that promoted hypothesis generation and identification of etiologies of signs and symptoms presented by patients. Randomized chart reviews were conducted pre and post intervention and included 225 records "containing 444 documented nursing diagnoses, corresponding interventions and outcomes" (p. 295). The Quality of Nursing Diagnoses Interventions and Outcomes (Q-DIO) instrument was used to determine accuracy of documentation. The Q-DIO measured nursing diagnoses as product, nursing interventions, and nursing-sensitive patient outcomes. Cronbach's alpha for the subscales were 0.98 for nursing diagnoses, 0.90 for interventions, and 0.99 for patient outcomes. There were no statistical differences noted between control and experimental patient characteristics. Independent t-tests revealed significant improvements in documentation of nursing diagnoses in the experimental group ($p = 0.0001$), interventions for both experimental and control groups ($p = 0.0001$), and outcomes for the experimental group ($p = 0.001$). The authors concluded that guided clinical reasoning fosters improved diagnostic reasoning and quality nursing documentation reflected in identification of accurate diagnoses with internal consistency between "diagnoses, interventions and outcomes" (p. 300).

Cruz et al.'s (2009) study provided further evidence that training and practice in critical thinking skills and habits of the mind improves nursing diagnostic accuracy even with highly educated nurses (N = 39). Following 16 hours of continuing education that included the need for critical thinking to promote diagnostic reasoning, dimensions of critical thinking, accuracy of nurses' data interpretations, application of critical thinking concepts to case studies, and a strategy for self-improvement in and teaching of critical thinking processes, there was a significant overall improvement in accuracy (Wilcoxon z = -3.34, p = .001). The investigators recommended that educational strategies be developed that guide application of the cognitive skills and habits of the mind.

Repeated Practice

In numerous critical thinking studies with children, it was shown that repeated practice with both critical thinking and domain knowledge were essential to improvements in thinking. (Willingham, 2008). Similarly, in nursing practice, repeated use of structured thinking processes that use consistent, accepted, and defined labels when solving patients' problems is likely to promote the development of appropriate thinking habits (Hayakawa & Hayakawa, 1990; Sternberg, 1988, 1997). Thinking processes must be "taught, practiced, and continually reinforced in meaningful context" to promote students' abilities to solve complex nursing problems (Cholowski & Chan, 1995). Repeated practice of thinking within the context of nursing knowledge such as nursing diagnoses, promotes pattern recognition and deep understanding of patients' responses to health problems (Lasater & Nielsen, 2009; Palese et al., 2009).

Nursing students' abilities to accurately identify nursing diagnoses using NANDA-I diagnoses was found to improve with practice over time in a three year

university nursing program in Italy (Palese et al., 2009). A 24-hour theory course based on the nursing process, Carpenito's Bifocal Model of nursing care, and NANDA-I was conducted in the first year of the program. In subsequent theory and clinical courses, students used concepts taught and practiced in the class to develop patients' plans of care. To study the effect of the theory course and repeated use of nursing concepts on correct use of nursing diagnoses, this 10-year retrospective study evaluated 3,784 nursing care plans written by 284 students. Study variables included admitting diagnoses, age, gender,, the number of problems identified, problem priority setting, number of objectives for each problem, number and type of interventions planned, and evaluation of student identified objectives. Interrater reliability with two-researchers was Cohen's K > .93 for 50 care plans. The Kruskal Wallis test of the differences in the median number of problems between students in first and third years showed that third year students identified more patient problems, which was an indication that knowledge and skills improved ($p = .00$). The ability to name patients' responses to health problems also improved over time with less use of miscellaneous terms.

Repetition and immersion in the study and practice of solving particular patient responses to health problems, using concept based learning, was found to improve clinical judgment in junior nursing students (Lasater & Nielsen, 2009). Concept-based learning activities provided a structured approach for the study of one distinct facet of patient care. In this study, 28 junior nursing students were divided into the control group ($n = 13$) who received traditional instruction and the intervention group ($n = 13$) who received concept-based instruction. Concept-based instruction included simulation experiences that focused on the selected concept and clinical experiences that included

concept- focused patient assessment and development of plans of care. The concept based activities were based on Tanners Clinical Judgment Model, i.e., noticing, interpreting, responding, and reflecting (Tanner, 2006a) and clinical judgment using Lasater's Clinical Judgment Rubric. Students in the intervention group scored statistically higher than the control group in all phases of clinical judgment: noticing, intervention mean 6.8 and control mean 5.15 ($F = 11.13$; $p < .01$); interpreting, intervention mean 4.33 control mean 3.46 ($F = 5.60$; $p = <.05$; responding, intervention mean 9.77 and control 8.00 ($F = 6.28$; $p < .05$); and reflecting, intervention mean 4.77 and control mean 3.85 ($F = 7.62$; $p = < .01$); and total clinical judgment, intervention mean 25.67 and control mean 20.46 ($F = 10.99$; $p = < .01$). Linking concepts taught in theory class with clinical assignments enabled students "to delve…deeply into… problem(s)" (p. 444) with improved student interpreting skills. One student said: "my interpreting skills have been sharpened as well as my responding through better knowledge of what symptoms might reflect certain health alterations" (p. 445).

In addition to the traditional model of nursing education to provide domain knowledge, professional nursing programs need to implement evidence-based models to guide students to learn to think like nurses. Learning to think like a nurse and solve patient problems is a complex process and requires instruction and repeated practice to develop effective thinking habits. Faculty and students use of structured models with standardized terminology to describe thinking processes will facilitate discussion and reflection of the process. Consideration of patient safety further promotes thinking habits that include the importance of patients' safety in clinical reasoning processes. Accurate identification of patients' responses to health problems and nursing diagnoses are the first

steps necessary to developing effective plans of care for the achievement of positive patient outcomes, including patient safety.

Chapter III

Method

The purpose of this study was to determine the effect of using the educational model, Developing Nurses' Thinking (DNT), on nursing students' accuracy of nursing diagnoses. The following hypothesis guided the study:

Students who practice use of the Developing Nurses' Thinking (DNT) model will have greater improvements in accurate identification of nursing diagnoses than students who do not use the DNT model.

Nursing diagnosis accuracy was measured using the Lunney Scoring Method (Lunney, 1990, 2001). The study sought to determine whether instruction and practice in use of the DNT model during four hours of clinical post conferences improves nursing students' diagnostic accuracy. This chapter presents the study method in five sections: design, sample, instruments, data collection procedures, student debriefing, and data analysis.

Design

The study design was quasi-experimental with control and intervention groups and pre and post-tests. There was one independent variable, use of the DNT model, and one dependent variable, accuracy of nursing diagnoses. The initial plan was to include students from one school of nursing; however, to increase the power of the study students from a second school of nursing were recruited. The study took place in two baccalaureate schools of nursing, one public (School 1) and one private (School 2), during the first clinical nursing course. In each school, the clinical sections were randomly assigned to either the control or intervention groups. Data collection

procedures were integrated into the lecture class format and, because this research was also a curriculum evaluation study, all students participated. The study took place during the last half of the Fall 2010 semester, after students had completed lectures on the domain knowledge for nursing care of patients with respiratory and oxygenation problems and risk states. Two research assistants conducted some of the study procedures with the researcher; one assistant instructed the control group post conferences and the other served as second rater of accuracy of nursing diagnoses.

Sample

The sample was recruited in the lecture portions of the first clinical courses in the junior year of two baccalaureate in nursing programs in the New York Metropolitan area. The recruited convenience sample was 113 students who were enrolled in 15 clinical sections of the two schools, seven sections from School 1 and eight sections from School 2. In School 1, one section (14 students) was omitted from study data because the researcher was teaching the students. All other students did not know the researcher. The sample that was eligible to participate in the study was 99 students; 57 from School 1 and 42 from School 2. This sample was consistent with Cohen's (1988) recommendation of a power of .80 with conducting a two sample *t*-test, predicting 49 students in each group and an effect size of .51. This moderate effect size enabled detection of differences in accuracy scores between treatment groups.

Randomization of Control and Intervention Groups. The clinical sections from each school were randomly assigned to control and intervention groups by clinical day. In School 1, three clinical sections had clinical experiences scheduled for Tuesdays and Wednesdays and three clinical sections had clinical experiences scheduled for

Thursdays and Fridays, six hours per day. In School 2, four clinical sections had clinical experiences scheduled for Mondays and four clinical sections had clinical experiences scheduled for Tuesdays, 12 hours per day. Clinical groups were given numbers, one through 14, and the clinical section numbers were placed in a hat by meeting day. Then, the numbers of clinical sections were randomly selected for the control and intervention groups. In School 1, there was one control group and two intervention groups on Tuesday and Wednesday and two control and one intervention group on Thursday and Friday. In School 2, there were two control and two intervention groups on both Monday and Tuesday.

Sample Group Curricular Attributes. Besides students in both schools being in the first clinical nursing course of the junior year, other similarities were that both schools required 12 hours of clinical experiences a week. Curricular differences were that School 1 had two-six hour clinical experiences a week and three hours of lecture and School 2 had one-12 hour clinical experience a week and four hours of lecture. Additionally, the curriculum of School 1 focused on fundamental content related to respiratory and oxygenation while School 2 included medical and surgical nursing content on this topic.

Instruments

Case Studies. Four realistic written case studies, two sets of parallel cases, were developed to meet six objectives for measurement of nursing students' diagnostic accuracy for simulated patients with respiratory and oxygenation health problems (see Appendix C). The two sets of case studies were parallel in that patient data were identical but the patient's name, age, gender, and medical diagnoses were different. The

priority nursing diagnoses represented in the case studies of both pre and posttests were *impaired gas exchange* and *ineffective airway clearance* because patients' with these diagnoses have the potential to experience poor health outcomes.

To determine content validity, the investigator obtained three experts in nursing diagnosis and teaching nursing fundamentals to evaluate item-objective congruence, using the legend: +1 = definitely a measure of objective, 0 = undecided, and -1 = not a measure of objective (see Appendix D). The content validity indexes (CVI) for the case studies were: case study one (CS 1)= 1.0, case study one a (CS 1a) = 1.0; case study two (CS 2) = 0.94; and case study two a (CS 2a) = 0.94 with an overall CVI of .97 (see Appendix D).

In the lecture classes of both schools, the two pre test case studies were administered to all students to interpret before the study intervention, use of the DNT model in clinical post conferences. Following the study intervention, the two posttest case studies were also administered in the lecture classes of both schools to all students. There were two weeks between pre and post testing in both schools.

Lunney Scoring Method. The Lunney Scoring Method enables judgments of nursing diagnostic accuracy on a continuum from high to low (Lunney, 1990, 1992, Lunney et al., 1997). There are seven levels of accuracy in this model that span from +5 for a diagnosis that is consistent with all of patient assessment data or cues to -1, which is assigned to incorrect diagnoses based on disconfirming cues (see Table 3.1). Accuracy is measured on a continuum because there is conceptual overlap of many nursing diagnosis concepts. For example, the cues for *impaired gas exchange* overlap with cues for *ineffective breathing pattern* and *anxiety*. Judging accuracy on a continuum enables

higher scores for nurses when diagnoses are close to the best diagnosis but not exactly the highest rated diagnosis and lower scores for nurses who state a diagnosis that is not a priority or for which there is no data.

Table 3.1

The Lunney Scoring Method

Score	Criteria
+5	Diagnosis is consistent with all of the cues, supported by highly relevant cues, and precise.
+4	Diagnosis is consistent with most or all of the cues and supported by relevant cues but FAILS to reflect one or a few highly relevant cues.
+3	Diagnosis is consistent with many of the cues but fails to reflect the specificity of available cues.
+2	Diagnosis is indicated by some of the cues but there are insufficient relevant cues for the diagnosis and/or the diagnosis is a lower priority then other diagnoses.
+1	Diagnosis is only suggested by one or a few cues.
0	Diagnosis is not indicated by any of the cues. No diagnosis is stated when there are sufficient cues to state a diagnosis. The diagnosis cannot be rated.
-1	Diagnosis should be rejected based on the presence of at least two disconfirming cues.

The purpose of the scale is to apply valid and reliable accuracy scores, using the detailed scoring manual, to nursing diagnoses that are depicted in case studies or clinical cases. In previous research, the Lunney Scoring Method had been used to rate accuracy using written case studies and actual clinical cases (Cruz et. al. 2009; Lunney, 1992; Lunney et. al., 1997; Spies, Myers & Pinnell, 1994). It was previously used with both BS degree students and practicing medical and surgical nurses who had from one to more than 10 years experience in nursing. The validity and reliability of the seven point scale are reflected in the scoring of case studies or clinical cases.

In the initial study (Lunney, 1992), six cases were sent to four nationally-known experts in medical surgical nursing and nursing diagnosis. The three cases with the highest content validity index (CVI), i.e., 91.7, were used in the study. In a subsequent study, conducted in three clinical settings of the metropolitan area (Lunney et al., 1997), the accuracy of actual clinical cases was measured and the tool performed as intended. Accuracy ratings in three hospital settings with 153 cases varied across the seven levels of accuracy (Lunney, et al., 1997). Inter rater reliability was reported in other studies: e.g.,. 96, .97, and .97 for scores of three case studies in Lunney (1992); .95 in Lunney et. al. (1997); and .96 in Cruz et. al. (2009).

Criterion-related validity was measured and supported in a study of the effect of a continuing education program on the diagnostic accuracy of practicing nurses in Brazil (Cruz, et. al, 2009). Thirty nine highly educated and experienced nurses participated in a four day, 16 hour program on critical thinking and diagnostic reasoning. Pre and post testing were done using three case studies and the Lunney Scoring Method. The Wilcoxon test was used to demonstrate differences between pre and post test scores, CS

1: *Z = -2.63, p = .008;* CS 2: *Z = -2.04, p = .042;* CS 3: *Z = -3.34, p = .001.* A statistically significant increase in scores after teaching sessions that focused on improvement in accuracy supported criterion-related validity.

For this study, the scoring method was used to develop and validate specific examples of scoring nursing diagnoses for the four case studies at each of the seven levels (see Appendix C). The expert judges who validated the case studies as well as the corresponding scoring manuals were experienced nursing educators and were teaching in undergraduate nursing programs. One faculty member had a doctorate degree and the other two faculty members were in doctoral programs.

In order to compute inter and intra rater reliability estimates, it was planned that two raters, the researcher and a research assistant, would independently score about 50% of students' responses to the case studies. The research assistant had a master's degree in nursing, 25 years of critical care experience, and four years of nursing education experience that included staff development and facilitation of nursing student clinical rotations. Training of the research assistant consisted of reading the manual for the Lunney Scoring Method (1990, 2001) and practice using the tool with two additional case studies. Training of the research assistant also included that the two raters co-scored 56 responses of the 14 students in the clinical group that was eliminated. When questions arose regarding the correct scoring of students' diagnoses, the raters consulted with the NANDA-I book, and, when needed, the author of the tool. For example, if a student chose *risk for impaired gas exchange* instead of *impaired gas exchange,* but noted the assessment data pertaining to low oxygen levels and selected an intervention of oxygen administration, the diagnosis was scored as 4 instead of -1.

Post Conference Student Evaluation. At the end of the last clinical post conference, an evaluation form was distributed to students in the control and intervention groups (see Appendix G). The evaluation form was designed to gain an understanding of students' experiences of the post conferences and their preferred teaching and learning formats.

Data Collection Procedures

The study procedures were approved by the Institutional Review Boards (IRBs) of the Graduate Center of the City University of New York, and the two colleges. After approval by the IRBs, the chairpersons and faculty teaching the first clinical courses at School 1 and School 2 were contacted in person, details of the study were provided, and permissions were sought to conduct the study. The researcher scheduled the two weeks needed for the study with the faculty members teaching the lecture and clinical portions of both courses. All data collection procedures for the study, that is, pre and posttests, post conferences, demographic data collection, and post conference student evaluations, were included in the curriculum for these courses.

Student-Generated Code Sheet. In order to maintain students' anonymity, a student-generated code sheet was used with permission of the author M. Jeffreys, (personal communication, April 10, 2010) (see Appendix E). The code sheet enabled comparison of pre and post tests without identifying specific students. The code sheet was attached to all data generated during the study and students' codes were included in the database for analysis.

In order to generate unique codes that would be remembered by students for subsequent data collection, the code sheet requires students to use family and other

related data for generation of codes. These data include mother's maiden name, month of mother's birth, and several questions regarding the number of siblings in the family. Additionally, the code sheets included students' clinical group number and instructor to cohort data for data entry, identify data that was not allowed to be used for research, and validate consistency of codes per participant to assure accurate data input.

Informed Consents. Informed consents were obtained from all students at the end of a lecture class prior to beginning the study (see Appendix H). Students were informed that the study data would enable evaluation of the effectiveness of teaching strategies. The consent form asked students' permission to use their data for research, which would be generated as part of normal class activities. The consent form outlined the data collection procedures and stated that the data would in no way influence their grades for the semester. The student-generated code sheet was attached to the consent form. The consents were placed in envelopes, sealed, and dated. They were stored in a locked file cabinet until students' grades had been submitted to the Registrar. After final grades were submitted, the envelopes were opened for data analysis. In the event that students were not present during the class that consents were signed, they completed the consent prior to the beginning of the intervention. Once complete, students placed the consent in an envelope, sealed it, and gave it to the researcher or research assistant to be placed in a locked file cabinet.

Pretest. The pretest was given after the content related to care of patients with respiratory and oxygenation problems was taught in both schools. The packet included: an instruction sheet, the student-generated code sheet, a four item demographic sheet, case study instruction sheet, and two case studies (see Appendix E). In each school, to

facilitate organized and timely distribution and collection of data in lecture classes that included all students, the data were collected by the researcher, the research assistant, and additional assistants (five in School 1 and three in School 2). Students were reminded that the study was designed to determine the effectiveness of teaching strategies and that responses to the case studies would not be evaluated until the end of the semester after grades had been posted.

For each case study, the students were asked to use nursing diagnoses, i.e., describe patients' responses to health problems, when identifying and writing priority patient responses. They were given 8 minutes to complete each case study. In previous research with practicing nurses, written case studies of similar length and complexity were answered in 3 minutes (Cruz et al., 2009; Lunney, 1992). Also, similar case studies had been used with second semester medical-surgical nursing students, which took an average of 5 minutes to complete. Students in this study were given 8 minutes to answer each case study because they are not as familiar with interpreting patient data in case studies as second semester students and practicing nurses.

Students were instructed to read each case study, identify the priority nursing diagnoses or describe the priority response to a health problem, and write it in the space indicated. If students were unable to provide an answer as instructed, they were instructed to enter: do not know. When the case studies were finished, the researcher and assistants checked that students' code sheets were completed, and all study data were placed in individual envelopes, sealed, and dated. The sealed envelopes with study data were stored in a locked file cabinet until students' grades had been submitted to the Registrar. In the event that students were not present in class when the pretest was

completed, they completed them before the start of the intervention, placed them in an envelope, sealed it, and gave it to the researcher or the research assistant to place in a locked cabinet. After final grades were submitted, the envelopes were opened for data analysis.

Post Conference Format. Following administration of the pretest packets in both schools, all students attended their previously scheduled clinical assignments for the next two weeks. Clinical assignments included providing nursing care to patients in health care facilities and practicing nursing care activities in college laboratories. The students from School 1 attended four-6 hour clinical assignments and the students from School 2 attended two-12 hour clinical assignments. After students completed their clinical assignments, all clinical sections met at the college campuses for post conferences. The research assistant, an experienced clinical teacher, instructed students in all control group clinical sections. The researcher, also an experienced clinical teacher, instructed students in all intervention group clinical sections.

The purpose of post conferences was to connect content taught in lecture to clinical data in order to help students gain deeper understandings of the concepts. Students from School 1 attended four-1 hour post conferences and students from School 2 attended two -2 hour post conferences. Students were asked to bring patient data from their clinical experiences to the post conferences. No patient identifying data were included in post conference discussions.

Post Conferences for Clinical Sections in the Control Group. The teacher of post conferences for clinical sections in the control group followed the usual post conference format:

a. The teacher generated discussion and questioned students to promote understanding of their patients' data and application of class content with a focus on respiratory and oxygenation problems and risk states.
b. The teacher asked students to reflect on patient data they collected regarding their last clinical experience and identify respiratory and oxygenation problems and risk states for their patients and discuss effective plans of care.
c. Common respiratory health problems and nursing diagnoses were reviewed.
d. Student concerns and questions were discussed. For example, one group requested clarification of medication dosage calculation procedures.

Post Conferences for Clinical Sections in the Intervention Group. The teacher of post conferences for clinical sections in the intervention group used the DNT model to help students structure their thinking and interpret patients' assessment data. Post conference format was conducted as follows:

a. In the beginning of the first post conference, for about 20 minutes, the teacher explained to students the components of the DNT model and accompanying worksheets. This included the goal of the model, which was to help students or nurses to develop effective thinking habits while considering patient safety in all phases of the process. The NANDA-I (2009) book was also introduced and the diagnoses *impaired gas exchange*, *ineffective airway clearance*, and *ineffective breathing pattern* were briefly reviewed. In each post conference thereafter, the teacher gave each student a book to use for review of domain knowledge necessary to help them choose accurate nursing diagnoses during post conferences.

b. At the beginning of each post conference, for about 20 minutes, the teacher guided students in use of the model with a short practice case study that depicted a patient with a respiratory problem. The case study was printed on a DNT worksheet (see Appendix B) and a copy given to each student. Students took turns reading portions of the case study aloud. They were directed to underline or draw boxes around pertinent cues as they were reading. When the case study was read, the group identified critical thinking processes from the DNT model that should be used to interpret meaning and then they applied those processes. For example, using the skill of analysis, the students collectively identified all pertinent cues, clustered them, and determined meaning. If a student did not identify all pertinent cues, he or she immediately identified the need to pay closer attention to the cognitive skill of analysis.

As the students progressed through the case study, the teacher encouraged them to be flexible and identify all possible patient problems. When a potential problem was identified by the group, it was written at the bottom of the page. The potential patient problems were then considered as students progressed through the case study and they used the skills of *applying standards, information seeking, and intellectual integrity* to either support or disregard these problems. When a cognitive skill or habit of the mind was identified and used, the teacher directed students to place an x next to that skill on the worksheet. This was done so the students could reflect on the thinking skills they used, identify those that were helpful, and consider use of

the thinking skills they did not select. When students finished reading the case study, they considered all possible patient problems that they had identified, examined the evidence to support choice of the best diagnosis considered possible risks to patient safety, and chose two priority problems.

The two possible nursing diagnoses were written in the Problem box on page two of the worksheet. In small groups, the students used the NANDA-I book to confirm or disconfirm the diagnoses by comparing actual patient data to the defining characteristics and related factors provided in the reference. When, students confirmed a diagnosis, the teacher initiated a discussion of the risk to patient safety. For example, when the diagnosis *ineffective breathing pattern* was chosen, the students identified hypoxemia as a possible consequence. Based on the problems' defining characteristics, related factors, and patient safety risks the students outlined a plan of care.

In the remaining time of the one hour post conferences, following guided instruction in use of the DNT model to interpret the short case study, the students interpreted a clinical case from one of the student's clinical experiences. The teacher directed them to identify problems or risk states related to respiratory or oxygenation problems. Students worked in small groups and selected data from a student's clinical experiences. While the students were working, the teacher coached the groups in use of the model. For example, the teacher asked students if they needed more information, or *information seeking.* to interpret patient data and if they were using *intellectual integrity* to best understand human responses and develop plans

of care. The teacher reminded students to consider the effect of the identified problems on patient safety. At the end of the post conference the students presented their nursing diagnoses to the group. When providing evidence for their choice of nursing diagnoses, the group used information in the NANDA-I book to validate the choice of nursing diagnosis. As time allowed, this activity was repeated using data from other student's clinical experiences. During the two hour post conferences, students were guided through two case studies and interpreted more than one student's clinical patient data.

c. All students' papers were collected at the end of the class to prevent sharing of the intervention with the control group. At the end of the study, the students' papers were returned to them.

Post Conference Student Evaluation. In both the control and interventions groups, at the end of the last post conference, students were asked to complete an evaluation of post conference activities (see Appendix G). The evaluation forms were collected and placed in a sealed envelope. As with other study data, the post conference student evaluations were analyzed after grades for the semester were posted to the Registrar.

Posttest. At the end of the lecture class following the two weeks of the study procedures, the post test packet was administered to all students by the researcher and assistants (see Appendix F). The post-test packet included an instruction cover sheet, the code sheet, which included a request for students to state the number of post conferences they attended and two parallel case studies. The same procedures were followed as for the pre-test.

Student Debriefing

The researcher debriefed the students following the post test and informed them that a new teaching strategy, Developing Nurses' Thinking (DNT), was tested in the study. Students were also told that, near the end of the Spring semester, the results of the study would be posted on a nursing department bulletin board.

To ensure that all students had the advantage of using the DNT model, a workshop was offered to all students in both schools to demonstrate its use before the end of the semester. Fifteen students attended from School 1 and no students attended from School 2. Higher attendance at School 1 may have been related to the fact that the workshop was scheduled at a more convenient time for the students, that the researcher was a faculty member at the school, and students thought that this workshop would be helpful in preparing for their final exams. The poor attendance at School 2 may have occurred because the study procedures were closer to the end of the semester and students preferred to use the debriefing time to study for final exams.

Data Preparation and Analysis

Data were analyzed using SAS ® software Version 9.1. The database was prepared in SPSS, Version 11.5 (Windows) to facilitate data entry and initial analysis and included consent, student code, clinical section number, site (School 1 or School 2), treatment group, student demographics, and nursing diagnosis accuracy scores for each of four case studies. When final grades were submitted to the Registrar, the envelopes containing the study data were opened, data organized into clinical groups and consents reviewed to assure that only data of students who consented were analyzed for this study. The student codes were attached to all student data (consent, pre and posttests, post

conference evaluation) to enable comparison of pre and post test data. Student data were arranged by clinical section to facilitate validation of correct and consistent student codes and enable data cleaning. A cover sheet, that did not include clinical group number, was maintained to ensure treatment group anonymity. To prevent bias in scoring case studies, the raters did not know students' clinical section number.

Data were entered into the data base by the researcher and accuracy of data entry verified by comparing the printed SPSS Version 11.5 (Windows) data base to 50% of raw data. Additionally, any cell in the database that had missing data was verified by comparing it to the raw data. Once the data were verified, the database was imported to the SAS ® software Version 9.1 for data analysis.

Descriptive statistics were used to describe the frequencies and percentages of demographic data by school and treatment group. Chi-square test or Fisher's exact test were used to determine similarities regarding age, gender, previous education, and English as a first language. The equivalence of schools and groups regarding pretest scores was determined with use of the independent samples *t*-test. Cohen's Kappa was used to compute inter rater and intra rater reliability of using the Lunney Scoring Method. The hypothesis was tested with independent sample *t*-tests and paired *t*-tests. A general linear regression model was used to determine possible interaction of school and treatment group and to provide coefficient estimates that could be interpreted in terms of the mean response to use of the DNT model for each group. The accuracy score data generated from this study failed the Shapiro-Wilk's test for normality, however, the *t*-test has been found to be resistant to the effects of non-normal data sets with sample sizes greater than 20 to 30 (Cohen, 1988; Doornik & Hansen, 2008). The Wilcoxon Signed

Rank test, a conservative statistic that does not require normally distributed data, was also used to confirm the equality of groups on the pretest scores and differences in pre and posttest accuracy scores by treatment group (control and intervention).

Chapter IV

The Results

This quasi-experimental study was designed to determine the effect of using the Developing Nurses' Thinking (DNT) model on accuracy of nursing diagnoses. The items used for measuring accuracy of nursing diagnoses were four validated case studies, two sets of parallel cases for the pretest (CS 1 and CS 2) and posttest (CS 1a and CS 2a). These items were scored for accuracy by two raters, the researcher and a trained research assistant, using the Lunney Scoring Method. The sample was 83 nursing students in the first clinical nursing courses of two bachelor degree programs in nursing. All data were analyzed using SAS ®, Version 9.1. The statistical findings of this study are presented in five sections: (a) data collection, (b) psychometric evaluation of the tool to measure accuracy, (c) pre test accuracy scores and sample characteristics, (d) primary data analyses, and (e) ancillary data analyses.

Data Collection

This study was both a curriculum evaluation study and a study to test the DNT model, so data collection procedures were incorporated with usual classroom activities. The recruited convenience sample was 113 students who were enrolled in 15 clinical sections of the two schools, seven sections from a public school (School 1) and eight from a private school (School 2). All students signed consents and were asked to select Yes or No regarding use of their data for research. One clinical section of 14 students from School 1 was omitted from the study because the researcher was the clinical instructor.

The clinical sections from each school were randomly assigned to control and intervention groups by clinical day(s). In School 1, three clinical sections had clinical experiences scheduled for Tuesdays and Wednesdays and three clinical sections had clinical experiences scheduled for Thursdays and Fridays, six hours per day. In School 2, four clinical sections had clinical experiences scheduled for Mondays and four clinical sections had clinical experiences scheduled for Tuesdays, 12 hours per day. Clinical groups were given numbers, one through 14, and the clinical section numbers were placed in a hat by meeting day to be randomly selected for the treatment groups.

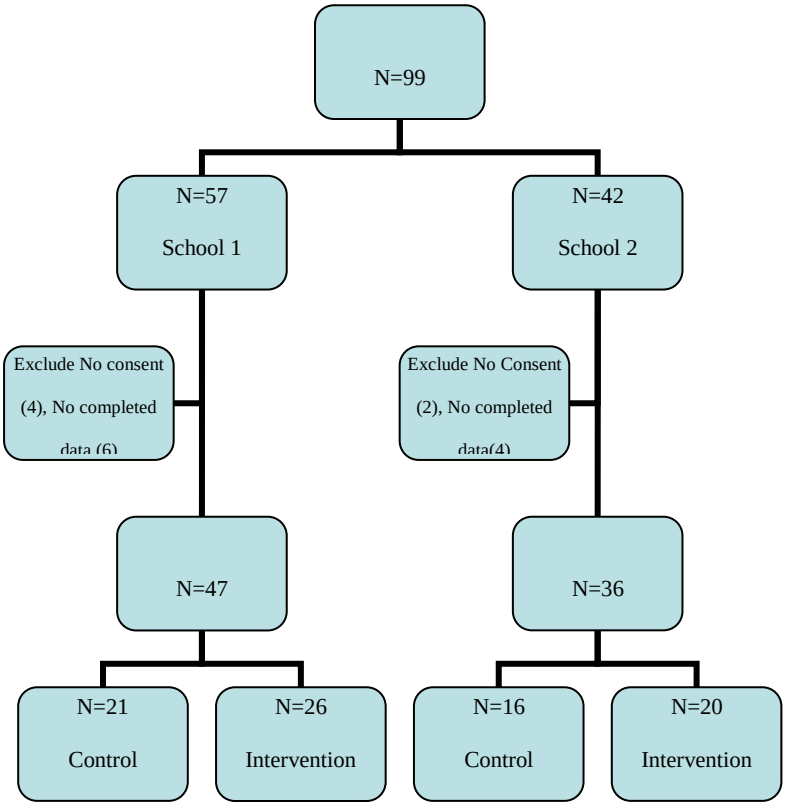
Of the 99 students, six were eliminated because they did not check Yes on the consent form. A high positive response rate, 93 of 99 (94%) was anticipated because the study procedures were included in usual activities of the class and participation had no impact on students' grades. Of the 93 students who consented to allow their data to be used for this research, 10 did not complete both pre and posttests, thus yielding a final sample of 83 students in the two groups, 37 in the control group and 46 in the intervention group (see Figure 4.1).

The student-generated codes protected students' anonymity. When the two raters scored the accuracy of students' nursing diagnoses, they did not know in which group students had participated. The student-generated codes also performed as predicted and provided distinct codes for each participant (see Appendix E). There was no duplication of codes for the 99 participants. These codes, however, were inconsistently generated by 29 of 99 (29%) students and required investigation by the researcher to match codes. Inconsistent codes were verified by beginning letters of the code, and by comparison to the codes of other students in the clinical group. Two issues that interfered with

consistent completion of the code sheet were that: (a) students did not always know their mother's maiden name or the month of her birth, and (b) some students had step brothers and sisters and did not consistently consider them when developing the code.

Figure 4.1

Study Sample Size Flow-Chart



For this study, post conferences were conceptualized as total hours that students attended. For School 1, there were four 1-hour sessions; for School 2, there were two 2-hour sessions. Students self-reported the number of post conferences that they attended to protect student anonymity and prevent the identification of students by name during

data collection. In School 1, 43 of 46 (94%) students reported that they attended all post conferences. In School 2, 35 of 37 (95%) students reported that they attended all post conferences.

Psychometric Evaluation

The Lunney Scoring Method was used to measure the dependent variable, accuracy of nursing diagnoses. The scoring method consists of seven levels of accuracy, which spans from +5 for a diagnosis that is consistent with all of patient assessment data or cues, to -1, which is assigned to incorrect diagnoses based on disconfirming cues. The validity, described in Chapter 3, was established in previous studies. Reliability was determined by agreement between (inter rater reliability) and within (intra rater reliability) the two raters of accuracy scores for the written case studies. The research assistant was an experienced master's prepared nurse with extensive critical care experience and four years of nursing education experience that included staff development and undergraduate nursing clinical instruction. Training took approximately one day using the Lunney Scoring Manual (1990, 2001) and included co-scoring of the 56 responses to the case studies of the 14 students in the clinical group that was eliminated.

Inter rater reliability was calculated based on independent scoring by the two raters of 199 of 332 (60%) answers to case studies. There was agreement in 193 of 199 of the scores. Cohen's Kappa was used to compute reliability because this statistic takes chance agreement into account, which means that the numbers are expected to be lower than those of percent agreement. Inter rater reliability using the Cohen's Kappa statistic was .651 or good agreement (Simon, 2008). Intra rater agreement was calculated for

each rater by scoring 33 (10%) of the students' answers to the case studies in two different time periods. Of these, all cases for both raters were scored the same in Time 1 and Time 2, yielding a Cohen's Kappa of 1, which is very good agreement.

Pretest Accuracy Scores and Sample Characteristics

The pretest accuracy scores were calculated by schools and treatment groups to determine equivalence of groups so that data from the two schools could be combined for hypothesis testing (Polit & Beck, 2008). Additionally, sample characteristics were analyzed by school to identify and describe similarities and differences of students from the two schools.

First, the Shapiro-Wilk's test for normality was used to test whether the data were normally distributed, an assumption in use of the two-sample *t*-test (Doornik & Hansen, 2008; Monroe, 2005). This test of normality showed that the pretest score data, an average of CS1 and CS2, were not normally distributed ($W = .96$, $p = .018$). The two sample *t*-test was used, however, to determine the equivalence of pretest accuracy scores because it is resistant to the effects of non-normal data sets with sample sizes greater than 20 to 30 (Cohen, 1988). In addition, the Wilcoxon Signed Rank test, a conservative statistic that does not require normally distributed data (Monroe, 2005), was also used to confirm the equality of groups on the pretest scores. Chi Square statistics and the Fisher's Exact test were used to determine the equality of sample characteristics.

Pretest Accuracy Scores by School. The independent sample *t*-test was used to determine if there were between group (school 1 and school 2) differences in accuracy of nursing diagnoses scores on the pretest case studies prior to the intervention. With a non statistically significant Levene's test assuring equality of variance $F(46, 35) = 1.04$,

p =.915) the *t*-test of equal variance was used to determine group differences (see Table 4.1). The mean pretest score

Table 4.1

Results of Independent Sample t-Test of Preteset Accuracy Scores by School (Mean Pretest: Averages of CS 1 & CS 2)

School	*N*	Lower CL*	*M*(*SD*)	Upper CL*	*t(DF)*	*p*
School 1	47	1.68	2.03(1.19)	2.38	-4.76(81)	<.001
School 2	36	2.88	3.28(1.17)	3.67		

Notes: * 95% Confidence Level, Effect Size = .56 (Faul et al., 2009)

for School 1 was significantly lower than School 2 ($p < .001$). Results of the Wilcoxon Signed Rank Test also showed a significant difference in the medians between School 1 (2) and School 2 (3.5) ($p < .001$).

Sample Characteristics by School. Student characteristics included on the demographic data form were age, gender, previous education, and English as a first language. Significant differences in the sample characteristics between School 1 and School 2 students were identified for age and English as a first language (see Table 4.2).

Regarding age, students in School 1 were significantly older than students in School 2 ($p < .001$). There was no significant difference for gender distribution between the schools with 37 (79%) females in School 1 and 32 (89%) in School 2 ($p = .253$).

Table 4.2

Sample Characteristics by School

Sample Characteristics	School 1 (n = 47)	School 2 (n = 36)	*p*
Age[1]			.001
<21	5(11%)	28(78%)	
21-30	31(66%)	8(22%)	
>30	11(23%)	0	
Gender[1]			.253
Female	37(79%)	32(89%)	
Male	10(21%)	4(11%)	
Education[1]			.335
First degree	39(83%)	33(92%)	
Second degree	8(17%)	3(8%)	
English as First Language[2]			.023
Yes	30(64%)	31(86%)	
No	17(36%)	5(14%)	

Notes: [1] = Fisher's Exact Test, [2] = Chi square statistics.

A majority of students from both School 1 and School 2 were enrolled in their first baccalaureate degree, 39 (83%) and 33 (92%) respectively with no significant difference noted (p = .335). There were statistically significant more students who said English was not their first language (ESL) in School 1 (17, 36%), than School 2 (5, 14%) (*p* = .023).

Pretest Accuracy Scores by Treatment Group. With significant differences of the two schools in pretest scores on accuracy of nursing diagnosis, further analyses were conducted to determine that the two groups could be combined to achieve adequate power for data analysis (Polit & Beck, 2008). Because the clinical sections of both

schools had been randomly assigned to intervention and control groups prior to provision of the study intervention, the pretest scores and sample characteristics were compared by treatment groups.

With a non statistically significant Levene's test assuring equality of variance ($F(45, 36) = 1.18$, $p = .612$) the independent sample *t*-test of equal variance was applied (see Table 4.3). The differences between control group and intervention group pretest scores were not significant ($p = .912$). Because there were no statistically significant differences between groups (control and intervention) of pretest scores on accuracy of nursing diagnosis, the data from the two schools were combined for hypothesis testing.

Table 4.3

Results of Independent Sample t-Test of Pretest Accuracy Scores by Treatment Group (Mean Pretest: Averages of CS 1 & CS 2)

Treatment	*N*	Lower CL*	*M*(*SD*)	Upper CL*	*t(DF)*	*p*
Control	37	2.13	2.55(1.27)	2.98	-.11(81)	.912
Intervention	46	2.18	2.59(1.38)	3.00		

Notes: * 95% Confidence Level, Effect Size = .56 (Faul et al., 2009)

Sample Characteristics by Treatment Group. To further ensure group (control and intervention) equality before the start of the intervention, sample characteristics were compared using chi square and the Fisher Exact Test statistics. The control and intervention groups were found to be equal on all demographic variables (see Table 4.4).

There were no statistically significant differences between groups (control and intervention) in demographic characteristics.

Table 4.4

Sample Characteristics by Treatment Groups

	Treatment		
Sample Characteristics	Control (n = 37)	Intervention (*n* = 46)	*p*
Age[1]			.239
<21	18(49%)	15(33%)	
21-30	16(43%)	23(50%)	
>30	3(8%)	8(17%)	
Gender[2]			.300
Female	29(78%)	40(87%)	
Male	8(22%)	6(13%)	
Education[1]			.556
First degree	33(89%)	39(85%)	
Second degree	4(11%)	7(15%)	
English as First Language[2]			.110
Yes	24(65%)	37(80%)	
No	13(35%)	9(20%)	
School[2]			.983
Public	21(57%)	26(57%)	
Private	16(43%)	20(43%)	

Notes: [1]=Fisher's Exact Test, [2]=Chi square statistics.

Primary Data Analyses

A combination of univariate and multivariate techniques were used to explore the effect of using the DNT model, which is the independent variable, on accuracy of nursing

diagnoses, the dependent variable. This section addresses: (a) the distribution of scores on accuracy of nursing diagnosis, and (b) hypothesis testing.

Distribution of Scores on Accuracy of Nursing Diagnosis. Descriptive data analyses were conducted to describe the pretest and posttest distributions of accuracy scores of the control and intervention groups. An inferential statistic, Chi Square, was applied to determine if there were differences in groups. In both the pretest and posttest, all seven levels of the scoring method were used to score accuracy. The frequencies and percents for scores from +5 to -1 are displayed in Tables 4.5 and 4.6. The frequencies of

Table 4.5

Distribution of Pretest Accuracy Scores by Treatment (Averages of CS 1 & CS 2)

	Treatment Group			
	Control		Intervention	
Score	Frequency	%	Frequency	%
5.0	0	0	2	2
4.5	7	19	4	2
4.0	0	0	2	4
3.5	5	14	10	7
3.0	3	8	4	9
2.5	5	14	3	22
2.0	6	16	10	7
1.5	4	11	4	9
1.0	5	14	3	22
0.5	2	5	2	4
-0.5	0	0	1	9
-1	0	0	1	4
Total	37	100	46	100

students' accuracy scores for pretests were equal for the control group with 41% (n = 15) scoring +3, (i.e., chose nursing diagnoses that reflected the general idea of the cues), or higher and for the intervention group with 48% (n = 22) scoring +3 or higher (see Table 4.5). Chi square analysis was used to determine similarity of accuracy score distribution between the control and intervention group. No significant differences were found (X^2 (11) = 9.77, p = .552).

Following the study intervention, 49% (n = 18) of students in the control group achieved accuracy scores of 3 or higher with 5% (n = 2) achieving the highest score of 5. In contrast, 74% (n = 34) of students in the intervention group had accuracy scores of 3, or higher, with 28% (n = 13) achieving the highest accuracy score of 5 (see Table 4.6). Chi square analysis was used and significant differences in distribution of posttest accuracy scores were found (X^2 (11) = 21.09, p = .032).

Table 4.6

Distribution of Posttest Accuracy Scores by Treatment (Averages of CS 1a & CS 2a)

	Treatment Group			
	Control		Intervention	
Score	Frequency	%	Frequency	%
5.0	2	5	13	28
4.5	4	11	9	20
4.0	4	11	2	4
3.5	5	14	7	15
3.0	3	8	3	7
2.5	5	14	0	0
2.0	5	14	5	11
1.5	3	8	5	11
1.0	2	5	0	0
0.5	1	3	0	0
-0.5	1	3	2	4
-1.0	2	5	0	0
Total	37	100	46	100

Hypothesis Testing. The study's hypothesis, nursing students who are taught and practice use of the Developing Nurses' Thinking (DNT) model to interpret patient data will have greater improvements in accuracy of nursing diagnosis of two written case studies than nursing students who do not use the DNT model, was tested by using independent samples *t-t*est and paired *t*-tests. The independent samples *t*-test was used to determine differences in posttest scores between the control and intervention groups. The assumption of normal distribution of data was not met as described by the significant

Shapiro-Wilk's value ($W = .92$, $p < .001$) however, the *t*-test has been found to be resistant to the effects of non-normal data sets with sample sizes greater than 20 to 30 (Cohen, 1988). With a non statistically significant Levene's test assuring equality of variance ($F(36, 45) = 1.04$, $p = .890$) the independent sample *t*-test (equal variance) was used to determine between group (intervention and control) differences (see Table 4.7). In the posttests, the mean score on accuracy of nursing diagnosis was statistically significantly lower for the control group ($M = 2.68$) compared to the intervention group ($M = 3.58$) ($t(81) = -2.78$, $p = .007$).

Table 4.7

Results of Independent Sample t-Test of Posttest Accuracy Scores by Treatment (Mean Posttest: Averages of CS 1a & CS 2a)

Treatment	*N*	Lower CL*	*M*(*SD*)	Upper CL*	*t(DF)*	*p*
Control	37	2.18	2.68(1.48)	3.17	-2.78(81)	.007
Intervention	46	3.14	3.58(1.45)	4.01		

Notes: * 95% Confidence Level, Effect Size = .56 (Faul et al., 2009)

To validate the findings of the independent sample *t*-test and determine the differences between pre and posttest accuracy scores by student, paired *t*-tests were used (see Table 4.8). For this data set of differences between mean post and pretests, the data were normally distributed with a non significant Shapiro-Wilk's test ($W = .98$, $p = .152$). Regarding, changes in accuracy scores by student, no significant improvements in

accuracy scores were realized in the control group (*M* = .12, SD = 1.85, *p* = .691) while significant improvements were observed in the intervention group (*M* = .99, SD = 1.89, *p* = .001). Students in the intervention group improved almost one level of accuracy in the posttests.

Table 4.8

Results of Paired t-tests of Treatment Groups for Improvement in Accuracy Scores (Mean Posttests-Mean Pretests)

	N	Lower CL*	*M(SD)*	Upper CL*	*t(DF)*	*p*
Posttest-Pretest Control	37	-0.49	0.12(1.85)	0.74	0.4(36)	.691
Posttest-Pretest Intervention	46	0.43	0.99(1.89)	1.55	3.56(45)	.001

Notes: * 95% Confidence Level, Effect Size: Control = .42, Intervention = .37 (Faul et al., 2009)

To further ensure that other more conservative tests would validate the sensitivity of the *t*-test, the Wilcoxon Signed Rank test was conducted to compare medians. The results supported the findings demonstrated in the independent sample *t*-test and the paired *t-t*ests that the median accuracy scores of the control and intervention groups were significantly different (*p* = .029).

Ancillary Data Analysis

Ancillary data analysis includes findings that do not directly relate to hypothesis testing. This section contains analysis of the: (a) accuracy score differences of School 1 and School 2, (b) consistency of students' performance on the four case studies, (c) accuracy scores for parallel case studies, and (d) student responses to the Post Conference Evaluation form.

Accuracy Score Differences of School 1 and School 2. Based on identified differences in pretest accuracy scores; students in School 1 scored significantly lower than those from School 2 (M = 2.03 and M = 3.28, respectively); and differences in sample characteristics; students in School 1 were older and had a higher percentage of ESL students than students from School 2; a possible interaction between treatment and school was suspected.

To explore this possibility, a general linear regression model was applied to compare the means of the differences between mean posttest and mean of pretest scores with predictors: treatment, school and their interaction term (see Table 4.9). Because the interaction term of treatment and school was not significant, p = 0.112, the model was rerun with only treatment and school. Both treatment and school had significant effects on the differences between posttests and pretest accuracy scores, p = .031, and p = .005 respectively. Besides the p values, parameter estimations were obtained, so the estimated model was written as: Estimated mean = 0.88 + 0.87 * treatment-1.14 * school; where treatment: 1=control, 2=intervention and Site: 1 = School 1, 2 = School 2 (see Table 4.9).

Table 4.9

p Values and Parameter Estimations from General Linear Model to Check the Differences Between Mean Posttest and Pretest Accuracy Scores with Treatment and School Effects

Parameter	Estimate	Standard Error	*t*	*P*
Intercept	0.88	0.87	1.03	0.31
Treatment	0.87	0.49	2.20	0.031
School	-1.14	0.40	-2.87	0.005

Without considering the effect of school, the change in accuracy scores between mean posttests and pretests in the intervention group was 0.87 higher than in the control group. Similarly, if from the same treatment group, the change in accuracy scores for School 2 was 1.14 lower than for students in School 1. All differences are statistically significant. These data suggest that the DNT model performed differently in School 1 and School 2.

Consistency of Accuracy Scores by Case Study. The four written case studies, two sets of parallel cases, were developed to be equivalent in students' use of domain knowledge and critical thinking abilities for decision making on what is the most accurate nursing diagnosis. Two case studies were used for the pretest and two parallel cases were used for the posttest with the intention that the mean scores would be used to test the hypothesis. In order to confirm the equivalence of items, students' performance on each set of parallel case studies was analyzed to describe consistency of performance.

Paired *t*-tests were used to determine differences in accuracy scores between CS 1 and CS 1a and CS 2 and CS 2a in the control and intervention groups. Results from these tests demonstrated consistency of students' performance in both posttest case studies with students in the intervention group scoring significantly higher ($p = .018$; $p = .018$) (see Table 4.10). Students in the intervention group improved over one accuracy level for CS1a ($M = 1.07$, SD = 2.94) and almost one accuracy level for CS2a ($M = .91$, SD = 2.51).

Table 4.10

Results of Paired t-Test of the Treatment Groups for Differences in Accuracy Scores for Case Studies CS 1 and CS 1a and CS 2 and CS 2a

	N	Lower CL*	*M(SD)*	Upper CL*	*t(DF)*	*P*
CS1a-CS1 Control	37	-1.00	-0.16(2.51)	0.68	-0.39(36)	.697
CS1a-CS1 Intervention	46	0.19	1.07(2.94)	1.94	2.46(45)	.018
CS2a-CS2 Control	37	-0.37	0.41(2.33)	0.74	1.06(36)	.296
CS2a-CS2 Intervention	46	0.17	0.91(2.51)	1.66	2.47(45)	.018

Notes: * 95% Confidence Level, Effect Size: Control = .42, Intervention = .37 (Faul et al., 2009)

Accuracy Scores for Parallel Case Studies. Interestingly, students in both the control and interventions groups scored higher in the case studies with the most accurate diagnosis of *Impaired Gas Exchange* (CS2 & CS2a) compared to the case studies with the most accurate diagnosis of *Ineffective Airway Clearance* (CS1 & CS1a) (see Table 4.11). This may be related to the difficulty of identifying and validating specific nursing diagnoses (Lunney, 2008; del Bueno, 2004).

Table 4.11

Mean Scores and Standard Deviations for Case Studies for the Control and Intervention Groups

Case Study	Control	Intervention
CS1 (pretest)	1.86(1.83)	2.02(1.88)
CS1a (posttest)	1.70(2.01)	3.09(2.24)
CS2 (pretest)	3.24(1.85)	3.15(2.08)
CS2a (posttest)	3.65(1.93)	4.07(1.47)

Post Conference Student Evaluations. For both groups, there was 99% completion of the post conference evaluations; 83 post conference evaluations were analyzed. The evaluation forms were completed on the last post conference day; students were familiar with completing evaluation forms related to curriculum issues and concerns.

A four question evaluation was administered to describe students' experiences of the post conferences (see Appendix G). The first question asked "Usually, I learn best by…" to determine students' preferred learning strategies. Students in both treatment groups listed multiple learning strategies in answer to this question with the most frequent strategies being: visual, learn by doing, group discussion, and lecture.

The second item was "My experience of the last 4 post conferences has been…" Students in both treatment groups and schools stated that it was a positive experience, with the intervention group writing more detailed answers that included positive impressions of using the NANDA-I book, building confidence, discussing critical thinking processes, and the use and prioritization of patient cues to diagnoses. One student from the intervention group wrote, "I now understand how to go through the process and arrive at a nursing diagnosis, before these sessions I was floundering." Another student from the intervention group wrote, "it is important to be a flexible thinker." One student from the control group wrote that they "understood nursing better as a whole and how everything ties in."

The third question asked students to complete the following: "During the last (2 or 4) post conferences, I liked…" Students in the control group stated they liked the clarification and coverage of material, and small group setting; students in the intervention group stated they liked use of the NANDA-I book, problem solving, and working with peers. One student in the intervention group wrote, "being told what was expected and given the tools to do it." Another student in the control group wrote, "it was helpful to construct my care plan."

To determine what students least liked about the post conferences, students were asked to complete the following: “During the last (2 or 4) post conferences, I did not like…”. A common dislike for both groups was that the post conferences were scheduled late in the day and students had to travel back to the college from clinical settings, which could often be as much as 45 minutes. One student in the intervention group felt that there was too much focus on care of patients’ with respiratory problems. Nine students in the control and 15 students in the intervention group had no dislikes.

Chapter V

Discussion

The purpose of this study was to determine the effect of using the Developing Nurses' Thinking (DNT) model with nursing students in their first clinical courses on students' accuracy of nursing diagnoses. The DNT model includes the dimensions of patients' safety, domain knowledge, critical thinking processes, and repeated practice. It was designed to be used with corresponding worksheets to promote purposeful use of domain knowledge and critical thinking processes in the context of patient safety to solve patients' problems and promote the development of effective thinking habits. A review of the literature suggested that training and practice in use of critical thinking processes during clinical reasoning improved nurses' diagnostic accuracy (Cruz et al., 2009; Lunney, 2008a; Tanner, 2006a).

The research hypothesis was supported that use of the DNT model would improve students' accuracy of nursing diagnosis. This chapter presents discussion of: (a) psychometric evaluation of the Lunney Scoring Method, (b) comparison of School 1 and School 2 of pretest scores and sample characteristics, (c) findings related to the research hypothesis, (d) ancillary data findings, and (e) the theoretical framework.

Psychometric Evaluation of the Lunney Scoring Method

The findings from using the Lunney Scoring method were consistent with the findings of previous studies (Lunney, et al., 1997; Cruz, et al., 2009). In this study, the validity and reliability were supported when rating accuracy of nursing diagnosis. The validity of measuring the concept of accuracy of nursing diagnosis on seven levels of accuracy was supported by the scoring of students' diagnostic answers to four case

studies across all seven levels of accuracy. In a study using three case studies, six of seven levels of accuracy were used for scoring accuracy (Lunney, 1992) and in a clinical study with actual cases; the seven levels of accuracy were used (Lunney et al., 1997). Cruz et al. (2009) conducted a study with highly educated and experienced nurses, and also found that seven levels of accuracy were used. Criterion-related validity was supported by improvement in accuracy scores after students were taught and had practiced using dimensions of the DNT model.

As in previous studies, inter rater reliability was estimated as good (Lunney 1992, Lunney et al., 1997). For this study, the inter rater reliability, using Cohen's Kappa, of two raters' independent scoring of 60% of cases was .651, or good agreement, suggesting that the determination of accuracy scores were consistent between raters (Simon, 2008). In previous studies, inter rater agreement was estimated at .95 and above using Pearson's Product Moment and Spearman's Coefficient (Lunney, 1992; Lunney, 1997).

Intra rater reliability, calculated for each rater in 10% of cases at two time periods, was estimated using Cohen's Kappa as 1, or complete intra rater agreement (Simon, 2008). In previous studies, intra rater agreement was not available. The estimates of inter rater reliability and intra rater reliability suggest that the scores given by raters were reliable and that the statistics generated from data analysis were valid.

Comparison of Pretest Scores and Sample Characteristics

A convenience sample of 83 nursing students in the first clinical courses of two schools of nursing, one public (School 1) and one private (School 2), agreed to participate and completed all procedures for the study. Two schools were necessary to obtain a large enough sample size for a two sample *t*-test to achieve a power of .80 to reject the null

hypothesis with α of .05 having a moderate effect size (Cohen, 1988). Because students were from two schools with different curricula, the equality of groups was determined for pretest scores and sample characteristics. It would have been ideal to be able to include students from two schools with the exact same curricula, but it is common in schools of nursing that curricula are organized differently (American Association of Colleges of Nursing [AACN], 2008).

Differences in Pretest Accuracy Scores. The statistically significant differences in pretest accuracy scores of School 1 and School 2, with School 1 scoring significantly lower than School 2, may have occurred because of differences in: (a) college preparation of students in the two schools, (b) curricula of the two schools both in the two years prior to this course and within the lecture component of the clinical course, and (c) significant differences in the sample characteristic of age and English as a second language. Preparation for college is not a likely reason, however, for differences in pre test scores because the SAT admission scores of the two schools are similar, with School 1 reporting SAT 75 percentile scores of 1000 for admitted students and School 2 reporting SAT 75 percentile scores of 1030 for admitted students (U.S. University Directory, 2011).

The lower pretest scores achieved in School 1 may have been related to curricula differences in the schools or domain knowledge that was provided in the two years of courses prior to the first clinical course and in the lecture component of the clinical course, i.e., the knowledge related to care of patients with respiratory and oxygenation problems. The domain knowledge that was available in the two years of courses in each school prior to the first clinical course is unknown. The knowledge included in the lecture components of these clinical courses differed in that students in School 1 learned

general content related to care of patients with respiratory and oxygenation health problems and students in School 2 learned more specific content, i.e., care of patients with chronic obstructive pulmonary disease. In a review of the literature regarding self-regulated learning theory, Kuiper & Pesut (2004) explained the requirement of knowledge to be stored and processed for use in problem solving. Tanner's model of clinical judgment in nursing (2006a) identified textbook knowledge, along with knowledge of the patient and practical clinical knowledge, as necessary components for critical thinking and clinical judgments. In a qualitative study of 12 students in their first clinical rotation, Baxter and Rideout (2006) found that students identified knowledge of course content and the patient as being important when identifying the existence of a problem and determining appropriate nursing interventions.

The sample characteristic of differences in students' ages in the two schools may explain differences in pretest scores but data from this study conflict with data from other studies (Hoyert & O'Dell, 2009; Kevern, Ricketts, & Webb, 1999). In this study, students in School 2, of which 78% were younger than 21 years of age, scored significantly higher on accuracy than students in School 1, of which 11% of students were younger than 21. In a study of 355 diploma nursing students, older age and education were significant predictors of academic achievement (p = .001)(Kevern, et al., 1999). Hoyert and O'Dell (2009) examined the relations of student goal orientation (learning and performance), and grades in traditional (18-23 years old) and nontraditional age students (over 24 years of age) (N = 369). The findings were that both grade point average and course grades were positively correlated with older age (F(1, 438) = 39.13,

$p < .001$) and older students maintained higher grades than their younger counterparts ($F(1, 432) = 6.46$, $p = .011$).

The sample differences in English as a second language (ESL), with School 1 (38%) having statistically higher numbers of students with ESL than School 2 (14%), may explain School 1's lower pretest accuracy scores than School 2. The case study design of the pretest and the research task to identify the most accurate nursing diagnosis was a new testing format, so practice prior to the pretest to achieve higher scores may have been necessary, especially for students with ESL. Even if ESL students have strong oral fluency they may have challenges in reading, writing, comprehending, and applying lecture content (Goldschmidt, Notzold, & Miller, 2003). In a review of the literature by Rubenstein (2006), it was concluded that content mastery may not be reflected in test scores because of test-taking strategies, e.g., interpretation of case studies.

Pretest Accuracy Scores by Treatment. The random assignment of clinical groups to control and intervention groups was successful in that the independent *t*-test showed the two treatment groups to be equal in pre test scores (Polit & Beck, 2008). Because this study was a pretest- posttest design, identification of changes in accuracy scores would only be relevant if pre test scores were similar in the control and intervention groups before the intervention was applied to determine its effect. These findings supported combining the two schools for hypothesis testing.

Differences in Sample Characteristics by Treatment. The differences in sample characteristics of the two schools were equalized by random assignment to the treatment groups (Polit & Beck, 2008). Chi square and Fishers' Exact tests showed that there were no significant differences of control and intervention groups in sample

characteristics of age, gender, previous education, or ESL. Both the control and intervention groups were equal in student characteristics and pretest accuracy scores prior to the intervention suggesting that changes in accuracy scores were related to the intervention, use of the DNT model.

Distribution of Accuracy Scores

The accuracy scores of this study varied across seven levels of accuracy just as in previous studies of accuracy (e.g., Cruz et al., 2009; Lunney, 1992; Lunney et al., 1997. Spies et al., 1994; Hasegawa et al., 2007). This supported the validity of the Lunney Scoring Method and reinforced the need for studies that focus on interventions to improve students' learning to achieve accuracy of nursing diagnosis. With accuracy, the goal is mastery or perfect accuracy scores (Gordon, 1994; Lunney, 2008a). Patient safety and outcomes are dependent upon accurate identification of patients' responses to health problems by nurses and the need to communicate these findings to patients and members of the health care team (del Bueno, 2004; IOM, 2011). Health problems that involve compromise of respiratory and oxygenation systems have the potential to produce poor patient outcomes and need to be identified and communicated early to the health care team (Cioffee, 2002; Clark & Aiken, 2003).

In the pre test, less than half of students in both control and intervention groups chose a nursing diagnosis that described the general idea of the patients' problem or slightly more specific (+3 or +4 accuracy scores) with only 2% (n = 2) choosing the most accurate diagnosis. Following the intervention, almost half of students in the control group and 74% (n = 34) in the intervention groups scored +3 or above with 28% (n = 13) of students in the intervention group achieving the highest accuracy score of +5. There

are no studies with which to compare beginning nursing students' accuracy scores for case studies. In a study of nurses' diagnostic accuracy, following a 16 hour course on critical thinking, greater than 70% scored +3 or above and an average of 34% achieved the highest accuracy score of +5 (Cruz et al. 2009). In a descriptive study of the accuracy of 86 staff nurses from a variety of hospitals a majority of nurses scored +3 or above with 40% of nurses achieving the highest accuracy score of +5 in two of the three case studies (Lunney, 1992).

The finding that the intervention group achieved statistically significant higher accuracy scores suggests that after the intervention, a majority of students in the intervention group may theoretically be able to identify respiratory and oxygenation problems in actual patients, thereby potentially positively impacting patient safety and outcomes. There are no reported studies that compared nursing students' abilities on written case studies with ability to achieve accuracy of actual clinical cases.

Higher accuracy scores suggest that those students were able to apply theoretical knowledge to identify patients' problems. Findings of Wolf, Regan, Pesut, & Black (2010) support the significance of improving diagnostic accuracy in beginning students. They explored the meaning of graduate nurses' readiness for practice using content analysis procedures with nurses from education, general practice, and regulatory sectors (N = 150). A theme that arose was the need for graduate nurses to possess and apply theoretical knowledge to deliver safe care.

The variation and improvement of diagnostic accuracy scores in this study are supported by Cruz et al. (2009), a study of the impact of a critical thinking and clinical decision making in a continuing education course on accuracy of nursing diagnosis. The

sample was 39 highly educated nurses with experience in using nursing diagnoses. The findings were that 73% of the participants scored +3 or above in the pretests, which consisted of two case studies, and 18% achieved the highest accuracy score of +5. Following four four-hour classes, 83% scored +3 or above in the post tests with 32% achieving the highest accuracy score.

Research Hypothesis

The findings that the research hypothesis was supported indicates that use of the DNT model during two weeks of clinical post conferences improved accuracy of nursing diagnosis in contrast to traditional post conference format, which showed no significant improvement in accuracy. With three statistical tests, independent *t*-test, paired *t*-test, and the Wilcoxon Signed Rank test, there was statistically significant improvement in posttest scores between the control and intervention groups.

Many literature sources support the positive impact of teaching and practicing critical thinking skills to improve clinical judgment (e.g., Cruz et al,. 2009; Muller-Staub et al., 2008; Tanner, 2006a). In a clinical study with practicing nurses in Switzerland, the findings of Muller-Staub et al. (2008) were consistent with the findings of this study, that accuracy of nurses' diagnoses improved with instruction and practice as measured in a random sample of patient charts. In that study, the effect of traditional discussion of case studies in the control group was compared to the intervention group, which was provided with guided clinical reasoning to achieve accuracy of nursing diagnosis. The study period spanned over a five month period and consisted of 1.5 hours of instruction per week for a total of 22.5 hours. Findings from a random sample of patient charts were that nurses in the guided clinical reasoning group scored statistically higher in accuracy of

nursing diagnosis, choice of appropriate interventions, and in evaluating patient outcomes ($p < .001$).

Similarly, Cruz et al. (2009) found that there was a significant improvement in diagnostic accuracy ($p = .001$) of highly educated and experienced nurses ($N = 39$) who participated in a class designed to improve critical thinking and clinical reasoning. While there was significant improvement in diagnostic accuracy, perfect accuracy (+5) is the goal and the authors suggested that classes on critical thinking and clinical decision making include specific strategies to improve thinking.

Ancillary Findings

Accuracy Score Differences of School 1 and School 2. Even though there was statistical improvement in accuracy scores for the intervention group, this improvement was greater in students from School 1 compared to School 2, as demonstrated in the general linear regression model (see Table 4.9). It was expected that although students in School 2 started at a higher level that they also would improve the same as students from School 1. In School 2, students in the control group were less accurate in the post test than the pretest and students in the intervention group had only modest improvement. Possible explanations for School 1 showing greater improvement in accuracy than School 2, after use of the DNT model, are that: (a) School 1 students were older than School 2 students; (b) in School 1, there was significantly more students with ESL; (c) in School 1, there were four 1-hour post conferences and School 2 had two 2-hour post conferences; and (d) the researcher and research assistants were faculty members at School 1.

***Student Age*.** The significantly higher percentage of older students in School 1 may partially explain statistically significant positive effects of use of the DNT model of

the School 1 intervention group. These students may have preferred to learn and understand the diagnostic processes necessary to interpret patient data even though they were not being graded on their participation or effort (Hoyert & O'Dell, 2009; Justice & Dornan, 2001). With older students, 24 years of age and older, study strategies and goal orientation were shown to be different (Hoyert & O'Dell, 2009; Justice & Dornan, 2001. The relation between student goal orientation and grades was explored in a study of 369 undergraduate students (Hoyert & O'Dell, 2009). A goal orientation questionnaire was administered to determine the correlation of student goal orientation and grades in a psychology course. The researchers found that older students tended to chose learning goals, as compared to performance goals, more strongly than younger students.

The DNT model and accompanying worksheets to structure thinking may have provided a learning format that older students preferred (Justice & Dornan, 2001). Use of the DNT model to guide thinking processes promotes identification of thinking skills and integration of domain knowledge to solve patient problems, a complex task. Justice and Dornan (2001) investigated metacognition in traditional and nontraditional aged college students ($N = 95$), using a questionnaire format. They found that older students preferred study activities that promoted generation of constructive information such as elaborating and integration of materials and "more self-initiated activities designed to assist in processing difficult materials" (p. 242) ($p < .03$). Older students chose study strategies that assisted them to process complex information, promote identification and elaboration of skills that are used, and integrate knowledge (Justice & Dornan, 2001).

English as a Second Language (ESL). The finding that a significantly higher number of students in School 1 reported English as a second language compared to

students in School 2 ($p < .001$) may partially explain improvement in accuracy scores. The ESL students may have preferred using the DNT worksheets to break down the clinical decision making task into simpler components while recording their progress on the worksheets. Students' comments on the Post Conference Evaluation form included students' desire to take home these worksheets at the end of sessions. The possibility that ESL status impacted engagement using the DNT model was supported in an exploratory study of 69 ESL students learning preferences (Lincoln & Rademacher, 2006). The 69 students from 17 countries completed the VARK (visual, aural, reading or writing, kinesthetic) learning style questionnaire. Overwhelmingly, students regardless of age, gender, or country of origin chose reading and note taking, e.g., note-taking on the DNT worksheets, as their preferred method of learning.

Use of the DNT model to structure thinking and diagnostic reasoning may also appeal to ESL students because it allows them to identify thinking processes that are strong and those that may need improvement. Goldschmidt, Notzold and Miller (2003) evaluated the outcomes of a 30-hour ESL transition to college program that facilitated students' identification of strengths, areas for improvement, and goal development. Students were provided with a tutor that assisted them to adjust to college and achieve their goals. Follow-up on program participants found that the program had a positive effect on academic performance and the ESL students who attended had a 15% higher retention rate by the third semester in college than all other freshman.

Number of Post Conferences. The number of sessions in School 1 may have positively impacted accuracy of nursing diagnosis. For this study, post conferences were conceptualized as total weeks and hours that students attended and repetition in use of the

model occurred during those time frames, four hours total. Repeated practice was described as the repetition of a process two or more times (Willingham, 2008). The four 1-hour sessions in School 1 may have been more effective than the two 2-hour sessions in School 2. With only two sessions, even though they were two hours each, students in School 2 may not have had enough time to process new knowledge for application on the posttests.

The finding that students in School 1 significantly improved in accuracy scores after only four sessions for a total of four hours of the intervention may support that a minimum of four separate teaching and practicing sessions are needed to improve accuracy scores. All other recently reported studies of specific teaching methods to improve accuracy, except Spies et al. (1994), were conducted with practicing nurses and the teaching interventions took more hours than this study (e.g., Cruz et al., 2009; Muller-Staub et al., 2008). In the Mueller-Staub et al. (2008) study, the intervention was conducted over a five month period that consisted of 15 one and a half hour sessions for a total of 22.5 hours. The Cruz et al. (2009) study intervention occurred over four 4-hour sessions for a total of 16 hours. Both of the studies reported statistically significant improvements in diagnostic accuracy at the end of the study period.

Research Faculty. With the researcher and the research assistant being teachers at School 1, students in School 1 may have been more motivated to actively participate and learn in post conferences because they may have these same teachers in future classes. If this was a factor, students in both groups, control and intervention, would have been expected to improve similarly. Considering the possible impact of faculty on improvements in accuracy scores in control and intervention groups, the researcher taught

both intervention groups at School 1 and School 2 and students in School 1 improved more than students in School 2. This suggests that improvement in the School 1 intervention group students was not due to faculty expertise but use of the model during four one-hour sessions.

Post Conference Evaluation Forms. Overall, students in both the control and intervention groups said they liked the post conferences; however, they did not like the commute back to their respective schools from the clinical site. Students in the control group particularly liked the clarification of material and students in the intervention group particularly liked use of the NANDA-I book during the post conferences, and development of thinking process with identification and prioritization of cues. This finding is similar to those of Yehle & Royal (2010) who piloted a change to traditional clinical post conferences. Post conferences were held on different days than clinical experiences and at the college to provide a milieu of active learning strategies for students. Students also enjoyed the experience with the percentage of students who felt "overwhelmed" (p. 258) decreasing from 21% to 5%. Students commented that post conferences on a different day and back at the college helped them to "analyze and evaluate complex patient situations without the pressure of being in the actual clinical setting" (Yehle & Royal, 2010, p. 258).

Theoretical Framework

The theoretical framework of this study, which combined the constructs of patient safety, domain knowledge, critical thinking, and repeated practice, was sustained in that the hypothesis was supported and differences in students' performance were explained by some of the constructs, i.e., domain knowledge and repeated practice. This was the first

reported study to compare a traditional teaching format for clinical post conferences to a structured format that included use of a model, the DNT model. The findings of this study are consistent with research findings that teaching and practicing critical thinking skills have positive impacts on clinical judgment (Cruz et al,. 2009; Muller-Staub et al., 2008). All of the constructs included in the DNT model are supported in the literature as having positive effects on nurses' clinical decision making and together they were found to improve nurses' diagnostic accuracy (see Chapter 1).

Patient Safety. The construct of patient safety was consistently used throughout the study intervention. The program on Quality and Safety Education for Nurses (QSEN) recommended that patient safety competencies be included throughout nursing curriculum (Cronenwett, 2009). Teaching students to make clinical decisions within the context of patient safety may further QSEN's efforts.

During each aspect of data interpretation and development of plans of care the questions were posed: "does this pose a risk to patient safety?", "if so how?", "is the risk imminent or possible in the future?. In the beginning, students did not readily identify possible patient safety risks; however, as they continued to use the model they considered multiple possible patient safety issues for each identified problem. Much of the discussion included the type of patient safety risks, e.g., for *ineffective breathing pattern* the patients would be at risk for atelectasis, possible respiratory infection, and hypoxemia (Black & Hawks, 2009). When students identified possible risks to patient safety they included interventions to prevent them and also to promote early recognition if patients did develop problems. They frequently identified the intervention of referral to health care providers. Students commented that identifying the risks to patient safety helped

them to prioritize care. Possibly, students who learn to integrate patient safety risk in their thinking habits early in their education will continue to conduct assessments and develop plans of care within the context of patient safety.

Using a context of patient safety to interpret patient data and develop plans of care helped students to prioritize their care and consider when to communicate with other health care providers. This early identification of complications of health problems should improve patient outcomes (Clarke & Aiken, 2003).

Domain knowledge: Even though the researcher controlled for domain knowledge by implementing the study in the first clinical courses of two schools, there probably were differences in domain knowledge from the two years of previous courses and the lecture component of the clinical courses. These differences may explain differences in students' performance in the two schools. Gordon (1994), a theorist and researcher on nursing diagnosis, postulated that knowledge is necessary, but not sufficient, for correct use of nursing diagnoses. In a pilot study of 15 beginning students in a baccalaureate nursing program, the relation of knowledge, as measured by course grades, and performance, as measured in a high fidelity simulation, the findings were that knowledge was significantly related to performance (Hauber, Cormier, & Whyte, 2010).

Domain knowledge that was used with the DNT model included student's previous knowledge of patients' responses to health problems, and the NANDA-I book (2009). Each student was provided with a NANDA-I book during the post conferences and used the book to develop nursing diagnoses, confirm and disconfirm diagnoses, and to validate that they and their classmates chose the most accurate diagnosis. In the post conference evaluations and verbally, students said that they liked to have the "tools in

their hands" to solve patient problems and that the NANDA-I book was easy to read and use to confirm and disconfirm patient problems. Sternberg and Williams (1998) explained the need to foster use of critical thinking by facilitating the application of domain knowledge to contextual situations, i.e., simulations of clinical cases in written case studies. For nursing students, this theoretical approach can be applied using patient data from clinical experiences and simulations of clinical cases (Hsu, 2007, Yehle & Royal, 2010)

Critical Thinking Processes. Identification and purposeful use of critical thinking process and habits of the mind (Scheffer & Rubenfeld, 2000) occurred consistently in post conferences and may have helped students to develop effective thinking habits. Students identified each process as they were using it by placing an "x" in the corresponding box on the first page of the worksheet. This gave them a sense of the different types of critical thinking processes that they used to solve different patient problems and gave them labels with which to communicate thinking concepts with each other (Hayakawa & Hayakawa, 1990). If students did not consider the *contextual perspective* when interpreting data or planning care they would identify that they should pay more attention to that thinking skill in the future. By the end of the last post conference, students began challenging each other with questions such as, "did you use *intellectual integrity*" when that diagnosis was confirmed. To assure that *intellectual integrity* was used the group turned to the specific nursing diagnosis in the NANDA-I book and validated that the diagnosis was correct based on defining characteristics and related factors.

Critical thinking process that were most frequently used were: *analyzing, applying standards, discriminating* (fit of a particular nursing diagnosis and determining normal from abnormal), *information seeking, predicting, contextual perspective, intellectual integrity,* and *flexibility*. The habit of the mind *reflection* was integrated with most of the other processes. What was particularly interesting was the *flexibility* that the students exhibited when determining possible patient problems. They were taught to identify possible patient problems as they interpreted patient data and were amazed that in many instances they arrived at five or more possible patient problems before focusing on the ones with the highest priority. Reinforcing these critical thinking processes throughout a nursing curriculum using the terms described above may promote improvement of diagnostic reasoning. For example, when developing plans of care for patients it is important for students to consider patients comorbidities, age, and preferences. The teacher may say, "did you consider the *contextual perspective*" or "is *information seeking* required?".

Repeated Practice. The Developing Nurses' Thinking (DNT) model was found to improve nursing students' diagnostic accuracy when used during two weeks (four hours) of clinical post conference. The improvement was significant in School 1, which had four 1-hour conferences. Students in School 2 also improved, although not statistically significant, during two 2-hour post conferences. Two weeks with only two meetings may not be sufficient repeated practice to improve students' diagnostic accuracy. Possibly, repeated use of consistent language, i.e., NANDA-I diagnoses, critical thinking skills and habits of the mind, patients' safety, and the identification, use, and recording of the use of these "words" on the worksheets, provided a map for students

to detect areas of weakness in thinking skills and helped to develop effective habits (Hayakawa & Hayakawa, 1990; Sternberg, 1988, 1997; Willingham 2007).

Chapter VI

Conclusions, Implications, and Recommendations

Nurses make up the largest group of health professionals in the United States and have the potential to improve patient care and promote patients' safety by delivering high quality, evidence based care (IOM, 2004, 2011). The American Association of Colleges of Nursing (ANCC, 2008) and the Institute of Medicine (2011) called for improvements in nursing education that include promoting critical thinking and clinical judgment. Accurate interpretations of patient data and identifying accurate nursing diagnoses are the first steps to develop effective interdisciplinary plans of care (Lunney, 2008). In this study, the researcher repeatedly taught the intervention group of students to use domain knowledge and critical thinking processes in the context of patients' safety, which has the potential to promote effective thinking processes with actual clinical cases.

The findings of this study are relevant for education, practice and research. This chapter presents the investigators' conclusions, implications for education, research, and practice, recommendations for future research, adaptation of the DNT worksheets for future use, and study limitations.

Conclusions

The conclusions that can be drawn from this study relate to (a) knowledge development for the advancement of nursing science, (b) Sternberg's theory of intelligence, (c) relation of the findings to the DNT model, (d) patient safety as the context for teaching data interpretations, and (e) the need for educators to apply evidence-based knowledge regarding accuracy of data interpretations. The DNT model adds to the body of nursing knowledge by providing educators with a model to help students learn to

think like nurses in the context of patient safety. This model and the accompanying worksheets can be used to reinforce effective thinking habits. The DNT model and associated worksheets can be used as a teaching strategy to help students accurately interpret patient data. This conclusion is supported by the statistical improvement in diagnostic accuracy of students in the intervention group of this study and that in the post conference evaluation, students responded positively to using the model for interpretation of patient data and developing plans of care. Students particularly liked that they were given a strategy to solve patient's problems and the tools with which to accomplish the task, i.e., the accompanying worksheets and the NANDA-I book. Some students said that using the model helped them to be more organized and confident when interpreting patient data and developing plans of care. Another student liked that they were given a method to confirm and disconfirm multiple diagnoses.

The findings of this study support Sternberg's Triarchic theory of human intelligence. Sternberg postulated that human intelligence can be improved through learning with education and practice. His theoretical framework of the Triarchic Theory explains the interaction between the "internal world of the individual, the external world, and the experience with the world that mediates between the internal and external worlds (Sternberg, 1988, p. 57-58). Teaching and coaching students through the diagnostic process using the DNT model helps individual students to consciously direct thinking processes in their internal worlds for identification of specific information in external worlds of patient care, which in this study was represented by written case studies, for purposes of meeting a standard of the external world, patient safety. "Experience with

the world" was interpreted as the repeated practice of using the DNT model and worksheets.

The findings of this study support continued use of the DNT model, i.e., patient safety, domain knowledge, critical thinking, and repeated practice, to help students achieve accurate interpretations of patient data. Use of the DNT model had different results, however, in the two schools, which suggests that factors such as age, non primary English speakers, and the number of repeated practice sessions may impact critical thinking processes when students use the model. Further research is needed to determine if changes in the model should be made based on these possible confounding variables.

The DNT model can be used to meet the standards promulgated by the program, Quality and Safety Education for Nurses (QSEN) (Cronenwett, Sherwood & Gelman, 2009). In this study, patient safety was a prominent part of the instruction, and beginning students were able to continuously use patient safety as the context for all their deliberations to identify the best interpretations of patient data.

The findings of this study that beginning students vary widely in accuracy of nursing diagnoses are consistent with all other research evidence that accuracy varies widely in students and nurses. It is important for educators in schools of nursing and clinical settings to address accuracy, whether or not they teach students and nurses about the concept of nursing diagnosis.

Nursing Implications

Implications for Education. The implications for educators in schools of nursing are to continuously use the concept of patient safety as the context for care, apply educational models such as the DNT model for students' accurate interpretation of patient

data, and begin helping students to achieve accuracy of data interpretations in the first clinical course. Integrating the concept of patient safety in nursing students' thinking habits may help to improve the safety of the patients for which they provide care. It was recommended by QSEN that improvements are needed in quality and safety education in undergraduate nursing programs (Cronenwett, Sherwood, & Gelman, 2009). In addition to providing specific instruction regarding patient safety issues, educators can teach course content within the context of patient safety. This will guide students to consider possible risks to patient safety in all situations. For example, students may easily identify that risk for patient falls is a safety issue, however, they may need reminding that a side effect of a newly prescribed medication may also put patients at risk for poor outcomes.

Using educational models that include the concepts of patient safety, domain knowledge, critical thinking process, and repeated practice throughout nursing curricula may help students to develop effective thinking habits and may ultimately improve patient care and safety. Purposefully including the concept of patient safety in all clinical decision making, as in the DNT model, has the potential to foster early identification of possibly dangerous clinical circumstances, increases the likelihood of timely and appropriate interventions, and may improve patient safety outcomes. If nursing students are educated to use critical thinking skills in the context of patient safety, when they graduate they may automatically think about safety, implement effective plans of care, and communicate with other members of the team.

Use of educational models that can help students develop effective thinking habits should begin in the first clinical course. These habits can then be reinforced throughout the curriculum, using the common language of the model. For example, instead of asking

beginning students to read a short case study and determine a patient's problem, teachers can guide students through case studies using the DNT model and worksheets. Teachers can first direct students to use the critical thinking skill *analyze* and identify cues in the very first sentence by placing boxes around them. When the cues are identified, teachers can direct students to cluster them and to determine what they may mean and integrate domain knowledge such as NANDA-I nursing diagnosis to accurately identify patient problems. As students become more comfortable with the diagnostic process, faculty can guide students through more complex scenarios with consistent use of the DNT model. With concern for patient safety as the context of care, careful instruction and practice with use of domain knowledge and critical thinking processes, these thinking habits will likely become embedded in student nurses' approaches to practice.

Implications for Research. This study provides further evidence that the Lunney Scoring method can be used to measure diagnostic accuracy in future research. The effects of educational interventions that are designed to improve accuracy need to be measured using valid and reliable tools such as this. The advantages of using the Lunney Scoring method is that it enables identification of small improvements and shifts in accuracy following teaching strategies and provides a standard of measurement when comparing research findings.

This study should be replicated in other areas of the country where the curricula of nursing schools may be similar such as in Oregon, which has a statewide standardized nursing curriculum (Tanner, Gubrud-Howe, & Shores, 2008). Testing the DNT model with larger groups of students with similar levels of domain knowledge would control for the confounding variable of differences in curricula. Also, study designs and analyses are

needed that address the effects of teacher and teaching strategies, students' age and primary spoken language, and consistency in the number of practice sessions.

Implications for Practice. The DNT model can be used as a way to help nurses accurately interpret patient data. This model and theoretical framework can be used in continuing education courses designed to promote good clinical judgment and helping nurses achieve higher levels of accuracy. Additionally, this model may provide a valuable framework to review clinical cases with poor patient outcomes. Discussion of clinical cases can include identification of critical thinking processes that may not have been used, such as *discriminating* between normal and abnormal findings. Review of the health record with focus on identifying and confirming patient problems based on assessment data may help to uncover pertinent data that was not considered and interventions that did not address patient safety risks.

Recommendations for Future Research

Further testing of the DNT model needs to be conducted with a broad range of nursing students and nurses to determine if: (a) the model is effective in a broad range of educational situations and student learning preferences, (b) repeated practice requires a specific number of meetings to succeed, (c) students retain improvements in accuracy over long time periods, (d) the model facilitates the achievement of accuracy of nurses' diagnoses as well as the etiologies and other elements of the nursing process, (e) validation of case studies and the complexity of case studies, and (f) the DNT model is effective when used with practicing nurses. Because the researcher developed and tested the DNT model it is important to determine other faculty's' success in using it. For the model to be an effective teaching strategy, faculty trained in use of the model should

realize similar outcomes as in this study. Studies that replicate this study should be conducted with trained faculty members to determine if the outcome of improved diagnostic accuracy occurs. This model should also be tested to determine if it is more suitable to certain types of learners. For example, possibly students who prefer visual learning would realize different outcomes as compared to those who prefer auditory learning strategies.

Repeated practice is a construct in the DNT model that is postulated to be a necessary component to promote development of effective thinking habits. Future research should focus on the number of repeated practice sessions, hours per session, and timing of sessions necessary to realize improvements in diagnostic accuracy and, ultimately, student and nurses' mastery of accurate interpretations of patient data.

Students who are taught and practice use of the model should be tested at later time frames after instruction to determine whether improvements in accuracy are sustained following instruction. The goal is that students and nurses will continuously apply effective thinking habits throughout their lifetimes of working with actual patients.

Future research to test the effectiveness of the DNT model with students in later courses of nursing curricula should include its effects on the selection of: (a) both diagnostic statements and etiologies, (b) the defining characteristics and risk states that were used to validate the diagnostic statement, (c) specific patient safety problems or risks, and (d) development of effective plans of care that include interventions to address identified patient safety risks.

Concept analysis is needed to describe complexity as it applies to simulations of clinical cases, such as the written case studies used for this study. Such simulations are

used for measurement of nursing process elements such as diagnosis and intervention. In the past, simulations such as written case studies have been labeled as simple or complex but the meaning of complexity has not been determined.

Finally, the DNT model should be tested with practicing nurses to determine if its use improves patient safety and outcomes. An example of a future study is determination of nurses' documentation before and after being taught to use the DNT model with real life clinical scenarios to apply the concepts. Measurement could include analysis of documentation with a focus on (a) identification of patient problems and risk states, (b) validation of the patient problems with appropriate patient assessments, (c) appropriate interventions that relate to the identified problem and include a focus on prevention of complications, and (d) evaluation of the effectiveness of interventions and an indication that patient safety risks were evaluated if appropriate.

Adaptation of DNT Worksheets

The study findings indicate that the DNT worksheets should be changed to include a reference to *Patient Safety* on the first page of the worksheet and to add a column on page two for *Expected Outcomes* (see Appendix J). The term *Patient Safety* was used continually through use of the worksheets and its prominence was needed on both pages of the worksheets. A column for *Expected Outcomes* was added to page two because patients' expected outcomes should be considered when developing plans of care.

Limitations

The limitations identified for this study are that there were not enough nursing schools represented in this study for generalization of the study findings, there were

differences in the curricula of the two schools, the sample from the two schools were dissimilar in initial performance on the pretest case studies, age and ESL, and the number of post conference sessions differed in the two schools. Ideally, testing the effects of this model in several schools of nursing would help to determine if the DNT model is useful to improve diagnostic accuracy in different schools.

Curricular differences between the two schools may have impacted the study results. Students in these two schools learned slightly different content related to the patient care issues that were addressed in this study, i.e., respiratory and oxygenation health problems. Knowledge has been identified as important, although not the only factor, in determining accurate nursing diagnoses (Gordon, 1994). Students gain knowledge from information delivered through schools' curricula. The nursing curricula in New York State are currently not standardized; course objectives and content vary among schools (AACN, 2008).

Dissimilar pretest scores and sample characteristics of age and ESL status may have impacted study results. Possibly, students with these described characteristics respond differently to using the DNT model. Testing the effects of the DNT model with more homogeneous samples regarding pretest accuracy scores, age, and ESL may have helped to determine if this model is more effective with different populations of students.

Finally, the number of post conference sessions was different in the two schools. Students in School 1 attended four sessions (one hour each) and students in School 2 attended 2 sessions (two hours each) over a two week period. This was a necessary limitation in this study because clinical experiences in School 1 were twice per week (six

hours each day) and clinical experiences in School 2 were once per week (12 hours per day). The actual number of practice sessions may have impacted the study results.

Appendix A

Developing Nurses' Thinking (DNT) Worksheets

Developing Nurses' Thinking (DNT) Worksheets

Critical Thinking Skills	Patient's presentation and assessment findings	Habits of the Mind
Analyzing • Break up the presentation/question into parts (cues) to determine meaning. (i.e. normal vs. abnormal). Identify cues. • Cluster cues to determine meaning • Generate hypotheses		**Confidence** Are you confident in your reasoning abilities?
		Contextual perspective Have you considered the entire context of this problem? Age, co-morbidities, medication, etc.
Applying standards • Use research based standards/rules to rule in or rule out hypothesis. • NDX defining characteristics, related factors and risk states; patho • Making a judgment as to "fit"		**Creativity** Were you creative when you generated or restructured ideas? Did you think of alternatives?
		Flexibility Did you consider multiple possibilities? Did you get stuck on one train of thought?
Discriminating • Look for differences and similarities • Does this help confirm or disconfirm hypothesis		**Inquisitiveness** Were you eager to correctly interpret the situation/problem and did you use observation and thoughtful questioning to explore possibilities?
Information seeking Do you need more information to solve this problem? Information from patient/SO? Lab data? Further physical assessment?		**Intellectual integrity** • Did you use research-based process and research-based criteria to interpret the situation/problem? • Guessing without a basis for deriving meaning does not count
Logical reasoning • Draw conclusions • If this then probably that • Confirm or disconfirm DX		**Intuition-pattern recognition** Did you recognize anything that seemed familiar from past experiences?
Predicting • Envision a plan and consequences. • How will this prob/plan affect patient safety? If I do this then….		**Open-mindedness** Were you open to other possible interpretations of the situation/data?
Transforming knowledge • How will you recognize this same concept/problem in other situations?		**Perseverance** Were you determined to accurately interpret the situation/problem?
Critical Thinking Skills and Habits of the Mind **(Scheffer and Rubenfeld, 2000)**		**Reflection** Did you constantly reflect on your thinking, assumptions, and decisions to assure accurate interpretation of data?

Problem sheet: these can be NANDA (decreased cardiac output), possible medical problem (infection, MI), or description of the problem (change in mental status)

Problem	**<u>Confirming</u> Defining characteristics Assessment findings that support the identification of the problem. (this includes related factors & those that put patients at risk for problems)**	**<u>Disconfirming</u> characteristics Assessment findings that do NOT support choice of this problem**	**Does this problem affect patient safety? If yes how?**	**Interventions/ Evaluation**
1.				
2.				

Appendix B

Post Conference Practice Case Studies

Critical Thinking Skills	Patient's presentation and assessment findings	Habits of the Mind
Analyzing • Break up the presentation/question into parts to determine meaning (i.e. normal vs. abnormal). Identify cues. • Cluster cues to determine meaning. • Generate hypotheses.	Mary Whittiker is an 87 year old woman who was admitted to long term care for self care deficits. She was admitted to the nursing home 10 months ago following a hospital admission for pneumonia. She has been adjusting well to her new surroundings and has made a friend on the unit with whom she shares meals. Her family, a son and daughter, visit her every week. PMH: Chronic Obstructive Pulmonary Disease, Hypertension, and osteoarthritis. She denies any history of smoking but states that her deceased husband used to smoke "a lot." She ambulates with a cane because of knee pain. Over the past 5 days Ms. Whittiker has had nasal congestion and a loose non-productive cough. Shift report included the following: Tmax 99.8 tympanic, BP 120/78, pulse 65 and regular, and respirations 20. She was given an Albuterol nebulizer treatment during the night shift for chest congestion and wheezing. It was effective. Current assessment findings are as follows: Patient was received by the student nurse in bed, awake, alert, and oriented. Her cane is at her bedside and the head of the bed is elevated in high fowler's position. Ms. Whittiker states that she feels "fine." Vital Signs: BP 138/78, pulse 100, respiratory rate 25, temperature 100.0 degrees F, pulse oximetry reading 96%. Respiratory assessment reveals bilateral scattered rhonchi throughout lung fields without use of accessory muscles. She has a non-productive loose cough.	**Confidence** Are you confident in your reasoning abilities?
		Contextual perspective Have you considered the entire context of this problem? Age, co-morbidities, medication, etc.
Applying standards • Use research based standards/rules to rule in or rule out hypothesis. • NDX defining characteristics, related factors and risk states; patho • Making a judgment as to "fit"		**Creativity** Were you creative when you generated or restructured ideas? Did you think of alternatives?
		Flexibility Did you consider multiple possibilities? Did you get stuck on one train of thought?
Discriminating • Look for differences and similarities • Does this help confirm or disconfirm hypothesis		**Inquisitiveness** • Were you eager to correctly interpret the situation/problem and did you use observation and thoughtful questioning to explore possibilities?
Information seeking • Do you need more information to solve this problem? Information from patient/SO? Lab data? Further physical assessment?		**Intellectual integrity** • Did you use research-based process and research-based criteria to interpret the situation/problem? • Guessing without a basis for deriving meaning does not count
Logical reasoning • Draw conclusions • If this then probably that • Confirm or disconfirm DX		**Intuition-pattern recognition** Did you recognize anything that seemed familiar from past experiences?
Predicting • Envision a plan and consequences. • How will this prob/plan affect patient safety? If I do this then….		**Open-mindedness** Were you open to other possible interpretations of the situation/data?
Transforming knowledge • How will you recognize this same concept/problem in other situations?		**Perseverance** • Were you determined to accurately interpret the situation/problem?
Critical Thinking Skills and Habits of the Mind **(Scheffer and Rubenfeld, 2000)**		**Reflection** • Did you constantly reflect on your thinking, assumptions, and decisions to assure accurate interpretation of data?

Problem sheet: these can be NANDA (decreased cardiac output), possible medical diagnosis (infection, MI), or description of the problem (change in mental status)

Problem	**<u>Confirming</u> Defining characteristics Assessment findings that support the identification of the problem. (this includes related factors & those that put patients at risk for problems)**	**<u>Disconfirming</u> characteristics Assessment findings that do NOT support choice of this problem**	**Does this problem affect patient safety? If yes how?**	**Interventions**
1.				
2.				

Critical Thinking Skills	Patient's presentation and assessment findings	Habits of the Mind
Analyzing • Break up the presentation/question into parts to determine meaning (i.e. normal vs. abnormal). Identify cues. • Cluster cues to determine meaning. • Generate hypotheses.	Mr. Redford is a 55 year old male admitted to the hospital yesterday with a diagnosis of unresolved pneumonia. Prior to admission he was treated with two courses of antibiotics without resolution of the infection. Mr. Redford states that he did "miss a few doses" of the prescribed antibiotics. PMH: denies any medical problems or surgical interventions. PSH: states that he drinks alcohol "occasionally" and works approximately 70 hours per week. The student nurse who is assigned to this patient collected the following patient data. Focused assessment: The patient stated: "I feel a bit short of breath and I have a headache especially in the morning" Vital signs: BP 145/88, pulse 110, respirations 25, temperature 98.0 F, SAO2 91% on room air (RA). Neuro: alert and oriented to person, place and time. Patient was noted to be restless during assessment. Respiratory: respiratory rate 25 with nasal flaring, chest rises symmetrically, inspiratory course crackles in the right lower lobe. Determine the patient's priority nursing problem.	**Confidence** Are you confident in your reasoning abilities?
		Contextual perspective Have you considered the entire context of this problem? Age, co-morbidities, medication, etc.
Applying standards • Use research based standards/rules to rule in or rule out hypothesis. • NDX defining characteristics, related factors and risk states; patho • Making a judgment as to "fit"		**Creativity** Were you creative when you generated or restructured ideas? Did you think of alternatives?
		Flexibility Did you consider multiple possibilities? Did you get stuck on one train of thought?
Discriminating • Look for differences and similarities • Does this help confirm or disconfirm hypothesis		**Inquisitiveness** • Were you eager to correctly interpret the situation/problem and did you use observation and thoughtful questioning to explore possibilities?
Information seeking • Do you need more information to solve this problem? Information from patient/SO? Lab data? Further physical assessment?		**Intellectual integrity** • Did you use research-based process and research-based criteria to interpret the situation/problem? • Guessing without a basis for deriving meaning does not count
Logical reasoning • Draw conclusions • If this then probably that • Confirm or disconfirm DX		**Intuition-pattern recognition** Did you recognize anything that seemed familiar from past experiences?
Predicting • Envision a plan and consequences. • How will this prob/plan affect patient safety? If I do this then….		**Open-mindedness** Were you open to other possible interpretations of the situation/data?
Transforming knowledge • How will you recognize this same concept/problem in other situations?		**Perseverance** • Were you determined to accurately interpret the situation/problem?
Critical Thinking Skills and Habits of the Mind **(Scheffer and Rubenfeld, 2000)**		**Reflection** • Did you constantly reflect on your thinking, assumptions, and decisions to assure accurate interpretation of data?

Problem sheet: these can be NANDA (decreased cardiac output), possible medical diagnosis (infection, MI), or description of the problem (change in mental status)

Problem	**<u>Confirming</u> Defining characteristics Assessment findings that support the identification of the problem. (this includes related factors & those that put patients at risk for problems)**	**<u>Disconfirming</u> characteristics Assessment findings that do NOT support choice of this problem**	**Does this problem affect patient safety? If yes how?**	**Interventions**
1.				
2.				

Critical Thinking Skills	Patient's presentation and assessment findings	Habits of the Mind
Analyzing • Break up the presentation/question into parts (cues) to determine meaning. (i.e. normal vs. abnormal). Identify cues. • Cluster cues to determine meaning • Generate hypotheses	Jane Ortiz is a 75 year old frail Caucasian female admitted to long term care facility 3 months ago for generalized weakness and inability to perform activities of daily living. Her husband died last year and she has no other family in the New York area. Her closest relative, a niece, lives in Florida. Mrs. Ortiz keeps to herself and will join unit activities when encouraged. Medical plan is to improve muscle strength and promote independence and discharge her back to her home when safe. Two days ago, Mrs. Ortiz fell and sustained contusions to her left lateral and posterior chest wall. X-rays were negative for rib fracture and pneumothorax. Mrs. Ortiz has been reluctant to get out of bed (OOB) and states that her pain is 10/10 in her chest wall relieved with pain medications (percocet). She has been receiving pain medicine q6h around the clock. PMH: anemia PSH: denies history of smoking or alcohol use Focused assessment: Vital signs: BP 110/67, pulse 96, respirations 24, temperature 98.0 F, SAO2 96% on room air (RA) Neuro: alert and oriented to person, place and time. States that she "slipped" and hit her chest on the sink. Moves all extremities equally. Respiratory: respiratory rate 24 with mild suprasternal retractions, chest rises symmetrically, light purple hematoma 4x3cm to left lateral chest wall, color pink, breath sounds diminished in left lower lobe both anterior and posterior. Left lateral chest wall tender to palpation, no crepitus noted.	**Confidence** • Are you confident in your reasoning abilities?
		Contextual perspective • Have you considered the entire context of this problem? Age, co-morbidities, medication, etc.
Applying standards • Use research based standards/rules to confirm or disconfirm hypotheses. • NDX defining characteristics, related factors and risk states; pathophysiology • Making a judgment as to "fit"		**Creativity** • Were you creative when you generated or restructured ideas? Did you think of alternatives?
		Flexibility • Did you consider multiple possibilities? Did you get stuck on one train of thought?
Discriminating • Look for differences and similarities among things or situations and distinguishing carefully as to category or rank		**Inquisitiveness** • Were you eager to correctly interpret the situation/problem and did you use observation and thoughtful questioning to explore possibilities?
Information seeking • Do you need more information to solve this problem? Information from patient/SO? Lab data? Further physical assessment?		**Intellectual integrity** • Did you use research-based process and research-based criteria to interpret the situation/problem? • Guessing without a basis for deriving meaning does not count
Logical reasoning • Draw conclusions • If this then probably that • Confirm or disconfirm DX		**Intuition-pattern recognition** • Did you recognize anything that seemed familiar from past experiences?
Predicting • Envision a plan and consequences. • How will this prob/plan affect patient safety? If I do this then….		**Open-mindedness** • Were you open to other possible interpretations of the situation/data?
Transforming knowledge • How will you recognize this same concept/problem in other situations? •		**Perseverance** • Were you determined to accurately interpret the situation/problem?
Critical Thinking Skills and Habits of the Mind **(Scheffer and Rubenfeld, 2000)**		**Reflection** • Did you constantly reflect on your thinking, assumptions, and decisions to assure accurate interpretation of data?

Problem sheet: these can be NANDA (decreased cardiac output), possible medical diagnosis (infection, MI), or description of the problem (change in mental status)

Problem	**<u>Confirming</u> Defining characteristics Assessment findings that support the identification of the problem. (this includes related factors & those that put patients at risk for problems)**	**<u>Disconfirming</u> characteristics Assessment findings that do NOT support choice of this problem**	**Does this problem affect patient safety? If yes how?**	**Interventions**
1.				
2.				

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Appendix C

Case Studies and Scoring Manuals

Case Study One

Mary W. is an 87 year old woman who was admitted to a nursing home 10 months ago for self care deficits after a hospital admission of pneumonia. She has been adjusting well to her surroundings and has made a friend on the unit with whom she shares meals. Her family, a son and daughter, visit her every week. Her past medical history includes Chronic Obstructive Pulmonary Disease, Hypertension, and Osteoarthritis. She denies any history of smoking but states that her deceased husband used to smoke "a lot." She ambulates with a cane because of knee pain.

Medical prescriptions:

Robitussin 15 ml po q6h for cough

Metaprolol 20 mg po BID for blood pressure control (hold for pulse <60 and systolic BP <100)

Motrin 600 mg po q6h prn for arthritis pain

Tylenol 650 mg po q4h prn for temperature > 101.4 degrees F

Albuterol nebulizer 1 unit dose q6h prn for shortness of breath and wheezing

Oxygen 2 liters/min nasal cannula for pulse oximetry reading < 94%

Chest PT BID

Over the past 5 days, Mary W. has had nasal congestion and a loose non-productive cough. Shift report included the following: vital signs - maximum temperature 99.8 tympanic, blood pressure 120/78, pulse 65 and regular, and respirations 20. She was given an Albuterol nebulizer treatment during the night shift for chest congestion and wheezing. It was effective and Mary. states she "feels much better." Her respiratory rate decreased from 28 to 20 breaths per minute. She refused chest physiotherapy during the night and stated "I don't need it."

Current assessment findings are as follows:

Mary W. was received by the student nurse in bed, awake, alert, and oriented. She was able to equally move all her extremities with painful movement of both legs. Her cane is at her bedside and the head of the bed is elevated in high fowler's position. She states that she feels "fine," "it is just a bit difficult for me to get to the bathroom." Vital Signs: blood pressure 138/78, pulse 100, respiratory rate 25, temperature 100.0 degrees F, pulse oximetry reading 98%. Respiratory assessment reveals bilateral scattered rhonchi without use of accessory muscles. She has a non-productive cough.

Please write below the PRIORITY nursing diagnosis that the student nurse will communicate to the RN and will be used to develop and implement a plan of care for Mary W. on this shift?

_____

_____

Case Studies and Scoring Manuals

Case Study One A

Robert M. is a 75 year old gentleman who was admitted to an acute rehabilitation nursing facility for difficulty in performing activities of daily living and for strengthening training. He was admitted to rehabilitation 4 weeks ago following a hospital admission for pneumonia. He has been adjusting well to his new surroundings and is engaging with both staff and residents. His family, a daughter and two grandchildren, visit on the weekends. His past medical history includes Chronic Obstructive Pulmonary Disease, Hypertension, and Osteoarthritis. He denies any history of smoking but states that he used to work in a factory that "had bad air". He ambulates with a cane because of chronic back pain.

Medical prescriptions:
Robitussin 15 ml po q6h for cough
Metaprolol 20 mg po BID for blood pressure control (hold for pulse <60 and systolic BP <100)
Motrin 600 mg po q6h prn for arthritis pain
Tylenol 650 mg po q4h prn for temperature > 101.4 degrees F
Albuterol nebulizer 1 unit dose q6h prn for shortness of breath and wheezing
Oxygen 2 liters/min nasal cannula for pulse oximetry reading < 94%
Chest PT BID

Over the past 5 days, Robert M. has had nasal congestion and a loose non-productive cough. Shift report included the following: vital signs - maximum temperature 99.8 tympanic, blood pressure 120/78, pulse 65 and regular, and respirations 20. He was given an Albuterol nebulizer treatment during the night shift for chest congestion and wheezing. It was effective; he said he "felt much better," and his respiratory rate decreased from 28 to 20 breaths per minute. He refused chest physiotherapy during the night and stated "I don't need it."

Current assessment findings are as follows:
Robert M. was received by the student nurse in bed, awake, alert, and oriented. He was able to move all her extremities equally with painful movement of both legs. His cane is at his bedside and the head of the bed is elevated in high fowler's position. He stated that he feels "fine," "it is just a bit difficult for me to get to the bathroom." Vital Signs: blood pressure 138/78, pulse 100, respiratory rate 25, temperature 100.0 degrees F, pulse oximetry reading 98%. Respiratory assessment reveals bilateral scattered rhonchi without use of accessory muscles. He has a non-productive cough.

Please write below the PRIORITY nursing diagnosis that the student nurse will communicate to the RN and will be used to develop and implement a plan of care for Mr. M. on this shift?

_____

_____

Scoring Manual for Case Study One and One A

Diagnostic Statement	Accuracy Score
Ineffective Airway Clearance	+5
Ineffective Breathing Pattern	+4
Risk for Ineffective Gas Exchange	+4
Respiratory distress	+3
Respiratory compromise	+3
Respiratory problem	+3
Airway obstruction	+2
Risk for Ineffective Coronary Perfusion	+2
Risk for falls	+2
Risk for infection	+2
Impaired Activities of Daily Living	+2
Impaired Physical Mobility	+2
Self Care Deficits	+2
Pain	+1
Elevated Blood Pressure	0
Albuterol nebulizer treatment	0
Non compliance	0
Ineffective Self-Health Management	0
Ineffective Therapeutic Regimen	0
Nasal congestion	0
Loose nonproductive cough	0
Knowledge deficit	0
Pneumonia	0
COPD	0
Impaired Gas Exchange	-1
Decreased oxygenation	-1
Loneliness	-1

Case Studies and Scoring Manuals

Case Study Two

Ms. Alice W. is a 67 year old woman who was admitted from home to the hospital with a diagnosis of pneumonia two days ago. Ms. Washington lives with her husband of 30 years in a two story walk-up apartment. PMH: Hyperlipidemia and Hypertension. She denies any history of smoking. Medications: Lisinopril 20 mg daily for hypertension and simvastatin 20 mg daily for hyperlipidemia.

History of present illness: Ms. W. states that she has had increasing chest congestion, fatigue, and temperature for the last week. She took Tylenol for the temperature with good results. Ms. W further states that she has had her flu shot this year.

Medical Prescriptions:
Activity: out of bed (OOB) as tolerated
Diet: regular 2 gm sodium diet
Oxygen 2 liters nasally prn pulse oximetry <95%
Medications:
Lisinopril 20 mg po daily
Albuterol nebulizer one unit q6h
Acetaminophen 650 mg po q4h for temperature > 101
Erythromycin 500 mg IVPB (intravenous piggyback) q12h for respiratory infection

Current assessment findings:
BP 139/90, pulse 105, respiratory rate 24, temperature 99 degrees F, pulse oximetery 91%

Ms. W. is awake, alert, and oriented to person, place, and time. She is restless and uncomfortable, shifting herself in the bed. She states that she feels congested and becomes short of breath when walking to the bathroom. Respiratory assessment reveals diminished breath sounds in both lung bases with course crackles in the right anterior and posterior lung fields. She is not using accessory muscles. She states that she feels very "tired." The IV saline lock in the right hand is intact without any redness, swelling or pain. The IV will be changed tomorrow.

Please write below the PRIORITY nursing diagnosis that the student nurse will communicate to the RN and will be used to develop and implement a plan of care for Ms. W. on this shift?

_____

_____

Case Studies and Scoring Manuals

Case Study Two A

Mr. William B. is a 76 year old gentleman who was admitted from home to the hospital with a diagnosis of pneumonia three days ago. Mr. B. lives with his wife and daughter in a two story walk-up apartment building. PMH: Hyperlipidemia, Coronary Artery Disease, and Hypertension. He states that he stopped smoking 30 years ago. Medications: Lisinopril 20 mg daily for hypertension, and simvastatin 20 mg daily for hyperlipidemia.

History of present illness: Mr. B. states that he has had a "cold that just won't get better". He further states that he has had chest congestion, fatigue, and temperature for the last week. He took Tylenol for temperature and "felt better". Mr. B. states that he has had the flu and pneumonia "shot" this year and doesn't understand why he is sick.

Medical Prescriptions:
Activity: out of bed (OOB) as tolerated
Diet: regular 2 gm sodium diet
Oxygen 2 liters nasally prn pulse oximetry <95%
Medications:
Lisinopril 20 mg po daily
Albuterol nebulizer one unit q6h
Acetaminophen 650 mg po q4h for temperature > 101
Erythromycin 500 mg IVPB (intravenous piggyback) q12h to treat pneumonia

Current assessment findings:
BP 139/90, pulse 105, respiratory rate 24, temperature 99 degrees F, pulse oximetery 91%

Mr. B. is awake, alert, and oriented to person, place, and time. He is restless in bed and uncomfortable. He states that he feels congested and "just can't catch my breath," particularly after walking to the bathroom. Respiratory assessment reveals diminished breath sounds in both lung bases with course crackles in the right anterior and posterior lung fields. There is no use of accessory muscles. He states that he feels very "exhausted." An IV saline lock is in place in the dorsal right hand. The site is intact without any redness, swelling or pain.

Please write below the PRIORITY nursing diagnosis that the student nurse will communicate to the RN and will be used to develop and implement a plan of care for Mr. B. on this shift?

_____

_____

Scoring Manual for Case Study 2 and 2A

Diagnostic Statement	Accuracy Score
Impaired Gas Exchange	+5
Decreased oxygenation	+5
Ineffective Airway Clearance	+4
Ineffective Breathing Pattern	+4
Respiratory distress	+3
Respiratory compromise	+3
Airway obstruction	+3
Risk for ineffective tissue perfusion	+3
Respiratory compromise	+3
Respiratory problem	+3
Risk for Decreased Cardiac Output	+3
Ineffective therapeutic regimen	+3
Fatigue	+2
Risk for Ineffective Self-Health Management	+1
Infection	+1
Risk for falls	+1
Ineffective Tissue Perfusion	+1
Risk for Vascular Trauma	+1
Risk for intravenous infiltration	+1
Elevated Blood Pressure	0
Hypertension	0
Deficient Knowledge	0
Impaired Activity of Daily Living	0
Imbalanced Nutrition	0
Ineffective Self Health management	0
Ineffective Role Performance	0
Risk for Impaired Gas Exchange	-1
Decreased Cardiac Output	-1
Hyperthermia	-1
Acute confusion	-1

Appendix D

Faculty Content Validity Packet and Results (CVI)

Mary Tesoro
The Graduate Center
City University of New York
365 Fifth Avenue
New York, New York 10016
Doctorate of Nursing Science Program

5/7/10

Dear Nursing Colleague,

This is a request for you to act as a content expert for my study **The Effect of an Educational Model, Developing Nurses' Thinking (DNT), on Nursing Students' Accurate Diagnoses of Patients' Responses to Health Problems.** I plan to conduct this research with nursing students in the fall of 2010. This study is a pre/post test design and will use 2 case studies in each time period to measure improvement in accuracy of nursing diagnoses following an intervention. The two sets of case studies are identical regarding patient data, or cues, with the exception of name, age, gender, and medical diagnoses.

You have been identified by colleagues as an expert in the field of medical-surgical and fundamentals nursing and I am requesting that you evaluate the enclosed case studies and scoring manuals to determine validity. If you agree to participate, please read the scoring instruction and complete the content validity rubric. Feel free to contact me with any questions that you may have at 914-589-9418 or at mary.tesoro@lehman.cuny.edu. I appreciate your time in consideration of my request and helping me to move forward with my study.

Sincerely,

Mary Tesoro

Obtaining Content Validity for the Instrument:

Identification of Patients' Responses to Respiratory and Oxygenation Health Problems and Risk States

Objectives for Case Studies:

Case studies will:

1. represent typical patient situations that nurses diagnose and manage in medical and surgical clinical settings;
2. be understood by nursing students in a nursing fundamentals class;
3. require intellectual abilities that are analogous to those used in natural clinical environments;
4. have at least four cues to confirm a highly accurate diagnosis (+5) or one major defining characteristics;
5. have the potential to generate diagnoses from high to low levels of accuracy;
6. be answered in a consistent way by nurses who follow principles of diagnostic reasoning.

Form for Recording Item-Objective Congruence

Please judge whether the enclosed 4 items (case studies) meet the objectives for the measure by assigning a value of +1, 0, or -1 (see the code below). Apply each of the 6 objectives to each of the 4 items. Each case study is viewed as an item.

+1 = definitely a measure of the objective

0 = undecided

-1 = definitely not a measure of the objective

OBJECTIVES

Items	1	2	3	4	5	6
1						
2						
3						
4						

Case studies 1, 1A, 2, and 2A are the same as items 1, 2, 3, 4

Item-Objective Congruence: Comparison of Matched Items in the Six-Item Tool

Judge	**Item 1**	**Item 2**	**Item 3**	**Item 4**
A	6/6	6/6	6/6	6/6
B	6/6	6/6/	5/6	5/6
C	6/6	6/6	6/6	6/6
Total	18/18	18/18	17/18	17/18
CVI	1	1	0.94	0.94

Lunney Scoring Method

Scale for Degrees of Accuracy

Number	Criteria
+5	Diagnosis is consistent with all of the cues, supported by highly relevant cues, and precise.
+4	Diagnosis is consistent with most or all of the cues and supported by relevant cues but fails to reflect one or a few highly relevant cues.
+3	Diagnosis is consistent with many of the cues but fails to reflect the specificity of available cues.
+2	Diagnosis is indicated by some of the cues but there are insufficient cues relevant to the diagnosis and/or the diagnosis is a lower priority than other diagnoses.
+1	Diagnosis is only suggested by one or a few cues.
0	Diagnosis is not indicated by any of the cues. No diagnosis is stated when there are sufficient cues to state a diagnosis. The diagnosis cannot be rated.
-1	Diagnosis is indicated by more than one cue but should be rejected based on the presence of at least two disconfirming cues.

The Lunney Scoring method was used to score accuracy of diagnoses in the scoring manuals.

Case Studies and Scoring Manuals

Case Study One

Mary W. is an 87 year old woman who was admitted to a nursing home 10 months ago for self care deficits after a hospital admission of pneumonia. She has been adjusting well to her surroundings and has made a friend on the unit with whom she shares meals. Her family, a son and daughter, visit her every week. Her past medical history includes Chronic Obstructive Pulmonary Disease, Hypertension, and Osteoarthritis. She denies any history of smoking but states that her deceased husband used to smoke "a lot." She ambulates with a cane because of knee pain.

Medical prescriptions:
Robitussin 15 ml q6h for cough
Metaprolol 20 mg BID for blood pressure control (hold for pulse <60 and systolic BP <100)
Motrin 600 mg q6h prn for arthritis pain
Tylenol 650 mg po q4h prn for temperature > 101.4 degrees F
Albuterol nebulizer 1 unit dose q6h prn for shortness of breath and wheezing
Oxygen 2 liters/min nasal cannula for pulse oximetry reading < 94%
Chest PT BID

Over the past 5 days, Mary W. has had nasal congestion and a loose non-productive cough. Shift report included the following: vital signs - maximum temperature 99.8 tympanic, blood pressure 120/78, pulse 65 and regular, and respirations 20. She was given an Albuterol nebulizer treatment during the night shift for chest congestion and wheezing. It was effective and Mary. states she "feels much better." Her respiratory rate decreased from 28 to 20 breaths per minute. She refused chest physiotherapy during the night and stated "I don't need it."

Current assessment findings are as follows:
Mary W. was received by the student nurse in bed, awake, alert, and oriented. She was able to equally move all her extremities with painful movement of both legs. Her cane is at her bedside and the head of the bed is elevated in high fowler's position. She states that she feels "fine," "it is just a bit difficult for me to get to the bathroom." Vital Signs: blood pressure 138/78, pulse 100, respiratory rate 25, temperature 100.0 degrees F, pulse oximetry reading 98%. Respiratory assessment reveals bilateral scattered rhonchi without use of accessory muscles. She has a non-productive cough.

Please write below the PRIORITY nursing diagnosis that the student nurse will communicate to the RN and will be used to develop and implement a plan of care for Mary W. on this shift?

_____

_____

Case Study One A

Robert M. is a 75 year old gentleman who was admitted to an acute rehabilitation nursing facility for difficulty in performing activities of daily living and for strengthening training. He was admitted to rehabilitation 4 weeks ago following a hospital admission for pneumonia. He has been adjusting well to his new surroundings and is engaging with both staff and residents. His family, a daughter and two grandchildren, visit on the weekends. His past medical history includes Chronic Obstructive Pulmonary Disease, Hypertension, and Osteoarthritis. He denies any history of smoking but states that he used to work in a factory that "had bad air". He ambulates with a cane because of chronic back pain.

Medical prescriptions:
Robitussin 15 ml q6h for cough
Metaprolol 20 mg BID for blood pressure control (hold for pulse <60 and systolic BP <100)
Motrin 600 mg q6h prn for arthritis pain
Tylenol 650 mg po q4h prn for temperature > 101.4 degrees F
Albuterol nebulizer 1 unit dose q6h prn for shortness of breath and wheezing
Oxygen 2 liters/min nasal cannula for pulse oximetry reading < 94%
Chest PT BID

Over the past 5 days, Robert M. has had nasal congestion and a loose non-productive cough. Shift report included the following: vital signs - maximum temperature 99.8 tympanic, blood pressure 120/78, pulse 65 and regular, and respirations 20. He was given an Albuterol nebulizer treatment during the night shift for chest congestion and wheezing. It was effective; he said he "felt much better," and his respiratory rate decreased from 28 to 20 breaths per minute. He refused chest physiotherapy during the night and stated "I don't need it."

Current assessment findings are as follows:
Robert M. was received by the student nurse in bed, awake, alert, and oriented. He was able to move all her extremities equally with painful movement of both legs. His cane is at his bedside and the head of the bed is elevated in high fowler's position. He stated that he feels "fine," "it is just a bit difficult for me to get to the bathroom." Vital Signs: blood pressure 138/78, pulse 100, respiratory rate 25, temperature 100.0 degrees F, pulse oximetry reading 98%. Respiratory assessment reveals bilateral scattered rhonchi without use of accessory muscles. He has a non-productive cough.

Please write below the PRIORITY nursing diagnosis that the student nurse will communicate to the RN and will be used to develop and implement a plan of care for Mr. McDougal on this shift?

_____

_____

Scoring Manual for Case Study One and One A

Diagnostic Statement	Accuracy Score
Ineffective Airway Clearance	+5
Ineffective Breathing Pattern	+4
Risk for Ineffective Gas Exchange	+4
Respiratory distress	+3
Respiratory compromise	+3
Respiratory problem	+3
Airway obstruction	+2
Risk for Ineffective Coronary Perfusion	+2
Risk for falls	+2
Risk for infection	+2
Impaired Activities of Daily Living	+2
Impaired Physical Mobility	+2
Self Care Deficits	+2
Pain	+1
Elevated Blood Pressure	0
Albuterol nebulizer treatment	0
Non compliance	0
Ineffective Self-Health Management	0
Ineffective Therapeutic Regimen	0
Nasal congestion	0
Loose nonproductive cough	0
Knowledge deficit	0
Pneumonia	0
COPD	0
Impaired Gas Exchange	-1
Decreased oxygenation	-1
Loneliness	-1

Case Study Two

Ms. Alice W. is a 67 year old woman who was admitted from home to the hospital with a diagnosis of pneumonia two days ago. Ms. Washington lives with her husband of 30 years in a two story walk-up apartment. PMH: Hyperlipidemia and Hypertension. She denies any history of smoking. Medications: Lisinopril 20 mg daily for hypertension and simvastatin 20 mg daily for hyperlipidemia.

History of present illness: Ms. W. states that she has had increasing chest congestion, fatigue, and temperature for the last week. She took Tylenol for the temperature with good results. Ms. W further states that she has had her flu shot this year.

Medical Prescriptions:
Activity: out of bed (OOB) as tolerated
Diet: regular 2 gm sodium diet
Oxygen 2 liters nasally prn pulse oximetry <95%
Medications:
Lisinopril 20 mg daily
Albuterol nebulizer one unit q6h
Acetaminophen 650 mg q4h for temperature > 101
Erythromycin 500 mg IVPB (intravenous piggyback) q12h for respiratory infection

Current assessment findings:
BP 139/90, pulse 105, respiratory rate 24, temperature 99 degrees F, pulse oximetery 91%

Ms. W. is awake, alert, and oriented to person, place, and time. She is restless and uncomfortable, shifting herself in the bed. She states that she feels congested and becomes short of breath when walking to the bathroom. Respiratory assessment reveals diminished breath sounds in both lung bases with course crackles in the right anterior and posterior lung fields. She is not using accessory muscles. She states that she feels very "tired." The IV saline lock in the right hand is intact without any redness, swelling or pain. The IV will be changed tomorrow.

Please write below the PRIORITY nursing diagnosis that the student nurse will communicate to the RN and will be used to develop and implement a plan of care for Ms. W. on this shift?

_____

_____

Case Study Two A

Mr. William B. is a 76 year old gentleman who was admitted from home to the hospital with a diagnosis of pneumonia three days ago. Mr. B. lives with his wife and daughter in a two story walk-up apartment building. PMH: Hyperlipidemia, Coronary Artery Disease, and Hypertension. He states that he stopped smoking 30 years ago. Medications: Lisinopril 20 mg daily for hypertension, and simvastatin 20 mg daily for hyperlipidemia.

History of present illness: Mr. B. states that he has had a "cold that just won't get better". He further states that he has had chest congestion, fatigue, and temperature for the last week. He took Tylenol for temperature and "felt better". Mr. B. states that he has had the flu and pneumonia "shot" this year and doesn't understand why he is sick.

Medical Prescriptions:
Activity: out of bed (OOB) as tolerated
Diet: regular 2 gm sodium diet
Oxygen 2 liters nasally prn pulse oximetry <95%
Medications:
Lisinopril 20 mg daily
Albuterol nebulizer one unit q6h
Acetaminophen 650 mg q4h for temperature > 101
Erythromycin 500 mg IVPB (intravenous piggyback) q12h to treat pneumonia

Current assessment findings:
BP 139/90, pulse 105, respiratory rate 24, temperature 99 degrees F, pulse oximetery 91%

Mr. B. is awake, alert, and oriented to person, place, and time. He is restless in bed and uncomfortable. He states that he feels congested and "just can't catch my breath," particularly after walking to the bathroom. Respiratory assessment reveals diminished breath sounds in both lung bases with course crackles in the right anterior and posterior lung fields. There is no use of accessory muscles. He states that he feels very "exhausted." An IV saline lock is in place in the dorsal right hand. The site is intact without any redness, swelling or pain.

Please write below the PRIORITY nursing diagnosis that the student nurse will communicate to the RN and will be used to develop and implement a plan of care for Mr. B. on this shift?

_____

_____

Scoring Manual for Case Study 2 and 2A

Diagnostic Statement	Accuracy Score
Impaired Gas Exchange	+5
Decreased oxygenation	+5
Ineffective Airway Clearance	+4
Ineffective Breathing Pattern	+4
Respiratory distress	+3
Respiratory compromise	+3
Airway obstruction	+3
Risk for ineffective tissue perfusion	+3
Respiratory compromise	+3
Respiratory problem	+3
Risk for Decreased Cardiac Output	+3
Ineffective therapeutic regimen	+3
Fatigue	+2
Risk for Ineffective Self-Health Management	+1
Infection	+1
Risk for falls	+1
Ineffective Tissue Perfusion	+1
Risk for Vascular Trauma	+1
Risk for intravenous infiltration	+1
Elevated Blood Pressure	0
Hypertension	0
Deficient Knowledge	0
Impaired Activity of Daily Living	0
Imbalanced Nutrition	0
Ineffective Self Health management	0
Ineffective Role Performance	0
Risk for Impaired Gas Exchange	-1
Decreased Cardiac Output	-1
Hyperthermia	-1
Acute confusion	-1

Appendix E

Pre Test Student Packet

Case Study Instruction Sheet

Today, we ask you to do something important so that faculty can evaluate the nursing curriculum. You will be asked to do a similar task in three weeks. This packet contains two case studies that you should answer to the best of your ability.

These case studies will NOT be graded or evaluated until the end of the semester after final grades have been posted. Please do NOT include your name on the packet. You will develop a personal code (known only to you) using the attached form to link your case study packet to your clinical group. A short demographic sheet is included.

Please read each case study carefully and identify the **PRIORITY** nursing diagnosis in the designated space. If you are unable to identify a nursing diagnosis, describe what you think is the patient's priority problem. Indicate **"don't know"** in the designated space if you are unable to determine the priority nursing diagnosis or describe the priority patient problem. You will have 8 minutes to complete each case study. I will inform you when to turn the page.

Thank you for your participation. The data will be used to improve knowledge of nursing education.

Questionnaire Cover Sheet for Personal Coding System

Please see Appendix L to contact author.

Demographic Data Collection Sheet

Purpose: This data is being collected to determine demographic characteristics of the Lehman College nursing students.

Directions: This is anonymous. Please do NOT put your name on the sheet.

Circle the best answer.

1. Education:
    a. This is my first degree
    b. I have a bachelors degree in another field

2. English is my first language:
    a. Yes
    b. No

3. Gender:
    a. Female
    b. Male

4. Age
    a. under 21
    b. 21 – 30
    c. 31 – 40
    d. 41 – 50
    e. 51 – 60
    f. over 60

Please turn to first case study when instructed.

You will have 8 minutes to complete.

Read the case study carefully and identify the PRIORITY nursing diagnosis and write in the designated area.

Case Study One

Mary W. is an 87 year old woman who was admitted to a nursing home 10 months ago for self care deficits after a hospital admission of pneumonia. She has been adjusting well to her surroundings and has made a friend on the unit with whom she shares meals. Her family, a son and daughter, visit her every week. Her past medical history includes Chronic Obstructive Pulmonary Disease, Hypertension, and Osteoarthritis. She denies any history of smoking but states that her deceased husband used to smoke "a lot." She ambulates with a cane because of knee pain.

Medical prescriptions:
Robitussin 15 ml q6h for cough
Metaprolol 20 mg BID for blood pressure control (hold for pulse <60 and systolic BP <100)
Motrin 600 mg q6h prn for arthritis pain
Tylenol 650 mg po q4h prn for temperature > 101.4 degrees F
Albuterol nebulizer 1 unit dose q6h prn for shortness of breath and wheezing
Oxygen 2 liters/min nasal cannula for pulse oximetry reading < 94%
Chest PT BID

Over the past 5 days, Mary W. has had nasal congestion and a loose non-productive cough. Shift report included the following: vital signs - maximum temperature 99.8 tympanic, blood pressure 120/78, pulse 65 and regular, and respirations 20. She was given an Albuterol nebulizer treatment during the night shift for chest congestion and wheezing. It was effective and Mary. states she "feels much better." Her respiratory rate decreased from 28 to 20 breaths per minute. She refused chest physiotherapy during the night and stated "I don't need it."

Current assessment findings are as follows:
Mary W. was received by the student nurse in bed, awake, alert, and oriented. She was able to equally move all her extremities with painful movement of both legs. Her cane is at her bedside and the head of the bed is elevated in high fowler's position. She states that she feels "fine," "it is just a bit difficult for me to get to the bathroom." Vital Signs: blood pressure 138/78, pulse 100, respiratory rate 25, temperature 100.0 degrees F, pulse oximetry reading 98%. Respiratory assessment reveals bilateral scattered rhonchi without use of accessory muscles. She has a non-productive cough.

Please write below the PRIORITY nursing diagnosis that the student nurse will communicate to the RN and will be used to develop and implement a plan of care for Mary W. on this shift?

_____

_____

Please turn to first case study when instructed.

You will have 8 minutes to complete.

Read the case study carefully and identify the PRIORITY nursing diagnosis and write in the designated area.

Case Study Two

Ms. Alice W. is a 67 year old woman who was admitted from home to the hospital with a diagnosis of pneumonia two days ago. Ms. Washington lives with her husband of 30 years in a two story walk-up apartment. PMH: Hyperlipidemia and Hypertension. She denies any history of smoking. Medications: Lisinopril 20 mg daily for hypertension and simvastatin 20 mg daily for hyperlipidemia.

History of present illness: Ms. W. states that she has had increasing chest congestion, fatigue, and temperature for the last week. She took Tylenol for the temperature with good results. Ms. W further states that she has had her flu shot this year.

Medical Prescriptions:
Activity: out of bed (OOB) as tolerated
Diet: regular 2 gm sodium diet
Oxygen 2 liters nasally prn pulse oximetry <95%
Medications:
Lisinopril 20 mg daily
Albuterol nebulizer one unit q6h
Acetaminophen 650 mg q4h for temperature > 101
Erythromycin 500 mg IVPB (intravenous piggyback) q12h for respiratory infection

Current assessment findings:
BP 139/90, pulse 105, respiratory rate 24, temperature 99 degrees F, pulse oximetery 91%

Ms. W. is awake, alert, and oriented to person, place, and time. She is restless and uncomfortable, shifting herself in the bed. She states that she feels congested and becomes short of breath when walking to the bathroom. Respiratory assessment reveals diminished breath sounds in both lung bases with course crackles in the right anterior and posterior lung fields. She is not using accessory muscles. She states that she feels very "tired." The IV saline lock in the right hand is intact without any redness, swelling or pain. The IV will be changed tomorrow.

Please write below the PRIORITY nursing diagnosis that the student nurse will communicate to the RN and will be used to develop and implement a plan of care for Ms. W. on this shift?

_____

_____

Appendix F

Post Test Student Packet

Case Study Instruction Sheet

This is the second administration of case studies, similar to the ones you completed three weeks ago. The purpose is to evaluate the nursing curriculum.

These case studies will NOT be graded or evaluated until the end of the semester after final grades have been posted. Please do NOT include your name on the packet. You will develop a personal code (known only to you) using the attached form to link your case study packet to your clinical group. This is the same personal code sheet that was used earlier in the semester. There is an additional question on this sheet that asks for you to enter the number of clinical post conferences that you attended at the college.

Please read each case study carefully and identify the **PRIORITY** nursing diagnosis in the designated space. If you are unable to identify a nursing diagnosis, describe what you feel is the patient's priority problem. Indicate **"don't know"** in the designated space if you are unable to determine the priority nursing diagnosis or describe the priority patient problem. You will have 8 minutes to complete each case study. I will inform you when to turn the page.

Thank you for your participation. The data will be used to improve knowledge regarding nursing education.

Questionnaire Cover Sheet for Personal Coding System

Please see Appendix L to contact author.

Please turn to the first case study when instructed.

You will have 8 minutes to complete.

Read the case study carefully and identify the PRIORITY nursing diagnosis and write in the designated area.

Case Study One A

Robert M. is a 75 year old gentleman who was admitted to an acute rehabilitation nursing facility for difficulty in performing activities of daily living and for strengthening training. He was admitted to rehabilitation 4 weeks ago following a hospital admission for pneumonia. He has been adjusting well to his new surroundings and is engaging with both staff and residents. His family, a daughter and two grandchildren, visit on the weekends. His past medical history includes Chronic Obstructive Pulmonary Disease, Hypertension, and Osteoarthritis. He denies any history of smoking but states that he used to work in a factory that "had bad air". He ambulates with a cane because of chronic back pain.

Medical prescriptions:
Robitussin 15 ml q6h for cough
Metaprolol 20 mg BID for blood pressure control (hold for pulse <60 and systolic BP <100)
Motrin 600 mg q6h prn for arthritis pain
Tylenol 650 mg po q4h prn for temperature > 101.4 degrees F
Albuterol nebulizer 1 unit dose q6h prn for shortness of breath and wheezing
Oxygen 2 liters/min nasal cannula for pulse oximetry reading < 94%
Chest PT BID

Over the past 5 days, Robert M. has had nasal congestion and a loose non-productive cough. Shift report included the following: vital signs - maximum temperature 99.8 tympanic, blood pressure 120/78, pulse 65 and regular, and respirations 20. He was given an Albuterol nebulizer treatment during the night shift for chest congestion and wheezing. It was effective; he said he "felt much better," and his respiratory rate decreased from 28 to 20 breaths per minute. He refused chest physiotherapy during the night and stated "I don't need it."

Current assessment findings are as follows:
Robert M. was received by the student nurse in bed, awake, alert, and oriented. He was able to move all her extremities equally with painful movement of both legs. His cane is at his bedside and the head of the bed is elevated in high fowler's position. He stated that he feels "fine," "it is just a bit difficult for me to get to the bathroom." Vital Signs: blood pressure 138/78, pulse 100, respiratory rate 25, temperature 100.0 degrees F, pulse oximetry reading 98%. Respiratory assessment reveals bilateral scattered rhonchi without use of accessory muscles. He has a non-productive cough.

Please write below the PRIORITY nursing diagnosis that the student nurse will communicate to the RN and will be used to develop and implement a plan of care for Mr. M. on this shift?

_____

_____

Please turn to the second case study when instructed.

You will have 8 minutes to complete.

Read the case study carefully and identify the PRIORITY nursing diagnosis and write in the designated area.

Case Study Two A

Mr. William B. is a 76 year old gentleman who was admitted from home to the hospital with a diagnosis of pneumonia three days ago. Mr. B. lives with his wife and daughter in a two story walk-up apartment building. PMH: Hyperlipidemia, Coronary Artery Disease, and Hypertension. He states that he stopped smoking 30 years ago. Medications: Lisinopril 20 mg daily for hypertension, and simvastatin 20 mg daily for hyperlipidemia.

History of present illness: Mr. B. states that he has had a "cold that just won't get better". He further states that he has had chest congestion, fatigue, and temperature for the last week. He took Tylenol for temperature and "felt better". Mr. B. states that he has had the flu and pneumonia "shot" this year and doesn't understand why he is sick.

Medical Prescriptions:
Activity: out of bed (OOB) as tolerated
Diet: regular 2 gm sodium diet
Oxygen 2 liters nasally prn pulse oximetry <95%
Medications:
Lisinopril 20 mg daily
Albuterol nebulizer one unit q6h
Acetaminophen 650 mg q4h for temperature > 101
Erythromycin 500 mg IVPB (intravenous piggyback) q12h to treat pneumonia

Current assessment findings:
BP 139/90, pulse 105, respiratory rate 24, temperature 99 degrees F, pulse oximetery 91%

Mr. B. is awake, alert, and oriented to person, place, and time. He is restless in bed and uncomfortable. He states that he feels congested and "just can't catch my breath," particularly after walking to the bathroom. Respiratory assessment reveals diminished breath sounds in both lung bases with course crackles in the right anterior and posterior lung fields. There is no use of accessory muscles. He states that he feels very "exhausted." An IV saline lock is in place in the dorsal right hand. The site is intact without any redness, swelling or pain.

Please write below the PRIORITY nursing diagnosis that the student nurse will communicate to the RN and will be used to develop and implement a plan of care for Mr. B. on this shift?

_____

_____

Appendix G

Post-Conference Student Evaluation

The nursing department would very much like to have your input regarding your experience during the last 4 post-conference sessions at the college. Student input is very important and helps us to develop effective educational experiences that meet your needs. Please answer the following questions. Thank you.

1. Usually, I learn best by:

2. My experience of the last 4 post conferences has been:.

3. During the last 4 post conferences, I liked:

4. During the last 4 post conferences, I did not like:

Appendix H

Consents

Lehman College Consent

LEHMAN COLLEGE

DEPARTMENT OF NURSING

T3 Building, Room 201
250 Bedford Park Blvd West
Bronx, NY 10468

Phone: 718-960-8214
Fax: 718-960-8488
www.lehman.edu

Consent Form: Curriculum Evaluation Study

A goal of the faculty members of Lehman College, Department of Nursing, is to help **you** achieve **your** potential as nursing students and your ability to provide quality nursing care. To do this, we must study proposed teaching strategies to help you think like nurses.
YOU can help!

This semester, we will conduct a curriculum evaluation study of teaching strategies to help you think like a nurse. The data that all students will provide for curriculum evaluation are as follows:

Week 9- 2 case studies, a code sheet, and a short demographic form will be completed
Week 10- a post conference evaluation form will be completed
Week 11- 2 case studies and a code sheet will be completed

The case studies, code sheets, demographic form, and the post conference evaluation form are part of the normal classroom activity. Everyone will participate in these activities.

We are asking for your consent to use the above listed data for research. Allowing us to use your data is completely voluntary. You may withdraw permission for use of your data at any time until the end of the semester. Refusal to allow use of your data will involve no penalty or loss of benefits to which nursing students are otherwise entitled. No deception is involved and the study involves no foreseen risk to you.

Data for this study will be analyzed by groups and no individual student will be identified in the study results. Use of the code sheet further promotes student confidentiality during data analysis. All data for the study will be placed in a sealed envelope and analyzed after course grades are submitted to the registrar. This includes the consent forms Participation in this study will not affect grades for the course. All data will be kept strictly confidential.

The potential benefit of participating in this study is that you will contribute to the body of nursing knowledge for nursing education and help nurse educators to improve teaching methods that benefit students.

If you have questions about the study, please contact the faculty researcher, Mary Tesoro at 718-960-8391. If you have questions about your rights as a study participant, please contact Kay Powell, Graduate Center IRB Administrator, 212-817-7525.

Please sign your name and circle the appropriate response. Thank you for your thoughtful consideration of this matter and your assistance to improve nursing education.

I agree that my data can be used for this curriculum evaluation study. YES or NO.

Student Name (print): _____ Signature: _____

Clinical instructor: _____ Code: Please complete the next sheet

College of Mount Saint Vincent Consent

LEHMAN COLLEGE
DEPARTMENT OF NURSING
T3 Building, Room 201
250 Bedford Park Blvd West
Bronx, NY 10468
Phone: 718-960-8214
Fax: 718-960-8488
www.lehman.edu

Consent Form: Curriculum Evaluation Study

A goal of the nursing faculty is to help you achieve your potential as nursing students and your ability to provide quality nursing care. To do this, we must study proposed teaching strategies to help you think like nurses.
YOU can help!

This semester, we will conduct a curriculum evaluation study of teaching strategies to help you think like a nurse. The data that all students will provide for curriculum evaluation are as follows:

November 18th- 2 case studies, a code sheet, and a short demographic form will be completed
Week of November 29th- a post conference evaluation form will be completed
December 2nd- 2 case studies and a code sheet will be completed

The case studies, code sheets, demographic form, and the post conference evaluation form are part of the normal classroom activity. Everyone will participate in these activities.

We are asking for your consent to use the above listed data for research. Allowing us to use your data is completely voluntary. You may withdraw permission for use of your data at any time until the end of the semester. Refusal to allow use of your data will involve no penalty or loss of benefits to which nursing students are otherwise entitled. No deception is involved and the study involves no foreseen risk to you.

Data for this study will be analyzed by groups and no individual student will be identified in the study results. Use of the code sheet further promotes student confidentiality during data analysis. All data for the study will be placed in a sealed envelope and analyzed after course grades are submitted to the registrar. This includes the consent forms. Participation in this study will not affect grades for the course. All data will be kept strictly confidential.

The potential benefit of participating in this study is that you will contribute to the body of nursing knowledge for nursing education and help nurse educators to improve teaching methods that benefit students.

If you have questions about the study, please contact the **doctoral student researcher**, Mary Tesoro at 718-960-8391 or project advisor, Margaret Lunney at 718-982-3845. If you have questions about your rights as a study participant, please contact Kay Powell, Graduate Center IRB Administrator, 212-817-7525.

Please sign your name and circle the appropriate response. Thank you for your thoughtful consideration of this matter and your assistance to improve nursing education.

I agree that my data can be used for this curriculum evaluation study. YES or NO.
Student Name (print): _____ Signature: _____
Clinical instructor: _____ Code: Please complete the next sheet

Appendix I

Post Conference Evaluation Form Responses: Control and Intervention Groups

The responses were categorized and counted to gain an understanding of the students' experiences. *N* = 82

1. Usually, I learn best by:

Control		Intervention	
Auditory	1	Auditory	3
Self-study	10	Self study	12
Hands on	24	Hands on	22
Repetition	4	Repetition	12
Visual	26	Visually	19
Note taking	6	Rewriting notes	13
Textbook and questions	4	Textbook and questions	3
Class prep	11	Class prep	15
Pictures and diagrams	4	Note taking and highlighting	2
Power points	7	Power points	3
Group discussion	28	Group discussion	9
Instructor lectures	16	Lecture notes and handouts	13
Application	1	Application/trial and error	6
Reinforcement	1	Organization	3
Outlining	2	Asking questions	1
Interactive learning	5	Teaching material to a peer	1

2. My experience of the last 4 post conferences has been:.

Control		Intervention	
Very positive feedback	13	NANDA book	8
Atmosphere	2	Very positive feedback	13
Professor's exuberance	2	Confidence building	6
Being with different students	1	Gained organization skills	2
Instructor interaction/professor	5	Critical thinking process	6
Different teaching style	9	Educational & informative	3
Negative feedback	4	Appreciative	13
		Development of nursing DX	3
		Identification & prioritization of cues	6
		Mediocre experience	5
		Timing before vacation	3

3. During the last 4 post conferences, I liked:

Control		Intervention	
Clarification & material coverage	24	Nanda book	9
Small group discussion	5	New experience	4
Working with those from a different clinical group	3	Method of teaching	5
Hands on	2	Working in a group	5
Med math question review	5	Group brainstorming	3
Prioritization of nursing DX	2	Problem solving	3
Simplification of information	4	Working with peers	6
		Critical thinking	2
		Professor's expertise	7
		Prioritizing nursing diagnosis	4
		Increased understanding	1
		Class should be included in curriculum	2
		Organization	3

4. During the last 4 post conferences, I did not like:

Scheduling after clinical	11	Time allotment too short for brainstorming	5
Too long in duration	3	Started too late in the semester	2
Too late in the day	5	The inconvenience of scheduling after clinicals	9
The travel issue	8	Too time consuming	3
Outdated case studies	1	Similar subject matter	3
Mandatory attendance policy	1	Unfair that not all clinical groups had to participate	3
No dislikes	9	No dislikes	15

Appendix J

Revised

Developing Nurses' Thinking (DNT) Model Worksheets

Developing Nurses' Thinking (DNT) Model

Critical Thinking Skills	Patient's presentation and assessment findings	Habits of the Mind
Analyzing • Break up the presentation/question into parts (cues) to determine meaning (i.e. normal vs. abnormal). Identify cues. • Cluster cues to determine meaning.. • Generates hypotheses.		**Confidence** Are you confident in your reasoning abilities?
		Contextual perspective Have you considered the entire context of this problem? Age, co-morbidities, medication, etc.
Applying standards • Use research based standards/rules to rule in or rule out hypothesis. • NDX defining characteristics, related factors and risk states; patho • Making a judgment as to "fit"		**Creativity** Were you creative when you generated or restructured ideas? Did you think of alternatives?
		Flexibility Did you consider multiple possibilities? Did you get stuck on one train of thought?
Discriminating • Look for differences and similarities • Does this help confirm or disconfirm hypothesis		**Inquisitiveness** Were you eager to correctly interpret the situation/problem and did you use observation and thoughtful questioning to explore possibilities?
Information seeking Do you need more information to solve this problem? Information from patient/SO? Lab data? Further physical assessment?		**Intellectual integrity** • Did you use research-based process and research-based criteria to interpret the situation/problem? • Guessing without a basis for deriving meaning does not count
Logical reasoning • Draw conclusions • If this then probably that • Confirm or disconfirm DX		**Intuition-pattern recognition** Did you recognize anything that seemed familiar from past experiences?
Predicting • Predict potential patient problems and envision a plan & desired outcomes . • How will this prob/plan affect patient safety? If I do this then….		**Open-mindedness** Were you open to other possible interpretations of the situation/data?
Transforming knowledge • How will you recognize this same concept/problem in other situations?		**Perseverance** Were you determined to accurately interpret the situation/problem?
Critical Thinking Skills and Habits of the Mind (Scheffer and Rubenfeld, 2000)		**Reflection** Did you constantly reflect on your thinking, assumptions, and decisions to assure accurate interpretation of data?
Patient Safety		

Developing Nurses' Thinking (DNT) Model

Problem sheet: these can be NANDA (decreased cardiac output), possible medical problem (infection, MI), or description of the problem (change in mental status)

Problem	**<u>Confirming</u> Defining characteristics Assessment findings that support the identification of the problem. (this includes related factors & those that put patients at risk for problems)**	**<u>Disconfirming</u> characteristics Assessment findings that do NOT support choice of this problem**	**Does this problem affect patient safety? If yes how?**	**Expected Outcomes**	**Interventions/ Evaluation**
1.					
2.					

Appendix K

IRB Approvals

Office of the Vice President for Research and Sponsored Programs
Committee on the Protection of Human Subjects

The Graduate School and University Center
The City University of New York
365 Fifth Avenue
New York, NY 10016-4309
TEL 212.817.7999 FAX 212.817.1628

TO: Ms. Mary Tesoro
Nursing Science

FROM: Richard G. Schwartz, Ph.D.
Graduate Center IRB

195

SUBJECT: IRB Approval (Expedited Review)

STUDY: **10-06-162-0135 The Effect of an Educational Model, Developing Nurses' Thinking (DNT), on Nursing Students' Accurate Diagnoses of Patients' Responses to Health Problems**

DATE: July 14, 2010

The Graduate Center IRB has approved the above study involving humans as research subjects. This study was Approved - Expedited Category: 7 - based on 45CFR46.

IRB Number: **10-06-162-0135** This number is a Graduate Center IRB number that should be used on all consent forms and correspondence

Approval Date: **July 14, 2010**
Expiration Date: **July 13, 2011**

THIS APPROVAL IS FOR A PERIOD OF ONE-YEAR OR LESS. YOU SHOULD RECEIVE A COURTESY RENEWAL NOTICE BEFORE THE EXPIRATION OF THIS PROJECT'S APPROVAL. HOWEVER, IT IS YOUR RESPONSIBILITY TO INSURE THAT AN APPLICATION FOR CONTINUING REVIEW APPROVAL HAS BEEN SUBMITTED BEFORE THE EXPIRATION DATE NOTED ABOVE. IF YOU DO NOT RECEIVE APPROVAL BEFORE THE EXPIRATION DATE, ALL STUDY ACTIVITIES MUST STOP UNTIL YOU RECEIVE A NEW APPROVAL LETTER. THERE WILL BE NO EXCEPTIONS. IN ADDITION, YOU ARE REQUIRED TO SUBMIT A FINAL REPORT OF FINDINGS AT THE COMPLETION OF THE PROJECT.

Consent Form: All research subjects must use the approved and stamped consent form. You are responsible for maintaining signed consent forms for each research subject for a period of at least three years after study completion.

Mandatory Reporting to the IRB: The principal investigator must report within five business days, any serious problem, adverse effect, or outcome that occurs with frequency or degree of severity greater than that anticipated. In addition, the principal investigator must report any event or series of events that prompt the temporary or

Tesoro ID-06-162-0635

permanent suspension of a research project involving human subjects or any deviations from the approved protocol.

Amendments/Modifications: All amendments/modifications of protocols involving human subjects must have prior IRB approval, except those involving the prevention of immediate harm to a subject. Amendments/modifications for the prevention of immediate harm to a subject must be reported within 24 hours to the IRB.

Stipulations:

If you have any questions, please do not hesitate to contact Kay Powell in the IRB Office at 212-817-7525.

Good luck on your project.

cc: Marge Lunney Ph.D.
Nursing

Sign the Verification Statement below. Return the original signed copy of this memo to the IRB Office and retain a copy for your records. The IRB Office must receive a copy of the signed verification statement before research may begin.

VERIFICATION:

BY SIGNING BELOW, I ACKNOWLEDGE THAT I HAVE RECEIVED THIS APPROVAL AND AM AWARE OF, AND AGREE TO ABIDE BY, ALL OF ITS STIPULATIONS IN ORDER TO MAINTAIN ACTIVE APPROVAL STATUS, INCLUDING TIMELY SUBMISSION OF CONTINUING REVIEW APPLICATIONS AND PROPOSED PROTOCOL MODIFICATIONS, AS WELL AS PROMPT REPORTING OF ADVERSE EVENTS, SERIOUS UNANTICIPATED PROBLEMS, AND PROTOCOL DEVIATIONS. I AM AWARE THAT IT IS MY RESPONSIBILITY TO BE KNOWLEDGEABLE OF ALL FEDERAL, STATE AND UNIVERSITY REGULATIONS REGARDING HUMAN SUBJECTS RESEARCH INCLUDING CUNY'S FEDERALWIDE ASSURANCE (FWA) WITH THE DEPARTMENT OF HEALTH AND HUMAN SERVICES OFFICE OF HUMAN RESEARCH PROTECTIONS.

Mary Tesoro — Signature of Principal Investigator — Date 7/19/10

Signature of Faculty Adviser for Student Research — Date 7/19/10

MARY TESORO

Date: Thu, 05 Aug 2010 13:40:17 -0400
From: Lois Levy <LOIS.LEVY@lehman.cuny.edu>
Subject: Research Study
To: "MARY TESORO" <MARY.TESORO@lehman.cuny.edu>
Cc: "Powell, Kay" <KPowell@gc.cuny.edu>

Mary-

Concerning your research study 10-06-162-0135 The Effect of an Educational Model, is accepted by the Lehman IRB chair. You may begin your research whenever you wish.

Lois

Dr. Lois M. Levy
Director
Office of Responsible Research Practices
Lehman College
PH: 718.960.8717
FAX: 718.960.8042
www.lehman.edu/provost/irb

Office of the Vice President for Research and Sponsored Programs
Committee on the Protection of Human Subjects

The Graduate School and University Center
The City University of New York
365 Fifth Avenue
New York, NY 10016-4309
TEL 212.817.7523 FAX 212.817.1538

TO: Ms. Mary Tesoro
Nursing Science

FROM: Richard G. Schwartz, Ph.D. RGS
Graduate Center IRB

SUBJECT: IRB Approval of Amendment

STUDY: **10-06-162-0135 The Effect of an Educational Model, Developing Nurses' Thinking (DNT), on Nursing Students' Accurate Diagnoses of Patients' Responses to Health Problems**

DATE: November 2, 2010

The Graduate Center IRB has approved the amendment to the above study involving humans as research subjects.

IRB Number: *10-06-162-0135* This number is a Graduate Center IRB number that should be used on all consent forms and correspondence.

The approval of your amendment does not affect your last approval and expiration dates.

Approval Date: **July 14, 2010**
Expiration Date: **July 13, 2011**

YOU SHOULD RECEIVE A COURTESY RENEWAL NOTICE BEFORE THE EXPIRATION OF THIS PROJECT'S APPROVAL. HOWEVER, IT IS YOUR RESPONSIBILITY TO INSURE THAT AN APPLICATION FOR CONTINUING REVIEW APPROVAL HAS BEEN SUBMITTED BEFORE THE EXPIRATION DATE NOTED ABOVE. IF YOU DO NOT RECEIVE APPROVAL BEFORE THE EXPIRATION DATE, ALL STUDY ACTIVITIES MUST STOP UNTIL YOU RECEIVE A NEW APPROVAL LETTER. THERE WILL BE NO EXCEPTIONS. IN ADDITION, YOU ARE REQUIRED TO SUBMIT A FINAL REPORT OF FINDINGS AT THE COMPLETION OF THE PROJECT.

Consent Form: All research subjects must use the approved and stamped consent form. You are responsible for maintaining signed consent forms for each research subject for a period of at least three years after study completion.

Mandatory Reporting to the IRB: The principal investigator must report, within five

business days, any serious problem, adverse effect, or outcome that occurs with frequency or degree of severity greater than that anticipated. In addition, the principal investigator must report any event or series of events that prompt the temporary or permanent suspension of a research project involving human subjects or any deviations from the approved protocol.

Amendments/Modifications: All amendments/modifications of protocols involving human subjects must have prior IRB approval, except those involving the prevention of immediate harm to a subject. Amendments/modifications for the prevention of immediate harm to a subject must be reported within 24 hours to the IRB.

Stipulations:

If you have any questions, please do not hesitate to contact Kay Powell in the IRB Office at 212-817-7525.

Good luck on your project.

cc: Marge Lunney Ph.D.
Nursing

COLLEGE OF
MOUNT SAINT VINCENT

Nov. 15, 2010

Dear Ms. Tesoro,

I wish to inform you that the College of Mount Saint Vincent's Institutional Research Review Board has completed a review of your proposal "The Effect of an Educational Model, Developing Nurses' Thinking (DNT), on Nursing Students' Accurate Diagnosis of Patients' Responses to Health Problems". The committee concurs with the CUNY IRRB and approves your application. We wish you well in your research endeavor and look forward to your sharing your results with our Department of Nursing.

Sincerely,

Justine Taddeo EdD, RN
Professor/Nursing
IRRB Member

Appendix L

Permission to Use Personal Coding System

COLLEGE OF STATEN ISLAND
The City University of New York
www.csi.cuny.edu

Department of Nursing

Date: May 1, 2010

This letter is to grant permission to

Mary McCaffery-Tesoro, DNS(c), CUNY Graduate College

for your use of the Personal Coding Sheet in your research study.

As requested, you may also add the questions delineated in your request and sample adapted Personal Coding Sheet(s) to the pretest and posttest questionnaires.

The questionnaires may be reproduced; however please be sure that all respondents return the questionnaire. I do request that you send me a copy of any published work resulting from use of the questionnaire.

Please acknowledge Dr. Marianne R. Jeffreys as the creator of the above mentioned questionnaire and note the appropriate copyright information.

Best wishes in your research endeavors and commitment to promoting student achievement and success.

Sincerely,

Marianne R. Jeffreys

Marianne R. Jeffreys, EdD, RN
Professor, Nursing
marianne.jeffreys@gmail.com
marianne.jeffreys@csi.cuny.edu
718-982-3825

Appendix M

Permission to Use Triarchic Theory Model

Brockman, Inc. 5 East 59th Street New York, New York 10022 Tel (212) 753-9900 Fax (212) 223-3565

March 4, 2011

Mary Tesoro
173 Beech Street
Eastchester, New York 10709

Re: THE TRIARCHIC MIND by Robert Sternberg

Dear Mary Tesoro,

Robert Sternberg has approved your request for the model of the "Triarchic Theory of Human Intelligence," detailed in your request dated 6/6/10, from the above referenced title, to be included in your doctoral dissertation. The following guidelines apply:

1. The extract must be quoted verbatim. The material must not be subjected to any derogatory treatment or appear in a negative context.

2. Permission is given for work by Robert Sternberg only and does not cover any incidental quotations or material from other sources.

3. Acknowledgements must be made to the title and author.

I sincerely apologize for the delay. If you have any questions please feel free to contact me.

Best regards,

Karina Knoll
knoll@brockman.com
Associate
Brockman, Inc.

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